

**STUDY ON CAUSES OF DEATH BY VERBAL AUTOPSY  
IN  
TAMILNADU STATE**

*(An ICMR Task Force Multi centre Study)*



**Report (2002-2005)**

**National Institute Of Epidemiology  
(Indian Council Of Medical Research)**

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## Executive Summary

Most estimates about deaths from various illnesses in India today are extrapolations from various small studies. This might not truly represent the real situations. Reliable information on deaths in the country by the cause of death is essential for proper health planning. Ministry of Health & Family Welfare, Government of India requested ICMR to undertake a study on cause of death in five regions of the country in phases. ICMR assigned the task of conducting the study in southern region to National Institute of Epidemiology, Chennai. Information on causes of death for a total of 3833 deaths that occurred over a period of one year (2001 – 2002) in four districts in Tamilnadu namely Kanchipuram & Tiruvallur, Tiruchirapalli, Salem and Virudhunagar districts was collected by verbal autopsy. Numbers of deaths covered in rural areas were 2845(74.2 %), and the remaining 988(25.8%) were covered in urban areas in a representative sample population of 350273 in 77 villages in rural areas and 172552 in 43 wards in urban areas. It was one of the largest verbal autopsy study conducted to ascertain all causes of deaths in all age groups in Tamilnadu state. An ICD-10 three digits code was adopted for assigning the cause of death.

Myocardial Infarction (12.3%), external causes like Injuries / poisoning / burns / falls / drowning (10.6%), stroke (9.2%), senility (8.5%), pulmonary tuberculosis (6.9%), renal failure (5.1%), diarrhoeal diseases (4.8%), suicide (3.9%), prematurity NEC (2.4%) and Asthma (2.2%) were the top ten causes that accounted for 66.0% of 3833 deaths in the study area.

A total of 29 maternal deaths were reported in the study period. Among top ten causes of maternal mortality, Post – partum haemorrhage was the leading cause of maternal death, while obstructed labour and eclampsia were ranked second and third respectively.

Among 98 stillbirths, prematurity (36.7%) was the leading cause, followed by Ante - partum haemorrhage (14.3%). Macerated stillbirths were 9.2%, anaemia and Obstructed Labor contributed as fourth and fifth important cause of stillbirths.

Out of 249 infant deaths reported, Prematurity (22.5%) ranked as first, Asphyxia at birth (18.1%) ranked second, low birth weight (10.4%) ranked third and Acute Lower Respiratory tract Infections (8.0%) ranked fourth and Diarrhoea / Dysentery (7.6%) as fifth, causes of infant death.

Major causes of death in children 1 – 4 years age group, were Diarrhoea / Dysentery (21.9%), injuries etc (18.8%) and Meningo – Encephalitis (17.2%) out of the 64 child deaths reported.

In the age group 5 – 14 years, 65 deaths were reported. External causes such as injuries (36.9%) ranked as first, infectious and parasitic diseases (16.9%) and diseases related to nervous system (16.9%) ranked as second and neoplasms (12.3%) ranked as third important causes of death.

A total of 690(18.0%) adult deaths were reported due to communicable diseases. It was observed 541(19.0%) and 149(15.1%) deaths due to communicable diseases occurred in rural and urban areas respectively. It was found almost similar proportion of deaths (18.3% and 17.6%) due to communicable diseases occurred in males and females.

Pulmonary Tuberculosis accounted for 266(38.6%) and ranked as topmost cause of communicable diseases. It was observed that 50.4% of deaths were due to pulmonary tuberculosis in males. Age distribution of deaths due to pulmonary tuberculosis showed higher proportion of deaths in 25 – 44 years age group.

Diarrhoea / Dysentery 185(26.8%) contributed as second leading cause of death due to communicable diseases. High proportion of deaths 117(40.2%) was due to Diarrhoea / Dysentery in females.

AIDS accounted for 47(6.8%) and ranked as third leading cause of death due to communicable diseases.

A total of 3143(82.0%) deaths reported due to noncommunicable diseases, out of 3833 total deaths. It was observed 2304(81.0%) and 839(84.9%) deaths due to noncommunicable diseases occurred in rural and urban areas respectively. It was found almost similar proportion of deaths (81.7% and 82.4%) due to noncommunicable diseases occurred in males and females.

A total of 472(15.0%) deaths were reported due to Myocardial Infarction and ranked as first among noncommunicable diseases and more deaths(18.0%) were in males. There were more deaths due to Myocardial Infarction in 44 – 59 age group.

External causes like injuries / poisoning / burns / falls / drowning accounted for 408(13.0%), of noncommunicable diseases and ranked as second and was higher in males. There were more deaths due to external causes 109(23.6%) particularly in 15 – 24 years age group. Further, 12.9% deaths were due to falls in 70+ age group.

In all 352(11.2%) deaths accounted for deaths due to stroke among noncommunicable diseases and ranked as third leading cause of death. High proportion of deaths occurred in females.

Apart from the top three deaths due to non communicable diseases, it was found 150(4.8%) suicide deaths among non communicable diseases.

By providing comprehensive emergency obstetric care, maternal mortality and stillbirth may be reduced. This is one of the strategies in goals of the National rural mission (2005 – 2006).

Prompt management of infections and parasitic diseases in post Neonatal period will prevent infant deaths.

Diarrhoeal diseases continue to be a major cause in death among children. Provision of safe drinking water and sanitation facilities are issues to be tackled to reduce diarrhoeal diseases.

In the case of adult deaths, two most pressing problems were myocardial infarction and pulmonary tuberculosis.

# Chapter I

## Introduction

Reliable information on the pattern of deaths by causes in the country due to some major diseases is essential for proper health planning. Many causes of death are largely or wholly confined to a particular age, age – sex group, region and socio – economic profile of the households. Information on the pattern of causes of death reflects the health status and in turn is vital for socio – economic planning of the communities. This will also help us in defining the population at risk from a given cause of death as a national priority for medical research. A reliable assessment of disease – specific mortality rates is not yet possible in many parts of India, either because the underlying cause of terminal illness was never known or relevant information not recorded. Verbal autopsy is a systematic retrospective inquiry of family members about the signs and symptoms of illness prior to death has been used to help determine the underlying medical cause of death. Verbal autopsies have been used to assess the medical causes of maternal and childhood deaths in many studies conducted in India and other developing countries. But there is less experience with verbal autopsies of adult deaths. A special study to estimate the cause specific mortality in all the age groups by verbal autopsy was conducted by National Institute Of Epidemiology. It was one of the largest studies conducted in Tamilnadu.

## Overview of the Causes of Death reporting system in India

At the national level, the Registrar General of India, RGI is responsible for collection, collation and publication of cause of Death statistics. 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 RGI. Until December 1998, cause of Death data for rural areas used to be collected under the Survey of Cause of Death Rural (SCD – Rural) scheme, from a sample of villages by lay diagnosis and reporting system. From January 1999 a cause of death component has been added to the SRS (RGI, 1999), It was called SRS – COD component. A major departure from the SCD – Rural design is the doing away with the

symptom record and another departure is the elimination of the structured questionnaire. Instead the instructions contain a list of causes, related symptoms for some, the corresponding ICD-10 Code. In case of urban areas, a medical certification of cause of death (MCCD) scheme is operational.

## **Review of Literature**

The verbal autopsy (VA) 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; 1990); Zimicki(1990) compared interviews by lay reporters with in-depth interview by physicians. For 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-Odhiaambo et al, 1984),Namibia (Mobley and Ties, 1996); In Phillipines (Kalter H.D.et al,1990)used physician diagnosis as reference to estimate validity of different verbal autopsy based algorithms , and in India ( Bang et al 1992; Awasthi and Pande 1998.) used VA method. Much of the verbal autopsy work remains unpublished. The current knowledge base on feasibility and validity is largely restricted to childhood mortality. Bang A.T. 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) .studies about the validity of VA in identifying causes of death have been undertaken recently (Garenne and Fontine, 1989;LSHTM,1993). In Kenya by Snow et al (1992) hospital diagnosis was used as a reference to check validity of cause of death coded by physicians from verbal autopsy data. In a review on Verbal autopsy based cause of death reporting systems in rural areas of India, Mahapatra et al (2000) stated that cause of death statistics are not usable for purposes of policy analysis as this suffers from poor coverage, high incidence of unclassified deaths, long delay and irregular publication of statistics .A special verbal autopsy study by Vendhan Gajalashmi et al (2004) of 48000 adult deaths in the city of Chennai (urban) during 1995 – 97 and 32000 deaths in Villupuram (rural) during 1997 – 98 was conducted to arrive at the probable underlying cause of death to estimate cause specific mortality. This study showed that verbal autopsy reduced the proportion of deaths attributed to unspecified and unknown causes from 54% to 23% ( $p<0.0001$ ) in rural areas in Tamilnadu for adult

deaths ( $\geq 25$  years). The sensitivity of VA to identify cancer was 95% in the age group 25 – 69 years.

Ministry of Health & Family Welfare, Government of India requested ICMR to undertake a study on cause of death (COD) in different states of the country in phases. ICMR identified NIE, Chennai to take up studies in Tamilnadu State in South India.

### **Objectives**

1. To assess probable **Causes of Death** in male and female population among rural and urban areas in all age groups in Tamilnadu state.
2. To study the socio – economic profile of the households with deaths in urban and rural areas.

## Chapter II

### Methodology

#### Sampling Design

The total number of deaths in Tamilnadu in a year under SRS is assumed as 2000. The death rate in Tamilnadu assumed as 9 per thousand. In order to cover 2000 deaths, In first stage one district in each of the four zones of Tamilnadu is selected namely Kancheepuram & Tiruvallur, Tiruchirapalli, Salem and Virudhunagar by PPS method. (Fig 1)

In the second stage, thirty areas (villages and towns) were selected by PPS sampling from each of the selected districts.

#### Study Area

The sample consists of 120 areas in four districts with 77 villages from rural and 43 wards from urban were selected from a total population of 522825 having 350273(67.0%) in rural and 172552(33.0%) in urban areas. (Table 1 & 2) The population of males 264239(50.5%) and females 258586(49.5%) were covered. (Table 3) The total number of deaths covered for verbal autopsy was 3833 in four districts of Tamilnadu state. Data on cause of death was collected to elicit cause of death, for the deaths that occurred during the first six months from the date of survey. The study teams revisited the same villages and repeated the procedure and elicited the information on cause of death for those deaths that occurred during the next six months to take care of seasonality.

#### Terms & Definitions

Definition of the underlying cause of death: “the disease or injury which initiated the train of morbid events leading directly or indirectly to death or circumstances such as the accident or violence which produced the fatal injury”.

**Maternal death:** The death of a woman while pregnant or within 42 days of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by pregnancy or its management, but not from accidental causes.

**Stillbirth:** No cry at time of birth or having no signs / symptoms of chest expansion, heartbeat, movements of the fetus.

**Neonatal:** If the death of the child occurred between 0 to 28 days of birth.

**Child death:** If the death of the child occurred between 29 days to 5 years of birth.

**Deaths > 5 years:** Deaths occurred after 5 years of age.

The following Five schedules were used for data collection

**Schedule – 0** ..... Identification & Socio – Economic particulars

**Schedule – 1** ..... Stillbirths

**Schedule – 2** ..... Neonatal Death (0 – 28 days)

**Schedule – 3** ..... Child Death (29 days – 5 years)

**Schedule – 4** ..... Adult Death (5+ years)

### **Validation Study**

Validation study was carried out in the Field practice area for National Institute of Epidemiology. There are 10 Primary Health Centers and one major hospital under the control of the State Government. Death registers are available for all referral cases. In Kanchipuram & Tiruvallur districts, 40% of deaths occurred in hospitals, with 80% of these in the district referral hospitals. Thus the death recording system provided the opportunity to validate Verbal autopsy findings for all age groups. However, it was not feasible to enroll adequate numbers of deaths to validate all possible combinations of main and associated diagnosis. We therefore allowed single cause of death for analysis. Still births, neonatal and child deaths, maternal and adult deaths that occurred during 1<sup>st</sup> March 2002 to 31<sup>st</sup> August 2002 were included in the analysis. Of the 819 deaths, 201 deaths occurred in the hospital and the hospital medical officer had entered on the underlying cause of death to the death certificate. For most of the remaining 618 deaths, the death certificate was obtained from the physician practicing in the locality, though he might not have had the chance of treating the deceased when he/she was alive. In this study hospital diagnoses were used as the ‘gold standard’. The interviewer, blinded to the hospital diagnosis, elicited symptoms and signs of the Disease condition and the Medical Officer determined the cause of death. Field medical officer and the hospital physician reviewed the hospital records and the death certificates independently and assigned a single probable cause of death. The validation consisted, calculation of sensitivity, specificity and positive predictive value.

For stillbirths, the major cause of death was “obstructed labour”, for which the sensitivity was 75%, specificity 100%, and positive predictive value 100%; among the neonatal deaths the major cause of death was “asphyxia”, for which the values were

89%, 90% and 86% respectively; among child deaths the major cause of death was “diarrhoea”, for which the values were 86%, 85% and 75% respectively; among maternal deaths, the major cause of death was “postpartum haemorrhage”, for which values were 60%, 92% and 75% respectively. For adult deaths the major cause of death was due to cardio-vascular diseases, for which values were 73%, 100% and 100% respectively; for accidents and injuries, the sensitivity was 100%, specificity 96%, and positive predictive value 80%.

## **Pilot Testing**

In Phase-1 it was decided to take up a Pilot study in the field practice area of NIE and selected hospitals of Chennai city.

Two medical officers of the Institute were deputed for training in the Institute of Health Systems (IHS), Hyderabad. The fieldwork was initiated after the training. The field team consisted of one Investigator who identified the households, one SRF (Social Sciences) who interviewed the respondent, one statistical supervisor who scrutinized the proformae on the spot and checked for the completeness of proformae and one medical supervisor who guided the SRF to take the interview. The SRF (Social Sciences) after collecting the information on the prescribed schedules assigned the probable cause of death using the algorithms provided to him.

The results for total deaths enumerated (hospital deaths and from the community) are as under:

Information on 188 deaths has been collected. (The Research Associate (medical) for comparison has independently collected 5 deaths). There were 13 stillbirths, 30 neonatal deaths (1 – 28 days), 20 child deaths (29 days – 5 years), 17 maternal deaths, and 108 adult deaths (5+ years).

There were 110 deaths with reference period below 1 year. Stillbirths have been identified as caused by obstructed labour (O66.9) (3 deaths), 2 each by ante – partum haemorrhage (O46.9), 1 each by pre maturity (P07.3), low birth weight (P07.1), eclampsia (O15.9), severe anaemia, premature rupture of membrane (O42.9) & undetermined (R 69). In neonates, asphyxia (9 deaths) was the major cause of death followed by pre maturity (8 deaths), low birth weight (6 deaths), congenital defect (4 deaths), acute LRI (2 deaths) and one due to birth trauma. Diarrhoea / Dehydration (7 deaths) was found to be the major cause among post – neonates and 1 or 2 deaths each due to pneumonia, congenital defects, meningo encephalitis, Bronchitis, sarcoma,

whooping cough, epilepsy, tubercular meningitis, and tetanus. Of the 17 maternal deaths 4 were due to post – partum haemorrhage, 3 were due to eclampsia, and 2 each were due to indirect obstetrical and abortion and 1 each obstructed labour and congenital heart disease.

In each selected district the field teams met VAO / headman / panchayat Assistant / local informants of each selected village / town and enquire about the list of deaths, if any during the last six months. Verbal autopsy Instruments were modified with the experience gained in the pilot study. All the schedules were pre-tested and validated in Thiruvallur and Kancheepuram districts.

### **Data Collection**

The field team contacted the household where death occurred and administered the verbal autopsy for ascertainment of cause. To ensure complete coverage of deaths, the teams made house – to – house visit in all selected areas. The field investigator identified the household, wherein death has occurred. The interview was carried out by SRF in the local language after explaining fully the objectives of the study and obtaining a written informed consent from the respondents.

The data was collected through five structured and pre – coded schedules and the appropriate modules, depending upon the type of death with a recall – period of 6 months. All the modules were translated into (Tamil) local language.

### **Reference period for collecting causes of death by verbal autopsy**

Zone	District	Refence.Period	No.of Deaths
North	1. Kancheepuram & Thiruvallur	15.03.2002 to 14.03.2003	855
Central	2: Tiruchirapalli	01.12.2003 to 30.11.2004	909
West	3: Salem	01.06.2003 to 31.05.2004	1200
South	4: Virudhunagar	01.12.2003 to 30.11.2004	869

Complete confidentiality was maintained in preserving the data at all the stages. The senior supervisor in turn verified this.

### **Quality Control Measures**

A Verbal autopsy field team consists of field investigator(s), senior research fellow(s), a statistical supervisor and a medical officer. All of them were trained specifically in verbal autopsy interview techniques and were standardized for data collection. Field – testing of proformae and validation of all instruments were undertaken

before initiating the study. Field investigators (FI) who were graduates identified the proper respondent to be interviewed and narrate them about the purpose of the study. Senior research fellows (SRF) who were postgraduates in social science collected the data by interview method in local language. The proformae were checked for completeness and scrutinized on the spot by statistical supervisor and field clarifications were sought whenever necessary. Apart from that, statisticians checked the reliability and reproducibility of the verbal autopsy report by a 5% random check in the field. Then a medical officer verified the cause of death assigned by SRF and allocated the ICD-10 codes. A separate physician reassessed all the unspecified deaths for diagnosis independently and will allocate the appropriate ICD-10 codes. About 33 undetermined cases for cause of death were referred to the second physician, only 14 were assigned the cause of death by the second physician after verification.

## **Analysis Plans**

### **Socio – Economic Factors**

Socio – Economic Factors influencing deaths such as household level factors (type of house, education of the head of the household, occupation, hygiene and cleanliness) and community level factors (health consciousness, availability of safe drinking water, sewerage system, availability and utilization of health services) were included in the survey. Analysis of socio – economic and cultural factors has been done according to age groups as well as at aggregate level.

### **Classification of Causes of Death**

The verbal autopsy is exhaustive because it contained verbatim, questions on symptoms, signs and modules. Based on the responses to the signs and symptoms preceding death, the causes of death were determined using the diagnostic criteria in the Algorithms. Classification of cause of death is based on ICD-10.

For certain broad specific groups of public health importance, details of subcategories of causes of death are highlighted.

## **Chapter III**

### **Distribution of Deaths by Socio – economic Factors**

#### **Distribution of Deaths by Category of Death**

The total number of deaths covered for verbal autopsy was 3833 in four districts of Tamilnadu. There were 855 deaths in Kanchipuram & Tiruvallur district (erstwhile old Chingleput district) in one year and of these 27(3.2%) were stillbirths, 45(5.3%) neonatal deaths, 35(4.1%) child deaths, 739(86.4%) were adult deaths and 9 (1.1%) were maternal deaths. In Tiruchirapalli district number of deaths covered were 909 in one year and of these 27(3.0%) were stillbirths, 37(4.1%) neonatal deaths, 26(2.9%) child deaths and 816(89.8%) adult deaths and 3(0.3%) were maternal deaths. In Salem district there were 1200 deaths in one year and of these 25(2.1%) were stillbirths, 69(5.8%) neonatal deaths, 33(2.7%) child deaths and 1063(88.6%) adult deaths and 10(0.8%) were maternal deaths. In Virudhunagar district the number of deaths covered were 869 in one year. Of these, 19(2.2%) were stillbirths, 29(3.3%) neonatal deaths, 39(4.5%) child deaths and 775(89.2%) were adult deaths and 7(0.8%) were maternal deaths. (Table 4)

#### **Distribution of Deaths by Residence**

2845(74.2 %) deaths were covered in rural areas and the remaining were covered in urban areas. (Table 5)

#### **Distribution of Deaths by Residence and Age**

Out of 3833 deaths, 98(2.6%) were stillbirths. Proportions in rural and urban areas were 71(2.5%) and 27(2.7%) respectively. A total of 249 infant deaths (0 – 1 years) were reported in all the four districts. Among these, 209(7.3%) occurred in rural areas and 40(4.0%) occurred in urban areas. There were 64 Child deaths (1 – 4 years) observed out of this 54(1.9%) occurred in rural areas and 10(1.0%) in urban areas. There were 3422(89.3%) adult deaths (5+ years) that occurred in the four districts out of which 2511 occurred in rural areas and 911 in urban areas. (Table 6)

#### **Distribution of Deaths by Age and Gender**

Analysis by gender showed 2175(56.7%) and 1658(43.3%) deaths were males and females respectively in all four districts combined.

The proportions of stillbirths were 2.7% and 2.5% among males and females respectively. 136(6.3%)and 113(6.8%) were male and female infant deaths (0 –1Y) respectively. There were 64 Child deaths (1-4 years). Among them 33(1.5%)were male and 31(1.9%) were female child deaths.. It was observed that 3422 adult deaths (5+ years) occurred in all four districts combined. Among them 1947(89.5%) were males and 1475(89.0%) were females. Age specific distribution of deaths revealed that there was high proportion (5.2%) of female deaths in 15 –24 years age group.(Table 7) (Fig 2)

### **Distribution of Deaths by Residence and Religion**

Out of total 3833 deaths covered, 93.5% were Hindus, 3.5% were Muslims, 2.9% were Christians and the others were 0.1%. It was observed that the deaths of Hindus were 96.1% and 85.9% belongs to rural and urban areas respectively. The remaining was contributed by other religions. (Table 8)

### **Distribution of Deaths by Age and Religion**

It was observed that the proportion of Infant deaths was high (6.6%) in Hindus when compared to other Religions (Table 9)

### **Distribution of Deaths by Residence and Place of Death**

It was found that maximum deaths occurred at home i.e. 2894(75.5%). It was observed that 77.0% and 71.1% deaths occurred at home in rural and urban areas respectively. The remaining deaths occurred in other places. (Table 10)

### **Distribution of Deaths by Age and Place of Death**

The proportion of stillbirths reported in private hospitals was 40.8%, which is higher when compared to other place of deliveries. In the case of infant death the proportion 45.0% was higher in home. (Table 11)

### **Distribution of Deaths by Residence and Occupation of the deceased or parent (For children < 5 years)**

It was found that 44.7% of deaths were unskilled workers, 15.9% were from household work and own cultivators were 12.6%. It was observed 48.6% and 33.4% of deaths reported in urban and rural areas respectively among unskilled workers group. The remaining deaths occurred in other groups. (Table 12)

### **Distribution of Deaths by Age and Occupation of the deceased or parent (For children < 5 years)**

The proportion of deaths occurred higher in unskilled worker category except in 5 – 14 years age group compared to other occupations. (Table 13)

### **Distribution of Deaths by Residence and Education of the deceased or parent (For children < 5 years)**

47.3% of deaths occurred among illiterates. The pattern of occurrence of deaths was decreasing both in rural and urban with respect to level of education. (Table 14)

### **Distribution of Deaths by Age and Education of the deceased or parent (For children < 5 years)**

It was found that 43.5% death occurred in 1 – 4 years age group among illiterate. Where as in the age group of 5 – 14 years the proportion was higher with 49.2% with primary education. But in all 73.4% of deaths were among the illiterate and with primary education. (Table 15)

### **Distribution of Deaths by Residence and Type of House**

Regarding the occurrence of deaths by type of house, it was observed 23.5%, 35.4%, and 41.2%, in Kutcha, pucca and semipucca houses respectively. (Table 16)

### **Distribution of Deaths by Age and Type of House**

The proportion of deaths is relatively more for all age groups in semipucca households, compare to other type of houses. (Table 17)

### **Distribution of Deaths by Residence and Toilet Facility**

It was observed that 84.6% and 33.7% at the place of residence of deceased had open field as toilet in rural and urban areas respectively (Table 18)

### **Distribution of Deaths by Residence and Drainage Facility**

Regarding drainage facility, 63.0% and 22.7% of households with death in rural and urban areas had no drainage facility. (Table 19)

## **Distribution of Deaths by Residence and Drinking Water**

It was observed that 90.6 %and 93.3% households with deaths in rural and urban respectively had tap water facility. (Table 20)

## **Chapter IV**

### **Causes of Stillbirths**

A total of 98 stillbirths occurred in four districts. It was observed that 71 and 27 stillbirths occurred in rural and urban areas respectively. There were 59 males and 39 females among the 98 stillbirths.

Conditions of perinatal period were the top most cause of stillbirths accounting for 51.0%. It was observed that 50.7% and 51.9% of stillbirths were due to this condition in rural and urban areas respectively. It was found that higher proportion 53.8% of deaths were due to this condition in females.

Causes related to pregnancy, childbirth and puerperium ranked as the second with 39.8%. It was observed that 36.6% and 48.1% of stillbirths were due to this condition in rural and urban areas respectively. It was found that higher proportion 40.7% of deaths were due to this condition in males. (Table 21 & 22)

### **Causes of Death in Perinatal period (0 – 7 days)**

There were 145 deaths occurred in perinatal period. It was observed that 121 and 24 perinatal death in rural and urban areas respectively. There were 77 males and 68 females among the perinatal deaths.

It was found that majority of deaths were due to conditions of perinatal period (74.5%). It was observed that 75.2% and 70.8% of perinatal deaths were due to this condition in rural and urban areas respectively. Also this condition showed higher proportion 76.6% of deaths were males.

Other causes of deaths in perinatal period were congenital malformations 9.0% and infectious and parasitic diseases 8.3%. (Table 23 & 24)

### **Causes of Death in Neonatal period (8 – 28 days)**

There were 35 deaths reported in neonatal period. Of this, 32 were reported in rural and 3 in urban areas. There were 20 male and 15 female neonatal deaths.

It was observed that the majority of deaths 51.4% were due to conditions of perinatal period). It was observed that 46.9% in rural areas and all the 3 neonatal deaths occurred in urban areas due to this condition. Death due to this condition was 50.0% in males and 53.3% in females.

Diseases due to respiratory system 31.4% ranked as second important cause of death among neonates (Table 25 & 26)

### **Causes of Death in Post – Neonatal period (29 days to <1 year)**

In all, 69 deaths were reported in post neonatal period. Of this, 56 were reported in rural and 13 from urban areas. There were 39 male and 30 female post – neonatal deaths.

It was observed that 31.9% of deaths were due to certain infectious and parasitic diseases and ranked as first. It was observed that 33.9% and 23.1% of deaths were due to this condition in rural and urban areas respectively. Death due to this condition was 28.2% in male infants and 36.7% in female infants.

Diseases of respiratory diseases ranked as the second with 17.4%. It was observed that 17.9% and 15.4% of deaths due to this condition occurred in rural and urban areas respectively. Deaths due to this condition were 23.1% in male infants and 10.0% among female infants.

Conditions of perinatal period accounted for 14.5% of total post neonatal deaths and ranked as third. It was observed that 12.5% and 23.1% of deaths due to this condition in rural and urban areas respectively. It was found higher proportion 15.4% were males. (Table 27 & 28)

### **Causes of Death in Children aged 1 – 4 years**

In all, 64 deaths were reported in children aged 1–4 years. Of this, 54 were reported in rural and 10 from urban areas. There were 33 male deaths and 31 female deaths.

It was observed that 29.7% of deaths were due to certain infectious and parasitic diseases and ranked as first. It was observed that 29.6% and 30.0% of deaths were due to this condition in rural and urban areas respectively. Deaths due to this condition were 18.2% in male and 41.9% in female children.

Diseases of nervous system ranked as the second with 23.4% of child deaths. It was observed that 22.2% and 30.0% of deaths due to this condition occurred in rural and urban areas respectively. This condition was present among 21.2% in male and 25.8% female children.

External causes accounted for 18.8% of total child deaths and ranked as third. It was observed that 22.2% child deaths in rural and no deaths in urban areas. It was found higher proportion 19.4% of deaths were in females. (Table 29 & 30)

### **Causes of Death in Adults aged 5 – 14 years**

There were 65 total deaths due to all causes in 5 –14 years age group. Of this 53 were reported in rural and 12 from urban areas. Out of these, 35 were males and 30 females. High proportion of deaths was observed in the following three broad categories of diseases.

i) External Causes accounted for 36.9% of total deaths and ranked as top most. It was observed that 35.8% and 41.7% of deaths due to this condition occurred in rural and urban areas respectively. It was found that these causes had a higher proportion 43.3% of deaths in females.

ii) Infectious & parasitic diseases and nervous system diseases accounted each for 16.9% of total deaths and ranked as second.

Regarding deaths due Infectious & parasitic diseases, it was observed that 15.1% and 25.0% of deaths occurred in rural and urban areas respectively. It was found higher proportion 20.0% of deaths were in males.

Regarding deaths due to nervous system diseases, it was observed that 17.0% and 16.7% of deaths occurred in rural and urban areas respectively. It was found higher proportion 17.1% of deaths were in males.

iii) Neoplasm accounted for 12.3% of total deaths in the age group of 5-14 years and ranked as third. It was observed 13.2% and 8.3% of deaths occurred in rural and urban areas respectively. It was found higher proportion 13.3% of deaths were in females. (Table 31 & 32)

### **Causes of Death in Adults aged 15 – 24 years**

There were 166 total deaths in 15 – 24 years age group. Of this 126 were reported in rural and 40 from urban areas. Of these 166, 79 were male deaths and 87 were female deaths. High proportion of deaths was observed in the following three broad categories of diseases.

i) External Causes accounted for 49.4% of total deaths of this age group and ranked as top most. It was observed that 49.2% and 50.0% of deaths occurred in rural and urban

areas respectively due to these causes. It was found higher proportion 58.2% of deaths were in males.

ii) Infectious & parasitic diseases accounted for 12.7% of total deaths of this age group and ranked as second. It was observed that 12.7% and 12.5% of deaths occurred in rural and urban areas respectively due to this condition and It was also found higher proportion 16.5% of deaths in males.

iii) Circulatory system diseases accounted for 6.6% of total deaths of this age group. and ranked as third. It was observed that 7.1% and 5.0% of deaths occurred in rural and urban areas respectively due to these diseases. It was found the proportion of deaths were similar (6.3% & 6.9%) in both sexes. (Table 31 & 32)

### **Causes of Death in Adults aged 25 – 44 years**

There were 495 total deaths in 25 – 44 years age group. Of this 376 were reported in rural and 119 from urban areas. There were 315 male deaths and 180 female deaths in this age group. High proportion of deaths was observed in the following three broad categories of diseases.

i) External Causes accounted for 28.1% of total deaths of this age group and ranked as top most. It was observed that 30.1% and 21.8% of deaths occurred in rural and urban areas respectively due to these causes. It was found that these causes had a higher proportion 31.7% of deaths in males.

ii) Circulatory system diseases accounted for 22.0% of total deaths of this age group and ranked as second. It was observed that 21.3% and 24.4% of deaths occurred in rural and urban areas respectively due to these cases. It was found that a higher proportion 24.8% of deaths were males due to this condition.

iii) Infectious & parasitic diseases accounted for 21.6% of total deaths of this age group and ranked as third. It was observed that 21.3% and 22.7% of deaths occurred in rural and urban areas respectively due to these diseases. It was found the proportion of deaths due to these diseases were similar (21.6% & 21.7%) in both sexes. (Table 31 & 32)

### **Causes of Death in Adults aged 45 – 59 years**

There were 647 total deaths in 45 – 59 years age group. Of this, 466 were reported in rural and 181 from urban areas. There were 421 male deaths and 226

female deaths reported in this age group. High proportion of deaths was observed in the following three broad categories of diseases.

i) Circulatory diseases accounted for 26.6% of total deaths of this age group and ranked top most. It was observed 24.9% and 30.9% of deaths occurred in rural and urban areas respectively due to these diseases. It was found higher proportion 30.2% of deaths were males due to this condition.

ii) Neoplasms accounted for 17.5% of total deaths of this age group and ranked as second. The proportions of deaths due to neoplasm were similar (17.4% & 17.7%) in both rural and urban areas. It was found higher proportion 27.9% of deaths due to neoplasms in females.

iii) Infectious & parasitic diseases accounted for 16.8% of total deaths of this age group and ranked as third. It was observed 17.8% and 14.4% of deaths occurred in rural and urban areas respectively due to this condition. It was found higher proportion 17.1% of deaths were in males due to this condition. (Table 31 & 32)

### **Causes of Death in Adults aged 60 – 69 years**

There were 619 total deaths in 60 – 69 years age group. Of this 445 were reported in rural and 174 from urban areas. There were 362 male deaths and 257 female deaths reported in this age group. High proportions of deaths were observed in the following three broad categories of diseases.

i) Circulatory system diseases accounted for 36.0% of total deaths in this age group and ranked as top most. It was observed that 33.7% and 42.0% of deaths occurred in rural and urban areas respectively due to this condition. It was found higher proportion 36.5% of deaths were males due to this condition.

ii) Infectious & parasitic diseases accounted for 13.2% of total deaths and ranked as second. It was observed that 14.4% and 10.3% of deaths occurred in rural and urban areas respectively due to this condition. It was found higher proportion 15.2% of deaths were males due to this condition.

iii) Neoplasms accounted for 12.8% of total deaths of this age group and ranked as third. It was observed that 12.4% and 13.8% of deaths occurred in rural and urban areas respectively due to this condition. It was found higher proportion 15.2% of deaths were females due to this condition. (Table 31 & 32)

## **Causes of Death in Adults aged 70 years and above**

There were 1430 deaths in 70+ age group. Of this 1045 were reported in rural and 385 from urban areas and 735 were male deaths and 695 were female deaths. High proportions of deaths were observed in the following three broad categories of diseases.

- i) Circulatory system diseases accounted for 26.0% of total deaths and ranked as top most. It was observed that 24.3% and 30.6% of deaths occurred in rural and urban areas respectively due to this condition. It was found higher proportion 27.2% of deaths were males due to this condition.
- ii) Signs and symptoms NEC accounted for 24.2% of total deaths and ranked as second. It was observed that 24.5% and 23.4% of deaths occurred in rural and urban areas respectively due to this condition. It was found higher proportion 27.5% of deaths were females due to this condition.
- iii) Infectious & parasitic diseases accounted for 12.2% and ranked as third. It was observed 13.9% and 7.5% of deaths occurred in rural and urban areas respectively due to this condition. It was found the proportion of deaths were similar (12.1% & 12.2%) in both sexes. (Table 31 & 32)

## **Chapter V**

### **Specific Causes of Maternal Death**

There were 29 maternal deaths occurred. In this 23 of them occurred in rural areas and 6 in urban areas. Among top ten causes of maternal mortality, Post – partum haemorrhage was recorded as the top most leading cause, while obstructed labour and eclampsia were ranked second and third respectively. (Table 33) Regarding place of maternal death 10 occurred in Government hospitals, 7 at home and 6 at private hospitals. (Table 34) In spite of deliveries attended by medical officer 17 maternal deaths occurred. (Table 35)(Fig 4)

### **Specific Causes of Stillbirths**

A total of 98 stillbirths occurred and it was observed that 71 in rural and 27 in urban areas.

Stillbirths 36(36.7%) occurred due to conditions of pre maturity and were ranked as first. The next common cause was due to Ante – partum Haemorrhage 14(14.3%) and ranked as second. Stillbirths with no specific cause 9(9.2%) ranked as third. Anaemia and other obstructed labour contributed as the other important causes of stillbirths. (Table 36)(Fig 5)

### **Specific Causes of Infant Deaths**

Out of 249 infant deaths reported, Pre maturity (22.5%) ranked as first, Asphyxia at birth (18.1%) ranked second, low birth weight (10.4%) ranked third and Acute Lower Respiratory tract Infection (8.0%) ranked fourth and Diarrhoea / Dysentery (7.6%) as fifth, causes of infant death. (Table 37)(Fig 6)

### **Specific Causes of death in children (1 – 4) years**

Major causes of death in children 1 – 4 years age group, were Diarrhoea / Dysentery (21.9%), injuries etc (18.8%) and Meningo – Encephalitis (17.2%) out of the 64 child deaths reported. (Table 38)

## Chapter VI

### Top Ten Causes of Death

Myocardial Infarction (12.3%), external causes like Injuries / poisoning / burns / falls / drowning (10.6%), stroke (9.2%), senility (8.5%), pulmonary tuberculosis (6.9%), renal failure (5.1%), diarrhoeal diseases (4.8%), suicide (3.9%), prematurity NEC (2.4%) and Asthma (2.2%) were the top ten causes that accounted for 66.0% of 3833 deaths in the study area. (Table 39) (Fig 3)

### Top Ten Causes of Death due to Communicable Diseases

There were 690(18.0%) deaths occurred due to communicable diseases. The top ten causes of deaths among communicable diseases were Pulmonary Tuberculosis 266(38.6%), Diarrhoea / Dysentery 185(26.8%), AIDS 47(6.8%), Hepatitis 42(6.1%), Meningo – Encephalitis 39(5.7%), Acute lower Respiratory Infection 20(2.9%), Tetanus (neonatal), Rheumatic fever and Broncholitis deaths contributed 13(1.9%) each and Malaria 9(1.3%) . (Table 40)(Fig 7)

### Rural

It was observed 541 deaths due to communicable diseases occurred in rural areas and Pulmonary Tuberculosis accounted for 207(38.3%) ranked as topmost cause of communicable diseases. Diarrhoea / Dysentery 153(28.3%) contributed as second leading cause of death. AIDS 41(7.6%) ranked as third important cause of deaths. It was found 29(5.4%) deaths were due to Meningo – Encephalitis and 26(4.8%) deaths were due to Hepatitis. Deaths due to Acute lower Respiratory Infections accounted for 19(3.5%) and deaths due to Tetanus (neonatal), Rheumatic fever and Broncholitis were 11(2.0%) each in rural areas. (Table 40)

### Urban

There were 149 deaths due to communicable diseases occurred in urban areas and Pulmonary Tuberculosis accounted for 59(39.6%) ranked as topmost cause of deaths in communicable diseases. Diarrhoea / Dysentery 32(21.5%) contributed as second leading cause of death. Deaths due to Hepatitis were 16(10.7%). It was found 10(6.7%) deaths were due to Meningo – Encephalitis and 6(4.0%) due to AIDS. Deaths

due to Malaria were 4(2.7%). The other causes of deaths were Tetanus (neonatal), Rheumatic fever & Broncholitis were 2(1.3%) each in urban areas. (Table 40)

### **Males**

It was observed 399(18.3%) deaths due to communicable diseases occurred in males. Pulmonary Tuberculosis accounted for 201(50.4%) ranked as topmost cause of death among males. Diarrhoea / Dysentery 68(17.0%) contributed as second leading cause of death. AIDS 29(7.3%) ranked as third important cause of death. It was found 23(5.8%) deaths were due to Hepatitis and 22(5.5%) deaths were due to Meningo – Encephalitis. Deaths due to Acute Respiratory Tract Infections accounted for 13(3.3%), Broncholitis were 10(2.5%), Rheumatic fever 6(1.5%) and Tetanus (neonatal) 4(1.0%) among males. (Table 41)

### **Females**

It was observed 291(17.6%) deaths due to communicable diseases occurred in females. Diarrhoea / Dysentery 117(40.2%) contributed as topmost leading cause of death. Pulmonary Tuberculosis accounted for 65(22.3%) ranked as second. It was found 19(6.5%) deaths were due to Hepatitis and AIDS 18(6.2%) ranked as third and fourth respectively. Deaths due to Meningo – Encephalitis were 17(5.8%) and Tetanus (neonatal) was 9(3.1%). Acute Respiratory Tract infections and Rheumatic fever accounted for 7(2.4%) each. Malaria 6(2.1%), Typhoid fever 5(1.7%) and Broncholitis 3(1.0%) were the other causes. (Table 41)

### **Top Ten Causes of Death due to Noncommunicable Diseases**

There were 3143(82.0%) deaths occurred due to noncommunicable diseases. The top ten causes of deaths among noncommunicable diseases were Myocardial infarction 472(15.0%), External causes like injuries / poisoning / burns / falls / drowning 408(13.0%), Stroke 352(11.2%), Senility 325(10.3%), Renal Failure 195(6.2%), Suicide 150(4.8%), Prematurity 93(3.0%), Asthma 86(2.7%), Acute Abdomen 78(2.5%) and Stomach Cancer 60(1.9%) respectively. (Table 42)(Fig 8)

### **Rural**

There were 2304 deaths occurred due to noncommunicable diseases in rural areas. A total of 302(13.1%) deaths were due to Myocardial Infarction and ranked as

top most. External causes like Injuries / poisoning / burns / falls / drowning accounted for 298(12.9%) deaths and ranked as second. Deaths accounted to Stroke were 263(11.4%) and ranked as third. Other causes were Senility 239(10.4%), Renal Failure 153(6.6%), Suicide 114(4.9%), Prematurity 75(3.3%), Acute Abdomen 69(3.0%), Asthma 65(2.8%) and Stomach Cancer 41(1.8%). (Table 42)

### **Urban**

There were 839 deaths occurred due to noncommunicable diseases in urban areas. A total of 170(20.3%) deaths were due to Myocardial Infarction and ranked as topmost. External causes like Injuries / poisoning / burns / falls / drowning accounted for 110(13.1%) and ranked as second. Deaths accounted to Stroke were 89(10.6%) and ranked as third. Other diseases were Senility 86(10.3%), Renal Failure 42(5.0%), Suicide 36(4.3%), Asthma 21(2.5%), Stomach Cancer 19(2.3%), Prematurity 18(2.1%) and Acute Abdomen 9(1.1%) respectively. (Table 42)

### **Males**

There were 1776 deaths occurred due to noncommunicable diseases in males. A total of 321(18.1%) deaths were due to Myocardial Infarction and ranked as top most. External causes like Injuries / poisoning / burns / falls / drowning accounted for 238(13.4%) deaths and ranked as second. Stroke 190(10.7%) ranked as third cause of death. Other causes were Senility 142(8.0%), Renal Failure 125(7.0%), Suicide 80(4.5%), Acute Abdomen 59(3.3%), Asthma 51(2.9%), Prematurity 50(2.8%), Stomach Cancer 34(1.9%) and Diabetes 31(1.7%) respectively. (Table 43)

### **Females**

There were 1367 deaths occurred due to noncommunicable diseases in females. A total of 183(13.4%) deaths were due to Senility and ranked as topmost. External causes like Injuries / poisoning / burns / falls / drowning accounted for 170 (12.4%) and ranked as second. Deaths accounted to Stroke were 162(11.9%) and ranked as third. Other diseases were Myocardial Infarction 151(11.0%), Renal Failure & Suicide 70(5.1%) each, Prematurity 43(3.1%), Asthma 35(2.6%), Diabetes 29(2.1%), Stomach Cancer 26(1.9%) and Acute Abdomen 19(1.4%) respectively. (Table 43)

## Summary and Discussion

Information on causes of death for 3833 deaths occurred over a period of one year (2001 – 2002) in four districts namely Kanchipuram & Tiruvallur, Tiruchirapalli, Salem and Virudhunagar was collected by verbal autopsy. Numbers of deaths covered in rural areas were 2845(74.2 %), and the remaining 988(25.8%) were covered in urban areas. Causes of deaths by verbal autopsy were assessed for 2175(56.7%) male and 1658(43.3%) female deaths in all age groups. The data on causes of death in all age groups was classified using ICD-10 classification.

Myocardial Infarction (12.3%), external causes like Injuries / poisoning / burns / falls / drowning (10.6%), stroke (9.2%), senility (8.5%), pulmonary tuberculosis (6.9%), renal failure (5.1%), diarrhoeal diseases (4.8%), suicide (3.9%), pre maturity NEC (2.4%) and Asthma (2.2%) were the top ten causes of death in the study area.

A total of 29 maternal deaths were reported in four districts. Among top ten causes of maternal mortality, Post – partum haemorrhage was recorded as the top most leading cause, while obstructed labour and eclampsia were ranked second and third respectively resulting from poor nutritional practices. Majority of maternal deaths 23 occurred in rural and 6 in urban areas. It was found, most of maternal deaths 17 occurred in hospitals.

A total of 98 stillbirths were assessed for causes of stillbirths. Among top ten causes of stillbirths, pre maturity (36.7%) was recorded as the top most leading cause, followed by Ante-partum haemorrhage (14.3%) as second leading cause of stillbirths. The third leading category was macerated (9.2%) stillbirths. Anaemia and Obstructed Labour contributed as fourth and fifth important causes of stillbirths.

In all 249 infant deaths were reported, the major cause of death was pre maturity (22.5%), asphyxia at birth (18.1%), low birth weight (10.4%) and acute respiratory tract infections (8.0%). RGI (India) surveys (2000) report stated that major cause of infants and child deaths in Tamil Nadu as prematurity (20.6%), respiratory tract infections (24.1%), diarrhoeal diseases (2.8%). The present study also revealed similar pattern.

In children 1 – 4 years age group, 64 deaths were reported. Diarrhoea / Dysentery (21.9%) ranked as first, injuries etc;(18.8%) ranked as second and Meningo – Encephalitis (17.2%)ranked as third important cause of death in this group.

A total of 65 child deaths in 5 – 14 years age group were reported in a year. Deaths were predominantly contributed by injuries (36.9%) and infectious & parasitic

diseases (16.9%) and diseases related to nervous system (16.9%) ranked as second and neoplasm ranked as third important causes of death in children in this group.

Out of 249 infant deaths reported, Prematurity (22.5%) ranked as first, Asphyxia at birth (18.1%) ranked second, low birth weight (10.4%) ranked third and Acute Lower Respiratory tract Infections (8.0%) ranked fourth and Diarrhoea / Dysentery (7.6%) as fifth, causes of infant death.

A total of 690(18.0%) deaths out of 3833 total deaths were reported due to communicable diseases. It was observed 541 and 149 of deaths due to communicable diseases occurred in rural and urban areas respectively. It was found similar proportion (18%)of deaths due to communicable diseases in males and in females.

Pulmonary Tuberculosis accounted for 266(38.6%) ranked as topmost cause of Communicable Diseases. It was observed more deaths due to Pulmonary Tuberculosis in males than in to females. It was found that there was higher proportion of deaths (20.3%) due to pulmonary tuberculosis in young adults aged 25-44 years age group onwards.

Diarrhoea / Dysentery 185(26.8%) contributed as second leading cause of death. It was observed high proportion of deaths (40.2%) due to Diarrhoea / Dysentery in females compared to males (17.0%). About 50% of deaths occurred in 70+ age group.

AIDS accounted for 47(6.8%) deaths, ranked as third cause of death due to communicable diseases. It was observed more deaths (41) occurred in rural areas.

It was observed 3143(82.0%) of deaths occurred due to noncommunicable diseases, particularly it had taken a heavy toll, 2304 in rural areas and 839 in urban areas and these were due to noncommunicable diseases. Regarding gender wise deaths, it was found 1776(56.7%) and 1367(43.3%) of deaths occurred in males and females respectively.

A total of 472(15.0%) deaths were reported due to Myocardial Infarction out of 3143 noncommunicable deaths and ranked as first. Out of these deaths two thirds were males. There were more deaths due to Myocardial Infarction in 45 – 49 years age group than in other age groups.

A special verbal study on 32000 adult deaths (above 25 years) by Vendhan Gajalakshmi et.al (1997 – 98) reported major causes of deaths in adults as Vascular disease (23.5%), respiratory tuberculosis (TB) (9.3%), neoplasm (4.3%) and infection except respiratory and TB (12.5%). This study also showed a similar pattern of causes of death (Above 25 Years).

External causes like injuries / poisoning / burns / falls / drowning accounted for 408(13.0%), of 3143 noncommunicable deaths and ranked as second. It was observed that higher proportion of deaths occurred in males. It was observed there is increase in deaths due to external causes particularly from 15 – 44 years age group.

In all 352(11.2%) of deaths accounted for deaths due to stroke among noncommunicable diseases and ranked as third leading cause of death. Higher proportion of deaths (11.9%) occurred in females. More deaths (14.0%) reported due to stroke in 60+ years onwards.

Apart from the top three deaths due to noncommunicable diseases, it was found 150(4.8%) deaths were reported due to suicide.

## **Conclusions**

1. Improved ante – natal and emergency obstetric care will help prevent stillbirths.
2. Regarding the maternal deaths, they are preventable by providing ante – natal and obstetric care particularly in rural areas to avoid delays in seeking medical care at all levels, starting from family, organizing transport and in obtaining standard treatment.
3. The Infant deaths can be prevented by prompt management of infectious & parasitic diseases in post neonatal period.
4. It reflects, there should be an increased focus on diarrhoeal management and prevention of injuries in children in the 1 – 4 years and in 5 – 14 yearsage group.
5. Regarding communicable diseases, high proportion of deaths due to pulmonary tuberculosis needs a priority allocation of health resources in management of pulmonary tuberculosis.
6. There was high proportion of deaths due to noncommunicable(NCD) diseases and needs focus on life style changes in the community. There is an urgent need to develop and implement a simple, inexpensive, reliable and sustainable system of NCD surveillance in order to monitor the ongoing cardio vascular disease epidemic.

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