Chapter-3

Causes of death in Andhra Pradesh, 1990s.

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Premature mortality is a major contributor to disease burden. According to the GBD estimates (Murray and Lopez, 1996) the YLL component of DALYs was about 50% in established market economies, where the epidemiological transition had already taken place. In former socialist economies, China, Latin America and the Caribbean (LAC), 57%-58% of disease burden was due to premature mortality. In India, Middle Eastern Crescent (MEC), the rest of Asia and islands (OAI), YLLs contributed 65-69% of total DALYs lost in 1990. In sub - Saharan Africa, more than 75% of DALYs was contributed by YLLs. In case of India (Table-3.1) 84% of the disease burden among children was estimated to be on account of premature mortality. A little more than half of DALYs, lost among older children and young adults, was due to premature mortality. For older people, the contribution of premature mortality to disease burden was 66% or higher. Hence the causes of these deaths is important for health policy.

Table-3.1 Premature mortality (YLLs) and disability (YLDs) components of disease burden in India as per GBD Version-5.

Age group	YLLs	YLDs	DALYs	% YLLs
0-4	53,378	10,086	63,464	84.11%
5-14	9,591	8,921	18,512	51.81%
15-44	16,767	15,506	32,273	51.95%
45-59	9,923	5,004	14,927	66.48%
60	6,423	3,108	9,531	67.39%
All ages	96,082	42,625	138,707	69.27%

[1] Source: Murray and Lopez, 1996 Annex tables 7c and 8c.

Since the major share of disease burden would be from premature mortality, accurate estimate of causes of death would constrain the accuracy of burden of disease estimates. Here we describe, for rural and urban areas of AP, respectively, the existing statistical base for cause of death reporting. We present results from a study undertaken in Andhra Pradesh to improve the

accuracy of cause of death data from the rural areas. Our study on causes of death in urban areas of AP is currently underway. Mean while, we have used medically certified cause of death statistics from the neighbouring state of Maharashtra, where coverage of the medical certification of cause of death is better.

A brief overview of the cause of death reporting systems in India:

At the national level, the Registrar General of India (RGI) is responsible for collection, collation and publication of cause of death statistics[1]. At the state level, the Vital Statistics Division of the Directorate of Health deals with cause of death statistics. Cause of death reports originate from lay reporters in rural areas and medical attendants in urban areas. The reports reach the State Vital Statistics office through the primary health centre, in case of rural areas, and the municipal health office for urban areas. Tabulation is usually done at the state level but the statistics are published by the RGI. Until December 1998, cause of death data for the rural areas used to be collected under the Survey of Cause of Death Rural (SCD-Rural) scheme, from a sample of villages by a lay diagnosis and reporting system. A paramedical person from the PHC is designated as the field agent who undertakes the primary survey. (S)he identifies key informants and maintains liaison with them. A household register is drawn up and updated on a half yearly basis. For each death occurring in the village, the field agent identifies one or more persons having knowledge of the circumstances of death, interviews them and records the symptoms and circumstances of death in Form-7. A structured questionnaire is used to investigate cause of death using the symptoms and circumstances of death. The structured questionnaire is supplemented by a check list. The field agent arrives at a probable cause of death by applying the structured questionnaire to symptoms and circumstances recorded in Form-7. The check list entry against the probable cause of death is tallied with the symptoms and circumstances of death. The cause of death thus arrived is reported in Form-3. The PHC statistician is designated as the recorder of events reported by the field agent. Half-yearly verification of the household list is done by the recorder. Medical officer of the PHC is expected to check and certify the correctness of cause of death assignment by the field agent. Assignment of cause of death is done by the

[1]The responsibility for collection of vital statistics was transferred from the Ministry of Health to the RGI from 1949. However, effective transfer of work from the Director General Health Services to the RGI took place only in 1960.

field agent based on a structured interview with a member of concerned household. The structured questionnaire currently in use was adopted after taking into account five years of field experience with a provisional questionnaire. The non medical list (NML) of causes of death was last revised in 1983 to correspond to ICD ninth revision (RGI, 1991). SCD-Rural used verbal autopsy (VA) to arrive at cause of deaths using paramedical personnel.

From January 1999 a cause of death component has been added to the SRS (RGI, 1999). We call this the SRS-COD component. Two more columns have been added to SRS Form-5 (Columns 16-17) and Form-10 (columns 12-13). The SRS part-time enumerator (PTE) records cause of death in column 16 and the code in column 17 of the revised Form-5. The SRS supervisor records similar information in columns 12 and 13 of the revised Form-10. A major departure from the SCD-Rural design is the doing away with the symptom record (SCD-Rural Form-7). Another departure from the SCD-Rural is the elimination of the structured questionnaire. Instead the instructions contain a list of causes, related symptoms for some, and the corresponding ICD-10 code.

In case of the urban areas, a medical certification of cause of death (MCCD) scheme is operational. This scheme has been acceded legal sanction under the Registration of Births and Deaths (RBD) Act. All medically attended deaths are expected to be registered (Form-2) along with cause of death reports in a format (Form-4) which is similar to what is prescribed by the WHO for International Classification of Cause of Death (ICD). The responsibility for reporting cause of death rests with the doctor / health care provider who last attended on the deceased. Reports are sent to the municipal health authorities, who forward them to the concerned state vital statistics office. The medical attendant is required to follow guidelines contained in the Physician's manual on medical certification of cause of death (RGI, 1992). This manual prescribed the WHO form for reporting cause of death according to the current version of ICD. Coding and tabulation is done according to the National List which is an adaptation of the ICD basic tabulation list. Since the MCCD essentially implements ICD coding and guidelines, the design of the system is considered satisfactory.

Characteristics of an usable cause of death reporting system:

Ruzicka and Lopez (1990) have listed five criteria used by the World Health Organisation to assess fitness of country-level cause of death data for inclusion in its compilations. Firstly, the proportion of all deaths attributed to residual categories such as "Symptoms, signs and ill defined conditions" is within limits, say less than 10%. Secondly, the proportionate distribution of deaths

by cause is consistent with the estimated mortality level for that country. Thirdly, no cause of death with a clear age-sex dependency has been incorrectly assigned. Fourthly, the age-sex distribution for major causes is consistent with what one may expect for each cause. Finally, data generated by the system are consistent with previous years. Note that these are basically plausibility checks. A data set failing these criteria is more likely to be biased. A data set satisfying these criteria may still not be usable, on account of poor statistical power of the generated estimates, and biases that are not readily noticeable. Building upon the criteria suggested by Ruzicka and Lopez (1990), we have identified the following nine criteria to assess the usability of any cause of death statistics:

1. Content validity of lay reporting systems[2], if any.
2. Adequate coverage and compliance.
3. Validity of statistics at sub-national levels of disaggregation.
4. Minimal usage of residual categories, such as unclassifiable, or ill-defined conditions.
5. Consistency of cause-specific mortality proportion with general mortality level.
6. Absence of incorrect assignment of causes with clear age-sex dependency.
7. Incidence of improbable age-sex distribution by cause is nil.
8. Consistency of cause specific mortality proportion over consecutive years.
9. Timely compilation and publication of the statistics.

Cause of death reporting in India. A performance analysis*:

We examine, below, the usability of the cause of death statistics in India from the rural and urban areas respectively. We take up each usability criteria, discuss its implications briefly and then examine how India's cause of death statistics fares, using national statistics and state level statistics from Andhra Pradesh. Where required, we supplement the published statistics with information about Andhra Pradesh, available to us from our study on cause of death in Andhra Pradesh. We have called this the Andhra Pradesh Rural Cause of Death (APRCD) study, 1998.

[2]We have assumed that medical certification of cause of death follows the ICD. Although ICD is not necessarily the most valid system of classification, it represents the consensus of professional opinion at the International level. We have omitted discussions about the content validity of the ICD.

* Dr. P.V. Chalapati Rao is the co-author for this section. Most of the material presented in this section (P 58 to 84) has appeared in National Medical Journal of India, Vol 14, No. 3, 2001, P 154 - 162.

Content validity of the verbal autopsy algorithm for lay reporting of cause of death in India:

Design characteristics of the reporting system have a bearing on the usability of cause of death statistics. For example, changes in the guidelines of the international classification of causes of death (ICD) have been seen to cause reduction or increase in assignment of deaths to certain causes, depending on the specific changes brought by the particular version of the ICD. Analogously, guidelines for verbal autopsy can have some effect on the cause of death structure produced by the concerned cause of death reporting system.

General design features of a verbal autopsy system:

The verbal autopsy method has been studied and applied in many parts of the world. For example the demographic surveillance system (DSS) in Matlab, Bangladesh (Nahar et al 1985; Zimicki, 1990); assessment of child mortality in Latin America (Puffer and Serrano, 1973); monitoring endemic diseases in West Africa (Bradley and Gilles, 1984; Greenwood et al, 1987) in Kenya (Omondi-Odhiambo et al, 1984), Namibia (Mobley and Ties, 1996); in Phillipines (Kalter et al, 1990) and in India (Bang et al 1992; Awasthi and Pande, 1998). Much of the VA related work, however, remains unpublished. For example the WHO-UNICEF (1994) memorandum on measurement of cause-specific mortality in children cites many unpublished sources.

The current knowledge base on feasibility and validity of VA is largely restricted to childhood mortality. The WHO-UNICEF memorandum, cited above, summarizes results of validation studies and has tabulated sensitivity and specificity of VA for detecting major causes of childhood death. In addition, the memorandum contains expert opinion about use of VA for investigation of causes of childhood death. This memorandum was the result of an internal consultation in December 1992 in which experts engaged in research and implementation of VA participated. Bang et al (1992) have used consensus development techniques to synthesize expert opinion on diagnostic criteria for identification of causes of childhood deaths. They have developed questionnaires incorporating local terminologies in their study area (Gadchiroli, Maharashtra) to generate the required information by verbal autopsy to satisfy the coding algorithm.

Studies about the validity of VA in identifying causes of adult death have been undertaken recently (Garenne and Fontaine, 1989; LSHTM, 1993). Garene and Fontaine (1989) have reported their experience in Senegal. The London School of Hygiene and Tropical Medicine (LSHTM) workshop (1993) on verbal

autopsy tools for adult deaths was conducted on the eve of a study in sub Saharan Africa. Proceedings of this workshop, cited above, documents a consensus of expert opinion about VA for adult deaths. The World Bank working paper by Hayes et al. (1989), is another summary and source of expert opinion. Chandramohan et al (1994) have published discussions at the LSHTM verbal autopsy workshop and have summarized all VA-based studies published upto mid-1993. Certain general design features are the key to wide applicability, efficiency and validity of data generated by a VA based cause of death reporting system. Over the years, some degree of consensus on major design issues has been achieved. I have drawn upon these sources in order, to critically examine the extent to which SCD-Rural meets the criteria of a good VA-based system.

The structured questionnaires of the SCD-Rural system are systematically examined for each of the conditions included in the non-medical list, in the light of available research results on verbal autopsy. A comparative statement of the SCD-Rural algorithm, expert opinion and findings from field studies about diagnostic algorithms and validity of verbal autopsy (VA) to assign specific cause of death, and the extent to which the SCD-Rural question satisfy expert opinion have all been included in Appendix-3.1. A summary is presented in Table - 3.2. SCD-Rural seems to satisfy most of these criteria except that of reporting multiple causes of death. However, assigning multiple causes of death creates problems for aggregation and reporting of deaths by cause. Manton and Stallard (1984) analyzed multiple cause of death patterns in the USA. Although their preferred suggestion is to use patterns of failure as the basis of analysis, it may not be a feasible alternative considering the small sample sizes inherent in verbal autopsy-based statistics. To the extent that certain deaths are assigned to a combination of causes, there will be reduction in number of deaths reported under the respective component causes (LSHTM, 1993). A compromise may be to restrict the number of multiple causes of death to a manageable number and develop algorithms to distribute these to their component causes. Manton and Stallard's (1984) study suggests that recording upto three multiple causes would include more than two third of deaths. Choosing the top three most probable causes contributing to death may help improve the accuracy of estimates and keep it manageable.

The trade off between the open-ended interview and the structured questionnaire needs further elaboration. Although an open-ended interview format allows for the pursuit of unusual diagnostic clues not covered by a structured questionnaire, it requires more skilled interviewers. For example, comparatively lower assignments to unknown category have been achieved with physicians acting as interviewers (Greenwood et al 1987). Open-ended interviews and coding of cause based on the judgment of the interviewer reduces the inter-regional and inter-temporal comparability of cause of death statistics.

Table-3.2 General design features of a good VA system and the SCD (Rural) scheme in India.

Criteria / Expert opinion	SCD (Rural)
Identification of respondents	
In the LSHTM workshop it was suggested that the field agent ask members from the household who were present at time of death, were close to the deceased and are available for the interview. A household roster would help identify these persons. The field agent then indicates who the actual respondents were, and a supervisor could later check appropriateness of the choice. Garene and Fontaine (1989) have noted that the best respondent for investigation of a childhood death is the child' s mother if she is alive and present. In her absence or unavailability, father, foster parents who used to take care of the child would be appropriate. For maternal deaths a person from among the women including traditional birth attendants or trained midwife, who took care of the deceased would be appropriate. For other adult deaths the spouse may be a good source.	Yes. The recorder does an independent survey of households once every six months and tallies with the report of field agent. Specific review of field agent's choice of respondent is not made. SCD guidelines do not contain recommendations on choice of respondent as is done by Garene and Fontaine (1990).
Recall period	
Participants in the LSHTM workshop believed that recall of circumstances of death by close relatives and attendants would be adequate up till 12 months after the event. It would be preferable to wait for a month after the death to avoid distress to the respondent. Garene and Fontaine (1989) found , in rural Senegal, that the best period to ask questions about cause of death was between 3-9 months after the death. Questions asked too early are either not	Yes. The field agent maintains regular contact with suitable informants from the village on a weekly or fortnightly basis. The recorder does an independent survey half yearly. The VA interview would take place

answered or inadequately answered. Deaths of children investigated more than 9 months after are poorly reported. Zimicki (1990) also noted from her study in Matlab, Bangladesh that intervals of upto ten months between death and interview do not affect the amount or quality of information. Stanfield and Glazacka (1984) report that omissions were minimal during 1-7 months period after neonatal deaths in a study in Ivory Coast.	between 2 weeks to 7 months after the date of death.
Structured questionnaire and diagnostic algorithm.	
Standardized pre-coded questionnaire and predefined algorithm is to be preferred (WHO-UNICEF, 1994). Participants at LSHTM work-shop (1993) preferred a check list as opposed to an open format of interview and a predefined algorithm for coding.	Yes
Filter questions	
At the LSHTM workshop (1993) most participants preferred the check list with filters to one without. Symptom based filtered modules (e.g. cough module) were preferred to disease specific filters. Zimicki (1990) reports that the respondents in Matlab, Bangladesh were asked a list of 16 questions. If the answer was yes, auxiliary questions specific to each symptom was asked. This was found superior to a large checklist of symptoms.	Yes
Recording multiple causes	
Multiple causes of death should be permitted (WHO-UNICEF, 1994, LSHTM 1993).	No

Since SCD-Rural satisfies most of the general design criteria for VA, does it follow that the statistics generated by it would automatically be valid? Not necessarily. Although the design features shown in Table-3.2 are necessary for efficiency and validity they are not sufficient. Validity of classification of deaths to particular causes will depend on characteristics of the cause of death per se, as also the content of the questionnaire and algorithm used for specific disease entities the latter two of which are discussed in the next sub section.

Validity of SCD-Rural disease-specific algorithms:

As the WHO-UNICEF (1994) consultation noted, VA is suitable only for causes that have clear and unambiguous set of symptoms at the time of death. The symptoms and signs chosen to code deaths due to a particular disease should result in most of the deaths truly due to the concerned cause to be coded as such (sensitivity) and exclude other causes that may have related symptoms. In addition, the choice of symptoms and signs must be parsimonious to reduce interviewer and interviewee fatigue. At the very least, questions and coding algorithms should have face and content validity. In other words, they should be based on expert judgment about their usefulness in identifying and excluding specific causes. In addition, validity with respect to a criterion will be desirable. The validity of an instrument is assessed by comparing its result with some reference standard. Thus the choice of a reference standard is the key to empirical validation of VA algorithms.

The gold standard reference for assignment of cause of death has been the autopsy. This is not a practicable solution to validate VA, since the later alternative to medical certification of cause of death is considered only in areas with scarce medical facilities. Two other references have been proposed (LSHTM, 1993) and used, namely (a) hospital diagnosis and (b) clinical diagnosis. To validate VA with respect to hospital diagnoses, deaths in a community are coded using the VA instrument under testing. If the deceased happened to have been hospitalized, the medical records from hospital are retrieved. The reference cause of death is assigned on the basis of the person's medical record in hospital. Alternatively patients discharged from a hospital may be followed up after a lapse of time and deaths if any may be coded by VA. The hospital-based reference diagnosis and the VA-based code are then compared. Selection bias is a major shortcoming of hospitals based reference.

The LSHTM workshop discussed possible ways of reducing selection bias. An example of hospital diagnosis-based reference is the study in Kenya by Snow et al (1992). In this study hospital diagnosis was used as a reference to check validity of cause of death coded by physicians from verbal autopsy data. On the other hand, clinical diagnosis in the community has less of a selection bias. This would require a lot of medical manpower, which may not be available in an area for which VA is considered. It may, however, be possible to temporarily mobilize physicians for purposes of a validation study, since methodological lessons learnt from it would be useful for wider application. Kalter et al (1990) used physician diagnosis as the reference to estimate validity of different verbal autopsy based algorithms. Zimicki (1990) compared interviews by lay reporters with in-depth interview by physicians.

Sometimes empirical validity of VA tools are assessed indirectly by checking consistency of VA-based statistics with known epidemiological patterns. One approach has used known efficacy of vaccination to reduce mortality due to concerned disease. Validity of a VA tool measuring mortality due to that disease may be indirectly inferred from the time trend of estimates generated by it and vaccination coverage. Stephens (1990) studied measles-related morbidity and mortality data collected by nonmedical field interviewers in a rural area in Senegal. Data on measles incidence and cause-specific mortality was aggregated by hamlets. Stephens examined if the movement of measles epidemic from hamlet to hamlet implied by the verbal autopsy data was consistent with known epidemiologic pattern of measles and vaccination coverage in respective hamlets.

SCD-Rural algorithm organizes all causes, at the highest level, into ten modules based on obvious age-sex-major symptom complex (Table-3.3). The solution to the first round of questions about applicability of these modules leads the interviewer into the detailed questions under that module. It will be fairly obvious to determine if the death was due to, say, accidents and injuries (SCD module-1), maternity (module-2) or if it was of an infant less than one year old. There is a problem about the last module on senility. There are no further expansions of causes under senility. Criteria for inclusion under senility is that the person was extremely old and apparently not sick? The person should be above 60 years and none of the specific causes in SCD list be traced. The age criteria of more than 60 years would tend to put more deaths under this category.

Table-3.3 SCD (Rural) cause groups, availability of expert opinion or validity information on each cause and concordance of SCD questions with expert opinion.

Category[1]	Not Available	Availability and Concordance[2]
Fevers (3)	Influenza, Typhoid	Malaria
Digestive disorders (6)	Food poisoning, Peptic ulcer, Acute abdomen	Gastroenteritis (diarrhoea), Cholera, Dysentery
Coughs (5)		Tuberculosis of lungs, Bronchitis, Asthma, Pneumonia, Whooping cough
CNS disorders (3)		Stroke, Meningitis, Convulsions
Diseases of the Circulatory System(3)	Anaemia	Congestive heart failure, Ischaemic heart disease
Other clear symptoms	Cirrhosis and chronic liver diseases,Chicken pox, Leprosy, Poliom yelitis, Mental disease, Diabetes, Hyperplasia of prostate, Uraemia, Obstructed hernia	Jaundice, Measles, Tetanus, Cancer
Infant deaths (6)		Prematurity, Congenital malformation, Birth injury, Respiratory infection of the new born, Cord infection (Neonatal tetanus), Diarrhoea of the new born

[1] Figures in parentheses are the number of conditions within the group. For 12 causes under Accident and Injuries, expert opinion is not available for an individual or specific cause. However, there is a general agreement that these causes are obvious to lay reporters and hence verbal autopsy is considered to accurately assign deaths due to these causes. For similar reasons, the six causes under maternal deaths is not shown. Senility and other residual codes are not shown.

[2] Expert opinion and SCD questions for the underlined causes of death listed under this column do not agree.

The SCD structured questions and checklist were compared with currently available expert opinion or validity information for respective causes of death in the SCD non medical list. Table-3.3 gives a summary of SCD non- medical list

causes of death for which at least some expert opinion or validation information is available and if the SCD questions are in accordance with them. Altogether there are 57 specific causes in the SCD non- medical list, excluding the residual categories. Accidents and injuries account for 12 of these. Consensus about validity of VA to code deaths due to accidents and injuries is quite strong, since most of these are easily recognized by lay persons. Discussions of VA on accidents and injuries are not available in the literature. So is the case with deaths due to maternal causes, under which SCD non medical list contains 7 causes. Excluding these 19 causes under accidents, injuries and maternal deaths, there are 38 specific codes in the rest of the SCD non- medical list. At least some expert opinion or validity information is available for 24 out of these 38 causes.

As can be seen in Table-3.3, most of the causes for which some expert opinion is available are infant deaths, respiratory and diarrhoeal diseases. For 21 out of these 24 causes the SCD questions appear to be in accordance with expert opinion and validity information available in the literature. The three causes for which there is major discrepancy are (a) cord infection, (b) pre maturity, and (c) cancer. Most experts agree and validation studies show that verbal autopsy is good at detecting neonatal tetanus. In SCD-Rural, neonatal tetanus is included under cord infection and thereby misses an opportunity for accurate estimation of deaths due to a cause which is very important from public health point of view. Experts opine that it is usually difficult to distinguish between prematurity and low birth weight (Garene and Fontaine, 1989; Gray, 1989). Hence they ought to be lumped together for accuracy of VA-based statistics. The SCD-Rural list does not include low birth weight in its list. It can be added to prematurity without any disturbance to the structure of the rest of the questionnaire. The SCD-Rural list homogenizes all cancers into one cause. Some expert opinion is usually available by site of cancer. Moreover some cancers would have symptoms which may be confused with the filter questions for other modules. For example, stomach cancer cases may be investigated as deaths due to digestive diseases. In that case, the field agent may not get to consider stomach cancer at all since there is no mention of it in the digestive causes module. So is the case for lung cancer.

Nonavailability of expert opinion or information pertaining to validity in the SCD-Rural nonmedical list does not imply that they are primaital facie not valid. The SCD-Rural design was based on expert opinion obtained at the time of drawing up blue print of the scheme and revision of manuals. The SCD-Rural design process included a phase of field testing of provisional questionnaires and finalisation by expert consultation. Considering the large extent to which questions for specific causes are in accord with expert opinion and information from VA validity studies, the SCD-Rural questionnaire appears to be prima facie valid.

The prima facie validity of SCD-Rural questionnaire is reassuring in the sense that the scheme design is largely in accord with current knowledge about verbal autopsy. But it does not assure us that the cause of death statistics are accurate for all causes. In case of causes for which VA is known to be highly sensitive and specific (say more than 75% for each) the SCD statistics can be mapped to medical causes directly. For other causes, more detailed algorithms for mapping of SCD statistics onto the desired set of medical causes will have to take into account available knowledge about the sensitivity and specificity of VA in general and specific peculiarities of SCD as also implementation.

SRS-COD Component:

From January 1999, the survey of cause of death was integrated with the SRS (RGI, 1999). It is understood that the SCD-Rural guidelines have been extended to the SRS-COD component. Although formal communication regarding this is yet to be made available, we were able to obtain a copy of the RGI rules and regulations on "Collection of data on causes of death" (Director of Census Operations, Andhra Pradesh, 1999). The elimination of the symptom record (SCD-Rural Form-7) has been a major departure from the SCD-Rural design. The SCD-Rural symptom record was similar in content to the WHO's cause of death report format, which requires information about the underlying causes of death. The SRS-COD component asks field agents to record the code to which the cause of death is assigned. No further information about symptoms and circumstances of death need be reported. This later information is required for the systematic screening and coding of cause of death reports. The phasing out of the structured questionnaire constitutes another significant departure from the SCD - Rural. Instead the instructions contain a list of causes, related symptoms for some diseases, and the corresponding ICD10 code. For some causes, no description of expected symptoms has been furnished. However, it is too early to sit in judgment on the new system. It will nevertheless be helpful if specific research studies are taken up to evaluate the performance of the new cause of death reporting system in rural areas.

The SRS-COD component is designed to generate verbal autopsy-based information on the causes of death for urban and rural areas, since SRS operates both in rural and urban areas. This will result in two sources of cause of death data from urban areas, namely the (a) SRS-COD component, and (b) the Medical Certification of Cause of Death (MCCD) reports. It is claimed that this will allow for comprehensive statistics on cause of death for all areas of India. While the availability of verbal autopsy-based cause of death data for urban areas will allow for some plausibility checks and comparisons with the MCCD based data,

the latter source is certainly more preferable, as it is based on medical certification. Urban areas face the hazard of poor co-operation offered by hospitals and medical attendants. This is mainly due to the fact that there is no effort, whatsoever by municipal authorities in demanding compliance with provisions of the Registration of BD Act. about reporting of cause of death.

Coverage by cause of death reporting systems:

Coverage of all deaths in the sample population by the cause of death reporting system would ensure that all types of causes of death are included. Conversely, inadequate coverage contains the possibility of bias and low statistical power of the cause-specific mortality estimates. Table -3.4 shows coverage of deaths by the SCD-Rural scheme over a period of five years from 1991 to 1995. Coverage is computed with respect to the estimated total deaths for the SCD-Rural sample areas, using the SRS death rates. Some states show more than cent percent coverage in the past few years. This could be the case either due to undercounting by the SRS giving rise to a small denominator in the coverage estimate, or undercounting of population by the SCD-Rural system leading to an inflated numerator.

Table -3.4: Percentage of estimated deaths covered by SCD-Rural, during 1991 to 1995

State	1991	1992	1993	1994	1995
India	NA	68.3	78.7	88.1	90.3
Andhra Pradesh	60.1	70.2	88.5	85.2	94.9
Assam	NA	38.1	43.0	71.5	65.5
Bihar	40.3	45.4	52.6	74.9	66.9
Gujarat	59.0	60.9	108.9	101.3	88.0
Haryana	NA	77.8	106.3	94.1	101.4
Himachal Pradesh	NA	92.7	76.0	94.7	147.2
Karnataka	76.1	79.5	101.6	97.9	103.1
Kerala	NA	66.1	56.9	125.1	101.4
Madhya Pradesh	36.2	47.1	63.3	81.4	102.4
Maharashtra	91.6	95.0	108.2	86.7	82.1
Orissa	66.7	80.9	77.7	107.6	89.5
Punjab	57.7	68.7	61.4	71.7	82.2
Rajasthan	65.4	76.8	91.2	95.5	92.9
Tamil Nadu	76.1	81.9	90.0	80.6	72.0
Uttar Pradesh	67.6	82.4	102.5	97.1	103.4
West Bengal	NA	NA	NA	NA	NA

NA = Not Available. Source: Compiled from SCD-Rural Annual Reports 1991-95 and Sample Registration System Fertility and Mortality Indicators 1991-1995, both published by RGI

At the all-India level, coverage by SCD-Rural ranges from 70% to 90% of deaths. But states differ considerably in terms of coverage of deaths by the SCD-Rural system. The state of Maharashtra has maintained more than 80% coverage consistently for all five years. Other states which have maintained a fairly high level of coverage from year to year are: Haryana, Karnataka, Tamilnadu, Rajasthan, Andhra Pradesh, Orissa, Himachal Pradesh, Punjab, and Uttar Pradesh. States like Assam, Bihar and Madhya Pradesh, indicate poor coverage by the SCD-Rural system. The SCD-Rural system seems to be completely defunct in West Bengal. The APRCD study catalogued all SCD-Rural reports for Andhra Pradesh for the year 1998. It is found that about 20% of sample PHC headquarter villages had not sent any report at all. Thus poor coverage appears to be on two accounts, namely (a) undercounting, and (b) complete lack of reporting from a subset of sample villages.

Table -3.5: Percentage of medically certified deaths with respect to expected urban deaths in major States.

Country / State	1991	1992	1993	1994
All India	25.1	24.2	27.7	24.2
Andhra Pradesh[1]	17.2	24.5	21.9	15.7
Assam	0.0	0.0	0.0	0.0
Bihar	0.0	0.0	0.0	0.0
Gujarat	0.0	0.0	0.0	0.0
Haryana	44.8	40.1	44.0	26.6
Himachal Pradesh	0.0	0.0	0.0	0.0
Karnataka	34.9	41.1	35.4	42.5
Kerala	40.3	17.0	17.1	11.4
Madhya Pradesh	10.8	13.0	9.3	17.5
Maharashtra	76.2	77.4	58.4	74.7
Orissa	68.0	53.3	36.5	56.9
Punjab	0.0	0.0	0.0	0.0
Rajasthan	22.5	27.8	17.2	27.0
Tamil Nadu	35.5	40.5	35.2	43.5
Uttar Pradesh	0.8	0.7	0.4	0.7
West Bengal	0.0	0.0	0.0	0.0

[1] Source: Compiled from MCCD Annual Reports 1991-94 and Sample Registration System Fertility and Mortality Indicators 1991-1994, both published by RGI

[2] For AP we have data for some more years, collected from state vital statistics division. The coverage of MCCD in urban areas of AP was as follows: 1995= 7.9%, 1996=13.9% and 1998=20.4%.

Table-3.5 shows coverage by the MCCD scheme, of deaths in urban areas. Coverage is computed with respect to SRS estimate of deaths rates applied to the urban population. At the all- India level, the coverage is about 25% of urban deaths. Note that coverage, in this case, is computed with respect to the total population of urban areas notified by the respective state government for medical certification of cause of death. In case of the SCD-Rural scheme the reference population is much smaller, consisting of the sample of villages included in the scheme. Even though coverage by MCCD is much lower, the number of cause of death reports arising out of the MCCD scheme is much larger. Variation between states in terms of coverage by the MCCD scheme is much more pronounced. Many states are simply not reporting a single death under the MCCD scheme. These are: Assam, Bihar, Gujarat, Himachal Pradesh, Punjab and West Bengal. Maharashtra is the only state with fairly high degree of coverage, between 60 to 75% in different years. Recall that Maharashtra has consistently achieved high levels of coverage in the SCD-Rural scheme also. States like Orissa, Haryana, Karnataka, Tamil Nadu have consistently collected cause of death reports for about 40% of deaths in urban areas.

Table -3.6: MCCD in AP, 1998: Compliance by municipalities and Health Care Institutions (HCIs) within municipalities.

Number of municipalities in Andhra Pradesh		100%
Number of municipalities notified by state for MCCD	116	
Number of municipalities sending some COD Reports to state	17	14.7%
Compliance by Institutions within the 17 reporting municipalities:		
Number of Institutions sending some COD reports	249	10.6%
Cumulative bed strength of these reporting Institutions	11,229	33%
Some Reporting Institutions in Hyderabad		
Number of registered deaths from these HCI		100%
Number of deaths for which COD Report received		

[1] Source: Compiled from data collected from the Vital Statistics Division, AP, and 3 hospitals at Hyderabad.

[2] Percentage of health care institutions and beds is arrived at with respect to total institutions and beds as in the AP Health Institutions Database (APHIDB) maintained at the Institute of Health System, Hyderabad, AP.

For a better understanding of factors leading to poor coverage, we looked at the performance of MCCD in Andhra Pradesh for the year 1998 (Table -3.6). The state government has notified 116 municipalities under the MCCD scheme. Thus the medical attendants, or concerned health care institutions (HCIs) are required, under the RBD Act, to send cause of death reports. In 1998 only 15% of these municipalities sent some cause of death reports to the State Vital Statistics Division. We call these the "reporting" municipalities. Only 11% of health care institutions, located in reporting municipalities and accounting for 33% beds, were sending some cause of death reports. We call these the "reporting HCIs". We studied the performance of three large reporting HCIs in the state capital, i.e. Hyderabad, to gain some more insights about completeness of cause of death reporting by them. We added up the number of deaths in these hospitals and registered with the muncipality, and compared with the number of cause of death reports received from them. Cause of death reports were filed only for about 65% of the registered deaths.

To understand the situation in case of the non-reporting municipalities, we looked at the list of the 99 non-reporting municipalities and found that five of them had teaching hospitals attached to medical colleges. We expected that at least some clinical teams in teaching hospitals would follow protocols and write cause of death reports. Investigations in two of these teaching hospitals revealed that they had indeed submitted cause of death reports for 1998 to the concerned Municipal Health Office. The latter did not forward these to the State Vital Statistics Office, apparently out of ignorance. As a result, cause of death reports from all reporting health care institutions within these registration areas stagnated at the municipality level. This finding is strengthened by the fact that the arrival of cause of death reports in the State Vital Statistics Division of AP increased significantly after our study was undertaken. For example, the number of reporting municipalities increased from 17 in 1998 to 24 in 1999.

We summarise our findings on causes of poor coverage by MCCD as follows. Firstly, many health care institutions, clinical teams and medical attendants are either not aware of their responsibility to write and send cause of death reports or simply do not care. In case of health care institutions reporting some cause of death reports, there is still the problem of compliance by all clinical teams. Thirdly, many municipal health officers and their staff, who are supposed to play a crucial role in collection of cause of death reports and enforcement of the provisions of the RBD Act, are either complacent or unaware of their role. As a result some of the cause of death reports pile up in municipal offices, without ever getting tabulated. Finally, there is the case of municipal health offices totally unaware and unconcerned about their responsibility in receiving and reporting of cause of death report. Needless to say, the overall coverage has been assessed as poor.

Validity of statistics at sub-national levels of disaggregation:

Valid cause of death statistics at the state level facilitates interstate comparisons. Small area comparisons of mortality experience are useful in identifying inequalities in health care services. In the Indian context, interstate and small area comparison of causes of death have the greatest potential to influence health policy. Ideally, the same nine criteria ought to be employed to assess validity of cause of death statistics in each of the states. But due to the inavailability of adequate data, one has to rely on differences in coverage by cause of death reporting systems in different states. Maharashtra is the only state with high coverage by cause of death reporting systems in both rural and urban areas. Haryana, Karnataka, Tamil Nadu and Orissa have reasonable coverage in both rural and urban areas. Rajasthan, Andhra Pradesh, Himachal Pradesh, Uttar Pradesh and Punjab boast of a reasonable coverage in rural areas, but poor coverage in urban areas. Thus only five out of 15 major states have coverage enough to warrant interstate comparison of their cause of death structures. Considering the size of the country and potential of small area comparisons of mortality statistics to inform health policy, one infers that the usability of cause of death statistics in India for interstate and small area comparisons is rather poor.

Deaths coded as unclassifiable:

Assignment of a large proportion of deaths to "unclassifiable", "ill defined", and other such residual categories affects the accuracy of cause of death statistics. If unclassifiable deaths are drawn equitably from all causes, the proportion of unclassifiable deaths may not affect the estimated cause of death profile. However, deaths due to causes with ill-defined symptoms, or those that give rise to multiple presentations become difficult to classify and end up in the unclassifiable category, in comparison to deaths due to clearly identifiable causes. For example, as Preston (1976) pointed out, many deaths due to cancer and cardiovascular diseases, especially of ischaemic variety that cause death by sudden heart attack tend to remain unrecognised and get subsumed under senility or unclassifiable categories on account of poor diagnosis. On the other hand, respiratory tuberculosis is easily recognised and is usually unlikely to contribute much to the deaths coded under miscellaneous categories. Insofar as the proportion of deaths assigned to miscellaneous categories like unclassifiable, senility etc. is small, the proportion of cause-specific mortality can be relied upon. Non availability of age or sex of the deceased poses yet another impediment and may contribute to a biased estimation of cause-specific mortality proportions.

Table -3.7: Percentage of deaths coded as unclassifiable by the SCD-Rural and MCCD Scheme.

Year	SCD Rural		MCCD (Urban areas)			
	India	AP	India		AP	
	Unclassifiable	Unclassifiable	Missing age	Unclassifiable	Missing age	Unclassifiable
1991	26.70%	22.10%	1.90%	14.50%	0.00%	12.40%
1992	26.40%	22.20%	2.20%	14.40%	0.00%	10.40%
1993	26.20%	23.90%	1.90%	15.40%	0.00%	8.30%
1994	24.30%	NA	2.50%	13.40%	0.00%	8.00%
1995	18.60%	NA	NA	NA	8.20%	8.80%
1996	NA	NA	NA	NA	4.80%	6.50%
1998	NA	27.93%	NA	NA	7.60%	NA

Source: Compiled from SCD-Rural and MCCD Annual Reports published by RGI.
[1] NA = Not Available. [2] SCD data for the years after 1995 is yet to be published. For 1995 - 1996 (MCCD) and 1998 (SCD) data from AP has been compiled by us for this study.

Table-3.7 shows the incidence of deaths coded as unclassifiable by the SCD-Rural and MCCD systems. More than 20% of deaths from the rural areas for which cause of death had been reported by the SCD-Rural scheme was coded under the unclassifiable category. In Andhra Pradesh during 1988-93, 38% of these deaths were coded as "not classifiable". Another 25% deaths were coded as "senility". These inferences are based on compilations of data obtained from the State Vital Statistics division. The incidence of unclassifiable deaths for urban areas is comparatively less at around 15%. But this is still higher than the 10% norm proposed by Ruzicka and Lopez (1990). Information about deaths where the age had not been specified is not available for the SCD-Rural data. In case of the MCCD data from urban areas of the country, age information was missing in about 2% of cases. In Andhra Pradesh, there were no cases reporting absence of age data for the period 1991 to 1994. Most probably the figures were either not tabulated or have not been reported. We consolidated the State's data for recent years and found that the incidence of cause of death reports without information on age was 4.8% in 1995 and 7.6% in 1998. We feel that the incidence of cause of death reports that do not mention the age of the deceased is considerably high both for urban and rural areas which in turn prompts us to infer that this is less the result of a lack of primary

data than an overall negligence on the part of the institutions and field agents responsible for filing the cause of death reports.

Consistency of reported cause of death structure with general mortality level:

Preston (1976) demonstrated, with help of cause of death data for 165 populations, that cause-specific mortality tend to be a function of the all-cause mortality. Simply put, high mortality populations tend to have a higher proportion of deaths attributable to infectious and parasitic diseases. As the general mortality reduces, the corresponding reduction in deaths due to infectious and parasitic diseases is usually more than proportionate. Preston estimated linear models relating the general mortality levels to mortality attributed to 12 cause groups. Recently, Murray and Lopez (1996: p142-148) have estimated logarithmic models using more recent data. These models estimate the cause of death structure with equations for specific age sex groups in the three categories of causes described for burden of disease estimation. Murray and Lopez (1996: Annex Table-5a-n) have published models of predicted cause-specific death rates for group 1, 2 and 3 causes[3] along with values at one, two and three standard deviations from the mean predictions. The models were used by Murray and Lopez to predict cause specific mortality for populations with poor cause of death statistics. The same models can be used to assess the quality of cause of death statistics in India. We believe that the models do not necessarily predict the truth. Although a true cause of death structure can be revealed only by an efficient cause of death reporting system, we can use the models to examine plausibility of cause structure suggested by currently available cause of death statistics. For this purpose, we have estimated mortality in respective cause groups for urban areas of India, with general mortality estimates from SRS as inputs. We compare these figures with the corresponding cause group mortality data from the cause of death statistics for the corresponding year. Accordingly each age- sex group and broad cause group combination is designated as a data point. For example, female deaths in age group 0-4 and attributed to group-1 causes is considered one data point. Thus, each age sex group has three data points corresponding to the three broad cause groups. Consequently there are 42 data points for seven age groups and both sexes If a data point is within one standard deviation of the mean predicted cause group mortality, the data point is considered to satisfy the cause of death model under One SD rule. On the other hand, if a data point differs from the mean predicted value by more

[3]The three groups are: group-1 = communicable, maternal, perinatal and nutritional conditions, group-2 = non communicable diseases, and group-3 = injuries.

than one standard deviation, then it is considered as not satisfying the model under One SD Rule. All data points are examined using One, Two and Three SD Rules. A data point satisfying the One SD rule will satisfy the Two and Three SD rule. A data point not satisfying the One SD Rule may, however, satisfy the Two SD Rule. In other words, One SD Rule is the most restrictive and Three SD rule the most liberal. If the cause of death structure revealed by the cause of death statistics is largely consistent with the cause structure predicted by the model, then most data points would satisfy the One SD Rule. In other words, the percentage of data points not satisfying the Two or Three SD Rule gives us an idea about the unreliability of the cause of death statistics.

Table-3.8: Age, sex cause-specific mortality proportions data points not satisfying general mortality model based expectations.

	One SD Rule		Two SD Rule		Three SD Rule	
Year	#	%	#	%	#	%
1991	21	50	18	43	16	38
1992	25	60	18	43	15	36
1993	34	81	23	55	14	33
1994	27	64	22	52	12	29
1995	29	69%	21	50%	14	33%
1996	23	55%	18	43%	16	38%

Table-3.8 shows the result of comparisons of model predicted cause-specific mortality for different age-sex groups with corresponding data points from MCCD for the years 1991 to 1996. About 30 to 40% of data points do not satisfy the Three SD rule. However, allowing for the possibility that the model-based predictions may not be necessarily accurate, this aspect of the cause of death reporting system in India is rated as tolerable.

Incorrect assignment of causes with clear age sex dependency:

Certain causes of death have a very clearcut age-sex dependency. Deaths due to reproductive organ pathology are limited to the concerned sex. For example, death due to carcinoma of cervix is impossible for a male. Certain other factors are improbable causes of death for some age sex groups such as death due to ischaemic heart disease in children below five years. Such impossibilities and improbabilities are usually rectified through systematic screening of cause of death reports by medical care supervisors at the health care provider level and vital statistics authorities at regional and national levels.

Reporting of deaths with a clear age- sex dependency under other age-sex groups are evidence of poor scrutiny at various levels. Table- 3.9 shows instances of such deaths between 1991 - 1994. The number of deaths with impossible or improbable cause and age- sex combination is less when compared to the total reported deaths (see footnote to the table). However, their very existence suggests a lack of systematic screening which may contribute to poor quality of cause of death data.

Table -3.9: Instances of deaths with clear age-sex dependency reported in other age-sex groups

Selected Cause with Clear	SCD-Rural				MCCD (Urban)			
Age-Sex Dependency.	1991	1992	1993	1994	1991	1992	1993	1994
Maternal deaths in females not in reproductive age group	0	0	0	0	1	10	23	4
Suicides in children aged less than five years.	1	2	3	3	8	4	5	3
Deaths at ages > 5 years attributed to low birth weight	0	0	0	0	33	2	118	0
Death at ages > 5 years attributed to birth trauma / birth asphyxia	0	0	0	0	0	2	86	1
Heart attack (SCD-Rural) / Ischaemic heart disease (MCCD) in children less than five years.	1	14	7	7	130	126	173	140
Pulmonary tuberculosis in in fants	1	8	12	4	202	141	226	191

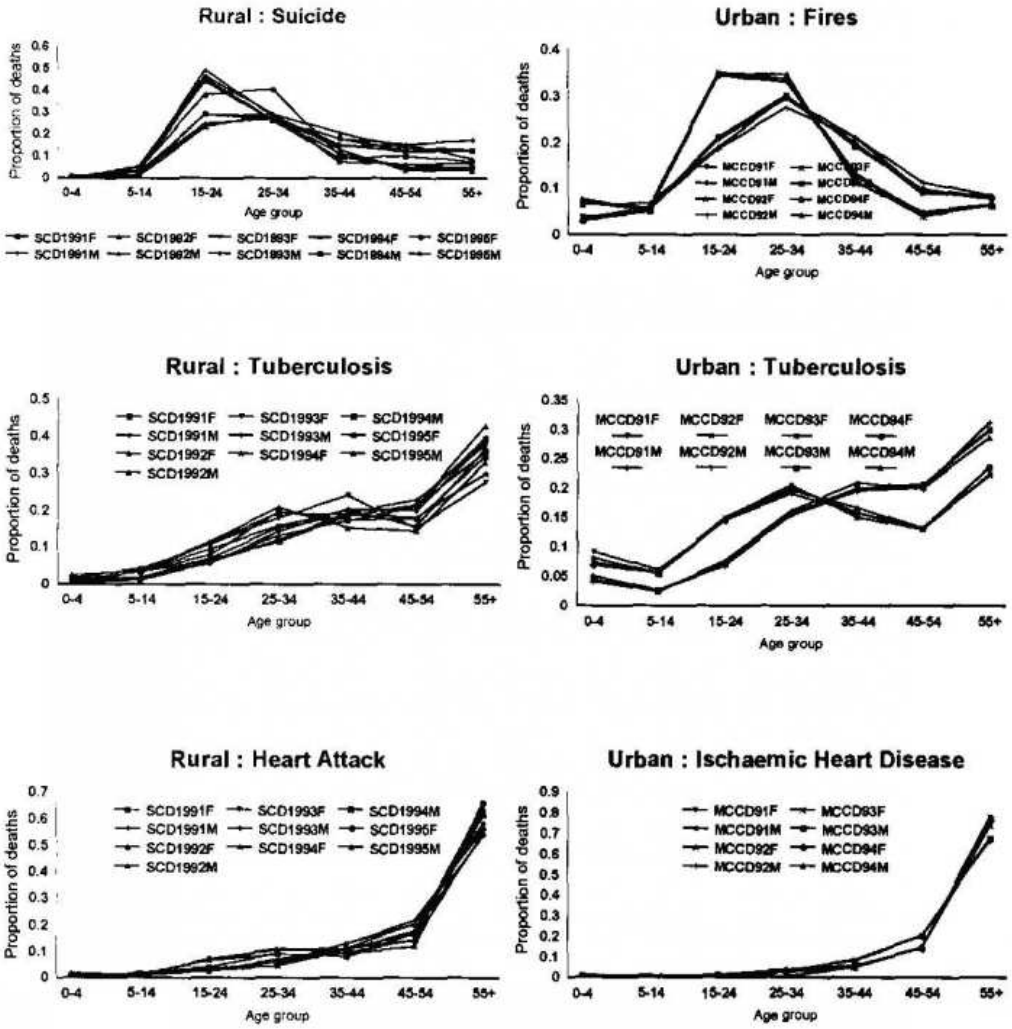
[1] Source: Compiled from SCD-Rural and MCCD Annual Reports 1991-94 published by RGI

[2] Total deaths reported under SCD-Rural: 1991=22629, 1992=26118, 1993=29597, and 1994=36799.

[3] Total deaths under MCCD: 1991=384325, 1992=374839, 1993=362581, and 1994=374141.

Incidence of improbable age sex distribution by cause:

Figure -3.1: Age distribution of deaths attributed to selected causes by SCD-Rural and MCCD.



Based on our knowledge of pathophysiology and disease epidemiology, a certain age pattern of deaths due to a cause can be expected. For example, we know that deaths due to cancer generally increase with age. We use this fact to assess the quality of cause of death statistics. If the age pattern of deaths attributed to a cause is found to deviate sharply from the expected age pattern, we suspect the validity of the cause of death statistics. The best way to perceive major deviations in age pattern is to look at graphs indicating the age pattern of deaths attributed to a cause. We plotted such graphs for the top ten causes,

using data for five consecutive years (1991 to 1995). Apropos SCD-Rural, these causes included suicide, excessive heat, gastroenteritis, tuberculosis, bronchitis, pneumonia, paralysis, congestive heart disease, heart attack and jaundice. In case of MCCD, these causes included: ischaemic heart disease, tuberculosis, lower respiratory tract infection, low birth weight, cerebrovascular disease, diarrhoeal disease, road accidents, chronic obstructive pulmonary disease, fires and birth asphyxia / birth trauma. Twenty such graphs were plotted (10 for SCD-Rural and 10 for MCCD) where each graph had 10 plots at the rate of two plots (female and male) for each year. The plots were visually examined, for unusual age patterns if any. No instance of unusual age pattern was detected. Figure -3.1 shows a sample of six such graphs. Assignment of deaths to neoplasm are known to be affected by deficiency in cause of death reporting systems. Hence the age pattern of such deaths as reported by SCD-Rural in 1995 and MCCD in 1995, 1996 (the graphs are not shown here) was examined. It is expected that mortality due to cancers increases as age advances. The plot of data from SCD-Rural 1995 also reflected the expected trend. But the plots of data from MCCD showed a decline in cause specific death rate after 55 years which we inferred was most probably due to the under-diagnosis of cancers at older ages. On the whole, it was found that by and large age-sex pattern of deaths attributed to major causes, by the Indian cause of death reporting systems followed expected patterns. However, the existence of deviations in age pattern for a few causes cannot be ruled out. The overall performance of this aspect of the system is deemed satisfactory.

Consistency of cause-specific mortality in consecutive years:

Since cause structure of deaths normally change slowly, we expect cause of death pattern to be similar for consecutive years. Table -3.10 shows percentage of deaths at all ages attributed to major cause groups by the SCD Rural and MCCD systems. We have examined data for the period 1990-95 for rural areas and 1990-1994 for urban areas. Miscellaneous cause groups like senility are not taken into account since these have been examined earlier under a separate criterion. The last column indicates variance of the cause-specific mortality percentages in different years. Evidently, the cause-specific mortality percentages at major cause group level do not vary much over consecutive years. To see if this characteristic is retained at the detailed cause level, we examined data for top ten[4] detailed causes of death for the same

[5]Top ten causes examined for SCD-Rural: Heart attack, Paralysis, Tuberculosis, Bronchitis, Suicide, Pneumonia, Gastroenteritis, Congestive heart disease, Excessive heat and Jaundice. For MCCD: Ischaemic heart disease, Tuberculosis, Lower respiratory tract infection, Low birth weight, Cerebrovascular diseases, Diarrhoeal diseases, Road traffic accidents, Chronic obstructive pulmonary disease, Fires, and Birth asphyxia / Birth trauma.

period. Variance of the cause- specific mortality percentages was low and in the same range as at the cause group level. The consistency of cause group specific mortality proportions for consecutive years reaffirms utility of the statistics. Hence we rate performance of the system on this criteria as satisfactory.

Table -3.10: Percentage deaths in all ages attributed to major cause groups by SCD - Rural and MCCD schemes in different years.

	1990	1991	1992	1993	1994	1995	Variance
SCD-Rural							
Accidents	8.87	8.54	8.63	8.36	8.79	10.29	0.406
Maternal	1.04	1.11	1.03	1.30	1.05	0.93	0.012
Fevers	7.57	7.29	7.62	6.66	7.25	7.34	0.098
Digestive	6.48	6.39	6.16	6.79	6.23	6.23	0.046
Coughs	19.43	18.88	19.50	19.21	19.30	20.75	0.344
CNS	4.43	4.40	4.52	4.21	5.04	4.75	0.072
CVS	11.52	11.05	10.75	10.64	11.18	12.49	0.380
Infant deaths	10.14	10.26	10.62	11.08	9.66	9.84	0.226
MCCD - Urban Areas							
Infectious diseases	16.300	17.000	16.700	17.300	16.700		0.112
Cancers	3.400	3.700	3.600	3.600	3.600		0.009
Central Nervous System	3.300	3.500	3.700	3.700	3.400		0.025
Cardio Vascular System	20.400	21.100	21.300	21.600	21.900		0.258
Respiratory diseases	7.700	8.100	7.800	7.700	7.400		0.050
GIT	4.000	4.300	4.600	4.600	4.500		0.052
Perinatal	8.900	8.700	9.100	9.200	8.500		0.065
Endocrine	2.600	2.700	2.800	3.300	3.300		0.090
Injuries	14.100	11.200	11.000	11.200	11.700		1.330
Blood disorders	2.000	2.000	2.100	2.000	2.200		0.006

[1] Blank space = Not Available. Source: Compiled from SCD-Rural and MCCD Annual Reports for respective years published by RGI

Timely compilation and publication of cause of death statistics:

The timely availability of data to a great extent determines its usefulness. Timeliness has two dimensions, namely (a) time taken for publication of results, and (b) regularity in publication. Table -3.11 shows the time taken for collation and publication of cause of death reports in India. The SCD-Rural reports usually take about one to two years for publication. The MCCD reports tend to take about four to seven years. In the pre computerisation era, a gap of about a year could be justified. But the delay has extended upto seven years in some cases. Even in case of SCD-Rural, for which the tabulations workload is less, there has been a delay upto two years. It is also pertinent to note that four MCCD reports were published in a single year which reveals that publication of the reports are episodic. Irregularity in publication of reports indicates that some potential users may decide not to use cause of death statistics, if the regularity of their own output is to be maintained. For example certain health care program evaluations could benefit from regularly available cause of death statistics. Instead, most programs use input measures and assume the program would have had the intended effect of mortality or morbidity reduction. Some programmes may generate their own statistics and use them for their evaluation purposes, inadvertently increasing the possibility of bias in favour of programme effectiveness. Thus both MCCD and SCD-Rural statistics suffer from long delays and episodic publication of results leading one to conclude that the performance in this area has been poor .

Table -3.11: Time taken for publication of cause of death reports in India.

Data year	SCD-Rural		MCCD	
	Publication date	Gap (years)	Publication date	Gap (years)
1989	1990 Dec	1		
1990	1992 Jan	1	1998 Mar	7
1991	1992 Dec	1	1998 Mar	5.25
1992	1994	2	1998 Jul	5.6
1993	1995	2	1998 Nov	4.9
1994	1996 May	1.5	1999 Feb	4.1
1995	1997	2		

[1] Publication dates have been taken as shown in respective reports. Where no date is discernible, the date of printing, usually printed by the Government printing press has been used.

Can we improve the cause of death reporting system in India?

We have examined the cause of death reporting system in India, using the nine aforementioned criteria to assess the usability of the cause of death statistics generated thereof . In Table -3.12 we summarize the findings and give our own rating of the contemporary Indian cause of death reporting system. We have followed a three category rating consisting of satisfactory, tolerable and poor. The prime factors affecting usability of the cause of death statistics in India are (a) poor coverage, (b) tendency to assign deaths to residual and "unclassifiable" categories, (c) long delay and irregular publication of statistics, and (d) lack of systematic screening. We present herewith our subjective assessment of factors contributing to various aspects of poor performance, and then discuss possible measures that we think will improve the usability of cause of death statistics in India.

Poor coverage has two aspects, namely (a) a total lack of reporting from certain areas, and (b) under- reporting from other areas. These areas are sample villages in case of SCD-Rural and non-reporting municipalities in case of the MCCD. Total non-compliance is a result of lack of awareness. A visit to a few SCD-Rural training programmes in Andhra Pradesh during the year 1998 revealed that some PHC medical officers were totally unaware of the cause of death reporting system that was supposed to operate in their area. Total apathy reigns supreme at all levels, regardless of whether the areas concerned are urban or rural. Most health care institutions, clinical teams, medical attendants and municipal offices are manifestly guilty of either ignorance or complacency, thus contributing to very poor coverage by cause of death reporting systems. Much of this apathy and managerial inattention could be attributed perhaps to the fact that the data is being analysed at the national level. There is neither any mechanism or any effort to analyse cause of death data at the state level and use the results for state level health policy analysis. Consequently, field agents and medical practitioners neither have any means of direct feedback about the nature of utilisation of data collected by them nor do they perceive any stake in the latter. This contributes to a gradual deterioration in the accuracy of cause of death statistics.

Table -3.12: Overall assessment of performance of cause of death reporting system in India

Criteria	Brief Review of Performance	Rating
Design of Reporting System	SCD-Rural based on verbal autopsy till Dec. 1998. SRS-COD component, thereafter. MCCD based on WHO-ICD basic tabulation lists.	Satisfactory [1]
Coverage and Compliance	In rural areas, coverage is about 60-75% of designed sample. In urban areas, cause of death reports are filed only for 20-25% deaths. Under - counting is uniform across age groups, except for children in 0-4 years.	Poor
Validity at Sub-National levels	Only 5 out of 15 major states generate cause of death statistics with reasonable coverage.	Poor
Unclassifiable deaths	SCD-Rural: 20% or more. MCCD: 15%	Poor
Consistency of cause-specific mortality proportion with general mortality level	In about 30 to 40% of age, sex and cause group, mortality reported by Indian cause of death systems deviated by more than 3 standard deviations from the general mortality-based model predictions for the corresponding groups.	Tolerable[2]
Incorrect assignment of causes with clear age-sex dependency	A few such cases are reported both by SCD-Rural and MCCD. Suggests no systematic screening of cause of death reports at any level.	Tolerable
Incidence of improbable age sex distribution by cause	No such evidence for top ten causes of death. However, deviations for other causes cannot be ruled out.	Satisfactory
Consistency of cause - specific mortality proportion over time	Examined for major cause groups and top ten detailed causes as well. Cause-specific mortality proportions are consistent over consecutive years.	Satisfactory
Timeliness of reports.	One to seven -year gap between the year to which data relates and the year of publication.	Poor

[1] Our rating is based on SCD-Rural system. The design of the SRS-COD component needs further study.

[2] We have avoided to give a poor rating to allow for possible inaccuracy of the model based predictions.

A review of the state of cause of death reporting systems and revamping of the same is needed. It is imperative for each state to build an infrastructure for local analysis of causes of death. Sponsored research to analyse cause of death statistics and the implications for health policy, will, it is hoped, generate the requisite enthusiasm for usable statistics. In addition, state departments of health and municipal administration need to pay some managerial attention and periodically review the performance of cause of death reporting systems. We feel that if the initiative is taken up by the health and municipal administration departments, consecutively for a period of, say, five years, the coverage of the MCCD scheme would improve substantially. It is our conjecture that once coverage is increased substantially to about 80% of estimated deaths, it is likely to sustain itself without the need for much managerial and supervisory resources. A drive is in order, so that there is widespread awareness of the links between filing of individual cause of death reports and the utility of cause of death statistics in planning and policy analysis. The RBD Act provides for a fine of upto Rs. 50 for the absence of, or incorrect of filling of cause of death reports. Our experience in Andhra Pradesh proves that this provision has not been used at all. The fine prescribed by the RBD Act is more of a token amount than a real financial burden on health care providers. We feel that this fact can be suitably exploited to increase awareness among health care providers about filing cause of death report so that the fine is an effective reminder to defaulting health care providers, enabling them to comply with the legal requirement of filing a cause of death report.

The high incidence of unclassifiable deaths can be attributed to report-writing skills. Chiefs of clinical units do not appropriately emphasize the importance of writing up the cause of death report. Short term training programmes[5] that help build cause of death report writing skills are necessary to remedy this lacuna. Non maintenance or poor maintenance of medical records also contribute to inaccurate assignment of cause of death. Faced with a situation of inadequate information from medical records, the physician writing the cause of death report tends to the assign the death to unclassifiable category or to some miscellaneous codes. Hence the RBD Act needs further amendments requiring health care providers to maintain appropriate medical records in order to facilitate accurate classification of cause of death.

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[5]The Institute of Health Systems (IHS) has developed a training package consisting of one day workshop on cause of death report writing. The workshops give an overview of cause of death reporting and classification systems and then requires participants to write cause of death reports from sample medical records obtained from hospitals. Participants then work with a sample of poorly written cause of death reports to identify the deficiencies.

Delay in compilation and publication of cause of death statistics can be further reduced by computerising the operations. At present a lot of the tabulation work is done manually. Some amount of computerisation has already been implemented in the office of the RGI, which in turn has also been subcontracting data entry to private computer service providers. Computerisation needs to be enforced at the state level, so that state level statistics can be published locally and utilised to inform state health policies. The tabulation and publication of state level statistics should be decentralised to State Vital Statistics offices. If the operations are computerised[6] at the state and municipal level, this decentralisation can be achieved without any significant addition to current staff. Suffice to say that computerisation of cause of death report filling and collation is essential.

The current state of affairs about reporting of causes of death in rural area is enough cause for concern. The SCD-Rural scheme analysed hitherto has been discontinued. Instead, certain cause of death questions have been added to the SRS data collection formats. It is too early to comment on the performance of the new system. It is clear that although the new guidelines prescribe use of the verbal autopsy guidelines developed for the SCD-Rural system, the cause of death data columns in the SRS forms do not allow for recording of symptoms and signs leading to death. These pointers to information in the cause of death reports allow for meaningful and systematic screening, review and coding of cause of death.

A study to estimate causes of death in rural areas of AP (APRCD study, 1998):

Materials and methods:

First a pilot study was undertaken in 1994 using data for two most recent years (1992 and 1993)[7]. 4741 deaths were recorded by the SCD system during the two years. Copies of death certificates (Form-7) recorded by SCD-Rural field agents or recorders were obtained from the state directorate of health.

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[5]IHS, Hyderabad, has developed a software called the PRISM (Processing and Research Information System for Mortality data). The software is designed to work in municipal offices as well as state vital statistics offices. This software allows for transmission of cause of death reports and statistics from municipal offices to state headquarters and processing of data to generate cause of death statistics according to the formats being used by the RGI.

[7]The pilot study was a part of the AP Burden of Disease (APBD) study was initiated by the author at the Administrative Staff College of India (ASCI). Dr. G.N.V Ramana is the collaborator for the pilot study. The APBD study is now continued at the Institute of Health Systems (IHS).

Only 300 such certificates could be readily obtained. In addition, details of 139 deaths coded as senility were obtained. The pilot study proceeded as follows.

1. The symptoms and circumstances of each unclassified death recorded in the certificate was reviewed by a physician. The summary of his findings was reviewed by a second physician. For any remaining ambiguity about interpretation of available information the opinion of specialists from medical colleges conversant with the age, sex and symptom profile of the case was sought and obtained. 134 deaths could be reclassified as a result of this review.

2. For the remaining 166 deaths, additional information from the field was required. These were subject to reinvestigation by a team consisting of a medical doctor and the local field agent or recorder. Their findings were reviewed by an expert committee consisting of a medicine specialist (internist), paediatrician and public health specialist. In some cases the information obtained from the reinvestigation opened up possibility for reclassification but needed additional information to complete the process. 60 such cases were subjected to a third investigation (consider the original investigation by SCD field agent as the first and the reinvestigation as the second). As a result, it was possible to reclassify all of the 300 deaths.

3. A separate survey of 139 deaths classified under 'senility' during 1994 was carried out by trained and experienced investigators to obtain more detailed description on events that led to death and symptoms at the time of death. 136 out of the 139 deaths originally coded under senility could thus be reassigned to more specific causes.

The results of the pilot study yielded important information about the SCD-Rural system. There was a lack of clarity about the forwarding and storage of SCD records. This might have been the reason why more of detailed reports (Form-7) could not be readily retrieved. It was learnt that copies of latter were available with respective primary health centres. The encouraging lesson from this pilot study was that it appeared feasible to improve the proportion of classified deaths under SCD if an appropriate system of review and reinvestigation could be implemented . The quality of interviewing skills available in the field would appeared to support a slightly more expanded non- medical list.

Armed with the lessons learnt from the pilot study, we planned for a more comprehensive study to estimate causes of death in rural areas of Andhra

Pradesh[8]. We obtained cause of death reports received by the Vital Statistics Division under the SCD-Rural scheme for a nine month period[9] from April to December 1998. The cause of death reports and accompanying symptom records were reviewed by a physician. Each reviewer was given initial training in classification of causes of death including ICD-9, ICD-10 and the Registrar General's non medical list (NML). The reviewer's task was to assess, for each report:

1. Whether information contained in the cause of death report and symptom record was adequate to classify the death into one of the causes in the NML.
2. If information was adequate, whether the classification proposed in the cause of death report was appropriate. Appropriateness was judged on the basis of ICD coding rules. If appropriate, the original classification was maintained. Otherwise a revised cause of death was assigned.
3. Whether the information allowed the assigning of a more specific cause of death code than what was envisaged in the NML. For example, most deaths due to cancer could be assigned to specific sites. But the NML had provided only for a single category of cancers.
4. In cases where the information was considered inadequate, specific remarks about the nature of information required had to be appended. For example, age-sex missing information, queries on the underlying cause of death, etc.

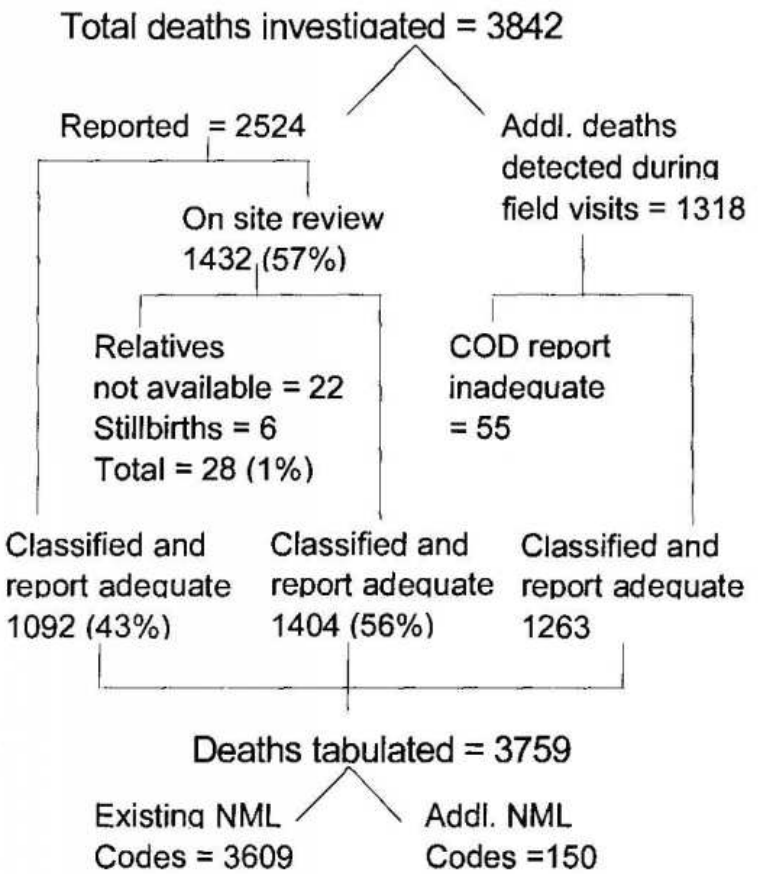
All deaths for which information was inadequate for assignment of a cause or tabulation of cause due to non-availability of age -sex information, were marked for field enquiry and onsite review. These deaths were sent to collaborating centres at regional medical colleges for field enquiry where the faculty from community medicine departments were provided with literature on classification of causes of death and requested to visit the concerned village along with the local primary health functionary in charge of the cause of death reports. An epidemiologist from the IHS visited the collaborating centres to clarify doubts. For some areas where a regional collaborator was not forthcoming, an epidemiologist from the IHS travelled to the villages, and reinterviewed the relatives to fill in gaps in the cause of death report. This process is called an "on site review". During field visits for on-site review additional deaths were detected. These deaths had taken place during the reference period of our

[8]Dr. GNV Ramana had by this time moved to other assignments. Dr. PV Chalapati Rao has been my collaborator from this point onwards.

[9]We had plans to collect data for one full year. Unfortunately the SCD-Rural scheme was discontinued by the Registrar General during the course of this study.

study but had not been reported through the SCD-Rural system. Our reviewers in the field collected complete information for these cases to facilitate classification of cause of death. Figure 3.2 shows a flowchart of deaths investigated from different sources.

Figure 3.2: Flow chart of deaths investigated in rural areas of AP, 1998.



Altogether, 3842 deaths were investigated. 2524 of these (66%) came from the SCD-Rural reports and the balance were detected by our field work in the SCD-Rrural areas. Thus the extent of under-recording of deaths by the SCD-Rural system was quite high (34%). Out of the 2524 SCD-Rural reports, 1092 (43%) had adequate information for categorisation of cause of death. The balance 1432 (57%) were sent for on site review. Six "infant death" reports were found to have been stillbirths. For another 22 cases, the on-site reviewers could not locate any relatives to enquire about circumstances of the death. Most of these were from major groups such as "cardiovascular causes" (10 cases) and "other clear symptoms" (6 cases). These 28 cases (1% of SCD-Rural reported cases) of stillbirths, and relatives not traced were dropped from

further analysis. Adequate information could be collected, for the rest 99% cases, through the on-site reviews to classify the cause of death. Another 1318 deaths were detected by on-site reviewers during the course of their field visits to the same SCD-Rural areas. Only 55 of these did not have adequate information for assignment of cause of death (as determined by scrutiny by the IHS team). The remaining 1263 cases had adequate information for classification into appropriate causes of death.

Data analysis and results from the APRCD study, 1998:

Table-3.13 shows age and sex-specific count of population from the surveyed villages and the total deaths recorded by this study under respective age sex groups. Annual age-specific death rates computed separately for females and males are shown under the respective "Study ASDR" columns. An independent estimate[10] of ASDR obtained from the Sample Registration Scheme, is shown in the columns titled "General ASDR".

Table-3.13: Comparison of age-specific death rates from the rural cause of death study (study ASDR) with an independent estimate of ASDR (General ASDR)

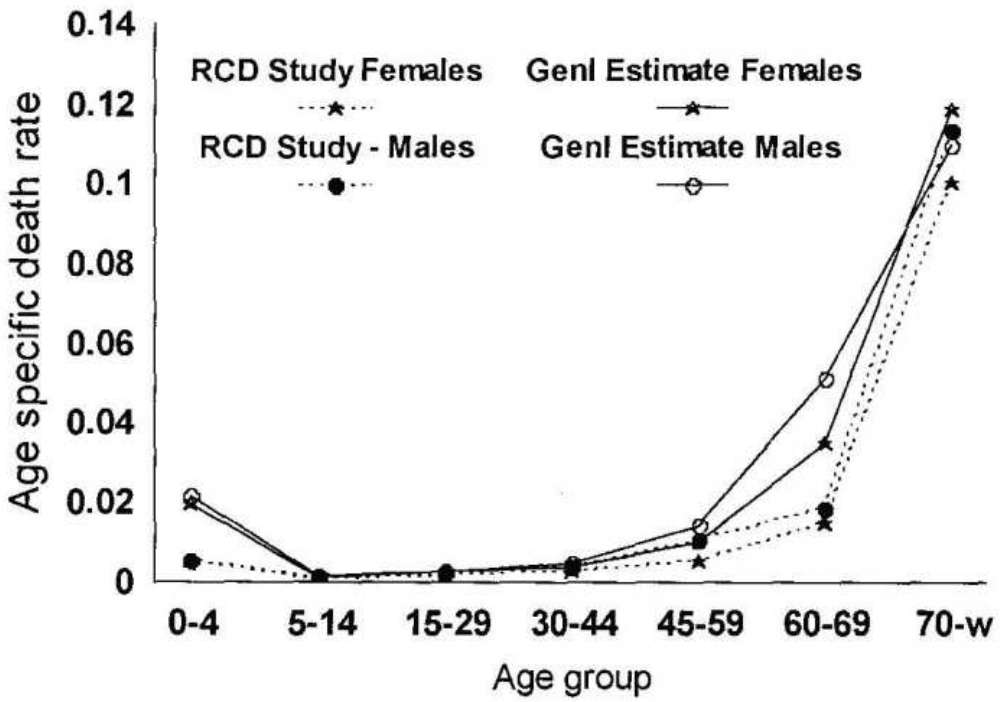
Age group	Females				Males			
	Pop	Deaths	Study ASDR	General ASDR	Pop	Deaths	Study ASDR	General ASDR
0-4	35311	145	0.00547	0.01983	37549	152	0.00539	0.02192
5-14	72022	50	0.00092	0.00138	73304	64	0.00116	0.00157
15-29	97445	152	0.00207	0.00312	98663	165	0.00222	0.00296
30-44	75011	151	0.00268	0.00390	78730	230	0.00389	0.00484
45-59	49884	197	0.00526	0.01037	51920	416	0.01068	0.01461
60-69	23527	263	0.01490	0.03462	23336	323	0.01845	0.05118
70-w	9030	678	0.10011	0.11842	9128	773	0.11291	0.10955
0-w	362230	1636	0.00600	0.01078	372630	2123	0.00759	0.01208

[1]Number of recorded deaths are for a period of nine months. These are inflated proportionately to a 12- month period to calculate the study ASDR, for comparability with general ASDR numbers.

[10]Data sources and method of correction for under-registration by the Sample Registration Scheme were described in Chapter - 2 on General Demographic Estimates.

The two estimates of ASDR follow the same age pattern for both females and males (Figure - 3.3). However, only about 60% deaths appear to have been recorded by us. Under- recording was a little more for female deaths (45%) compared to males (38%). Recording of deaths is relatively better for age groups 5 - 44 and also for the very old (age group 70+). Problem of under-recording is most pronounced at age group 0- 4 years (about 70%) and 60-69 years (about 60%).

Figure-3.3: Completeness of recorded deaths: age-specific death rates from the APRCD study, 1998 and general estimate of age specific death rates.



Discounting the small number of cases found to have been stillbirths (6), and those where relatives were not available (22), there were altogether 2495 cause of death reports from the SCD-Rural system for which cause of death could be finally tabulated. We detected another 1263 deaths making it a total of 3759 tabulated. It would be interesting to look at the change in cause-specific mortality proportions (CSMP) estimated from the original SCD-Rural data and the final results after the reviews and field enquiry for an idea about the usability of cause- specific mortality proportions derived from SCD-Rural data. If both under reporting and misclassification by SCD-Rural are non-differential, then the CSMP would not alter. If, however, there are biases in

reporting and classification, then the CSMP would change. Percentage change in CSMP is measured with respect to the original estimate. Thus:

$$\% \text{ Change in CSMP} = \frac{\text{CSMP Final} - \text{CSMP Original}}{\text{CSMP Original}} \times 100$$

Change in CSMP would be positive if SCD-Rural under estimates deaths attributable to the concerned cause. A negative change in CSMP would mean that the SCD-Rural over estimated deaths attributable to the concerned cause. Table 3.14 shows the overall movement of these cases between major NML cause groups and changes in CSMP at the major cause group level.

Table -3.14: Review of SCD-Rural Cause of Death Reports. Movement of deaths to and from other major cause groups.

NML Cause	Original	Out flow	In flow	Addl. in.Flow	Final	CSMP Original	CSMP Finalin	Change CSMP
Under estimates by SCD Rural:								
Digestive disorders	145	34	63	111	285	0.058	0.076	30.46
CNS Disorders	247	25	59	119	400	0.099	0.106	7.49
Coughs	435	64	64	252	687	0.174	0.183	4.83
Other clear symptoms	316	44	52	167	491	0.127	0.131	3.13
Fevers	66	30	12	54	102	0.026	0.027	2.58
Accidents and Injuries	366	30	52	174	562	0.147	0.150	1.92
Over estimates by SCD Rural:								
Senility	362	89	21	149	443	0.145	0.118	-18.77
Infant deaths	128	10	14	33	165	0.051	0.044	-14.44
Maternal causes of death	21	8	7	9	29	0.008	0.008	-8.34
Cardiovascular diseases	409	65	55	196	595	0.164	0.158	-3.44

A reduction in the proportion of deaths assigned to senility was expected since a specific objective of this study was to improve classification of deaths assigned to senility and miscellaneous causes. Changes in other cause group specific mortality proportions were not very high at the group level, except for cause groups (a) digestive disorders, and (b) infant deaths. The reduction in proportion of "infant deaths", after taking into account the results of on-site review and field enquiries, can be attributed to two factors. Firstly, (a) the proportion of infant deaths additionally detected during field enquiry equalled almost half (2.6%) of the proportion of such deaths detected by the SCD-Rural system in the first instance (5.6%). Secondly, some deaths at higher ages had been erroneously assigned by the SCD-Rural to this cause group.

If we look at the movement of deaths and detection of additional deaths at a detailed cause level, we come across instances of clear bias in cause-specific mortality proportions reported by the SCD-Rural scheme. Table-3.15 reflects instances of biased reporting by the SCD-Rural system. Deaths due to burns, suicides, rabies, natural calamities, road accidents and abortion are being under reported. On the other hand SCD-Rural has perhaps overestimated deaths attributed to bleeding of pregnancy and puerperium, excessive cold, drowning, snakebite, toxaemia of pregnancy and anaemia. (See Appendix 3.2 for details of movement of deaths and detection of additional deaths by cause for all causes in the non medical list.)

Table-3.15 : Biased reporting by the SCD-Rural for some top causes of death

NML Cause	Original	Out flow	In flow	Addl. In.Flow	Final	CSMP Original	CSMP Final	% Change in CSMP
Under estimates by SCD Rural:								
Burns	32	3	56	63	148	0.013	0.039	206.98
Suicide	64	11	6	76	135	0.026	0.036	40.01
Rabies	123	13	42	89	241	0.049	0.064	30.05
Natural calamity	42	3	14	28	81	0.017	0.022	28.01
Vehicular accident	100	1	19	62	180	0.040	0.048	19.47
Abortion	37	4	11	19	63	0.015	0.017	13.02
Over estimates by SCD Rural:								
Bleeding of preg & puerpm.	52	26	6	20	52	0.021	0.014	-33.63
Excessive cold	75	13	8	15	85	0.030	0.023	-24.78
Drowning	192	55	32	49	218	0.077	0.058	-24.64
Snake bite	362	89	21	149	443	0.145	0.118	-18.77
Toxaemia	46	10	11	11	58	0.018	0.015	-16.31
Anaemia	41	13	6	18	52	0.016	0.014	-15.82

Finally a total of 3759 deaths including the SCD-Rural reports and additional deaths detected by us in the field, are available for tabulation of causes of death. We first tabulated according to the non medical list. The non medical list used by us is an expanded version of the Registrar General's NML. It includes, in addition, some site specific causes of death due to cancer, some accidents and injuries which may be of local public health importance for example, deaths due to electric shock. Appendix 3.3 gives our final tabulation of deaths according to the non medical list. In Table -3.16 we show the ten leading causes of death

in the non medical list, excluding non specific cause groups like senility. Ischaemic heart disease, cerebrovascular accidents, tuberculosis, suicide, bronchitis and excessive heat are among the ten leading causes of death for both females and males.

Table-3.16: Top ten non medical list causes of death in rural areas of Andhra Pradesh

All		Females		Males	
Cause	%	Cause	%	Cause	%
Heart attack	11.86	Heart attack	9.11	Heart attack	13.99
Paralysis or cerebral apoplexy	8.78	Paralysis or cerebral apoplexy	8.62	Paralysis or cerebral apoplexy	8.9
Tuberculosis of lungs	6.38	Gastroenteritis	4.95	Tuberculosis of lungs	7.72
Bronchitis	5.72	Suicide	4.77	Bronchitis	6.5
Suicide	4.79	Bronchitis	4.71	Suicide	4.8
Gastroenteritis	3.96	Tuberculosis of lungs	4.65	Asthma or allergic disorders of resp. syst.	4.1
Asthma or allergic disorders of resp. syst.	3.59	Asthma or allergic . disorders of resp. syst	2.93	Gastroenteritis	3.2
Jaundice	2.66	Congestive & other heart diseases	2.69	Jaundice	2.73
Cong.&other heart dis.	2.47	Excessive heat	2.69	Vehicular accident	2.36
Excessive heat	2.23	Jaundice	2.57	Congestive & other heart diseases	2.31
Residual cause with % deaths higher than last cause included above:					
Senility	11.76	Senility	15.59	Senility	8.81

Deaths tabulated according to the non- medical list was mapped to the burden of disease cause list (BDL) in a two-step process. Some causes in the non medical list map directly to a single cause in the BDL (Appendix 3.4). These were assigned to the respective BDL cause in the first step. The remaining NML causes map to more than one BDL. These deaths were mapped to the BDL using separate algorithms for each NML cause (Appendix 3.5). The algorithms comprise our judgment which is based on insights gained during the pilot study and the review process in this study. Some of these are adhoc. We hope that such algorithms for mapping of non medical list of causes of death will improve as more such studies are undertaken to understand verbal autopsy based classification of causes of death. BDL cause-specific mortality proportions by seven age groups were computed based on mapping of deaths from the

NML. Deaths by cause were estimated (Appendix 3.7) from the cause-specific mortality proportions described above and age-sex-specific estimates of death in rural areas. Table-3.17 shows the top ten causes of death according to the BDL causes. Ischaemic heart disease, cerebrovascular disease, tuberculosis, COPD, diarrhoeal disease, self-inflicted injury (suicide) are among the ten leading causes of death.

Table-3.17 : Top ten causes of death in rural areas of Andhra Pradesh

All		Females		Males	
Cause	%	Cause	%	Cause	%
Ischaemic heart disease	16.01	Ischaemic heart disease	14.46	Ischaemic heart disease	17.21
Cerebrovascular disease	11.01	Cerebrovascular disease	11.66	Cerebrovascular disease	10.51
Tuberculosis	6.84	Diarrhoeal diseases	7.02	Tuberculosis	8.25
Chronic Obstructive Pulmonary Disease	5.97	Tuberculosis	5.01	Chronic Obstructive Pulmonary Disease	6.76
Diarrhoeal diseases	5.79	Chronic Obstructive Pulmonary Disease	4.94	Diarrhoeal diseases	4.84
Self-inflicted injury	4.79	Self-inflicted injury	4.77	Self-inflicted injury	4.81
Asthma	3.65	Stomach cancer	4.38	Asthma	4.19
Stomach cancer	3.64	Dementia and other degenerative neuorlogical disorders	3.58	Lower Respiratory Infections	3.32
Lower Respiratory Infections	3.33	Lower Respiratory Infections	3.35	Stomach cancer	3.07
Residual cause with % deaths higher than last cause included above:					
Other unintentional injuries	4.95	Other unintentional injuries	4.91	Other unintentional injuries	4.98

Causes of deaths in Urban Areas:

To estimate disease burden in Andhra Pradesh, I have used the urban cause of death pattern in the neighbouring state of Maharashtra has been used , where about 58 to 76% of urban deaths appear to have been medically certified (Table -3.4). It would have been ideal to directly study the cause of death pattern

in Andhra Pradesh. Plans are underway to take up such a study[11]. Meanwhile, using data from the neighbouring state of Maharashtra as an approximation of the cause of death pattern in urban Andhra Pradesh appears to be the most prudent thing to do. The time period of the Maharashtra data (1986 - 90) corresponds quite closely to the reference period of the disease burden estimate, which is 1990-91.

Table-3.18: Top ten causes of death in urban areas of Maharashtra and probably in AP

All		Females		Males	
Cause	%	Cause	%	Cause	%
Ischaemic heart disease	10.09	Lower respiratory infections	9.3	Ischaemic heart disease	11.76
Tuberculosis	8.59	Ischaemic heart disease	7.68	Tuberculosis	10.23
Lower respiratory infections	7.92	Low birth weight	7.62	Lower respiratory infections	6.95
Low birth weight	5.97	Tuberculosis	6.24	Cerebrovascular disease	5.18
Cerebrovascular disease	4.62	Diarrhoeal diseases	5.71	Low birth weight	4.82
Diarrhoeal diseases	4.32	Fires	5.64	Road accidents	4.4
Road traffic accidents disease	3.49	Cerebrovascular Pulmonary Disease	3.81	Chronic Obstructive	3.49
Chronic obstructive pulmonary disease	3.38	Chronic obstructive pulmonary disease	3.23	Diarrhoeal diseases	3.35
Fires	3.13	Birth asphyxia and birth trauma	3.2	Other infectious diseases	3.17
Birth asphyxia and birth trauma	2.55	Perinatal conditions	2.9	Cirrhosis of the liver	2.53
		Iron-deficiency anaemia			
Residual cause with % deaths higher than last cause included above:					
Other cardiac diseases	9.04	Other cardiac diseases	8.7	Other cardiac diseases	9.27
Other infectious diseases	3.45	Other infectious diseases	3.85	Other digestive diseases	3.62
Other digestive diseases	3.05			Other neuropsychiatric disorders	2.3

[11] I am making efforts to secure funding for study to improve coverage and usability of cause of death statistics for urban areas in Andhra Pradesh. In the mean while, I have established contacts with the municipal administration department, individual municipalities and the State's Vital Statistics Division.

Maharashtra MCCD data for the years 1986 to 1990 was aggregated over the years within respective cause, age and sex groups. Cause-specific proportionate mortality rates were calculated for seven age groups separately for both sexes. For two years (1986 and 1988) external cause code (E Code) data of deaths due accidents and injuries was not available. However, Normal code (N code) data was available. For the other three years, the accident and injury death data was available under both N and E codes. A mapping from N code to E code was derived from these three years. The N code injury deaths for the two years 1986 and 1988 were mapped to the E codes using the proportionate distribution of N code deaths to E codes obtained from the three years for which double coding was available. E codes were then mapped to the BDL group 3 accidents and injury codes. The medically certified cause of death statistics is available according to the ICD9 basic tabulation list. Mapping to the BDL was done using algorithm from Murray and Lopez (1996, pp. 120-123). These cause-specific mortality proportions are applied to the estimated deaths for urban AP in each age and sex group to arrive at the estimates of cause-specific deaths in urban AP (Appendix 3.8). Table 3.18 shows the ten leading causes of death in urban area of Maharashtra and probably in Andhra Pradesh. Ischaemic heart disease, tuberculosis, lower respiratory infection, low birth weight, diarrhoeal disease, and burns (fires) are among the top causes of death. Deaths due to road accidents appear in the top ten causes of death in urban areas.

Summary and conclusion:

Valid and reliable statistics on cause of death is an essential input for the 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 the writing and filing 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 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 the utility 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 the 1990s using nine criteria for utility. 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 proportions 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 the 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. We recommend, based on our subjective understanding of the problems, certain measures required to improve the utility of cause of death statistics in India. We propose that a drive be launched by the 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 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 improve coverage substantially. Other measures recommended by us include: (a) training programmes to hone 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, both 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.) making the maintenance of records mandatory in hospitals and health care institutions. We are unable to make any definite recommendations specifically for the rural areas, since system has been revamped recently. We wish to point out that the cause of death columns added to the SRS data collection forms do not provide for recording of symptoms necessary for the systematic screening and coding of cause of death reports. However, it is too early to sit in judgment on the new system. Research is recommended in order to evaluate the performance of the new cause of death reporting system in rural areas.

Table-3.19: Leading causes of death - all age groups in Andhra Pradesh, 1991

All		Females		Males	
Cause	%	Cause	%	Cause	%
Ischemic heart disease	13.21	Ischemic heart disease	12.2	Ischaemic heart disease	14.08
Cerebrovascular disease	8.11	Cerebrovascular disease	8.33	Cerebrovascular disease	7.92
Lower respiratory infections	7.02	Diarrhoeal diseases	7.49	Tuberculosis	7.76
Diarrhoeal diseases	6.61	Lower respiratory infections	7.15	Lower respiratory infections	6.91
Tuberculosis	6.32	Low birth weight	5	Diarrhoeal diseases	5.86
Low birth weight	4.96	Tuberculosis	4.67	Chronic obstructive Pulmonary Disease	5.34
Chronic obstructive pulmonary disease	4.76	Chronic obstructive pulmonary disease	4.08	Low birth weight	4.93
Self-inflicted injury	3.54	Self-inflicted injury	3.76	Self-inflicted injury	3.34
Asthma	2.55	Stomach cancer	2.71	Asthma	3.14
Stomach cancer	2.28	Dementia and other degenerative CNS dis.	2.09	Road accidents	2.59
				Cirrhosis of the liver	2.19
Residual cause with % deaths higher than last cause included above:					
Other unintentional injuries	3.94	Other unintentional injuries	4.09	Other unintentional injuries	3.81
Other cardiac diseases	2.32	Other cardiac diseases	2.58		

To estimate the cause of death structure in rural areas, we implemented the Andhra Pradesh Rural Cause of Death (APRCD) study, 1998. All SCD-Rural death reports received by the state's Vital Statistics Division for a nine-month period, 1998 April to December, were systematically reviewed by a physician. SCD-Rural system uses verbal autopsy to determine cause of death in sample areas. Reports considered to have adequate information for assignment of cause of death from the non- medical list were coded by the physician. In some cases, this code was identical to code originally given by the SCD-Rural system and for some others there was a change in coding. Reports without adequate information for assignment of cause of death were dispatched for field enquiry and on-site review by a physician. A final cause of death code was assigned based on the on-site review. Additional deaths were

detected by the visiting physicians from the same sample villages and pertaining to the study period. These deaths were investigated using verbal autopsy and a cause of death was assigned after systematic screening by another physician reviewer. Altogether 3842 deaths from the rural areas of Andhra Pradesh were investigated. For urban areas, MCCD data from the neighbouring state of Maharashtra for the years 1986-90 was used as an approximation. Deaths by cause in the rural and urban areas respectively were added up to arrive at the estimate of causes of death in Andhra Pradesh (Appendix 3.6).

Figure -3.4.: Age pattern of cause-specific mortality proportions of ten leading causes of death in Andhra Pradesh.

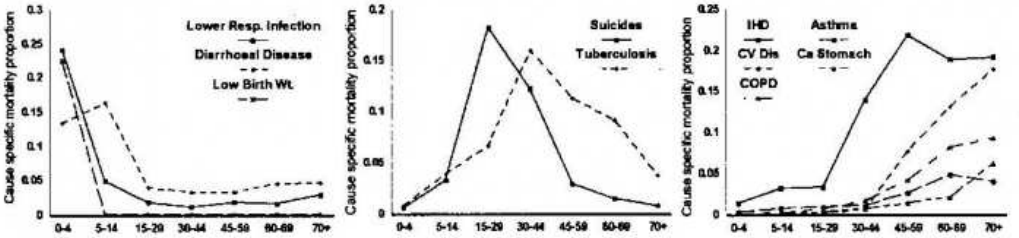


Table-3.19 shows the ten leading causes of death in Andhra Pradesh. Figure-3.3 indicates the cause-specific mortality proportions for the same ten causes but within different age groups. Lower respiratory infection (LRI), diarrhoeal diseases and low birth weight predominantly affect infants and children. Poor nutrition, unsafe water, poor sanitation, and personal hygiene as well as access to appropriate treatment are responsible for the three main causes of death among children. In young adults, suicides and tuberculosis are the top causes of death. High incidence of suicides is a pointer to educational, social and cultural factors. Tuberculosis continues to be an important public health problem despite decade-long programmes to control the incidence of this disease. Ischaemic heart disease shows up as an important cause of death among older adults and further increases as age advances. Other important causes of death for older adults are cerebrovascular disease, chronic obstructive pulmonary diseases, asthma and Stomach cancer. Ischaemic heart diseases, and cerebrovascular diseases call for changes in lifestyle. Chronic obstructive pulmonary diseases point to the need for control of indoor and outdoor air pollution and smoking. Stomach cancer could be, to some extent, dealt with by early diagnosis and treatment. In a nutshell, the mortality profile of Andhra Pradesh clearly reflects the persisting problems arising from poor nutrition, water supply and hygiene as also socio- cultural problems and the emergence of non communicable and degenerative diseases.

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