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Original Research Article

Addressing the rising cause of death due to diseases of the circulatory system geared towards achieving SDG 3: evidence from data on medical certification of cause of deaths in Rajasthan State, India: 1999-2015

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ABSTRACT

Background: Medical certification of cause of death (MCCD) scheme is imperative tool to obtain scientific and reliable information in terms causes of mortality. The office of the registrar general of India (ORGI) initiated the scheme on MCCD under civil registration system (CRS), during the third five year plan.
Methods: This paper analyzes the data for the last 16 years for MCCD in Rajasthan from 1999 to 2015. The findings are based on more than half a million deaths, for which cause of death data is reported. The per cent of cause of deaths have been computed and the curve estimation method has been used to project the cause of death due to circulatory diseases.
Results: The data reveals that the percentage of medically certified deaths hovers around 10 to 13 percent during 1999 to 2015 of the total deaths registered under the civil registration system, which is about 5 million deaths. The highest percentage of deaths that has been medically certified is due to circulatory diseases as seen for the combined period of sixteen years (1999-2015) (21 percent) followed by deaths due to certain infectious and parasitic diseases (16 percent). This has increased from 13.8 per cent in 1999 to 20.2 per cent in 2015. This proportion has been projected upto 2030, the target year of achievement of Sustainable Development Goals (SDGs).
Conclusions: Addressing this cause, could help in the achievement of indicator of 3.4.1, mortality rate attributed to cardiovascular disease, cancer, diabetes or chronic respiratory disease under the target of reducing by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being by 2030 subsumed under the SDG 3 of ensuring healthy lives and promote well-being for all at all ages.

Keywords: MCCD, CRS, SRS, Rajasthan, India

INTRODUCTION

Civil registration system in India is quite old. The Government of India passed an Act regarding registration of births and deaths, in 1969, which was enforced in Rajasthan state in April, 1970.[1] Birth registration is the first birth right of every child. Cent percent birth registration is one of the major goals of the National Population Policy 2000.[2] But still, civil registration is a major concern all over India. Many states are lagging behind in this area. The Government of India passed an act regarding registration of births and deaths (RBD), in

1969, which was enforced in Rajasthan state in April, 1970**.** For the implementation of RBD Act 1969 in the state, "Rajasthan Registration of Births and Death Rules, 1972" were framed.[1] The state rules were further amended in the year 2000, which were called the Rajasthan Births and Deaths Registration Rules, 2000. Subsequently, in the Rajasthan births and deaths registration (Amendment) rules, 2005, Rule No. 9 of the Rajasthan Births and Deaths Registration Rules, 2000 was amended by substituting the existing expressions of "rupees two", "rupees five" or "rupees ten" by the expression "rupees one". These rules were further amended in 2007, which were called the Rajasthan Births and deaths registration (Amendment) rules, 2007. The formats 1, 2, 5, 6, 7 and 8 were revised in this amendment.

The activities undertaken under this scheme include its implementation, publicity for increasing public awareness towards registration of births and deaths through documentary films, TV, Radio, hoardings, posters, newspapers, pamphlets etc., inspections of registration units and flow of returns of civil registration. Monthly returns regarding progress of registration are collected from the field through District registrars for onward transmission to the Registrar General of India. The quarterly progress reports of film shows, progress on implementation of the recommendations of the conferences, recording and reporting efficiency of the registration work are sent to the Registrar General of India and the annual progress report of births and deaths registration scheme is prepared by the Chief Registrar. Regular trainings for officials concerned with birth and death registration are organized at district as well as block level.

Process of civil registration

There are three reporting forms for the collection and registration of births and deaths. Live births are registered in the births form, deaths are registered in the deaths form and still births are registered in the still birth form. The forms have two sections; the legal part and the statistical part. The legal part is kept at the gram panchayat office in case of rural areas and in the Nagarpalika in case of urban areas and the statistical part along with a tabular compilation is sent to the Panchayat Samiti in the rural areas, where it is compiled by the PEO and sent onward to the DSO along with a tabular compilation of the data. In the urban areas, the data from the Nagarpalika is sent to DSO. The DSO sends them forward to the Directorate of Economics and Statistics for final compilation and publication.

The state of Rajasthan in India

Rajasthan is situated in the northern part of India. It is the largest State in India by area constituting 10.4 percent of the total geographical area of India and it accounts for 5.5 percent of population of India. The decadal growth rate of population of Rajasthan is 21.44 percent compared to 17.64 percent in case of India. The population of Rajasthan is 68.5 million. It comprises of 33 districts.[3]

Medical certification of cause of death

The 1961 conference on improvement of vital statistics endorsed the gradual introduction of scheme on medical certification of cause of death only in limited areas with support by legal sanction (as subsequently provided in the registration of birth and deaths act of 1969).[4] ORGI initiated scheme on MCCD under civil registration system during the third five year plan. It was in operation in some of the states in the beginning of 70s. It has got statutory backing under sections 10 (2), 10 (3), 17 (1) b and 23 (3) of the registration of birth and deaths act, 1969. Under this scheme, a certificate of cause of death is issued by the Medical Officer at the time of death. These certificates are scrutinised and coded by the Director, Medical and Health Services and compilation and analyzed by the Directorate. MCCD provides cause-specific mortality profiles and is a key indicator for analyzing the health trends of the population in a scientific manner. The information is of considerable use to public health planners, administrators, medical professionals and research workers.

The information is made use of in the assessment of the effectiveness of public health programme. It is a feedback for better health planning and management as well as for deciding priorities of health and medical research programme.

Legal provisions of medical certification of cause of deaths: section 10 (2)

In any area, the State Government having regard to the facilities available therein in this behalf may require that a certificate as to the cause of death shall be obtained by the Registrar from such person and in such form as may be prescribed.

Section 10 (3)

Provides for issuing a certificate free of cost, of the cause of death by the medical practitioner who attend to the deceased at the time of death.

Section 17 (1) (b)

Subject to any rules made in this behalf by the State Government, including rules relating to the payment of fees and postal charges, any person may obtain an extract from such register relating to any birth or death.

Provided that no extract relating to any death, issued to any person, shall disclose the particulars regarding the cause of death as entered in the register.

Section 23 (3)

Any medical practitioner who neglects or refuses to issue a certificate under sub section (3) of section 10 and any person who neglects or refuses to deliver such certificates shall be punishable with fine which may extend to fifty rupees.

Objectives

The objective of this paper is to analyse the trends in cause of deaths and estimate the future levels of cause of deaths upto 2030.

METHODS

The percentage share of deaths due to diseases of the circulatory system has been projected using a linear and exponential curve to the data from 1999 upto 2030. The projections were carried out using PASW statistics 18, release 18.0. Based on the sixteen years of data on MCCD from 1999 to 2015, the future level has been projected upto 2030 by the curve estimation method. It has been estimated using the linear and exponential curve fitted to the model:

The linear curve fitting equation is in the form of: Y=a (1+bt)

The exponential curve fitting equation is in the form of: Y=a exp (bt)

RESULTS

The overall results reveal that though there is a steep increase in the birth and death registration during 2000 and 2015, a 63.5% point increase in birth registration and 44.3% point increase in case of death registration, the percent of medical certification of cause of death has increased by a meagre 1.7% point during the same period.

Levels of birth and death registration

The percentage of birth registration in Rajasthan has increased from 35.0 per cent in 2000 to 98.7 per cent in 2015 compared to 56.2 per cent and 88.3 per cent respectively in India during the same period. Similarly, death registration in Rajasthan has increased from 45.6 per cent in 2000 to 89.9 per cent in 2015 compared to 48.7 per cent and 76.6 per cent respectively in India during the same duration. The level of death registration is low in both Rajasthan as well as India.[5-9]

Table 1: Trends in birth, death registration and medically certified cause of deaths in India and Rajasthan, 2000-2015 (%).

Year	India		Rajasthan		Rajasthan
	Birth registration (%)	Death registration (%)	Birth registration (%)	Death registration (%)	Percentage of deaths with medically certified cause of deaths (%)
2000	56.2	48.7	35.0	45.6	10.8
2001	58.0	52.2	39.5	55.1	10.9
2002	59.5	52.1	55.6	62.4	10.0
2003	57.7	53.5	46.2	59.1	9.9
2004	60.4	55.2	56.9	70.4	8.3
2005	62.5	55.0	65.3	65.9	10.0
2006	68.3	63.4	81.5	72.9	10.8
2007	74.5	69.3	83.2	74.6	9.6
2008	76.4	66.4	85.9	74.5	9.8
2009	81.3	66.9	92.4	77.4	9.5
2010	82.0	66.9	97.4	82.4	10.0
2011	83.6	67.4	96.7	78.9	11.8
2012	84.4	69.3	98.0	78.1	10.3
2013	85.6	70.9	98.4	87.9	11.6
2014	88.8	74.3	98.2	87.1	13.1
2015	88.3	76.6	98.7	89.9	12.5

Sources: Directorate of Economics and Statistics (2011). A Decade of Medical Certification of Cause of Deaths in Rajasthan, 1999-2008, Government of Rajasthan; Directorate of Economics and Statistics (2011). Annual Vital Reports, 2009-2015. Government of Rajasthan. Vital Statistics of India Based On The Civil Registration System 2015, Office of the Registrar General, India Ministry of Home Affairs. Govt of India.

Table 2: Per cent of causes of death in major cause groups in Rajasthan: 1999-2015.

No.	Cause of Death	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Certain Infectious And Parasitic Diseases (A00-B99)	19.6	16.3	16.8	16.1	16.8	16.1	8.7	15.0	15.1	15.0	17.2	18.6	13.7	16.9	19.2	18.4	15.9
2	Neoplasms (C00-D48)	1.5	1.9	2.3	2.5	2.5	2.2	1.6	2.5	2.2	2.5	2.7	2.8	1.5	2.2	2.9	3.6	2.9
3	Disease of The Blood And Blood Forming Organs And Certain Disorders Involving The Immune Mechanism (D50-D89)	2.8	3.0	3.4	3.2	3.1	2.1	1.8	1.8	1.8	1.6	1.8	1.8	1.3	2.2	1.5	1.5	1.2
4	Endocrine, Nutritional And Metabolic Disease (E00-E89)	1.3	1.5	2.0	2.2	2.1	2.1	1.0	1.4	1.8	2.0	3.7	3.8	3.2	2.1	1.9	2.4	1.9
5	Mental And Behavioural Disorders (F01-F99)	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.3	0.0	0.0	0.0	0.0	0.2	0.1	0.1
6	Diseases of The Nervous System (G00-G98)	5.2	2.6	4.4	4.1	4.0	3.8	3.5	3.5	2.9	2.8	2.8	2.3	1.8	1.7	1.7	1.8	1.8
7	Diseases Of The Eye And Adnexa (H00-H59)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
8	Diseases Of The Ear And Mastoid Process (H60-H95)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	Diseases Of The Circulatory System (I00-I99)	13.8	22.0	20.5	23.2	22.2	23.1	28.9	22.1	20.4	20.6	25.2	21.8	19.5	19.4	18.5	20.6	20.2
10	Diseases Of The Respiratory System (J00-J98)	7.7	8.7	8.3	8.1	8.9	8.8	9.6	11.3	9.3	10.1	11.9	10.2	16.7	10.1	14.0	10.3	13.4
11	Diseases Of The Digestive System (K00-K92)	4.1	4.3	5.0	4.4	4.7	5.1	2.1	2.6	2.8	2.8	2.9	2.6	1.9	1.3	3.7	3.9	3.9
12	Diseases Of The Skin And Subcutaneous Tissue (L00-L98)	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.3	0.3	0.2	0.2	0.0	0.1	0.2	0.2	0.1
13	Diseases Of The Musculoskeletal System And Connective Tissue (M00-M99)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
14	Diseases Of The Genitourinary System (N00-N99)	2.4	2.6	3.0	3.6	2.8	3.1	3.4	3.9	3.1	2.2	1.0	0.9	0.9	2.3	1.9	2.9	2.5
15	Pregnancy, Child Birth And The Puerperium (O00-O99)	0.0	0.4	0.2	0.2	0.4	0.4	0.4	0.3	0.5	1.0	1.3	1.3	0.8	0.2	1.6	0.5	2.3
16	Certain Conditions Originating In The Perinatal Period (P00-P96)	8.6	12.3	11.5	10.7	9.8	9.6	15.0	13.1	17.5	16.8	21.9	17.1	24.2	23.0	20.0	16.8	18.9
17	Congenital Malformations, Deformations And Chromosomal Abnormalities (Q00-Q99)	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.2	0.1	0.3	0.3	1.5	0.8	0.6
18	Symptoms, Signs And Abnormal Clinical And Laboratory Findings, Not Elsewhere Classified (R00-R99)	15.5	7.7	7.2	7.5	7.9	8.4	9.4	8.8	7.8	7.3	7.2	9.1	4.3	4.6	5.2	5.7	5.4
19	Injury, Poisoning And Certain Other Consequences Of External Causes (S00-T98)	17.5	16.8	15.3	14.2	14.7	15.2	14.1	13.4	14.4	14.8	0.0	7.3	9.9	13.6	5.9	10.6	8.8
	All causes (major group 1 to 19)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source : Report on Medical Certification of Cause of Death, 2015, Office of the Registrar General of India, Government of India, 2009-2015

Table 3: Per cent of causes of death in eight leading cause groups in Rajasthan : 1999-2015.

No	Cause of Death	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Certain Infectious & Parasitic Diseases (A00-B99)	19.6	16.2	16.7	16.1	16.7	16.1	8.7	15.0	15.1	15.0	17.2	18.6	13.7	16.9	19.2	18.4	15.9
2	Neoplasms (C00-D48)	1.5	1.8	2.2	2.4	2.5	2.2	1.5	2.5	2.2	2.4	2.7	2.8	1.5	2.2	2.9	3.6	2.9
3	Disease of Circulatory System (I00-I99)	13.8	21.9	20.5	23.2	22.2	23.1	28.8	22.0	20.4	20.6	25.2	21.8	19.5	19.4	18.5	20.6	20.2
4	Diseases of the Respiratory System (J00-J98)	7.7	8.7	8.3	8.0	8.8	8.8	9.6	11.2	9.3	10.0	11.9	10.2	16.7	10.1	14	10.3	13.4
5	Diseases of the Digestive System (K00-K92)	4.1	4.2	4.9	4.3	4.6	5.0	2.0	2.5	2.7	2.7	3.7	2.6	1.9	1.3	3.7	3.9	3.9
6	Certain Conditions Originating in the Perinatal Period (P00-P96)	8.6	12.3	11.4	10.7	9.7	9.5	15.0	13.1	17.4	16.7	21.9	17.1	24.2	23	20	16.8	18.9
7	Symptoms, Signs & Abnormal Clinical & Laboratory Findings N.E.C. (R00-R99)	15.5	7.7	7.2	7.4	7.9	8.3	9.4	8.8	7.7	7.2	7.2	9.1	4.3	4.6	5.2	5.7	5.4
8	Injury, Poisoning and Certain Other Consequences of External Causes (S00-T98)	17.5	16.7	15.2	14.2	14.6	15.1	14.1	13.4	14.3	14.8	0	7.3	9.9	13.6	5.9	10.6	8.8
	Sub-Total (Col2+3+4+5+6+7+8+9)	88.3	90.0	86.9	86.7	87.4	88.4	89.5	88.8	89.4	89.8	89.8	89.5	91.7	91.1	89.4	89.9	89.4
	Other Groups	11.7	10.0	13.1	13.3	12.6	11.6	10.6	11.2	10.6	10.2	10.2	10.5	8.3	8.9	10.6	10.1	10.6
	Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source : Report on Medical Certification of Cause of Death, 2015, Office of the Registrar General of India, Government of India, 2009-2015

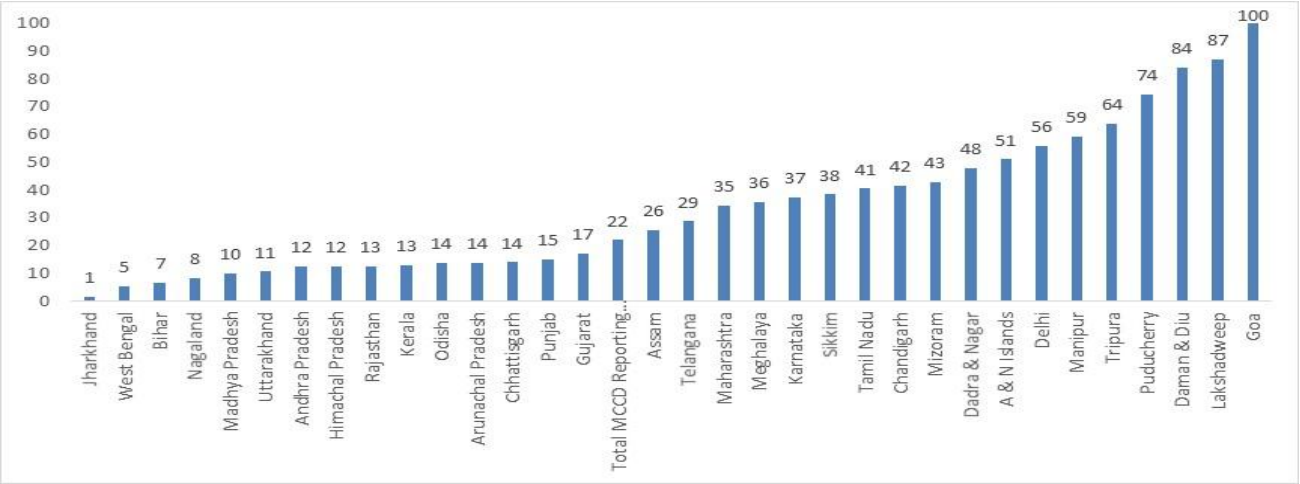

Figure 1: Certified causes of deaths out of the total registered deaths under the civil registration system in India, 2015 (%).

Source: Report on Medical Certification of Cause of Death, 2015, Office of the Registrar General of India, Government of India, 2015.

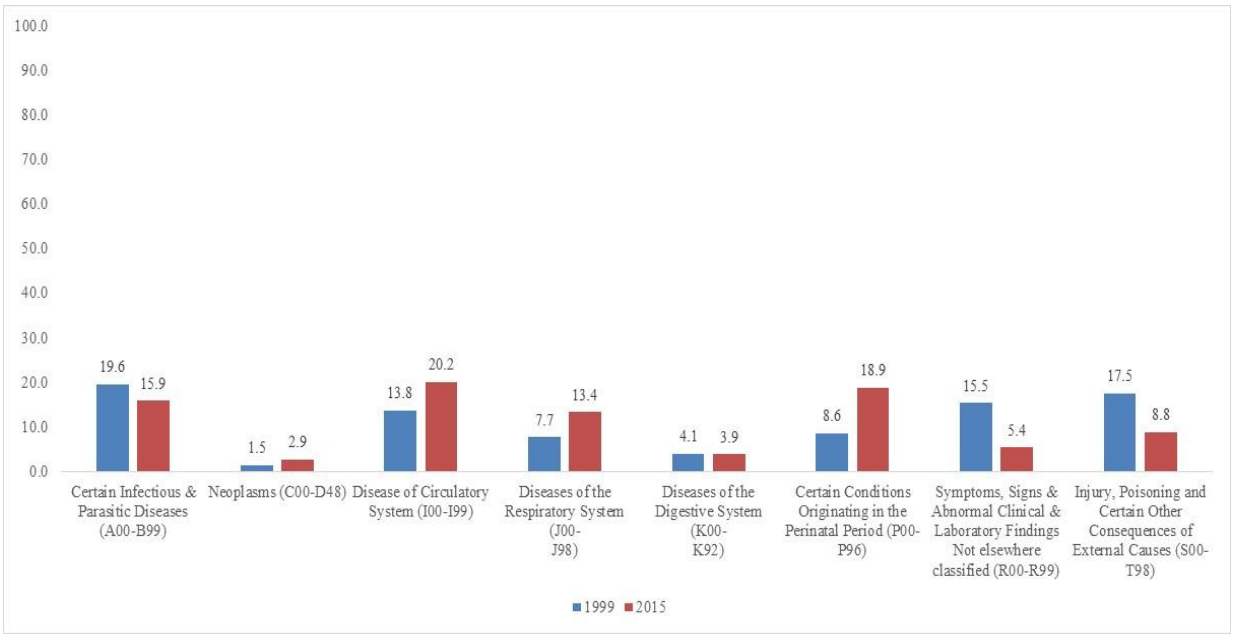

Figure 2: Trends in major causes of deaths from 1999 to 2015 in Rajasthan state, India.

Source: Report on MCCD, 2015, office of the Registrar General of India, Government of India, 2015.

Percentage of medical certification of cause of deaths of the total registered deaths

Medical certification of cause of deaths in India varies considerably among its states from 1 per cent in Jharkhand to cent per cent in Goa. In the sixteen years from 1999 to 2015, 5.4 million (5,388,140) deaths have been registered, out of which about half a million (578, 841) deaths have been medically certified in Rajasthan. It is 10.7 per cent of the total deaths registered under the civil registration system. The trend in per cent of medically certified deaths hovers around the range of 8-13 percent of the total deaths registered under the civil registration system.[10-20]

Pattern of causes of death during 1999 and 2015

In 1999, the percentage share of causes of deaths due to circulatory system was 13.8 per cent, which has risen to 20.2 per cent in 2015. In 1999, the highest proportion of causes of deaths was due to certain infectious and parasitic diseases (19.6 per cent) followed by injury poisoning and certain other consequences of external causes (17.5 per cent). While in 2015, the highest

proportion share of cause of deaths were due to diseases of circulatory system (20.2 per cent) followed by certain conditions originating in the perinatal period (18.9 per cent) and certain infectious and parasitic diseases (15.9 per cent).

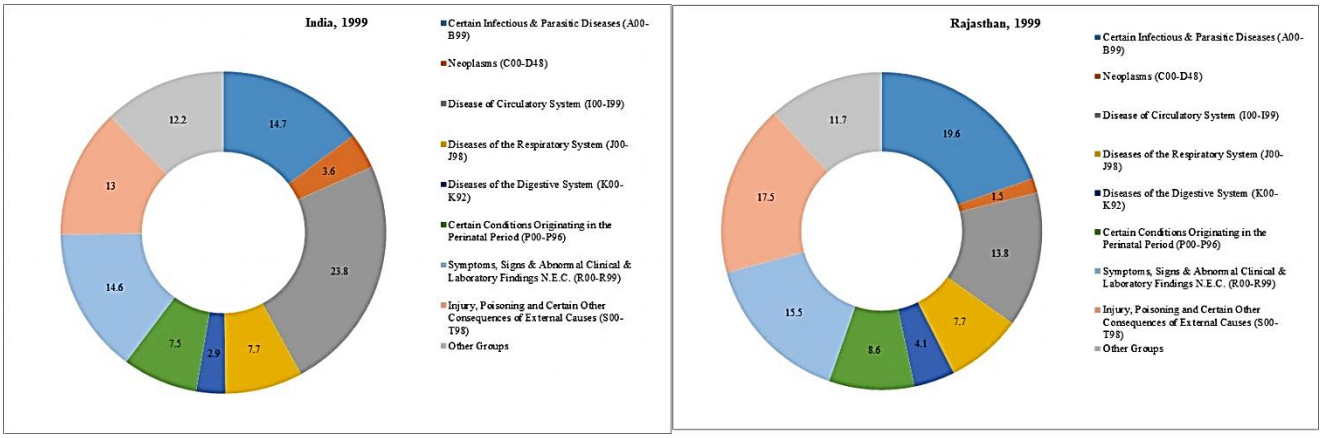

Figure 3: Levels of major causes of deaths in 1999 in India and Rajasthan.

Source: Report on MCCD, 2015, Office of the Registrar General of India, Government of India, 2015.

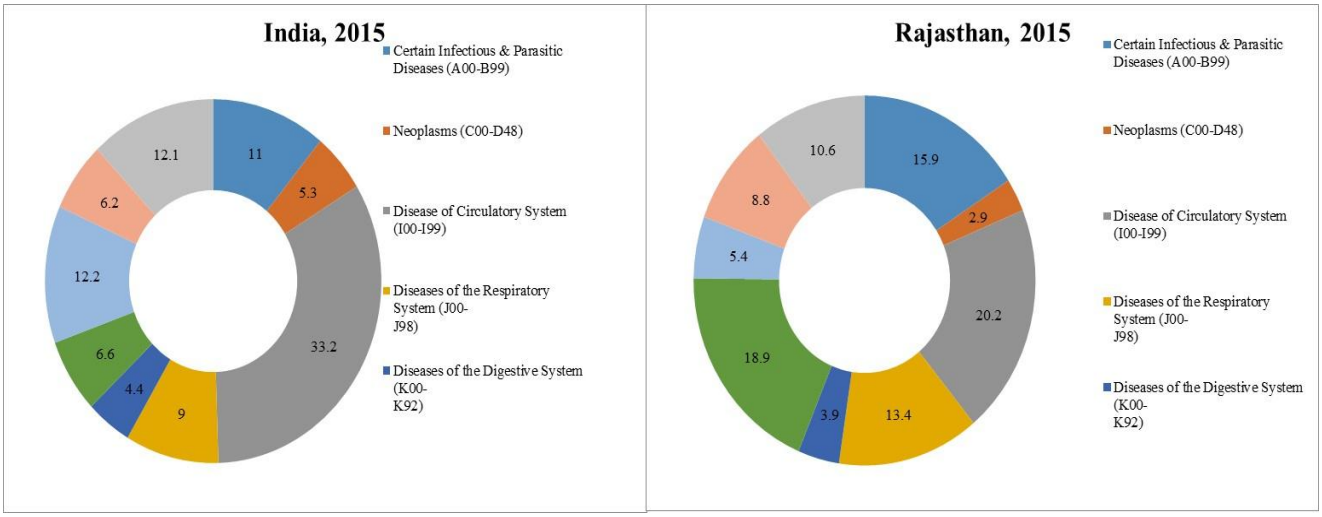

Figure 4: Levels of major causes of deaths in 2015 in India and Rajasthan.

Source: Report on MCCD, 2015, Office of the Registrar General of India, Government of India, 2015

Table 4: Percentage of medically certified deaths by eight leading cause groups in Rajasthan: 1999 to 2015.

S. No.	Major cause group	N = 578,841 deaths for which cause of death has been certified (%)
1	Diseases of the circulatory system (I00-I99)	21.1
2	Certain infectious and parasitic diseases (A00-B99)	16.3
3	Injury, poisoning and certain other consequences of external causes (S00-T98)	11.5
4	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99)	7.2
5	Diseases of the respiratory system (J00-J98)	10.9
6	Certain conditions originating in the perinatal period (P00-P96)	
7	Diseases of the digestive system (K00-K92)	16.5
8	Other group	10.7
	Total	100.0

Source: Report on MCCD, 2015, Office of the Registrar General of India, Government of India, 2009-2015

Leading causes of death in the combined data of the decade from 1999 to 2015

The total number of deaths registered in Rajasthan in the sixteen years from 1999 to 2015 was 5.4 million. The total number of deaths, for which the causes of deaths were certified, was about half a million. This is 10.7 per cent of the total registered deaths. Among these deaths, which were certified, the highest percentage share of deaths was due to diseases of the circulatory system (I00-I99), which stood at 21.1 per cent followed by certain conditions originating in the perinatal period (16.5 per cent) and certain infectious and parasitic diseases (16.3 per cent).

Projection of share of deaths due to diseases of the circulatory system

The percentage share of deaths due to diseases of the circulatory system has been projected using a linear and exponential curve to the data from 1999 upto 2030. The percentage share of deaths due to diseases of circulatory system is expected to touch a figure of 20.8 per cent according to the linear curve estimation and 21.3 per cent as per the exponential curve estimation of the total share of causes of deaths.

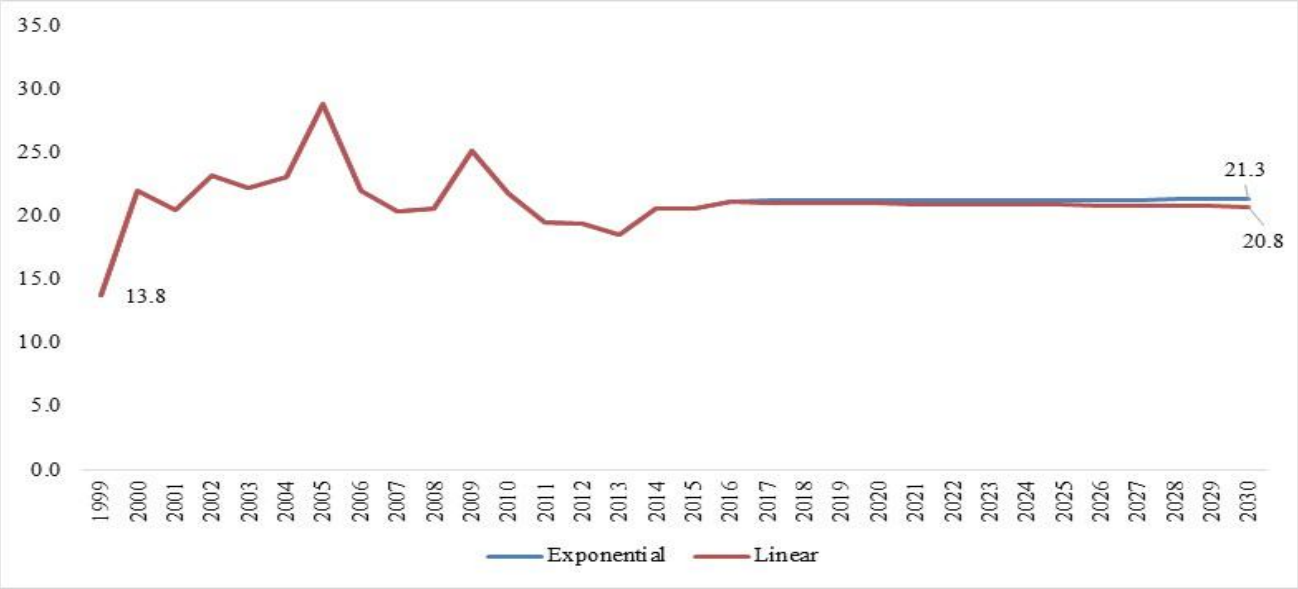

Figure 5: Projection of share of cause of deaths due to diseases of circulatory system upto 2030 in Rajasthan (%).
Author's computation

DISCUSSION

Medical certification of cause of death under civil registration system was initiated by the office of Registrar General of India during third Five Year Plan. It was operational in many states. This study, analyses medical certified causes of death of Rajasthan state from 1999 to 2015. The study reveals that there is considerable increase of birth and death registration in Rajasthan state. The percentage of birth registration has increased from 35.0 percent in 2000 to 98.7 in 2015. Concurrently, the registration of death has increased from 48.7 per cent to 76.6 per cent. The study highlights fact that the medical certification of cause of death varies among states i.e. about 1 per cent in Jharkhand to about cent per cent in Goa. The data reveals that the percentage of medically certified deaths hovers around 10 to 13 percent during 1999 to 2015 of the total deaths registered under the civil registration system, which is about 5 million deaths. The highest percentage of deaths that has been medically certified is due to circulatory diseases as seen for the combined period of sixteen years (1999-2015) is 21 percent followed by deaths due to certain infectious and parasitic diseases (16 percent). This has increased from 13.8 per cent in 1999 to 20.2 per cent in 2015. This proportion has been projected upto 2030, the target year of achievement of Sustainable Development Goals (SDGs).

CONCLUSION

The medical certificate of cause of death (MCCD), commonly called the death certificate, is a document of considerable importance. It is legal as well as ethical responsibility of doctor to issue medical certificate of cause of death based on international classification of diseases (ICD).

It contains epidemiological data that are necessary for formulating vital statistics and guiding the allocation of resources for research and national health programmes. Because health statistics, national morbidity and mortality statistics, and data on disease prevalence in population are derived from death certificates, it is

essential to ensure completion and accuracy of the 'cause of death' section in death certificates. Besides, there needs to be proper filling up of death registration forms 4 and 4A. A nosologist needs to be appointed to oversee the coding of the causes of death.

The system of ICD-10 needs to be popularized at all levels for correct coding of causes of deaths. The nurse/LHV needs to code and fill up the gender and allied information of the deceased following the Doctor's certification of the cause of death. There needs to be regular orientation and training of doctors on the ICD system. Regular entry of data needs to be done to reduce time lag in reporting. Finally, a regular annual publication of MCCD similar to Civil Registration System needs to be brought out for the use by policy planners at the state levels. This data will help us in analyzing the levels and trends in cause-specific mortality data and in tracking the prevalence of a particular disease and death caused due to it in a geographical and making it useful for health policy planning on a regular basis.

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