DOI:10.26524/jms.2017.65

Journal of Management and Science ISSN: 2249-1260 | e-ISSN: 2250-1819 |

Sdg 3 monitoring at sub-national level with data from the civil registration system in rajasthan state, india : 2001-14

Manoj Kumar Raut[a] and Ananta Basudev Sahu[b]

[a]*Regional Manager, Research and Evaluation, Asia, Nutrition International, Regional Office for Asia, New Delhi, India B-28, Second Floor, Qutab Institutional Area, Tara Crescent, New Delhi - 110 016, Tel: + 91 11 46862059 (Direct), Fax: +91 11 46862048, Mobile : +91-9650035551, Email: rautmanojkumar@gmail.com*

[b]*Technical Consultant-M&E, Directorate of ICDS, (Supported by UNICEF), Vijaya Raje Vastsalya Bhavan, Arera hills, Bhopal- 462 01, Madhya Pradesh, Email: ananta.iips@gmail.com*

ABSTRACT: In India, Civil registration was initiated under the registration of births and deaths act, 1969 to give reliable estimates of fertility and mortality situation for the nation up to the lowest administrative levels, but due to its inadequate and underreporting, still the Sample Registration System is used to generate reliable indicators of fertility and mortality. In this paper, an attempt is made to compute certain indicators from the civil registration system for the period of 2001-14 in the State of Rajasthan, India. The major SDG indicators of goal 3 of ensuring healthy lives and promoting well-being for all at all ages; targets 3.1 (By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births) and 3.2 (By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births) with indicators of Under-five Mortality Rate (indicator 3.2.1) and Maternal Mortality Ratio (indicator 3.1.1) and other fertility and mortality indicators can be computed, if certain denominator bases are available every year. As the civil registration data has not been classified by the place of residence, it is not strictly comparable to SRS figures. But it has been presented here so as to serve as an indication and for the improvement of the system for generation of reliable vital rates at sub-national levels using civil registration data, which is the need of the day for planning purposes for programme managers and policy makers

Keywords: SDGs; CRS; India; Rajasthan; MMR; IMR

1. INTRODUCTION

Vital Registration or Civil Registration is concerned with the continuous recording of key life cycle or vital events. These are “A live birth, death, foetal death, marriage, divorce, adoption, legitimating of birth, recognition of parenthood, annulment of marriage, or legal separation” (UN, 2003). Civil registration was initiated in India to generate reliable estimates of fertility and mortality situation of the nation upto the lowest administrative levels, but due to its inadequate reporting, still the sample registration system is being used to generate fertility and mortality indicators. In this paper, an attempt has been made to compute certain indicators from the civil registration system in Rajasthan. These indicators can be computed from the Civil Registration System on a regular basis, if the reporting level improves.

This system has many social, political, and economic benefits apart from their public-health importance. The primary function of civil registration systems is to create and maintain legal documents proving the identity of individuals. Certain issues that come in the way of this generation of vital statistics are under-enumeration of births, deaths, infant deaths, maternal deaths, misclassification of cause of deaths, differences in *defacto* (place of occurrence) and *dejure* (place of usual residence).

This paper presents certain indicators computed from CRS 2001-14 like; SRB, SBR, CBR, CDR, IMR and MMR. Though the CRS data has not been classified by the place of residence as in case of SRS, it is presented here for indicative purposes only, not for comparison. In CRS, the rural areas and urban areas notified by the State Government are considered, while in case of SRS, the urban

areas include notified urban areas as well as census towns. For the first time in 2007, the Office of the Registrar General of India (ORGI) computed vital rates from the civil registration data for the years 2002 to 2004 for Kerala after classifying the data according to the place of usual residence of the mother or deceased as the case may be. The events had also been included with respect to the concerning year, while aggregating the births and deaths for the year. In 2009, ORGI computed vital rates from the civil registration data for the years 2004 to 2006 for Tamil Nadu, though the data was not classified by the place of residence. Major MDG indicators of 4 and 5 like Infant Mortality Rate and Maternal Mortality Ratio and other similar indicators can be computed, if certain denominators are available every year. The percentage of delayed registration has not been computed in this paper due to unavailability of data.

1.1 Evaluation of SRS based estimates

In rural Kerala, during 1965-66, a check was undertaken which indicated that 8 per cent of births and 5 per cent of deaths were omitted (Agenda Notes of the National Conference of Chief Registrars of births and deaths – 2009, ORGI, Govt. of India) and in Assam during 1972-73, it was found that in rural areas, birth and deaths were omitted to the extent of 2.4 per cent and 3 per cent respectively. In urban areas, the corresponding figures were 5.8 and 5.2 per cent respectively (Agenda Notes of the National Conference of Chief Registrars of births and deaths – 2009, ORGI, Govt. of India). In 1973-74, the extent of under enumeration in urban areas of Andhra Pradesh was 7.7 per cent of births and 9.2 per cent of deaths (Agenda Notes of the National Conference of Chief Registrars of births and deaths – 2009, ORGI, Govt. of India). An enquiry in a ten per cent of sub-sample of SRS units was undertaken during 1980-81 by the Office of the Registrar General, India. This survey provided correction factors at national and state level. At the national level, the correction factors were 3.2 per cent of birth and 3.4 per cent of deaths (Agenda Notes of the National Conference of Chief Registrars of births and deaths – 2009, ORGI, Govt. of India). Another comprehensive enquiry suggested a correction factor of 1.018 of births and 1.025 of deaths (Agenda Notes of the National Conference of Chief Registrars of births and deaths – 2009, ORGI, Govt. of India). The Panel on India of the Committee on Population and Demography, National Academy of Sciences, USA estimated that SRS births were under reported to the extent of 7.3 per cent during 1970-73. These estimates were based on the data on children ever born collected in the fertility survey, 1972 undertaken in a sub sample of SRS units (Manual on Vital statistics, 2010). Using Brass growth balance method on the SRS data for the period 1970-75, it was estimated that the births were under estimated to the extent of 6 per cent Agenda Notes of the National Conference of Chief Registrars of births and deaths – 2009, ORGI, Govt. of India). In the series of Who counts published by Lancet series (2007 & 2015), the importance of civil registration and negligence accorded to it by national governments have been discussed and presented at a global level. Mahapatra et al. (2007) in the lancet series of 2007 of "Civil registration systems and vital statistics: successes and missed opportunities" have concluded in their paper that countries and developmental partners have not recognised that civil registration systems are a priority.

1.2 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 consists of 33 districts. Topographically, deserts in the State constitute a large chunk of the land mass, where the settlements are scattered and the density of population is quite low. It constitutes about three-fifths (233,100 sq. km.) of the total land mass of the state (342,239 sq. km.). It is administratively divided into 7 divisions, 33 districts and 44,672 villages as of Census 2011. As part of the geographical reorganization of the districts, historically, in the last three decades (1981-2011), during the period of

1981-1991, Dhaulpur was formed, during 1991-2001, five districts of Baran, Dausa, Hanumangarh, Karauli and Rajasamand were carved out and during 2001-2011, the district of Pratapgarh was carved out of the three districts of Banswara, Chittaurgarh and Udaipur.

1.3 Civil Registration System in Rajasthan

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. 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, 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. 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.

1.4 Process of civil registration

There are three forms for the collection and registration of births and deaths. The three forms relate to births, deaths and still birth. Live births are registered in the births form, deaths are registered in the deaths form and still births are reported in the stillbirth form. Following this, the registration certificates are issued.

1.5 Levels of Civil Registration in Rajasthan and India

According to the Civil Registration data, for the year 2014, the level of birth registration for Rajasthan is 98.2 per cent and the level of death registration is 87.1 per cent compared to 88.8 per cent and 74.3 per cent respectively at the national level. Some states have also achieved cent percent levels of birth and death registration. Amongst the states and union territories, Chandigarh, Delhi, Goa, Kerala, Puducherry, Punjab and Tamil Nadu have achieved cent percent levels in both birth and death registration. These states could start using this data to estimate vital statistics with certain assumptions.

Considering the background that there is a gross lack of data on outcome indicators like IMR and MMR below the State level to capture the diversity in measuring the outcomes of national health programmes like; NHM and there are barriers in the process of localization of indicators to monitor, Five year Plan goals, and major indicators of MDGs 4 and 5 and SDGs and the low priority status accorded to Civil Registration, there is a need for a regular and continuous source of data for the computation of data on IMR and MMR at the district level.

2. OBJECTIVES

1. To compute indicators from CRS data
2. To advocate for enhancing the importance and priority of civil registration system data

3. DATA SOURCES

The data sources include publications of Annual Reports on Birth and Death Registration from 2001 to 2014, published by the Directorate of Economics and Statistics, Government of Rajasthan, and for

India data, the data from the publication of the office of the Registrar General of India (ORGI), Govt. of India has been used.

4. COMPUTATION AND ANALYSIS

The following indicators could be computed from CRS data:

4.1 Sex composition indicators

1. Sex ratio at birth (SRB): Expressed as Number of Males per 100 Females or Number of Females per 1,000 Males.

4.2 Health facility system performance indicator

1. Percent of institutional births

4.3 Fertility indicators

1. Adolescent Fertility Rate : Number of live births to 1,000 women 15-19 years of age (Denominator of women 15-19 years of age is required)
2. Age specific fertility rates (Denominator of number of women 15-49 years of age is required)
3. Total Fertility Rate (Denominator of number of women 15-49 years of age by five year age group is required)

4.4 Mortality indicators

1. Percentage of institutional deaths
2. Age Specific Death Rates as input for life table (Denominator of age specific population is required)
    - Life table could be used to compute
        1. under five mortality rate at district level and
        2. life expectancy at birth at district level
3. Still birth rate
4. Neonatal Mortality Rate
5. Post neonatal Mortality Rate
6. Infant Mortality Rate
7. Maternal Mortality Ratio (MMR)
8. Maternal Mortality Rate (Denominator of number of women 15-49 years of age is required)

In this paper, the following indicators have been computed for Rajasthan for the years 2001-2014. The data has not been classified by the place of usual residence of the mother or the deceased:

1. Sex Ratio at Birth (SRB)
2. Stillbirth Rate (SBR)
3. Crude Birth Rate (CBR)
4. Crude Death Rate (CDR)
5. Infant Mortality Rate (IMR)
6. Maternal Mortality Ratio (MMR)

5. METHODS

For the purpose of computation, direct methods of estimation were used. The following formula were used to estimate the indicators:

1. **Stillbirth rate (SBR) :** Number of still births/ Number of Total births *1000
2. **Sex Ratio at Birth (SRB) :** Number of female births / Number of male births * 1,000 in the Indian context and Number of male births / Number of female births * 100 for international formula.
3. **Crude Birth Rate (CBR) :** Number of live births in a year / Total Mid-year Population * 1,000
4. **Crude Death Rate (CDR) :** Number of deaths in a year / Total Mid-year Population *1,000
5. **Infant Mortality Rate (IMR) :** Number of infant deaths in a given year / Number of live births in that year * 1,000
6. **Maternal Mortality Ratio (MMR) :** Number of maternal deaths / Number of live births * 100,000

6. FINDINGS

The vital statistics have been estimated from the civil registration system data. This has been compared with data form Sample registration system and presented in the form of tables and graphs. In Rajasthan, the registration of live births has increased from 700,121 in 2001 to 1,751,191 in 2014. The registration of deaths has increased from 250,985 to 397,468 during the same period.

Table 1. Trends in number of registered Live Births by gender, Stillbirths, Deaths, Infant Deaths and Maternal Deaths in Rajasthan : 2001-14

Year	Registered Male live births	Registered Female live births	Registered Combined male and female Live Births	Registered Stillbirths	Registered Deaths	Registered Infant Deaths	Registered Maternal Deaths
2001	383,619	316,502	700,121	2,527	250,985	8,618	427
2002	546,442	440,703	987,145	2,534	278,978	10,415	440
2003	451,740	376,367	828,107	2,250	266,034	7,212	395
2004	547,799	448,966	996,765	1,368	297,562	7,880	455
2005	636,960	512,857	1,149,817	1,021	283,813	8,799	525
2006	790,725	654,950	1,445,675	1,118	315,308	7,724	583
2007	808,101	672,583	1,480,684	1,364	323,587	8,679	544
2008	858,560	674,145	1,532,705	1,129	328,953	8,294	529
2009	891,649	767,788	1,659,437	1,472	337,248	7,620	635
2010	948,748	796,309	1,745,057	2,457	370,460	9,495	1,016
2011	9,04,325	8,23,996	17,28,321	5,169	3,60,560	9,713	577
2012	9,44,401	8,13,292	17,57,693	7,317	3,56,946	15,324	707
2013	9,52,361	8,17,724	17,70,085	9,887	4,01,656	12,862	1,011
2014	9,73,425	7,77,766	17,51,191	14,536	3,97,468	12,908	968

Source: A Decade of Medical Certification of Cause of Deaths in Rajasthan : 1999-2008, Published by the Directorate of Economics and Statistics, Govt. of Rajasthan. Annual Vital Report, 2009-2014.

The level of birth registration in Rajasthan state has increased from 39.5 per cent in 2001 to 98.2 per cent in 2014 compared to 58.0 per cent to 88.8 per cent during the same period at the all India level. The level of death registration has increased from 55.1 per cent in 2001 to 87.1 per cent in 2014 compared to 52.2 per cent to 74.3 per cent at the all India level during the same period.

Table 2 : Trends in Birth & Death Registration in India and Rajasthan : 2001-14 (%)

		India		Rajasthan	
Sl. No.	Year	Birth Registration (%)	Death Registration (%)	Birth Registration (%)	Death Registration (%)
1	2001	58.0	52.2	39.5	55.1
2	2002	59.5	52.1	55.6	62.4
3	2003	57.7	53.5	46.2	59.1
4	2004	60.4	55.2	56.9	70.4
5	2005	62.5	55.0	65.3	65.9
6	2006	68.3	63.4	81.5	72.9
7	2007	74.5	69.3	83.2	74.6
8	2008	76.4	66.4	85.9	74.5
9	2009	81.3	66.9	92.4	77.4
10	2010	82.0	66.9	97.4	82.4
11	2011	83.6	67.4	96.7	78.9
12	2012	84.4	69.3	98.0	78.1
13	2013	85.6	70.9	98.4	87.9
14	2014	88.8	74.3	98.2	87.1

Source: A Decade of Medical Certification of Cause of Deaths in Rajasthan : 1999-2008, Published by the Directorate of Economics and Statistics, Govt. of Rajasthan. Annual Vital Report, 2009-2014.

The stillbirth rate computed from CRS was 3.6 in 2001 and 8.3 in 2014. The sex ratio at birth was computed to be 825 in 2001 and 799 in 2014. The crude birth rate reveals better registration of births with 12.3 computed in 2001 compared to 22.8 in the year 2014. Similarly, there seems to be an improvement in the level of death registration, which ranges from 4.4 in 2001 compared to 5.2 in 2014. The most under reported were found to infant and maternal deaths.

Table 3: Computation of Indicators from CRS for Rajasthan : 2001-14

Year	Stillbirth Rate (SBR), SB/ 1,000 total births	Sex Ratio at Birth (Indian context) (Female/ Males*1000)	Sex Ratio at Birth (International) (Males/ Females*100)	Crude Birth Rate (CBR) Live Births/ 1,000 MYP	Crude Death Rate (CDR) Deaths/ 1,000 MYP	Infant Mortality Rate (IMR) Infant deaths/ 1,000 LBs	Maternal Mortality Ratio (MMR) Maternal deaths/ 100,000 LBs
2001	3.6	825	121	12.3	4.4	12	61
2002	2.6	806	124	17.0	4.8	11	45
2003	2.7	833	120	14.0	4.5	9	48
2004	1.4	820	122	16.5	4.9	8	46
2005	0.9	805	124	18.7	4.6	8	46
2006	0.8	828	121	23.1	5.0	5	40
2007	0.9	832	120	23.2	5.1	6	37
2008	0.7	785	127	23.6	5.1	5	35
2009	0.9	861	116	25.1	5.1	5	38

Contd..

Year	Stillbirth Rate (SBR), SB/ 1,000 total births	Sex Ratio at Birth (Indian context) (Female/ Males*1000)	Sex Ratio at Birth (International) (Males/ Females*100)	Crude Birth Rate (CBR) Live Births/ 1,000 MYP	Crude Death Rate (CDR) Deaths/ 1,000 MYP	Infant Mortality Rate (IMR) Infant deaths/ 1,000 LBs	Maternal Mortality Ratio (MMR) Maternal deaths/ 100,000 LBs
2010	1.4	839	119	26.0	5.5	5	58
2011	3.0	911	110	25.3	5.3	6	33
2012	4.2	861	116	25.0	5.1	9	40
2013	5.6	859	116	24.7	5.6	7	57
2014	8.3	799	125	22.8	5.2	7	55

Source: Author's computation

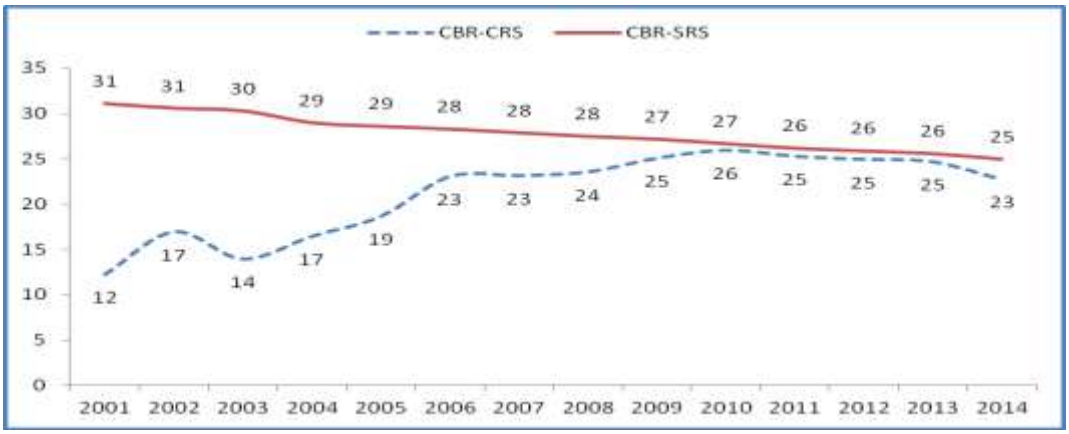

Figure 1 : Crude Birth Rate according to Civil Registration System (CRS) and Sample Registration System (SRS) : 2001-14

Note: The CRS estimates reported here need not be used or referred in any publication as it is evident that they are quite underreported as the level of civil registration is not cent percent. The CRS data has not been adjusted according to the place of residence as is the case in SRS. So, CRS and SRS are not strictly comparable. It is only indicative.

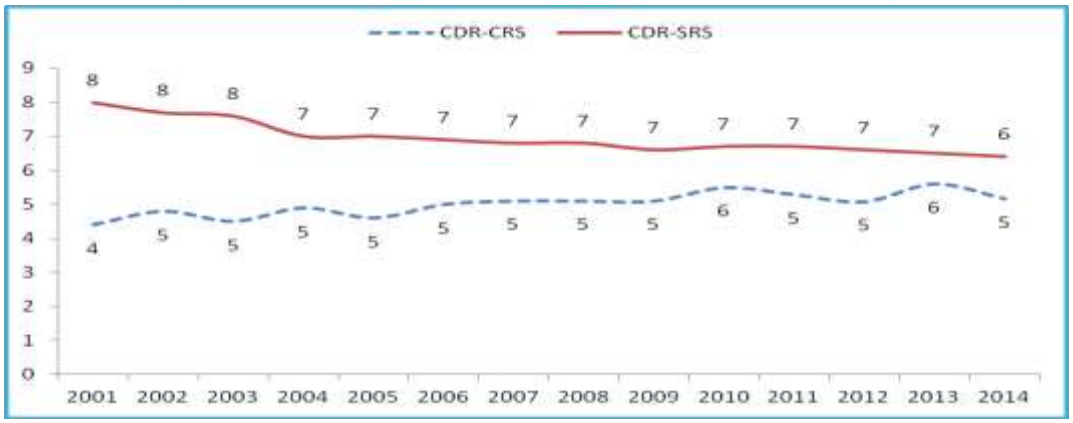

Figure 2 : Crude Death Rate according to Civil Registration System (CRS) and Sample Registration System (SRS) : 2001-14

Note: The CRS estimates reported here need not be used or referred in any publication as it is evident that they are quite underreported as the level of civil registration is not cent percent. The

CRS data has not been adjusted according to the place of residence as is the case in SRS. So, CRS and SRS are not strictly comparable. It is only indicative.

The sex ratio at birth computed from CRS was 820 females per thousand males during 2001-03 and 839 females per thousand males during 2012-14 compared to 855 and 893 respectively in the SRS.

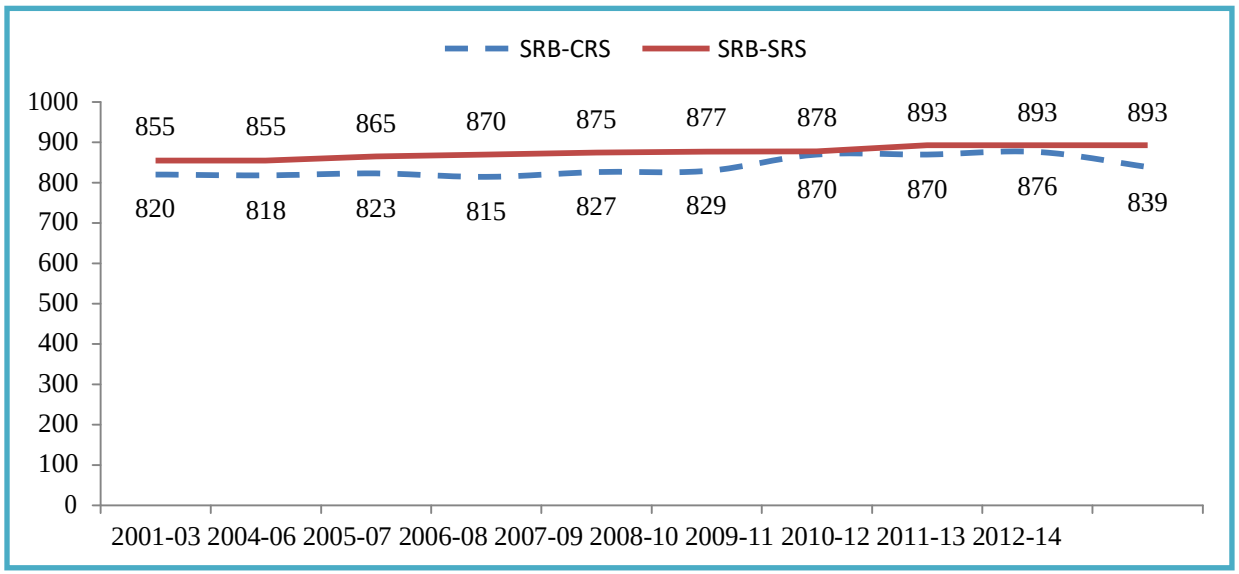

Figure 3: Sex Ratio at Birth (SRB) according to Civil Registration System (CRS) and Sample Registration System (SRS) (Females per thousand males): 2001-14

Note: The CRS estimates reported here need not be used or referred in any publication as it is evident that they are quite underreported as the level of civil registration is not cent percent. The CRS data has not been adjusted according to the place of residence as is the case in SRS. So, CRS and SRS are not strictly comparable. It is only indicative.

During the fourteen years from 2001 to 2014, difference between the two systems in crude birth rate has substantially narrowed down from 18.8 to 2.2, while the difference with respect to crude death rate has narrowed down from 3.6 in 2001 to 1.2 in 2014, while the difference with respect to Stillbirth rate has not lowered much through the years.

Table 5 : Trends in Stillbirth Rate (SBR), Crude Birth Rate (CBR) and Crude Death Rate (CDR) in Rajasthan in CRS and SRS : 2001-14

	SBR		CBR		CDR		Difference		
Year	CRS	SRS	CRS	SRS	CRS	SRS	SBR	CBR	CDR
2001	3.6	9.0	12.3	31.1	4.4	8.0	5.4	18.8	3.6
2002	2.6	8.0	17.0	30.6	4.8	7.7	5.4	13.6	2.9
2003	2.7	6.0	14.0	30.3	4.5	7.6	3.3	16.3	3.1
2004	1.4	10.0	16.5	29.0	4.9	7.0	8.6	12.5	2.1
2005	0.9	11.0	18.7	28.6	4.6	7.0	10.1	9.9	2.4
2006	0.8	10.0	23.1	28.3	5.0	6.9	9.2	5.2	1.9
2007	0.9	10.0	23.2	27.9	5.1	6.8	9.1	4.7	1.7

Contd..

	SBR		CBR		CDR		Difference		
Year	CRS	SRS	CRS	SRS	CRS	SRS	SBR	CBR	CDR
2008	0.7	10.0	23.6	27.5	5.1	6.8	9.3	3.9	1.7
2009	0.9	8.1	25.1	27.2	5.1	6.6	7.2	2.1	1.5
2010	1.4	6.0	26.0	26.7	5.5	6.7	4.6	0.7	1.2
2011	3.0	5.0	25.3	26.2	5.3	6.7	2.0	0.9	1.4
2012	4.2	6.0	25.0	25.9	5.1	6.6	1.8	0.9	1.5
2013	5.6	4.0	24.7	25.6	5.6	6.5	-1.6	0.9	0.9
2014	8.3	4.0	22.8	25.0	5.2	6.4	-4.3	2.2	1.2

Source: Janm Mrityu Registrikaran, : Varshik Prativedan, Varsh 2001 to 2014 (Annual Report on Birth and Death Registration, 2001 to 2014).

Note: SBR is expressed as number of stillbirths per thousand total births, CBR expressed as number of live births per thousand mid-year population and CDR expressed as number of deaths per thousand mid-year population

During 2001 to 2014, difference between the two systems in infant mortality rate and maternal mortality ratio is quite high, as the infant and maternal deaths registered in the CRS is quite low. The IMR and MMR computed from CRS is under 20% of the SRS IMR and MMR.

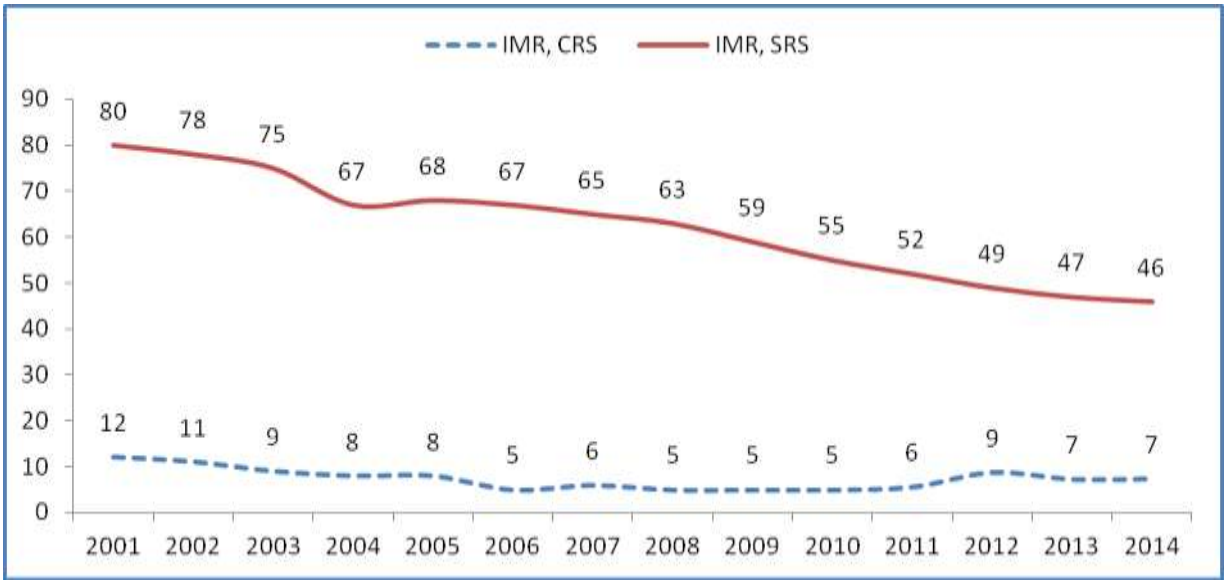

Figure 4 : Infant Mortality Rate (Number of infant deaths per thousand live births) according to Civil Registration System (CRS) and Sample Registration System (SRS) : 2001-14

Note: The CRS estimates reported here need not be used or referred in any publication as it is evident that they are quite underreported as the level of civil registration is not cent percent. The CRS data has not been adjusted according to the place of residence as is the case in SRS. So, CRS and SRS are not strictly comparable. It is only indicative

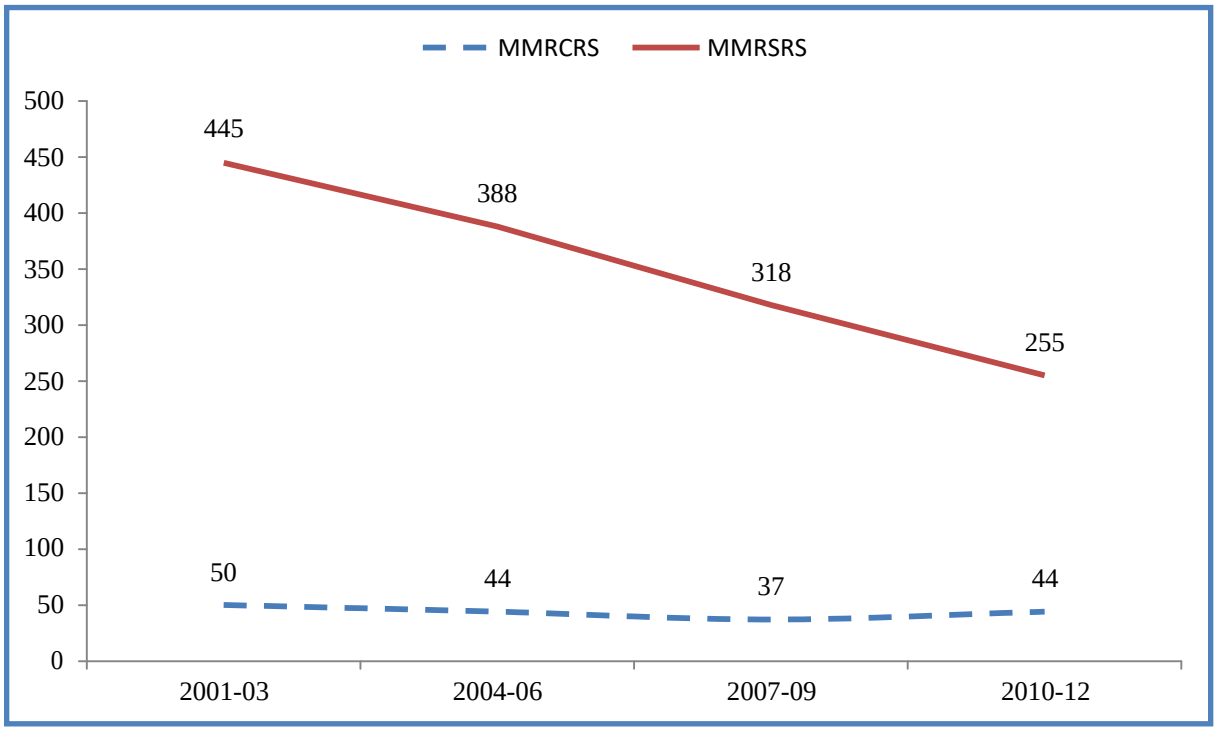

Figure 5 : Maternal Mortality Ratio (Number of maternal deaths per 100,000 live births) according to Civil Registration System (CRS) and Sample Registration System (SRS) : 2001-12

Note: The CRS estimates reported here need not be used or referred in any publication as it is evident that they are quite underreported as the level of civil registration is not cent percent. The CRS data has not been adjusted according to the place of residence as is the case in SRS. So, CRS and SRS are not strictly comparable. It is only indicative.

6.1 Live births by birth order and Mother's age

The live births registered are the highest among mothers in the age group of 20 to 24 years followed by those in the age group of 25 to 29 years and 30 to 34 years of age.

Table 7 : Number of births by mother's age and order of birth registered in Rajasthan : 2014

Mother's age in years	1st order birth	2nd order birth	3rd order birth	4th order birth	5th order birth	6+ order birth	Total
15-19 years	29,953	4,114	0	0	0	0	34,067
20-24 years	502,144	209,760	67,806	21,009	5,476	935	807,130
25-29 years	263,103	178,969	101,474	32,704	9,195	2,722	588,167
30-34 years	78,618	67,147	49,277	26,256	11,217	4,691	237,206
35-39 years	23,760	19,056	17,393	10,359	6,144	3,219	79,931
40-44 years	374	397	895	1,041	865	588	4,160
45+ years	6	12	61	176	118	157	530
Total	**897,958**	**479,455**	**236,906**	**91,545**	**33,015**	**12,312**	**1,751,191**

Source : *Janm Mrityu Registrikaran, : Varshik Prativedan, Varsh* 2014 (Annual Report on Birth and Death Registration, 2014).

6.2 District-wise registration of live births, deaths, infant deaths, maternal deaths and stillbirths in Rajasthan

With regards to the number of live births and number of deaths registered in the year 2014, it is the highest in Jaipur and the lowest in Pratapgarh. The highest number of infant deaths have been registered in Jaipur district and the lowest in Baran district. The highest number of maternal deaths have been reported in Jaipur district and the lowest in Jaisalmer. With respect to the registered stillbirths, the highest has been registered in Pali district and four districts have reported no stillbirths.

Table 8 : Number of district-wise registered Live births, Stillbirths, Deaths, Infant Deaths in Rajasthan : 2014

Sl. No.	State/ Districts	Registered live births	Registered deaths	Registered infant deaths	Registered maternal deaths	Registered still births
	Rajasthan	**1,751,191**	**397,468**	**12,908**	**968**	**14,536**
1	Ajmer	78,477	22,821	883	51	1,087
2	Alwar	70,357	20,524	528	45	764
3	Banswara	35,602	8,914	617	63	1,139
4	Baran	22,660	7,212	25	23	222
5	Barmar	61,566	8,796	439	13	439
6	Bharatpur	67,978	11,043	180	54	536
7	Bhilwara	60,144	16,264	591	30	491
8	Bikaner	57,558	13,264	441	40	694
9	Bundi	19,746	7,009	165	11	248
10	Chittorgarh	35,530	10,344	62	16	259
11	Churu	57,494	9,979	26	30	17
12	Dausa	32,326	6,026	115	8	290
13	Dholpur	25,763	5,949	252	15	346
14	Dungarpur	25,963	4,648	459	32	346
15	Ganganagar	47,152	11,817	228	16	82
16	Hanumangarh	47,677	10,803	332	9	364
17	Jaipur	212,462	45,779	1,673	104	196
18	Jaisalmer	24,287	2,575	123	5	292
19	Jalore	55,442	8,140	163	23	236
20	Jahalawar	31,820	10,286	834	23	923
21	Jhunjhunu	54,129	12,304	114	15	0
22	Jodhpur	98,366	20,724	1,606	24	0
23	Karoli	27,134	5,897	194	14	0
24	Kota	52,855	14,095	318	23	338
25	Nagaur	89,337	15,120	195	41	0
26	Pali	57,670	11,632	986	23	1,690
27	Pratapgarh	17,676	5,172	54	14	1,074
28	Rajsamand	29,297	8,048	118	41	474
29	Sawai Madhopur	40,622	6,275	179	22	147
30	Sikar	77,724	16,513	87	33	343
31	Sirohi	27,134	7,336	109	29	520
32	Tonk	30,532	9,423	176	26	152
33	Udaipur	78,711	22,736	636	52	827

Source : *Janm Mrityu Registrikaran, : Varshik Prativedan, Varsh* 2014 (Annual Report on Birth and Death Registration, 2014).

6.3 Projection of IMR & MMR

The projections were carried out using PASW Statistics 18, Release 18.0. Based on the fourteen years of data on IMR from CRS and SRS from 2001 to 2014, the future level of IMR has been projected. According to the exponential curve fitted to the model, the IMR of Rajasthan is projected to decline to 28 by 2020. The model has an R Square of 0.979, which means that the model explains 97.9 percent of the total variance in case of CRS data and an R Square of 0.886 in case of SRS data, which means that the model explains 88.6 percent of the total variance.

The Exponential Curve Fitting Equation is in the form of : $Y=a \exp(bt)$

Similarly, based on the twelve years of data on MMR from CRS and SRS from 2001-12, the future levels of MMR has been projected through an exponential curve fitting equation. According to the exponential curve fitted to the model, the MMR of Rajasthan is projected to decline to 148 by 2019-21. The increase in MMR as per CRS may be due to the fact that the reporting levels are improving though not at the expected pace. The model has an R Square of 0.338, which means that the model explains 33.8 percent of the total variance in case of CRS data and a R Square of 0.990 in case of SRS data, which means that the model explains 99.0 percent of the variance. There is a rising trend in the reporting of number of infant deaths, which can be attributed to higher levels of reporting due to pressure on the reporting system to report maternal deaths.

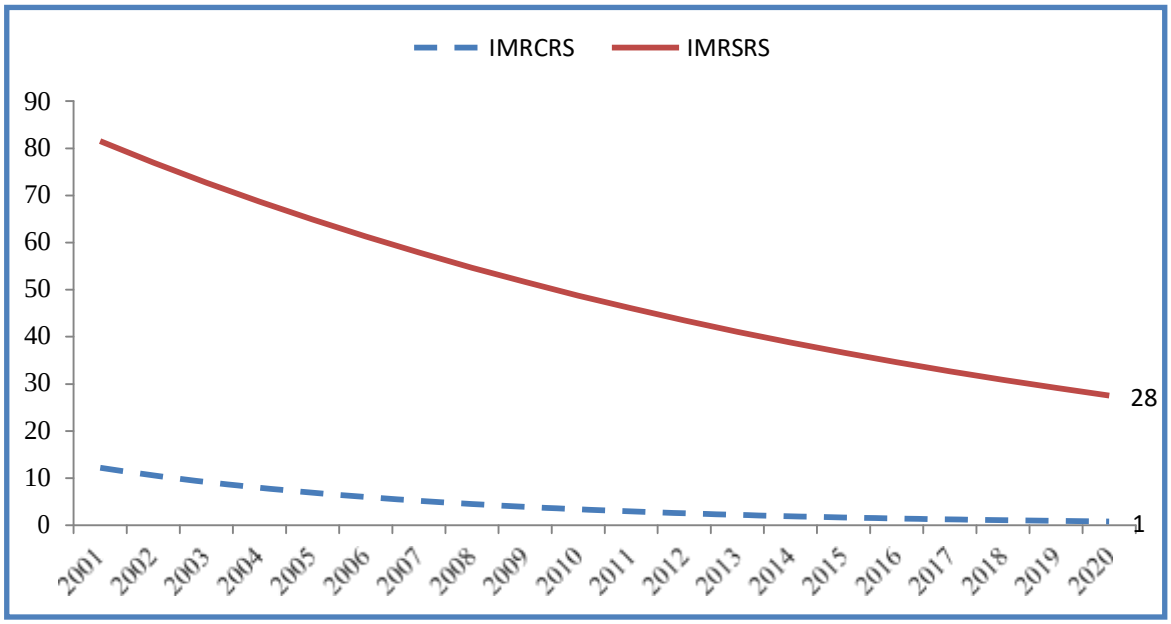

Figure 6: Projection of IMR: 2015-2020

Source : Author's estimation based on CRS and SRS data

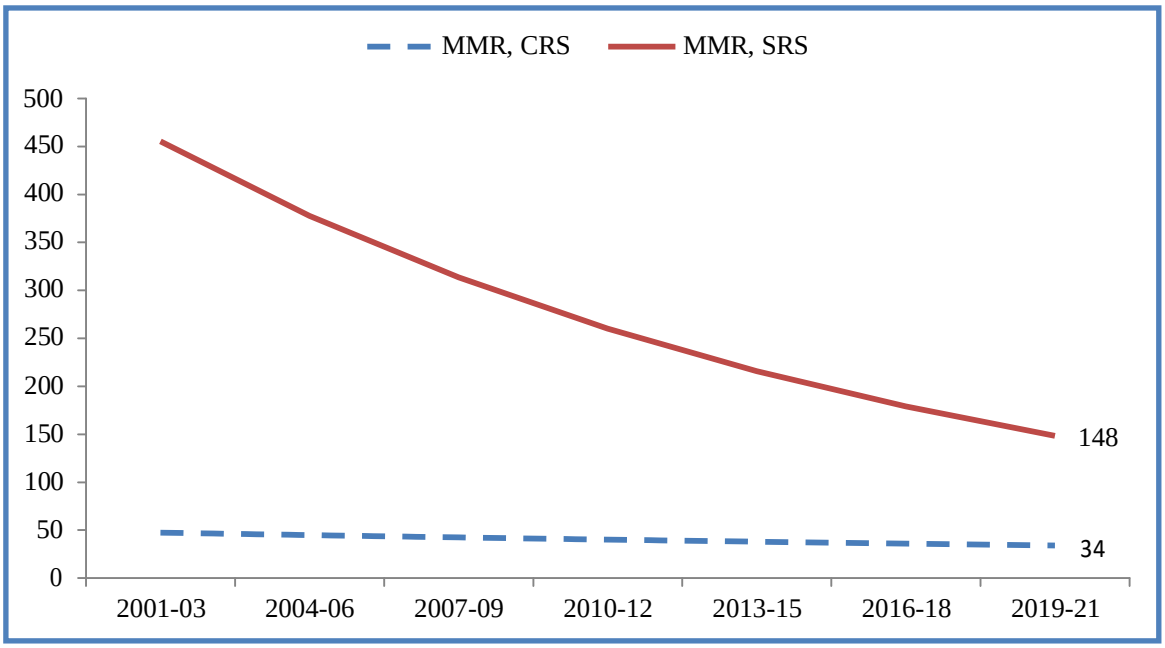

Figure 7: Projection of MMR : 2013-2021

Source : Author's estimation based on CRS and SRS data

If we use these conversion factors to the future levels of IMR computed from CRS data, we can get a fairly good estimate of IMR comparable to SRS. For example, if the IMR is 1 in CRS for 2020, the converted IMR will be 1 x 0.0333 x 1,000 = 28 per 1,000 live births. If the MMR for years 2019-21 is 34 in CRS, the corresponding MMR figure will be 34 x 0.00004 x 100,000 = per 100,000 live births for the period of 2019-21. A matter of caution here is that the CRS and SRS data are not strictly comparable as the CRS data has not been classified by the place of residence as in case of SRS. So, the estimate obtained will refer to the place of occurrence of the event only.

Table 12 : Conversion factors for CRS for IMR for the year 2015-20

Indicators	Conversion Factor per live birth (From CRS to SRS), 2015	Conversion Factor per live birth (From CRS to SRS), 2016	Conversion Factor per live birth (From CRS to SRS), 2017	Conversion Factor per live birth (From CRS to SRS), 2018	Conversion Factor per live birth (From CRS to SRS), 2019	Conversion Factor per live birth (From CRS to SRS), 2020
IMR	0.0218	0.0237	0.0258	0.0281	0.0306	0.0333

Source: Author's computation

Table 13 : Conversion factors for CRS for MMR for the period of 2013-21

Indicators	Conversion Factor per live birth (From CRS to SRS), 2013-15	Conversion Factor per live birth (From CRS to SRS), 2016-18	Conversion Factor per live birth (From CRS to SRS), 2019-21
MMR	0.00006	0.00005	0.00004

Source: Author's computation

These estimations have been carried out to indicate that with improved reporting and the reclassification of the events by the place of residence, reliable estimates can be obtained from CRS. Some limitations of the data quality are as follows:

- Gross under reporting of data on infant and maternal deaths
- Data on delayed registration could not be considered as the data is not entered or published in this regard
- Probability of duplication of registration of the vital events at two different places is there
- Identification of maternal deaths

7. CONCLUSIONS AND WAY FORWARD

The civil registration system for the year 2014 in Rajasthan registered more than 1.7 million births and more than 0.39 million deaths. This data is a rich source, which could be used to generate estimates of fertility and mortality below State level, upto which data is provided by SRS. But, due to the reporting issues, it is not being used to estimate vital rates. But, this statistics has been grossly neglected and offered the least priority amongst all the official statistics collected. This is an attempt to estimate vital rates from this data with the hope that this exercise will surely help in making it a statistics of priority amongst the Govt. administrators, policy and programme planners and facilitated in generating the much needed awareness to improve the level of reporting in this data, which will in turn help in generating estimates at sub-state level for use in the planning, implementation, monitoring of development programmes. Considering that it will take substantial time to improve the reporting of registration levels, in the meanwhile, some conversion factors have been proposed in this paper, based on which a better estimate of mortality can be arrived at.

Certain issues that come in the way of this generation of vital statistics are under-enumeration of births, deaths, infant deaths, maternal deaths, misclassification of cause of deaths, differences in *defacto* (place of occurrence) and *dejure* (place of usual residence). The rates computed from CRS are far below the levels of SRS, though they are strictly not comparable given the fact that CRS is based on the place of occurrence of the events and SRS is based on the place of usual residence. There is an urgent need to analyze the SDG indicators from CRS data and share it with policy makers with the note the data is underreported, but it is improving. This paper aims to bring more focus to the civil registration and vital statistics data, which would may help in arriving at annual estimates of SDGs and other indicators on a regular basis to inform programming and evidence based decision-making.

8. FUNDING STATEMENT

This work was not supported by any grant and nobody had any role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

9. ACKNOWLEDGMENTS

Directorate of Economics and Statistics, Government of Rajasthan, Department of Planning, Government of Rajasthan and Office of Registrar General of India, Ministry of Home Affairs, Government of India.

10. REFERENCES

[1] Bhat, P.N.M, (2000). Completeness of India's sample registration system: an assessment using the general growth balance method, Population Studies 56 (2): 118-134.

[2] Directorate of Economics and Statistics, Rajasthan, (2001). Janm Mrityu Registrikaran, : Varshik Prativedan, Varsh 2001 (Annual Report on Birth and Death Registration, 2001).

[3] Directorate of Economics and Statistics, (2002). Population Projections : Rajasthan (2001-2021) Provisional.

[4] Directorate of Economics and Statistics, (2002). Janm Mrityu Registrikaran, : Varshik Prativedan, Varsh 2002 (Annual Report on Birth and Death Registration, 2002).

[5] Directorate of Economics and Statistics, (2003). Janm Mrityu Registrikaran, : Varshik Prativedan, Varsh 2003 *(Annual Report on Birth and Death Registration, 2003)*.

[6] Directorate of Economics and Statistics, (2003). Janm Mrityu Registrikaran, : Varshik Prativedan, Varsh 2003 (Annual Report on Birth and Death Registration, 2003).

[7] Directorate of Economics and Statistics, (2004). Janm Mrityu Registrikaran, : Varshik Prativedan, Varsh 2004 (Annual Report on Birth and Death Registration, 2004).

[8] Directorate of Economics and Statistics, (2005). Janm Mrityu Registrikaran, : Varshik Prativedan, Varsh 2005 (Annual Report on Birth and Death Registration, 2005).

[9] Directorate of Economics and Statistics,(2006). Janm Mrityu Registrikaran, : Varshik Prativedan, Varsh 2006 (Annual Report on Birth and Death Registration, 2006).

[10] Directorate of Economics and Statistics, (2007). Janm Mrityu Registrikaran, Varshik Prativedan, Varsh 2007 (Annual Report on Birth and Death Registration, 2007).

[11] Directorate of Economics and Statistics, (2008). Janm Mrityu Registrikaran, Varshik Prativedan, Varsh 2008 (Annual Report on Birth and Death Registration, 2008).

[12] Directorate of Economics and Statistics, (2009). Janm Mrityu Registrikaran. 2009 Varshik Prativedan, Varsh 2009 (Annual Report on Birth and Death Registration, 2009).

[13] Directorate of Economics and Statistics, (2010). Janm Mrityu Registrikaran. 2010 Varshik Prativedan, Varsh 2010 (Annual Report on Birth and Death Registration, 2010).

[14] Directorate of Economics and Statistics, (2011). Janm Mrityu Registrikaran. 2011 Varshik Prativedan, Varsh 2010 (Annual Report on Birth and Death Registration, 2011).

[15] Directorate of Economics and Statistics, (2012). Janm Mrityu Registrikaran. 2012 Varshik Prativedan, Varsh 2010 (Annual Report on Birth and Death Registration, 2012).

[16] Directorate of Economics and Statistics, (2013). Janm Mrityu Registrikaran. 2013 Varshik Prativedan, Varsh 2010 (Annual Report on Birth and Death Registration, 2013).

[17] Directorate of Economics and Statistics, (2014). Janm Mrityu Registrikaran. 2014 Varshik Prativedan, Varsh 2010 (Annual Report on Birth and Death Registration, 2014).

[18] Government of Rajasthan, (2000). Rajasthan Births and Deaths Registration Rules, 2000, Rajasthan Gazette. Statistics Department.

[19] Government of Rajasthan, (2006). Rajasthan Births and Deaths Registration (Amendment) Rules, 2005, Rajasthan Gazette. Statistics Department.

[20] Government of Rajasthan, (2007). Rajasthan Births and Deaths Registration (Amendment) Rules, 2007, Rajasthan Gazette. Statistics Department.

[21] Mahapatra, P. et al. (2007). Civil registration systems and vital statistics: successes and missed opportunities. The Lancet, Volume 370, Issue 9599, Pages 1653 - 1663, 10.

[22] Ministry of Health and Family Welfare, Govt.of India. (2000). National Population Policy, 2000, MoHFW.

[23] Office of the Registrar General of India.(1993). Handbook of Civil Registration.

[24] Office of the Registrar general of India. (2001). Maternal Mortality in India: 1997-2003 - Trends, causes and risk factors, Registrar General of India, New Delhi, in collaboration with Centre for global health research University of Toronto, Canada

[25] Office of the Registrar General of India. (2006). Population Projections for India and States, Report of the Technical Group on Population Projections Constituted by the National Commission on Population.

[26] Office of the Registrar General of India. (2009). Vital Statistics of India Based on Civil Registration System : Special Report : 1996-200.

[27] Office of the Registrar General of India. (2009). Vital Statistics of India Based on Civil Registration System : Special Report : 2002-2005.

[28] Office of the Registrar General of India. (2009). Special Bulletin on Maternal Mortality in India, Sample Registration System : 2004-2006.

[29] Office of the Registrar General of India. (2007). Agenda Notes of the National Conference of Chief Registrars of births and deaths – 2007, ORGI, Govt. of India.

[30] Office of the Registrar General of India. (2009). Agenda Notes of the National Conference of Chief Registrars of births and deaths – 2009, ORGI, Govt. of India.

[31] Office of the Registrar General of India. (2010). Vital statistics of India based on the Civil registration system.

[32] Office of the Registrar General of India. (2011). Vital statistics of India based on the Civil registration system.

[33] Office of the Registrar General of India. (2012). Vital statistics of India based on the Civil registration system.

[34] Office of the Registrar General of India. (2013). Vital statistics of India based on the Civil registration system.

[35] Office of the Registrar General of India. (2014). Vital statistics of India based on the Civil registration system.

*****