

Maternal Mortality Rate and Infant Mortality Rate in Assam, Northeast India: A Serious Public Health Challenge

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KEYWORDS: Healthcare. Public health. MMR and IMR. Health facilities. Assam.

ABSTRACT: India is facing one of the biggest challenges in the area of maternal and child healthcare and development including Assam. We are facing major public health concerns in the areas of anaemia, maternal mortality, child sex-ratio and infant mortality in Assam, Northeast India. The objectives of the present paper are to evaluate and compare the current situations of maternal mortality rate (MMR) and infant mortality rate (IMR) in Assam. The Government of Assam has made significant advancements to reduce the MMR and IMR and has shown an increase in institutional delivery and immunization coverage, however, it is still below the adequate requirement. Therefore, there is an urgent requirement to improve the overall and target-specific healthcare facilities, and improving the infrastructural facilities in the peripheral hospitals to combat these serious healthcare problems in population.

INTRODUCTION

Undernutrition is considered to be the major public health problem in many developing countries including India. Recent nutritional trend has shown a significant decline in the prevalence of malnutrition (i.e., undernutrition), but India contributes to the largest number of child undernutrition in world. The prevalence of undernutrition is associated with 2.2 million children deaths and 21% of disability-adjusted life years lost and more than 178 million children are stunted in developing countries (Black *et al.*, 2008). The severities of malnutrition are also linked with increased risk of all-cause mortality and increased risk of death due to diarrhea, pneumonia, and measles in children (<5 years) (Black *et al.*, 2013). Prevalence of child undernutrition is also strongly correlated with poor maternal nutritional status (Pelletier and Frongillo, 2003; Subramanian *et al.*, 2009; Bhutta *et*

al., 2013; Black *et al.*, 2013) and attributed to 60% of total mortality in children (<5 years). The prevalence of undernutrition and significant micronutrients deficiencies are observed to be very high among vulnerable segments (e.g., infant and children) residing in rural areas in India (Varadharajan *et al.*, 2013; Ramachandran, 2014). Globally, maternal undernutrition contributes to fetal growth restrictions and neonatal deaths (i.e., 800,000) annually due to small gestational age births, child undernutrition (i.e., stunting and/or wasting), and micronutrient deficiencies are estimated to underlie nearly 3.1 million child deaths annually (Black *et al.*, 2013; Bhutta *et al.*, 2013; Christian *et al.*, 2015; Narayan *et al.*, 2018). Several researchers have reported that the prevalence of undernutrition is alarmingly high among adolescent girls, pregnant and lactating women in India (Ramachandran, 2014; Narayan *et al.*, 2018). The World Health Organization (WHO) estimates that more than half a million women lose their lives in the process of reproduction worldwide (e.g., postpartum mortality) (New Series ©SERIALS 119

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of these deaths about 99.0% were accounted in developing countries (WHO, 2004). It is estimated that the largest number of maternal death [i.e. maternal mortality rate (MMR)] is accounts for 22.0% in India (WHO, 2007). India contributes one-fifth of the global burden of absolute MMR; however, it has experienced an estimated 4.7% annual decline in MMR (Registrar General of India, 2006; WHO, 2015). India, with a population of more than 1.21 billion, has the highest MMR in the world and child death was estimated to be 1.2 million (United Nations Children's Fund, 2015; WHO, 2015). Recent trend has shown an appreciable progress in improving the overall health status by reducing the overall burden of MMR of the population but the results were found to be unsatisfactory in the field of maternal and child health (MCH) in India (Cousins, 2016). It is estimated that the world MMR had declined 44.0% since 1990, but still every day 830 women die from pregnancy or childbirth related causes in India till 2017 (United Nations Population Fund, 2017).

The MCH continues to be a major public health concern in the country among the nutritionally vulnerable segments (e.g., children, adolescents, pregnant and lactating women) of the population. The continuing high levels of mortality and morbidity associated with poor pregnancy outcomes, neonatal care and child birth represent a grim scenario in India (Cousins, 2016; Dehury and Samal, 2016; Gorain *et al.*, 2017). It is mainly attributed to poverty, food insecurity, ignorance, lack of appropriate infant and young child feeding practices, heavy burden of infectious diseases, undernutrition and poor hygiene or living condition, sanitation, early age at marriage and conception, poor control over resource and allocation, inadequate decision making power, unregulated fertility and enhancement the purchase power of women are considered being the crucial factors of unsatisfactory health situations (Ahmed *et al.*, 2012; Bhutta *et al.*, 2013; Vir, 2016; Wickham *et al.*, 2017; Mondal *et al.*, 2018; Dey *et al.*, 2019). Moreover, poor socio-economic status, maternal undernutrition, micro-nutrient deficiencies and anemia can increase the relative risks of adverse pregnancy outcomes (e.g., low birth weight) and survival of the newborn (Muthayya 2009; Sen *et al.*, 2011; Mbule, *et al.*, 2013; Nnam, 2015; Vora *et al.*, 2015; Daru *et al.*, 2018; Kim *et*

al., 2018; Mondal *et al.*, 2018; Dey *et al.*, 2019). At the same time, poor infrastructure and ineffective public health services is also responsible for low inadequate obstetric care indicating an urgent public health concern in India (Singh *et al.*, 2012; Kumar, 2013; Singh and Badaya, 2014; Cousins, 2016; Mondal *et al.*, 2018).

Health is an essential component for a region for its development and internal stability. The MCH is one such area of concern, where Assam's record has been very unsatisfactory in the both present and past decades (Cousins, 2016). The state is infamous for its high MMR which stands as high as 328 maternal deaths per hundred thousand mothers per year during 2010-12 is the highest in the country (all India average: 178, with Kerala having the lowest MMR), the corresponding national attainment level is 178 (Sample Registration Survey, 2013). The data shows that 67.0% of girls in the age groups of 15-19 years are anemic in Assam (NFHS-4, 2015-16). There is an overall high prevalence of anemia and undernutrition among girls and 32.6% of the women in Assam, aged 20-24 years were married before age of 18 years (NFHS-4, 2015-16). All these factors are may be attributed for poor MCH in the state (e.g., Zaman and Begum, 2014; Cousins, 2016). In Assam almost 86% of the people live in rural areas and the rural women are mostly illiterate and poor health consciousness (Census, 2011). Interventions in Assam have failed because those in rural areas tend to trust local midwives who do not have sufficient training. Many women in labor living in remote areas die on the way to hospitals because of poor communication and bad road conditions. Likewise, child mortality is also high in the state Assam, as per the Sample Registration Survey, the IMR in Assam is 54 per 1000 live births against 40 for the country as a whole (Sample Registration Survey, 2013).

Moreover, the Government has made significant advancements to reduce the Maternal and child health burden (i.e., IMR and MMR) and shown an increase in institutional delivery and immunization coverage (<5 years children), but still found below the adequate/satisfactory requirements in population. Moreover, the improving overall health and well-being of women, infants and children is an important public health goal for the world and determines the health of the next generation and can help predict future public health challenges for the families, communities and healthcare

system. The prevalence of IMR and MMR are much higher in the vulnerable segments of the population especially in the rural areas and mainly attributed to lack of adequate healthcare facilities, lack of knowledge about health, hygiene, awareness of healthcare services and less institutional delivery and acute shortage of doctors and medical staff in the hospitals. Therefore, the objectives of the present manuscript are to review and evaluate the present situation, causes and consequences of IMR and MMR in Assam.

METHODOLOGY

The present study is based on secondary data/sources which have been collected from the Statistical Hand Book, Assam (2014), National Family Health Survey-3, National Family Health Survey-4, Sample Registration System (2010-12), Sample Registration Survey (2013) and Sample Registration Survey (2016). Relevant literatures surveys were also done using various scientific research journals, articles, internet etc. Online data bases were also searched to collect the necessary information of the demography and data related to maternal and child health. National census data and several published reports were used to analyzed and discuss the objectives of the present study. The analysis carried out in this paper is qualitative and descriptive. The data has been analyzed with the help of frequencies, percentages, rates and ratios and are presented in table and figure.

DISCUSSION

Maternal Mortality Rate and Infant Mortality Rate in Assam

The Planning Commission's recent data reveal that in terms of percentage increase in the rate of growth that Assam may be ranked at 6th of the top among all the states in the country during the period 2001-2010 (Planning Commission, 2014). The Human Development Report of India (2011) has also clearly showed that the state has performed appreciably well in all fronts of human development and the improvement in Human Development Index (HDI) is considerably above the national average. However, it is the matter of concern that improvement in the HDI or health index of the state has not been as impressive

as income and education index, which is serious challenge for the state. Several investigations have reported that the higher prevalence of IMR, higher fertility rate, and greater undernourishment are the important public health concern in Assam (e.g., Phukan and Mahata, '98; Saddichha, 2009; Saikia and Das, 2014; Tiwari *et al.*, 2017). Assam is the largest among the states of India consist of 31 million population with a growth rate of about 17% and the literacy rate in the state is improved tremendously to 73.0% from the last decade which was 63.25% (Census, 2011). The high prevalence of MMR in a country or state may cause huge losses in terms of human life and social welfare. Assam has shown appreciably higher MMR than the national average (Sample Registration System, 2010-12). The MMR is considered to be one of the biggest challenges in the area of children and women development in Assam (Sullivan *et al.*, 2011; Cousins, 2016; Serbanescu *et al.*, 2017). Maternal death (i.e., MMR) is defined by the World Health Organization (WHO) as "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes" (Khan *et al.*, 2006). The MMR depicts the number of maternal deaths relative to the number of live births and is usually reported as the number of maternal deaths per 100,000 live births (UNICEF, 2017). As per the Sample Registration System (2011), the MMR in Assam (2010-12) of 328 (per 100000 live births) was the highest in the country (all India average: 178, with Kerala having the lowest MMR), the corresponding national attainment level is 178. The comparison of MMR in the highest 10 number of states of India and the country as a whole is depicted in Table 1. The comparison showed that Assam occupied the highest MMR with 328, followed by Uttar Pradesh with 292 and Uttaranchal with 292 per 100000 live births (Sample Registration System, 2010-12). Though, the prevalence of maternal mortality rate (MMR) records for Assam has significantly decreased from 480 (Sample Registration System 2004-2006) to the current figure of 328 but still it is higher in number in comparison to the Indian sates (Sample Registration System, 2013).

TABLE 1
Maternal Mortality Ratio: India and highest 10 number of states of India

State	MMR (SRS, 2007-2009)	MMR (SRS, 2010-2012)	MMR (SRS, 2014-2016)
India Total	212	178	130
Assam	390	328	237
Uttar Pradesh	359	292	201
Uttarakhand	359	292	201
Rajasthan	318	255	199
Orissa	258	235	180
Madhya Pradesh	269	230	173
Chhattisgarh	269	230	173
Bihar	261	219	165
Jharkhand	261	219	165
Punjab	172	155	122

Source: Register General of India (Sample Registration System), 2007-09, 2010-12, 2018

Maternal health is considered to be important as it not only affects mother but also the future generation (Das *et al.*, 2016). The detail description of commissioner/district (e.g., Hills and Barak Valley Division, Lower Assam Division, North Assam Division and Upper Assam Division) wise data on MMR in Assam is presented in Table 2. The comparison of MMR among these four regions has shown that the Upper Assam division including the districts of Tinsukia, Dibrugarh, Sivsagar, Jorhat and Golaghat occupies the highest MMR constituting 430 which was found to be significantly higher the state average of 381 (see Table 2). The lowest prevalence of MMR is shown in the Hills and Barak Valley division including the districts Karbi Anglong, North Cachar Hills, Cachar, Karimganj and Hilakandi constituting 342 (Annual Health Survey, 2010-11). In 2003-04, Assam's MMR was 490 (India 301) which declined by a mere 2.0% to 480 (India 254) in 2004-06. However, the decline during 2006-2009 has been remarkable i.e. near 19.0% considering the high base. The introduction of the Janani Suraksha Yojana from the year 2005, under the National

Rural Health Mission promoting institutional delivery among the poor pregnant women (Gupta *et al.*, 2012; Vora *et al.*, 2015; Thongkong *et al.*, 2017). However, improving the safe motherhood still remains a major challenge for overall improvement in the maternal and therefore child health in the state. Safe deliveries remain a challenge in India; as per the District Level Household and Facility Survey (International Institute of Population Sciences, 2010), only 39.9% of deliveries are attended by trained attendants in Assam; the all India average is 52.7. As per National Family Health Survey, increasing trend has been seen in India in percentage of Institutional birth 38.7% in 2012-13 (NFHS-3, 2005-06) and 78.9% in 2015-16 (NFHS-4, 2015-16). Several states include Kerela, Lakshadweep and Puducherry have registered highest percentage of Institutional Births 99.9% during 2015-16 (NFHS-4). Nagaland has lowest percentage of Institutional Births 32.8% during 2015-16 (NFHS-4) in comparison to other states. The comparison with several other Indian states indicated very unsatisfactory progress in maternal and child healthcare in Assam.

TABLE 2
Maternal Mortality Ratio (MMR) in Assam, Northeast India

State/ Commissionerary /(District)	Sample female population	Sample live births	Maternal deaths	MMR	Confidence interval (95%)		Maternal mortality rate	Life time risk (%)
					Lower limit	Upper limit		
Assam	483287 (460250)	111246 (111150)	386 (423)	347 (381)	312 (344)	382 (417)	27 (31)	0.93 (1.07)
Hills and Barak Valley Division (Karbi Anglong, North Cachar Hills, Cachar, Karimganj, Hilakandi)	76001 (71640)	19444 (19290)	56 (66)	288 (342)	213 (260)	363 (425)	25 (31)	0.86 (1.07)
Lower Assam Division (Kokrajhar, Dhubri, Goalpara, Darrang, Bongaigaon, Barpeta, Kamrup, Nalbari)	134163 (128018)	29886 (29520)	97 (108)	325 (366)	260 (297)	389 (435)	24 (28)	0.84 (0.98)

North Assam Division (Morigaon, Nagaon, Sonitpur, Lakhimpur, Dhemaji)	123502 (117042)	30245 (30259)	95 (111)	314 (367)	251 (299)	377 (435)	26 (32)	0.89 (1.10)
Upper Assam Division (Tinsukia, Dibrugarh, Sibsagar, Jorhat, Golaghat)	149621 (143550)	31671 (32081)	138 (138)	436 (430)	363 (359)	508 (502)	31 (32)	1.07 (1.12)

Source: Annual Health Survey, 2011-12

TABLE 3

Infant Mortality Rate (IMR): India and highest 10 number of states of India

State	IMR (SRS, 2011)	IMR (SRS, 2012)	IMR (SRS, 2013)	IMR (SRS 2016)
India Total	44	42	40	34
Assam	55	55	54	44
Madhya Pradesh	59	56	54	47
Odisha	57	53	51	44
Uttar Pradesh	57	53	50	43
Meghalaya	52	49	47	“
Rajasthan	52	49	47	41
Chhatisgarh	48	47	46	39
Bihar	44	43	42	38
Haryana	44	42	41	33
Andhra Pradesh	43	41	39	34

Source: Register General of India (SRS), 2011, 2012, 2013, 2016

Recent data has suggested that India has registered a significant decline in IMR by three points (~8%) from 37 per 1,000 live births (in 2015) to 34 (in 2016) (Sample Registration System, 2016). The comparison of IMR in 10 highest Indian states is depicted in Table 3. According to the Sample Registration Survey (2013), the prevalence was observed to be higher in Assam (i.e. 54/100) and Madhya Pradesh (i.e. 54/100). Madhya Pradesh is at the bottom with 47 per 1,000 live births followed by Assam and Odisha, both with 44 per 1,000 live births (Sample Registration Survey, 2016). The data has reported the high prevalence IMR in Assam is 54 per 1000 live births against 40 for the country as a whole (Sample Registration Survey, 2013). Child mortality is a critical indicator of social and economic progress and a country's commitment to child health and development. Admittedly, the IMR has improved considerably during 2000-2013 but still it is highest in the country. In 2000, the IMR for the state was 74.5 against the all India figure of 67.8. Despite a marginal reduction in the IMR (by 3 points) from 61 per 1,000 live births (in 2009) to 58 per 1,000 live births (in 2010), Assam continues to rank among the four highest IMR States in the country, next only to Madhya Pradesh

(62 per 1,000 live births), Uttar Pradesh and Orissa (61 per 1,000 live births), and far higher than the national average of 47 per 1,000 live births. The data showed that the state Assam and Madhya Pradesh occupy the highest rank in the country with IMR 54 followed by Odisha with 51 per 1000 live births (Sample Registration System, 2013). The district wise prevalence of IMR in Assam is mentioned clearly where it is found that Kokrajhar district has highest IMR constituting 76% which is much higher than the state average (60.0%) followed by Marigaon and Dhubri district with 72% IMR and lowest IMR is found in Dhemaji district with 44.0% (Annual Health Survey, 2010-11) (Figure 1). Moreover within the Northeast region, all the other states have better IMR as compared to Assam. Moreover, the Neonatal Mortality Rate, i.e. the number of infant deaths in less than 28 days of birth for Assam is 33 per 1,000 live births in 2009 which indicates that, of the total infant deaths in the state, 54.7% take place within the first 28 days of birth. The prevalence <5 years mortality rate in Assam is 87/1,000 live births 3 in 2009, as compared to the all India figure of 64. Here again, the bias against the girl child with Assam recording 91 per 1,000 live births, which is one of the highest in the country. The high

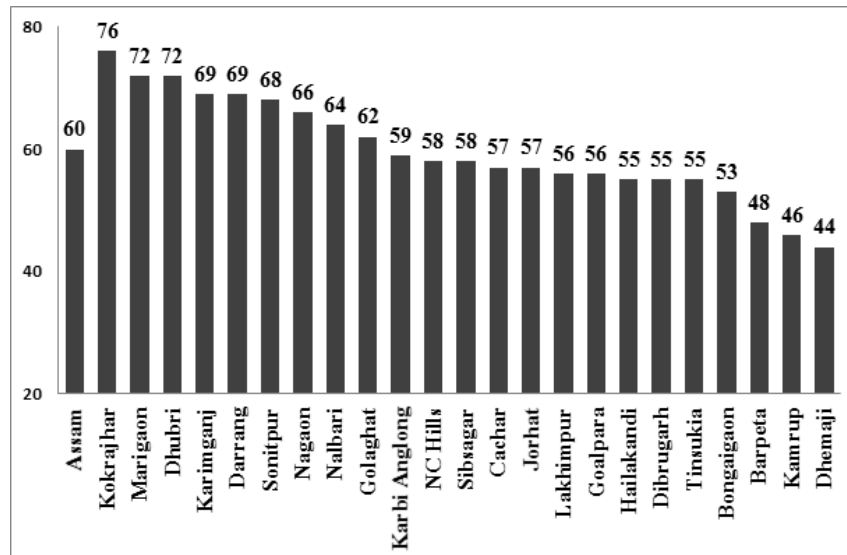


Figure 1: District wise Infant Mortality Rate in Assam

(Source: Annual Health Survey, 2010-11)

prevalence of MMR is also a major health problem in Assam. The high prevalence of MMR continues to be a cause for concern despite investment from the central and the state Government of Assam (Gogoi, 2014; Cousins, 2016). Moreover, the prevalence high fertility, poverty, abortion, transport, emergency care, maternal autonomy and/or decision making with respect to movement and healthcare accesses and poor awareness and ignorance of healthcare schemes, poor rate of institutional deliveries and distant hospitals, health-related behaviours, decisions making, poor socio-economic and demographic situations are considered to be the key determinants of MMR (Raj *et al.*, 2009; Sen *et al.*, 2011; Goli and Jaleel, 2014; Zaman and Begum, 2014; Vora *et al.*, 2015; Mondal *et al.*, 2018).

There are several causes of high rate of IMR and MMR in population of our country. Many other factors contribute premature births, small gestational period, infant mortality such as the mother's level of education, environmental conditions and political and medical infrastructure (Rutstein, 2000; Damghanian *et al.*, 2014; Genowska *et al.*, 2015; Grepin and Bharadwaj, 2015; Vail *et al.*, 2018). Bhutta *et al.* (2013) has suggested the continued investments in nutrition-specific population interventions to avert maternal

and child undernutrition through community engagement and delivery strategies that ensure reach to the vulnerable segments of the population at greatest risk can make a great difference. If this improved access is linked to nutrition-sensitive approaches of women's empowerment, agriculture, education, employment, social protection, adequate access to healthcare facilities and safety nets % they can greatly accelerate progress in countries with the burden of maternal and child undernutrition and mortality in population. One of the most common preventable causes of infant and maternal mortality is smoking during pregnancy (Hall *et al.* 2016) and moreover early marriage is also one such cause of high IMR and MMR in our country (Goli *et al.*, 2015; Paul, 2018; Mehra *et al.*, 2018). Young mothers face higher risks of complication and death during pregnancy than older mothers (WHO, 2004; Raj *et al.*, 2009; McCormick *et al.*, 2011; Efevbera *et al.*, 2017; Mehra *et al.* 2018). Moreover hypertension in pregnancy is one of the potential causes of maternal and fetal morbidity and mortality. It complicates 7-10% of pregnancies (Sharma *et al.* 2018). Environmental and social factors such as access to healthcare and early intervention services, educational, employment, and economic opportunities,

social support and availability of resources to meet daily needs influence maternal health behaviors and health status and also under-five mortality (Braveman *et al.*, 2011; Huda *et al.*, 2016). The illness or death of a woman has serious and far-reaching consequences for the health of her children, family and community (Clark *et al.*, 2013; Talukdar and Das, 2016; Scott *et al.*, 2017). Moreover, efforts may be given to optimal weight gain during pregnancy and nutritional status a desirable fetal outcome and reduce the relative risk of IMR may be a result of synergistic effects of improved food intake, food supplementation, improved micronutrient intake, education and the environment of the pregnant woman.

CONCLUSION

The MCH has a major concern in demographic and health outcomes and which also reflects the status of women in the society and empowerment level and also appalling the basic healthcare facilities in a particular region. The manuscript has discussed the IMR and MMR in Assam. Safe motherhood practices and child survival programs are therefore important in a region like Assam especially in rural areas with high MMR and IMR. Though central and state government schemes have taken initiatives to improving the overall health of the child and their mothers, but Assam has emerged as the state with highest MMR and IMR in the country. Glaring shortcomings in the healthcare services like poor coverage and quality of antenatal care, unsafe deliveries, lack of emergency obstetric care and poor referral services also contribute to high MMR and IMR. Although, the recent government schemes have succeeded in increase the institutional birth proportions significantly, but not translated into significant reduction in the mortality rates in population. Government initiatives must work towards building the awareness of healthcare in community level. Moreover, the implementation of multi-sectoral intervention policies and programs focusing on poverty alleviation and primary healthcare would greatly improve the present situation of MMR and IMR. Economic development, improved access to health services and effective community-based nutrition programs contributed to these positive trends.

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