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Original Research Article

Epidemiologic Transition in Urban India: An Analysis of Medical Certification of Cause of Death Data

Bal Kishan Gulati[1], Arvind Pandey[2]

[1]Scientist-C, [2]Director,
National Institute of Medical Statistics, ICMR, Ansari Nagar, New Delhi-110029.

Corresponding Author: Bal Kishan Gulati

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ABSTRACT

Background: Epidemiologic transition is reflected by the change in pattern of causes of death in which infectious and parasitic diseases shift to chronic and degenerative diseases of adulthood. Cause of death trends and patterns are important for future health policy planning.
Objectives: To measure mortality trends of different causes of deaths for urban population of India.
Materials and Methods: The study used MCCD data for 1990-2010 and calculated proportion of major cause of death to total deaths by age and sex for all these years.
Results: Analysis indicated that there had been shift in the age structure and cause of mortality. The unique feature of epidemiologic transition in urban India is that circulatory and respiratory deaths had increased their relative shares in mortality over time but infectious diseases did still remain a major cause of death at the same time. There was reduction in share of children's deaths and concentration of mortality in older age group.
Conclusion: India is presently facing the dual burden of disease specific mortality.

Keywords: Epidemiologic transition, cause of death, mortality, major cause, MCCD, dual burden.

INTRODUCTION

Epidemiologic transition is reflected by the change in pattern of causes of death which is characterized by the shift from the predominance of infectious and parasitic diseases to that of chronic and degenerative diseases into four stages: first stage being the stage of pestilence and famine, followed by the stage of receding pandemics; third is the stage of degenerative and manmade disease, and finally, the stage of delayed degenerative diseases. [1-3] In epidemiologic transition greater emphasis is laid on the social, cultural and behavioural factors affecting health. [4]

India is in the midst of an epidemiologic transition and has profile of a poor as well as an affluent country. [5,6] Out of six global deaths in a year one is from India which equals to 9.5 million deaths. [7] It is experiencing changes in the mortality pattern as a result of its socioeconomic and demographic changes. [8-10] The crude death rate (CDR) was 14.9 in 1971, which was declined to 7.1 in 2010. During the same period, the crude birth rate (CBR) fell from 36.9 to 22.1. [11,12] Over the last century, life expectancy has increased by almost threefold, rising from 23 years in 1901 to 67.5 years in 2009-13. [13,14] This calls for the examination of changes in the pattern of causes of death to see the epidemiological transition in the country. It demands good quality data on health situation of its population. However, there is limited data on cause of death particularly the rural population where three-fourth of its total population lives. Of course, there is Medical

Certification of Cause of Death (MCCD) scheme for obtaining authentic and scientific information regarding causes of mortality which is limited to urban population only. In this light, an attempt has been made to measure the trends in mortality by different causes of death between 1990 and 2010 and their relative contribution in different age groups of urban population of India by calculating percentage of major cause of death to total deaths by age and sex for all these years using MCCD data.

MATERIALS AND METHODS

Table 1: Causes of Death Combined as per ICD-9 and ICD-10 Codes

Major Cause of Death Groups	ICD-10	ICD-9
Infectious and Parasitic Diseases	Certain Infectious and Parasitic Diseases (A00-B99)	Infectious and Parasitic Diseases (001-139)
Neoplasms	Neoplasms (C00-D48)	Neoplasms (140-239)
Diseases of the Circulatory System	Diseases of the Circulatory System (I00-I99)	Diseases of the Circulatory System (390-459)
Diseases of the Respiratory System	Diseases of the Respiratory System (J00-J98)	Diseases of the Respiratory System (460-519)
Diseases of the Digestive System	Diseases of the Digestive System (K00-K92)	Diseases of the Digestive System (520-579)
Certain conditions originating in the perinatal period	Certain Conditions Originating in the Perinatal Period (P00-P96)	Certain Conditions Originating in the Perinatal Period (760-779)
Symptoms, signs and ill-defined conditions	Symptoms, signs and abnormal clinical and laboratory findings not elsewhere classified (R00-R99)	Symptoms, signs and ill-defined conditions (780-799)
Injury and Poisoning	Injury, Poisoning and Certain Other Consequences of External Causes (S00-T98)	Injury and Poisoning (800-999)
Other Causes	Diseases of blood and blood forming organs and certain disorders involving the immune mechanism (D50-D89)	Diseases of blood and blood forming organs (280-289)
	Endocrine, Nutritional and Metabolic Diseases (E00-E89)	Endocrine, Nutritional & Metabolic Diseases and Immunity Disorders (240-279)
	Mental and Behavioural Disorders (F01-F99)	Mental Disorders (290-319)
	Diseases of the Nervous System (G00-G98)	Diseases of the Nervous System and Sense Organs (320-389)
	Diseases of the eye and Adnexa (H00-H59)	
	Diseases of the Ear and Mastoid Process (H60-H95)	
	Diseases of the Skin and Subcutaneous Tissue (L00-L98)	Diseases of the Skin and Subcutaneous Tissue (680-709)
	Diseases of the Musculoskeletal System and Connective tissue (M00-M99)	Diseases of Musculoskeletal System and Connective Tissue (710-739)
	Diseases of the Genitourinary System (N00-N99)	Diseases of the Genitourinary System (580-629)
	Pregnancy, Childbirth and the Puerperium (O00-O99)	Complication of Pregnancy Child-Birth and the Puerperium (630-676)
	Congenital Malformations, Deformations and Chromosomal Abnormalities (Q00-Q99)	Congenital Anomalies (740-759)

The Medical Certification of Cause of Death (MCCD) reports for the year 1990 to 2010 is the main data source used in the study, as from 1990 the death estimates are classified according to sex in MCCD. [15] This scheme is operational in urban areas. The health facilities in the rural areas are designated to give information in MCCD, however the information is sent mainly from the urban regions. Data derived from MCCD is tabulated in conformity with the International Classification of Diseases (ICD) - Tenth Revision (1993). [16] It has been adopted in the Office of the Registrar General, India (ORGI) for classification of causes of death since MCCD 1999 report. The statistics on medically certified cause of death is being tabulated as per the National List (ICD-10, modified according to Indian conditions). The underlying cause of death

is taken into account while tabulating the cause-specific mortality. [17] Since MCCD essentially implements the ICD coding and guidelines, the design of the system is considered satisfactory. More details can be found at other places. [18] MCCD data for the year 1990 to 1998 was collected according to ICD-9 classification and ICD-10 classification from 1999 onward. In order to make the data comparable for both the time duration, all cause of death groups have been combined into nine major causes of death groups.

Table 1 shows the comparison of ICD-9 and ICD-10 classification and the cause of death included in the nine major causes of death groups. The group symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified reflects the quality of cause of death data. The decline in this cause group shows improvement in the quality of data.

While compiling MCCD data, it was observed that there were a large number of deaths under the head 'NS' (Age Not Stated) in each cause of death group. These deaths were redistributed in all age groups in proportion of cause of death to total medically certified deaths. This was done for all years for all causes of death by age and sex. In order to make the data comparable, MCCD data were clubbed into the following age groups - below 1 year, 1-4 years, 5-14 years, 15-24 years, 25-64 years, 65 years and above. Percentage of major cause of death to total death by age and sex is calculated for all these years.

RESULTS

While analysing an ICD coded cause of death database, Salomon and Murray (2002) observed that even when cause of death patterns quite vary across countries and over time, one tends to get empirical regularities relating to variation in mortality rates from all causes to the relative contribution of communicable diseases, non-communicable diseases and injuries. They found that as all-cause mortality declines, the composition of mortality by cause changes systematically in many age groups and concluded that epidemiologic transition is "not simply the result of changing age structure in the population but a real transition in the cause composition of age-specific mortality". [19]

Thus, along with the change in age structure of mortality, it is essential to examine the changes in cause-specific mortality in each age group over time. Tables 2-3 give the relative share of major cause of death to total death for the years 1990, 1994, 1998, 2002, 2004, 2010 over a long term transition period for male and female. This helps us to locate the significance of a particular cause of death group over time and judge its relative position in relation to other cause of death groups for each age group.

Male infants (below 1 year) depict a higher concentration of certain conditions originating in the perinatal period, infectious and respiratory deaths. The relative share of infectious deaths was falling over these years. It declined to almost half in 2010. The share of respiratory death was 9.9% in 1990 declined to 6.2% in 2010.

In child of 1-4 years age group, mortality occurred due to infectious, respiratory diseases, and injury & poisoning. Share of infectious deaths were decreasing over these years however share of respiratory deaths had increased till 2002 and later declined in 2006 and 2010. Injury & poisoning had shown increasing and decreasing trend during the period.

In child of 5-14 years age group, mortality occurred due to infectious, circulatory, respiratory diseases, and injury & poisoning. Yet, for the entire child population below 14 years, the infectious deaths were the most common form of mortality.

For the age group 15-24 years, the foremost cause of death group was injury & poisonings followed by infectious and circulatory diseases.

Table 2: Cause Composition of Age-specific Mortality in Male (1990-2010)

Major Cause of Death Groups	Age Groups (in years)						
1990	**Below 1**	**1-4**	**5-14**	**15-24**	**25-64**	**65+**	**Total**
Infectious and Parasitic Diseases	16.4	34.8	26.8	18.1	17.7	9.0	20.0
Neoplasms	0.2	1.0	2.5	2.5	4.6	4.6	3.0
Diseases of the Circulatory System	2.5	4.1	8.2	9.3	26.8	36.2	15.0
Diseases of the Respiratory System	9.9	14.9	6.6	4.1	5.6	10.2	9.0
Diseases of the Digestive System	0.9	2.7	4.0	4.2	6.9	3.2	4.0
Certain conditions originating in the perinatal period	51.0	0.0	0.0	0.0	0.0	0.0	8.0
Symptoms, signs and ill-defined conditions	8.0	12.0	15.3	13.8	12.3	23.4	14.0
Injury and Poisoning	2.9	10.5	19.3	38.2	17.4	4.6	15.0
Other Causes	8.2	19.9	17.3	9.8	8.8	8.8	12.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
1994	**Below 1**	**1-4**	**5-14**	**15-24**	**25-64**	**65+**	**Total**
Infectious and Parasitic Diseases	14.4	35.1	27.4	20.5	19.8	10.0	21.0
Neoplasms	0.1	1.3	2.9	2.7	4.5	4.6	3.0
Diseases of the Circulatory System	1.8	3.2	6.8	8.6	27.3	38.5	14.0
Diseases of the Respiratory System	10.0	16.6	7.7	3.8	5.2	9.0	9.0
Diseases of the Digestive System	1.0	4.1	4.8	4.6	7.5	3.4	4.0
Certain conditions originating in the perinatal period	54.8	0.8	0.0	0.0	0.0	0.0	9.0
Symptoms, signs and ill-defined conditions	8.5	10.2	16.4	13.3	11.2	19.8	13.0
Injury and Poisoning	0.8	6.7	13.9	35.2	14.6	4.0	13.0
Other Causes	8.8	21.9	20.2	11.3	9.9	10.7	14.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
1998	**Below 1**	**1-4**	**5-14**	**15-24**	**25-64**	**65+**	**Total**
Infectious and Parasitic Diseases	9.8	29.6	27.6	20.0	19.6	11.4	20.0
Neoplasms	0.1	0.9	2.7	2.1	3.6	3.8	2.0
Diseases of the Circulatory System	2.4	6.4	10.1	13.1	27.8	41.4	17.0
Diseases of the Respiratory System	6.3	16.7	10.4	5.3	6.0	10.1	9.0
Diseases of the Digestive System	0.7	3.2	4.6	3.9	7.7	4.1	4.0
Certain conditions originating in the perinatal period	65.0	1.8	0.0	0.0	0.0	0.0	11.0
Symptoms, signs and ill-defined conditions	6.8	13.6	10.4	12.7	11.5	15.7	12.0
Injury and Poisoning	1.0	8.1	16.1	33.6	15.2	3.7	13.0
Other Causes	7.9	19.6	18.0	9.3	8.7	9.9	12.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
2002	**Below 1**	**1-4**	**5-14**	**15-24**	**25-64**	**65+**	**Total**
Infectious and Parasitic Diseases	9.7	26.0	22.8	18.9	17.4	8.7	17.0
Neoplasms	0.1	1.1	2.2	2.1	3.8	4.5	2.0
Diseases of the Circulatory System	2.5	9.4	11.1	13.3	29.1	43.1	18.0
Diseases of the Respiratory System	7.0	19.4	10.9	7.0	7.5	11.5	11.0
Diseases of the Digestive System	0.6	3.1	4.5	4.0	7.5	3.3	4.0
Certain conditions originating in the perinatal period	66.5	0.0	0.0	0.0	0.0	0.0	11.0
Symptoms, signs and ill-defined conditions	2.9	10.0	11.1	11.0	9.0	13.2	10.0
Injury and Poisoning	1.3	9.4	16.5	32.6	15.2	3.8	13.0
Other Causes	9.5	21.6	20.8	11.1	10.6	12.0	14.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
2006	**Below 1**	**1-4**	**5-14**	**15-24**	**25-64**	**65+**	**Total**
Infectious and Parasitic Diseases	8.3	22.2	21.8	19.4	17.0	9.1	16.0
Neoplasms	0.2	1.7	2.6	2.6	4.2	4.9	3.0
Diseases of the Circulatory System	2.9	8.3	11.2	10.9	28.3	39.9	17.0
Diseases of the Respiratory System	7.8	15.4	8.2	5.2	7.3	11.7	9.0
Diseases of the Digestive System	0.4	2.0	2.8	3.3	7.1	3.0	3.0
Certain conditions originating in the perinatal period	67.0	0.0	0.0	0.0	0.0	0.0	11.0
Symptoms, signs and ill-defined conditions	4.9	17.8	18.6	19.5	13.4	15.6	15.0
Injury and Poisoning	0.8	7.0	12.6	27.7	11.8	2.7	10.0
Other Causes	7.7	25.6	22.2	11.5	11.0	13.1	15.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
2010	**Below 1**	**1-4**	**5-14**	**15-24**	**25-64**	**65+**	**Total**
Infectious and Parasitic Diseases	8.0	22.8	24.3	19.6	15.7	8.7	17.0
Neoplasms	0.4	2.3	3.9	3.0	4.7	5.1	3.0
Diseases of the Circulatory System	4.1	18.3	16.7	14.1	30.1	41.6	21.0
Diseases of the Respiratory System	6.2	13.9	9.7	6.5	8.6	13.0	10.0
Diseases of the Digestive System	0.5	2.2	2.8	3.1	7.7	3.2	3.0
Certain conditions originating in the perinatal period	70.0	0.0	0.0	0.0	0.0	0.0	12.0
Symptoms, signs and ill-defined conditions	3.4	11.6	13.3	17.4	12.4	13.9	12.0
Injury and Poisoning	0.8	7.5	11.1	26.5	10.2	2.5	10.0
Other Causes	6.6	21.4	18.2	9.8	10.7	11.9	13.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: RGI (1990-2010) [15]

Table 3: Cause Composition of Age-specific Mortality in Female (1990-2010)

Major Cause of Death Groups	Age Groups (in years)						
1990	**Below 1**	**1-4**	**5-14**	**15-24**	**25-64**	**65+**	**Total**
Infectious and Parasitic Diseases	15.9	35.9	28.8	16.8	14.6	6.0	20.0
Neoplasms	0.1	0.8	2.0	1.6	6.0	3.9	2.0
Diseases of the Circulatory System	2.3	3.1	7.7	8.4	23.7	36.0	14.0
Diseases of the Respiratory System	10.6	16.8	7.5	3.8	4.9	10.4	9.0
Diseases of the Digestive System	0.9	2.5	3.8	3.5	4.3	2.0	3.0
Certain conditions originating in the perinatal period	51.2	0.0	0.0	0.0	0.0	0.0	9.0
Symptoms, signs and ill-defined conditions	8.3	13.4	11.8	10.1	11.7	28.3	14.0
Injury and Poisoning	2.7	8.7	20.6	37.8	20.5	4.2	16.0
Other Causes	8.0	18.9	17.8	18.1	14.3	9.3	14.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
1994	**Below 1**	**1-4**	**5-14**	**15-24**	**25-64**	**65+**	**Total**
Infectious and Parasitic Diseases	14.3	33.3	26.2	17.1	15.9	7.1	19.0
Neoplasms	0.1	0.9	1.7	1.6	6.0	4.3	2.0
Diseases of the Circulatory System	1.7	3.1	7.1	9.2	23.6	39.4	14.0
Diseases of the Respiratory System	10.8	18.3	8.7	3.2	4.9	9.8	9.0
Diseases of the Digestive System	0.8	3.2	4.5	3.9	4.7	2.5	3.0
Certain conditions originating in the perinatal period	54.2	0.9	0.0	0.0	0.0	0.0	9.0
Symptoms, signs and ill-defined conditions	8.9	11.4	15.3	11.8	12.5	21.7	14.0
Injury and Poisoning	0.8	6.6	15.9	33.8	16.7	3.8	13.0
Other Causes	8.5	22.3	20.5	19.3	15.6	11.4	16.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
1998	**Below 1**	**1-4**	**5-14**	**15-24**	**25-64**	**65+**	**Total**
Infectious and Parasitic Diseases	10.0	30.4	27.2	18.7	16.9	8.9	19.0
Neoplasms	0.1	0.8	1.7	1.3	5.3	3.6	2.0
Diseases of the Circulatory System	2.2	5.9	10.4	10.5	26.2	42.7	16.0
Diseases of the Respiratory System	6.6	15.8	9.6	3.5	5.6	9.3	8.0
Diseases of the Digestive System	0.6	3.5	4.0	3.1	4.4	2.9	3.0
Certain conditions originating in the perinatal period	64.2	2.0	0.3	0.0	0.0	0.0	11.0
Symptoms, signs and ill-defined conditions	8.0	12.8	10.5	10.1	11.3	19.1	12.0
Injury and Poisoning	1.0	7.8	16.4	36.8	16.7	2.9	14.0
Other Causes	7.3	21.0	20.0	16.1	13.7	10.4	15.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
2002	**Below 1**	**1-4**	**5-14**	**15-24**	**25-64**	**65+**	**Total**
Infectious and Parasitic Diseases	9.1	26.9	24.9	18.7	15.6	7.2	17.0
Neoplasms	0.2	1.0	2.1	1.6	6.5	4.4	3.0
Diseases of the Circulatory System	2.1	9.1	10.8	13.7	28.9	42.3	18.0
Diseases of the Respiratory System	8.2	21.1	12.7	5.2	6.9	12.3	11.0
Diseases of the Digestive System	0.4	2.5	3.9	2.6	3.6	2.0	2.0
Certain conditions originating in the perinatal period	66.3	0.0	0.0	0.0	0.0	0.0	11.0
Symptoms, signs and ill-defined conditions	3.1	9.2	10.2	11.3	9.1	16.4	10.0
Injury and Poisoning	1.1	8.7	16.0	30.2	14.0	3.3	12.0
Other Causes	9.5	21.4	19.5	16.8	15.4	12.2	16.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
2006	**Below 1**	**1-4**	**5-14**	**15-24**	**25-64**	**65+**	**Total**
Infectious and Parasitic Diseases	9.0	24.2	24.2	19.6	15.3	8.0	17.0
Neoplasms	0.2	1.6	2.3	1.6	7.3	5.2	3.0
Diseases of the Circulatory System	3.0	7.3	9.5	10.0	27.8	42.0	17.0
Diseases of the Respiratory System	9.1	17.1	8.8	4.4	7.0	10.1	9.0
Diseases of the Digestive System	0.5	2.0	2.9	2.6	3.7	1.8	2.0
Certain conditions originating in the perinatal period	63.9	0.0	0.0	0.0	0.0	0.0	11.0
Symptoms, signs and ill-defined conditions	5.6	13.6	15.0	14.7	11.8	17.2	13.0
Injury and Poisoning	0.8	7.0	12.8	28.6	11.3	2.5	10.0
Other Causes	8.0	27.2	24.6	18.4	15.7	13.2	18.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
2010	**Below 1**	**1-4**	**5-14**	**15-24**	**25-64**	**65+**	**Total**
Infectious and Parasitic Diseases	7.8	23.2	23.2	19.1	15.3	7.8	16.0
Neoplasms	0.4	1.8	2.7	2.0	7.6	4.8	3.0
Diseases of the Circulatory System	3.7	19.1	14.7	12.6	29.3	44.2	21.0
Diseases of the Respiratory System	6.2	15.0	8.6	6.7	8.5	11.0	9.0
Diseases of the Digestive System	0.4	1.5	2.3	2.3	3.5	2.1	2.0
Certain conditions originating in the perinatal period	71.5	0.0	0.0	0.0	0.0	0.0	12.0
Symptoms, signs and ill-defined conditions	3.2	11.8	22.2	14.9	11.7	16.0	13.0
Injury and Poisoning	0.7	5.9	9.9	25.2	9.1	1.9	9.0
Other Causes	6.2	21.7	16.3	17.2	15.0	12.3	15.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: RGI (1990-2010) [15]

The age group 25-64 years, which is the most productive age group, had witnessed a progressive increase in the circulatory death share for this long period. Such a pattern was observed during the entire reference period. This age group had also witnessed death share of infectious diseases and injury & poisoning. However in successive years, share of these diseases had declined for each individual age group, paving the way for other kinds of mortality, like digestive mortality.

In elderly population of 65 years and above, the leading cause of death was circulatory diseases followed by respiratory and infectious diseases. Share of circulatory deaths had shown increasing trend over these years.

Female infants (below 1 year) depict a higher concentration of certain conditions originating in the perinatal period, infectious and respiratory deaths. The relative share of infectious deaths was falling over these years. It declined to almost half in 2010. The share of respiratory death was 10.6% in 1990 declined to 6.2% in 2010.

In child of 1-4 years age group, mortality occurred due to infectious, respiratory diseases, and injury & poisoning. Share of infectious deaths were decreasing over these years, however respiratory deaths, and injury & poisoning had shown increasing and decreasing trend during the period.

In child of 5-14 years age group, mortality occurred due to infectious, circulatory, respiratory diseases, and injury & poisoning. Yet, for the entire child population below 14 years, the infectious deaths were the most common form of mortality.

For the age group 15-24 years, the foremost cause of death group was injury and poisoning followed by infectious and circulatory diseases. Share of circulatory deaths had shown increasing trend during the reference period.

The age group 25-64 years, which is the most productive age group, had witnessed a progressive increase in the circulatory death share for this long period. Such a pattern was observed for the entire reference period. This age group had also witnessed death share of infectious and injury & poisoning. However in successive years, shares of these diseases had declined for each individual age group, paving the way for other kind of mortality, like respiratory and digestive mortality.

In elderly population of 65 years and above, the leading cause of death was circulatory diseases followed by respiratory and infectious diseases. Share of circulatory deaths had shown increasing trend over these years.

A noticeable and relevant feature is that each major cause of death group affects every age group differently, and there are variations in the way cause of death group impact age groups over a period of time.

The scheme of MCCD has been functioning at different levels of efficiency in various States/UTs. During 2010, 27 States/UTs reported the data on MCCD in the prescribed format. The percentage of medically certified deaths to total registered deaths during 2010 has also gone up to 20.2 compared to 19.9 in the year 2009. Though there has been a consistent but slow increase in the number of States implementing the MCCD scheme. The time series data on medical certification of cause of death for the years 1990 to 2010 reveals a significant long-term growth in absolute numbers of medically certified cases. During these years, the share of medically certified deaths to total registered deaths has been hovering around 13-20%. [20] The share of Symptoms, signs and abnormal clinical and laboratory findings not elsewhere classified has gone down from 14.2% in 1990 to 12.5% in 2010 indicating the improvement in data quality over time. [15]

In the year 2010, every seventh reported medically certified death had been of infants (below 1 year). About 71% of infant deaths had been caused by “certain conditions originating in the perinatal period”. In children in the age groups of 1-4 and 5-14 years, “certain infectious and

parasitic diseases" had taken the highest toll of 23% and 24% respectively. In youth in the age group of 15-24 years, "injury, poisoning and certain other consequences of external causes" was the leading cause of death contributing around 26% share which implied that youth was more vulnerable to injuries and poisoning related deaths. In the age group 25-64 years, the first two leading causes, "diseases of the circulatory system" and "certain infectious and parasitic diseases" were having the shares of 30% and 16% respectively. In the age group 65 years and above, "diseases of the circulatory system" was the first leading cause of death with 43% share. The contributions of male and female deaths in the total medically certified cases had reported to be 61.6% and 38.4% respectively. [20]

There has been shift in the structure of mortality by cause. The following causes of death have shown rise in their percentage share to medically certified deaths during 1990-2010 [15]

- Diseases of the circulatory system (20.4% in 1990, 29.8% in 2010);
- Diseases of the respiratory system (7.7% in 1990, 9.5% in 2010);
- Diseases of the digestive system (4% in 1990, 4.2% in 2010);
- Neoplasms (3.4% in 1990, 4.6% in 2010);
- Endocrine, nutritional and metabolic diseases (2.6% in 1990, 3.9% in 2010);
- Diseases of the genitourinary system (1.3% in 1990, 2.8% in 2010).

The following causes of death have shown decline in the percentage share to total medically certified deaths during 1990-2010 [15]

- Certain infectious and parasitic diseases (16.3% in 1990, 13.1% in 2010);
- Symptoms, signs and abnormal clinical and laboratory findings not elsewhere classified (14.2% in 1990, 12.5% in 2010);
- Injury, poisoning and certain other consequences of external causes (14.1% in 1990, 7.4% in 2010);
- Diseases of blood and blood forming organs and certain disorders involving the immune mechanism (12% in 1990, 1.5% in 2010);
- Certain conditions originating in the perinatal period (8.9% in 1990, 6.9% in 2010);
- Diseases of the nervous system (3.3% in 1990, 2.3% in 2010);
- Pregnancy, childbirth and the puerperium (2.4% in 1990, 1.3% in 2010);
- Mental disorders (0.2% in 1990, 0.1% in 2010).

Age Structure of Mortality (1991-2010)

The change in age structure of mortality over time is crucial in understanding the feature of mortality transition. Table 4 indicates the share of deaths as per broad age groups. The percentage share of death in the below 14 years age group was 40.3% in 1991, stood at 21.1% in the year 2010. The death share of middle-age category (15–59 years) increased marginally from 27.7% in 1991 to 30.90% in 2010. The percentage share of death for the age group 60 years and above was 32.10 in 1991, increased substantially to 48 in the year 2010. [21]

Table 4: Percentage Share of Deaths to Total Deaths by Age (1991-2010)

Age (in years)	Year					
	1991	1994	1998	2002	2006	2010
Below 1	24.10	22.80	21.00	19.60	17.90	14.50
1-4	11.20	8.10	7.70	5.20	5.10	3.90
5-14	5.00	4.50	4.50	3.30	3.70	2.70
15-59	27.70	26.90	27.40	30.80	29.40	30.90
60+	32.10	37.70	39.30	41.10	43.90	48.00
Total	**100.10**	**100.00**	**99.90**	**100.00**	**100.00**	**100.00**

Source: RGI [21]

A further break-up of the below 14 years age group shows that infant deaths share reduced from 24.1% in 1991 to 14.5% in the year 2010. The child death share fell from 11.2% to 3.9%; and share in the 5-14 years category fell from 5% to 2.7% in respective period. The overall reduction in below 14 years mortality during the period was 48%, with the fall being 65% in the age group 1-4 years, 40% in those below 1 year and 46% in children between 5 and 14 years. For the same period, there was a 12% increase in mortality in the group 15-59 year adult population. Mortality in the oldest age group of 60 years and above also increased by 50%.

There had been greater contribution of infant and child deaths in the total number of deaths in India. In early nineties, about one quarter of all deaths was due to infant deaths (24%). This share had shown a steady decline over time. In the beginning of the millennium, the share of infant death came down to the level of one fifth of all deaths. In 2010, about 14.5% of all deaths were the infant deaths showing a satisfactory improvement in the expectation of life as the latter greatly affected by the deaths under age one. The contribution of child mortality in the age group (1-4 years) used to be around 11% of all deaths with a declining trend throughout the last two decades. In 2001, deaths among children age (1-4 years) was to the tune of 6.5% of all deaths. In 2010, this share came down to 3.9%. The share of death in the age group 5-14 years of all deaths remained around 5-4% during the end of the previous century. It had, however, declined in the last two decades. The share was hovering in the range of 4 to 3 during 2001-2 and was 2.7% in 2010. The contribution of the deaths of the age group 15-59 years to all deaths remained almost constant (around 27%) during the nineties but started increasing slowly and had reached to 30.9% in 2010. The above trend, despite simultaneous decrease in maternal mortality, showed the preponderance of population momentum as well as increase of new emerging diseases in the above age group at the national level. About one-third of all deaths used to belong to the aged population in early nineties. This share had sharply increased to the level that every 2 deaths of all 5 deaths belong to the age group 60 and above. Now, every second death is an aged person in India. [21]

DISCUSSION

In this study, the analysis of MCCD data provided key insights into the epidemiologic transition in urban India. Deaths due to "certain conditions originating in the perinatal period" were the main cause of death of both male and female infants from 1990 to 2010. "Certain infectious and parasitic diseases" was the main cause of death of both male and female children in 1-4 and 5-14 years age groups from 1990 to 2010. Among youth (15-24 years), the leading cause of death was "injury, poisoning and certain other consequences of external causes" of both males and females from 1990 to 2010. In the adult (25-64 years) as well as elderly population (65 years and above), "disease of the circulatory system" was the leading cause of death of both male and female from 1990 to 2010.

It emerges from the study that India has witnessed a phase of gradual decline of infectious and communicable deaths and has increasingly been facing injuries and non-communicable diseases. The epidemiologic transition shows that circulatory and respiratory deaths have increased their relative shares in mortality over a long-term period. At the same time, infectious diseases do still remain a major cause of death. The age structure of mortality has undergone a shift depicting reductions in share of children's deaths over time and concentration of mortality in the older age groups. It indicates that India is presently facing the dual burden of disease specific mortality. Though the results of the study may not be generalized to whole of India because 70% of population resides in rural

areas [22] but in the absence of quality cause of death data at the national level, these results can become inputs for predicting current and future health care needs and possible changes in national health policy agenda and strengthening existing health system. The results of the study also align with the findings of other studies in developing countries. [23-26]

In a study it was found that in India non-communicable diseases are increasing, and communicable diseases like HIV, malaria, TB, etc. are not still under control and quite often the previously controlled infectious diseases are also re-emerging. [27] Another study conducted in urban Maharashtra discovered that communicable diseases are decreasing over time but they are still predominant in infants, children, youth and adult population. [28] In another study it was found that Goa has witnessed a phase of gradual decline of infectious and communicable deaths and has increasingly been facing non-communicable type of mortality. [29] These findings closely resemble the findings of this study.

CONCLUSION

Most of the diseases are preventable either by changing life style and improving environment, housing condition or by vaccination/immunization. A number of infections are still dominating in India and are taking many lives each year. John [30] has indicated that instead of adopting different policies to control different types of infectious and communicable diseases it would be more effective for India to promote primary health care for a few selected communicable diseases like tuberculosis, malaria and leprosy. This approach will control these diseases and generate some positive externality in terms of promoting environmental awareness, consciousness about health and hygiene and improving life style to avert other disease related vulnerability.

The findings reinforce the need of bringing in health care interventions not just at diagnostic and curative levels but more particularly at preventive and promotional levels. India needs to have a planned approach towards evolution of a time-bound health policy with a clear focus on specific aspects of mortality and disease.

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