

Low Birth Weight and Infant Deaths in India: A District-Level Analysis Using the Health Management Information System Data

Pradeep S. Salve^{*1}, Mahadevi N. Korkoppa², Channabasappa Noolvi³,
H.R. Channakki⁴ and Jyoti Hallad⁵

Abstract: Study aims to investigate the state and district wise scenario of Low Birth Weight (LBW) among newborns and infants' deaths due to LBW. Study used service statistics data of Health Management Information System (HMIS) which extracted the consolidated health facility-based data throughout the country. The available data of newborns with LBW and infant deaths due to LBW is calculated for the year 2015-16 at the state and district level. Results show that 12.5 percent of infants were born with LBW at national level and states including Rajasthan (25%), Odisha (19%), Assam (17%), West Bengal (16%), Haryana (15%), Madhya Pradesh (14%), Maharashtra (14%) and Tamil Nadu (13%) have higher percent of newborns with LBW. Majority of districts in Madhya Pradesh (34 districts), Rajasthan (30 districts), Odisha (26 districts), Assam and Maharashtra (21 districts each) and Uttar Pradesh (18 districts) have comparatively more LBW newborn. Betul, Barwani, Umaria and Dindori of Madhya Pradesh, and Deogarh district and Naupada of Odisha have the highest infant deaths due to LBW per 100,000 live births. States and districts with higher LBW newborns need to be closely monitored for programs and policies that are initiated to improve the nutrition and health of pregnant women and adolescent girls in India.

Keywords: Low birth weight, HMIS, newborn, Infant deaths, EAG, India.

Introduction

The World Health Organization (WHO) defined Low Birth Weight (LBW) as a weight at birth of a newborn less than 2,500 grams (WHO and UNICEF, 2004). The estimate shows that one in seven live births that are about 20.5 million babies globally suffered from LBW in 2015 (WHO, 2011; Blencowe et al., 2019). Whereas more than one-fourths (27%) of newborns in India are of LBW and the death rate considerably high among them during the first year of life (UNICEF, 2009). The Sustainable Development Goals (SDGs) 3.2 ensure to reduce the preventable deaths of newborns and neonatal mortality to at least as low as 12 per 1000 live births by 2030 (UNDP, 2020). Subsequently, the National Health Policy of India targets to reduce the neo-natal mortality to 16 and still birth rate to "single digit" by 2025 (Government of India, 2017). However, achieving set targets would be difficult in absence of proper implementation of health schemes introduced in considering these policy goals. Particularly, the Empowered Action Group (EAG) states which have higher maternal mortality, infant mortality, child morbidity and higher prevalence of communicable diseases performing poorly

*Corresponding Author

¹ Assistant Director, Population Research Centre, JSS Institute of Economic Research, Dharwad, Karnataka, India. Email: pradeep_salve@biari.brown.edu, pradeep8889@gmail.com

² Field Investigator, Population Research Centre, JSS Institute of Economic Research, Dharwad. Email: korkoppam@gmail.com

³ Data Assistant, Population Research Centre, JSS Institute of Economic Research, Dharwad. Email: channunoolvi@gmail.com

⁴ Field Investigator, Population Research Centre, JSS Institute of Economic Research, Dharwad. Email: hrchannakki@gmail.com

⁵ Director and Professor, Population Research Centre, JSS Institute of Economic Research, Dharwad. Email: jshallad@rediffmail.com

in all health indicators and need special attention while focusing on the achieving SDG goals (IIPS and ICF, 2017).

Considering the LBW, maternal age, mother's poor health and nutrition conditions, the total number of antenatal visits, physical activities during pregnancy, height and weight during pregnancy, maternal education, and per capita income of the household determined the LBW of newborns (Metgud et, al., 2012; Malhotra et.al., 2014; Shashikantha and Sheethal, 2017; WHO, 2004; Kumari et, al., 2020). The gestation period less than 36 weeks has probability of LBW newborn which may result in a higher risk of death, morbidity and permanent disability (Wilcox, 2001). The health complications including anemia, pregnancy-induced hypertension, repeated infections, especially urinary tract infections, gestational diabetes and other obstetric problems among pregnant women increases the risk of LBW in newborns (He Z, et.al., 2018; Gopalan, 2018). LBW determined the endogenous condition of the fetus and principal element of perinatal survival, chronic illness, mortality, along with the risk of developmental disabilities and diseases in the future (Singh, 2009). The previous studies suggest that there is a high prevalence of undernutrition in terms of stunting, wasting and underweight which may be the result of LBW and requires suitable nutrition involvement programs in India (Kshatriya and Ghosh, 2008).

The LBW is one of the major health issues in developing countries including India. Despite around half of the Asian LBW newborn are in India, there is scope for developing a policy which can subjugate the severity of the issue. The high proportion of neonatal deaths within the first week of birth is considerably high in India which has a major share in the Infant Mortality Rate (IMR) (Singh et. al., 2019; IIPS and ICF, 2017). In the larger perspective LBW remained an underestimated endogenous cause which resulted in the underdevelopment of children over life. This issue needs to be addressed through every possible data source; in this context we have not come across a single study which explores the LBW in India using the Health Management Information System data which is the largest vital statistics data source based on the public health facilities in India. Therefore, the present study investigates the district and state-wise scenario of LBW and burden of deaths among infants due to LBW.

Data source and methodology

The present study has used HMIS data which is the official health service statistics facility-based data source of the Ministry of Health and Family Welfare (MoHFW), Government of India. HMIS extracted the consolidated data from the Health Sub-Centres, Primary Health Centres, Community Health Centres, Sub-Divisional Hospitals and District Hospital throughout the country. At the same time, it also covers the private health facilities in respective regions of India. For the present study, we have used available data of newborns with LBW and infant deaths due to LBW is calculated for the year 2015-16 at the state and district level. The HMIS is a rich data source and provides the information on health indicators at the health sub-center level. The HMIS data source is an established data source for the reproductive, maternal and child health indicators and also provides the empirical evidence on the national health programs and policies implemented by the government. The HMIS extensively covers the Reproductive (*Rashtriya Kishor Swasthya Karyakram and Rashtriya Bal Swasthya Karyakram*), Maternal (*pregnancy registration, antenatal care, delivery, post-natal care, family planning etc.*), Neonatal (*Sick Newborn Care Unit*), and Child Health (*Immunization, childhood diseases, Nutritional Rehabilitation Centers and child mortality*) (RMNCH) care indicators and other national health programs including Malaria, Tuberculosis, Leprosy, National vector-borne diseases, Janani Suraksha Yojana, Janani Shishu

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Suraksha Karyakaram, HIV/AIDS, general outpatients and in-patients care, and data on non-communicable diseases (*screening and treatment*) etc. The reporting of the HMIS data is taking place at all the public health facilities; an assigned paramedical staff will update the data of services delivered at the health facility every month to the respective HMIS representatives in the facility. And the HMIS data operator will update it in the HMIS web portal at the end of the month. The HMIS data has been validated at four stages starting with the chief medical officer of the particular-health facility, block development officer at sub-district level, monitoring and evaluation (M&E) officer at district level and state validation by state M&E. The quality of HMIS data on child indicators is satisfactory and improving.

For the present study we have used five data elements from the HMIS which are 1) Number of newborns weighed at birth at the government health facility and 2) Number of newborns having weight less than 2.5 kg in respective health facility 3) Percent of deaths due to LBW to total reported infant deaths. Additionally, we have used two elements including 4) Total Number of reported live births and 5) Total Number of reported Infant Deaths. The paper estimated the state and district level deaths due to LBW in India and the number of infant deaths due to LBW at the state and district level for per 100,000 live births. The QGIS software has been used for regional mapping

Results

Low Birth Weight in States and Districts

Table 1 demonstrates the percent of LBW among newborns in India according to the HMIS (2015-16). The HMIS shows that 12.5 percent of newborns in India are born with a low birth weight during 2015-16. The state-level results depict that state such as Rajasthan (25%), Odisha (19%), Assam (17%), West Bengal (16%), Haryana (15%), Madhya Pradesh (14%), Maharashtra (14%) and Tamil Nadu (13%) have a higher percent of LBW than the national average. On the other hand, Himachal Pradesh (12%), Chhattisgarh (12%), Kerala (12%), Karnataka (12%), Gujarat (11%), and Tripura (11%) have lower than the national average (Table 1).

The district-level analysis depicted that at the national level, a total of 267 districts have more than 12.5% percent of LBW among newborns and 409 districts out of 676 have less than 12.5% of LBW newborns. Majority of districts in Madhya Pradesh (34 districts), Rajasthan (30 districts), Odisha (26 districts), Assam and Maharashtra (21 districts each) and Uttar Pradesh (18 districts) have more than 12.5 percent of newborns with low birth weight.

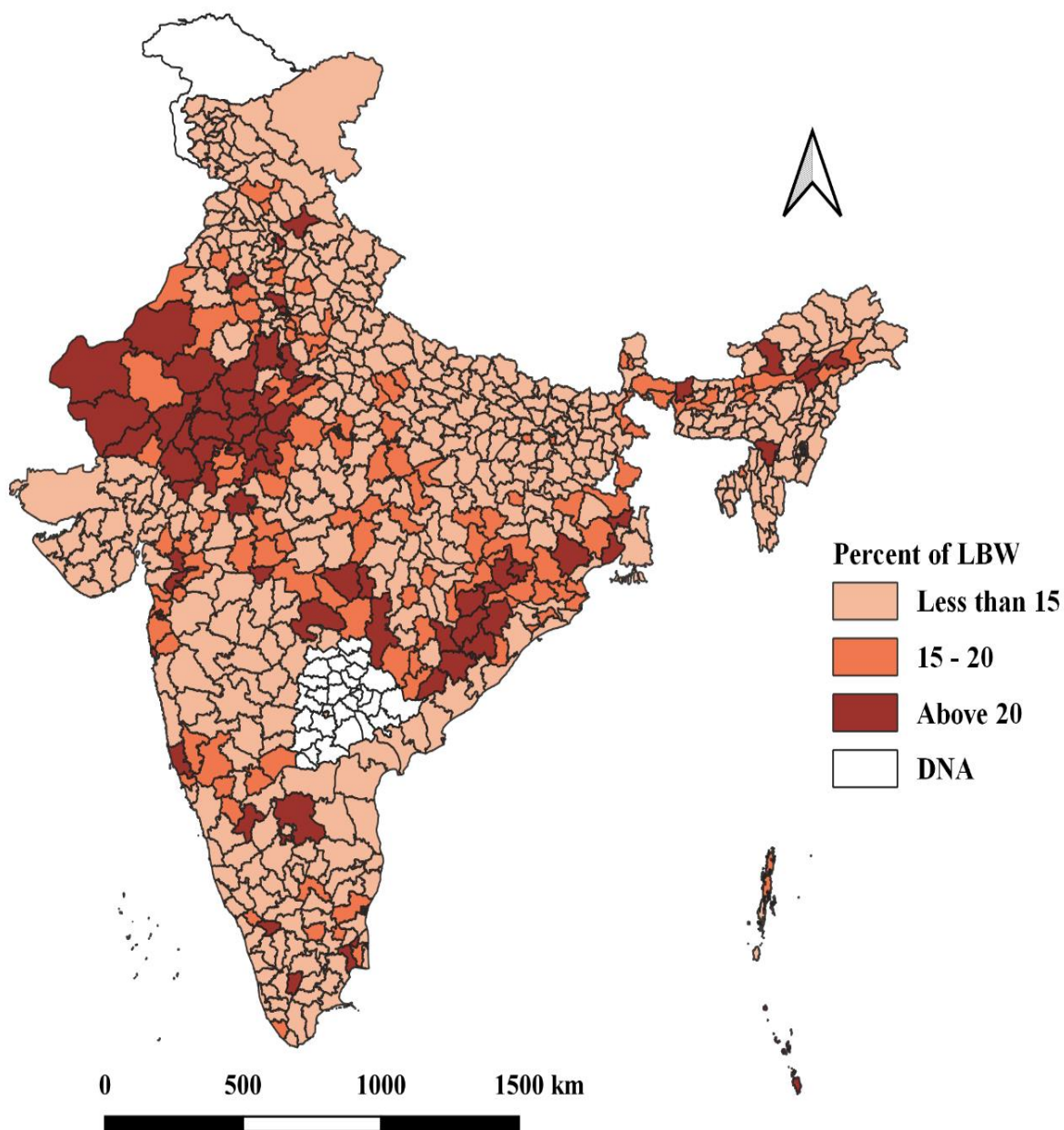
Particularly, considering the districts like – Udaipur (30%), Pali (31%), Dungarpur (36%), Sawai Madhopur (42%), Baran (46%), Rajsamand (49%), and Bharatpur (52%) of Rajasthan have the highest percent of LBW in India (Map 1). Similarly, districts of Odisha including Koraput (24%), Kalahandi (24%), Mayurbhanj (27%), Rayagada (27%), Balangir (28%), Nabarangapur (29%) and Sambalpur (30%) have a higher percent of LBW.

Table 1: Low Birth Weight and Infant Deaths during 2015-16 in India

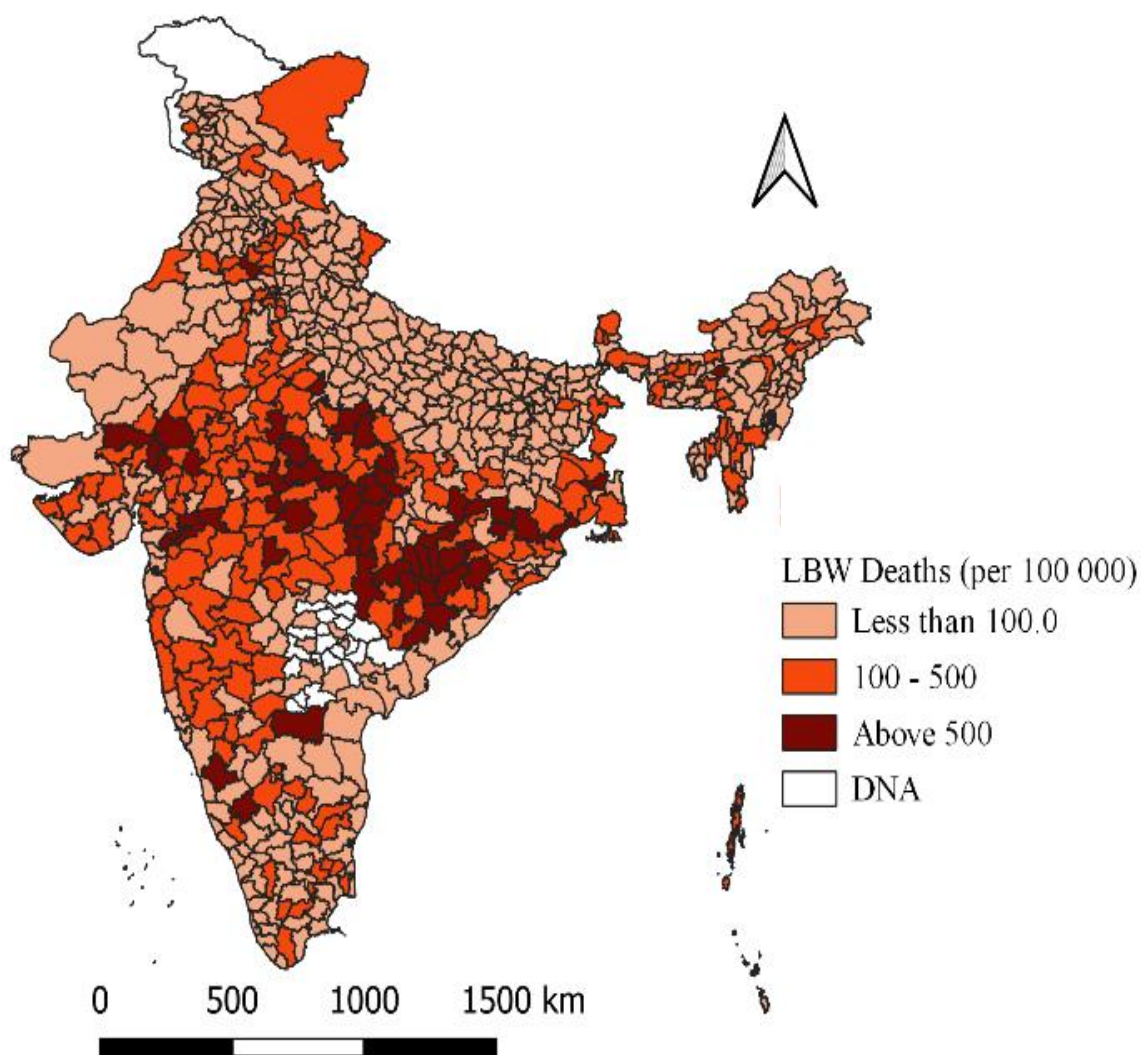
States and Union Territories	Low Birth Weight (%)	Infant Deaths due to LBW (%)	Infant Deaths due to LBW (Per 100,000 Live Births)	Number of Infant Deaths	Total Number of reported Live Births
Andhra Pradesh	6.7	24.4	119	3,936	805,572
Arunachal Pradesh	6.6	11.5	45	66	16,775
Assam	17	17.9	140	4,833	617,367
Bihar	7.2	14.5	15	2,041	2,034,753
Chhattisgarh	12.1	29.5	305	4,999	483,375
Goa	15.5	4.5	8	36	18,963
Gujarat	10.6	28.4	184	8,024	1,241,585
Haryana	14.9	13.4	233	8,651	496,659
Himachal Pradesh	12.6	9.7	118	1,127	92,461
Jammu & Kashmir	5.9	21.5	77	682	190,185
Jharkhand	7.5	15.3	30	1,339	678,992
Karnataka	11.5	22.9	194	7,673	906,613
Kerala	11.7	22.5	8	173	477,139
Madhya Pradesh	14.1	23.1	382	23,349	1,411,362
Maharashtra	13.7	28.4	233	13,665	1,665,831
Manipur	3.5	10.1	24	93	39,640
Meghalaya	7.8	4.5	132	2,508	85,814
Mizoram	4.7	11.3	254	449	19,945
Nagaland	3.9	9.8	57	125	21,663
Odisha	19.1	19.7	383	13,039	671,548
Punjab	6.9	7.6	30	1,544	390,955
Rajasthan	25.4	16.6	217	18,226	1,389,258
Sikkim	7.8	13.7	185	104	7,703
Tamil Nadu	12.8	19.2	108	5,162	921,035
Telangana	5.7	21.8	34	937	601,443
Tripura	11.1	10.1	104	518	50,276
Uttar Pradesh	9.6	14.2	7	2,052	4,000,710
Uttarakhand	7.3	20.6	50	358	147,784
West Bengal	16.4	21.8	269	16,718	1,352,404
Union Territories					
Andaman & Nicobar Islands	17.2	16.1	213	62	4,692
Chandigarh	21	2.3	83	1,012	28,032
Dadra & Nagar Haveli	29.6	30.2	585	176	9,092
Daman & Diu	24.4	15.8	232	53	3,614
Delhi	21.3	14.9	179	3,227	267,974
Lakshadweep	5.6	33.3	235	6	852
Puducherry	15.5	30.2	36	49	41,028
INDIA	12.5	20.7	143	1,47,012	21,193,094

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Map 1: District wise Low Birth Weight in India (HMIS 2015-16)



Map 2: District wise number of deaths due to Low Birth Weight in India - HMIS 2015-16
(Per 100,000 Live births)



Death due to LBW in States and Districts

The percent of infant deaths due to the Low Birth Weight to the total infant deaths during 2015-16 is presented in table 1. The table depicted that LBW shares the one-fifths (21%) burden of death into total infant death in India. The state-wise burden of infant death shows that states like Chhattisgarh (30%), Maharashtra and Gujarat (28% respectively), Andhra Pradesh (24%), Madhya Pradesh (23%), Kerala (23%), Karnataka (23%), Jammu Kashmir (22%), Telangana (22%), West Bengal (22%) and Uttarakhand (21%) tolls more than one-fifths infant death due to LBW in total infants' deaths in India (Table 1). On the other hand, Union Territories including Lakshadweep (33%), Dadra and Nagar Haveli (30%), Puducherry (30%) shows a higher burden of infant deaths due to LBW in India. Subsequently, we have estimated the infant deaths due to LBW for per 100,000 live births in India presented in Table 1. Altogether, the estimates show that total of 143 newborns with LBW die per 100,000 live

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births at the national level. The state-level analysis revealed that Odisha (383) and Madhya Pradesh (382) have the highest infant deaths due to the LBW per 100,000 live births. Further states like West Bengal (269), Mizoram (254), Maharashtra (233), Haryana (233) Karnataka (194) and Gujarat (184) have higher newborns deaths per 100,000 live births.

The district-level estimates of newborn deaths due to the LBW per 100,000 live births is presented in Map 2. The districts have been categorized into three categories such as districts having less than 100 infant deaths due to LBW per 100,000 live births followed by 100-500 deaths and deaths above 500 per 100,000 live births. Results show that the majority of the districts from Chhattisgarh, Odisha and Madhya Pradesh have infant deaths more than 500 per 100,000 live births (Map 2). The districts wise analysis shows that Madhya Pradesh (16 districts) have the highest number of districts with 500 deaths due per 100,000 live births followed by Odisha (12 districts), Chhattisgarh (7 districts), Maharashtra (5 districts), Rajasthan and Karnataka (2 districts respectively). The Betul district of Madhya Pradesh (1207) has the highest infant deaths due to LBW per 100,000 live births followed by Raigarh of Chhattisgarh (1193), Deogarh (1021) and Naupada (1082) of Odisha, Barwani (978), Umaria (914) and Dindori (913) of Madhya Pradesh.

Discussion

The findings of study revealed that LBW among newborns in India is significantly high and tolling the majority of deaths into infant deaths. States including Rajasthan (25%), Odisha (19%), Assam (17%), West Bengal (16%), Haryana (15%), Madhya Pradesh (14%), Maharashtra (14%) and Tamil Nadu (13%) have a higher percent of LBW than the national level. Whereas the district level analysis shows that majority districts of Rajasthan, Odisha, Madhya Pradesh, West Bengal, Assam and Maharashtra have higher percent of LBW. The previous studies reinstate our finding and highlighted that the EAG states like Rajasthan, Odisha, Assam, Madhya Pradesh have higher prevalence of LBW in India compared to other states (Bharati, P et.al., 2011; IIPS and ICF, 2017; Kumari, et.al., 2020). Specifically, Udaipur, Pali, Dungarpur, Sawai Mashhour, Baran, Rajsamand, and Bharatpur of Rajasthan have the highest proportion of LBW. Similarly, Koraput district, Kalahandi, Mayurbhanj, Rayagada, Balangir, Nabarangapur and Sambalpur have a higher percentage of LBW. Majority of these districts are dominated by the tribal population which has less access to health facilities.

The estimation of the contribution of LBW into the total infant deaths shows that Chhattisgarh, Maharashtra and Gujarat, Andhra Pradesh, Madhya Pradesh, Kerala, Karnataka, Jammu Kashmir, Telangana, West Bengal and Uttarakhand have one-fifths of infant deaths due to LBW into total infants' deaths in India. Further, the majority of the big states have one-fourths deaths of newborn due to the LBW. Subsequently, it has been found that the districts from Madhya Pradesh (16 districts), Odisha (12 districts) and Chhattisgarh (7 districts), Maharashtra (5 districts), Rajasthan and Karnataka (2 districts respectively) have more than 500 per 100,000 live births. Districts of Maharashtra and Madhya Pradesh with highest infant deaths due to LBW have low socio-economic development and are dominated by the tribal populations (Narwade and More, 2018; Kumari, et.al., 2020). Further, the districts like Betul of Madhya Pradesh followed by Raigarh of Chhattisgarh, Deogarh and Naupada of Odisha, and Barwani, Umaria and Dindori of Madhya Pradesh show around 1000 infant deaths per 100,000 live births.

Conclusion

In conclusion the present study highlighted that despite the number of policies and programs introduced by the Government to improve the RMNCH care indicators in India; the empirical evidence is not promising. With initiation of the National Rural Health Mission, government has implemented number of schemes and policies (*Nutritional Rehabilitation Center, Newborn Care Corner, Newborn Stabilization Unit, Sick Newborn Care Unit, Janani Shishu Suraksha Karyakram, Navjaat Shishu Suraksha Karyakram, Integrated Management of Neonatal and Childhood Illness, Facility Based-Integrated Management of Neonatal and Childhood Illness, Home Based Newborn Care*) to improve the infant health indicators and to reduce the infant mortality rate and child morbidity in India. However, the Low Birth Weight issue among infants is somewhat neglected considering the government policy and scheme perspective. The Integrated Child Development Services (ICDS) Scheme provides the supplementary food, health and nutrition education etc. to pregnant and lactating mothers, however only half (51.5%) of the women received the benefits in India according to the National Family Health Survey-4 (NFHS-4). And the situation of EAG states is even poor considering all RMNCH care indicators (IIPS and ICF, 2017). With this lacuna, in order to improve the newborn's health indicators, the government needs to formulate policies and programs which may improve the health and nutrition of adolescent girls and pregnant women in India. In particular, our study recommends that states such as Rajasthan, Chhattisgarh, Odisha, Assam, West Bengal, Haryana, Madhya Pradesh, Maharashtra and Tamil Nadu need to be targeted and considered for policy implication which may reduce the LBW among newborns. Continues monitoring is required for the programs and policies initiated to improve the nutrition and health of pregnant women and adolescent girls. At the same time, the government can adopt a target-oriented intervention policy and program to reduce the LBW and related infant deaths in the districts from respective states.

Limitation

The HMIS data is information of services delivered through the public health facilities in India and it does not provide the information on the socioeconomic and demographic characteristics of the people accessing the services.

Availability of data and materials

The data used for the study is obtained from the web portal of Health Management Information System (<https://nrhm-mis.nic.in/SitePages/Home.aspx>). No separate ethics statement and consent for publication was required for this study as the HMIS collected the secondary data from the health facilities of India.

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