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Maternal Health Challenges in North Eastern India: An Analysis of Mortality Rates and Contributing Factors

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Abstract

Maternal health remains the most basic of health concerns for women. Maternal health is considered an indicator of social development. There is no doubt that maternal mortality reflects the discrimination and economic disparities faced by the women of a society. Several factors contribute to pregnancies being a safe conclusion, and maternal deaths, near misses, morbidities, lack of access to a proper health care system, backlogs in vaccinations during the pregnancy stage, and improper education on reproductive health. These factors remain a priority issue in a developing nation like India, particularly in the Northeastern region. Despite the efforts of the government, NGOs, and basic awareness through education, efforts are not evident in bringing the desired results (Khan & Ranjan Pradhan, 2013).

Northeast India represents a special geographical location characterised by diverse demographics and sociocultural practices and lifestyles. This region is different from the rest of India in several aspects. Poverty, education, employment, and gender discrimination concerning women remain major societal challenges. Maternal mortality remains a serious issue despite the efforts of officials at the Centre and the State governments to reach the vision of saving every mother and unborn child (Illias Kanchan Sk et al., 2019).

Keywords

Maternal Mortality Ratio (MMR), North Eastern India, Antenatal Care (ANC), Socio-cultural Determinants, Health Infrastructure

1. Introduction

India ranks the highest in maternal mortality among Southeast Asian countries, with records showing about 67,000 deaths every year (Khan & Ranjan Pradhan, 2013). The maternal mortality ratio (MMR) has declined from 570 in 1990 to 230 in 2008, but remains high. Among maternal deaths in India, significant maternal mortality is occurring in the North East (L. Montgomery et

al., 2014). Addressing maternal health concerns through policy implementation, research, and understanding of the socio-economic levels of the North East States holds utmost importance for the abatement of the aforementioned high mortality.

Maternal health is a critical area of concern globally and even more in a developing country like India. The maternal mortality situation in India points toward acute attention to this sector, covering all aspects influencing maternal health. India ranks the highest in maternal mortality among Southeast Asian countries, with records showing about 67,000 maternal deaths every year. The maternal mortality ratio (MMR) has declined from 570 in 1990 to 230 in 2008, but remains high. Significant maternal mortality is occurring in the North East Region of India. Maternal mortality reflects the social, cultural, and economic disadvantages faced by women and has been a priority issue in the health policy outlook of the country.

Efforts and policies such as the Child Survival and Safe Motherhood Programme, Reproductive and Child Health Programme, and National Rural Health Mission have been directed towards addressing the mortality rates, yet the journey is still far from the finish line. Haemorrhage, sepsis, post-abortion complications, and obstructed labour remain the major causes of maternal death, while delays in decision making, travel and treatment contribute to the high statistical count. The crucial matters of concern, therefore, are to find out the reasons for the high maternal mortality in the North-Eastern States of India, gather evidence about the situation in the region encompassing all possible angles, undertake research studies on the gaps existing in the maternal health scenario concerning both policy and health systems, and to contemplate over the steps needed to be taken for the lowering of mortality stats.

Khan and Ranjan Pradhan state that the death of women from pregnancy-related causes underlines the social, cultural, and economic disadvantages that deprive them of respected and dignified treatment and have therefore become a priority issue in health policy. “Public health strategies addressing the specific maternal health needs of women, including early complication identification and referral, access to skilled care, and a sociocultural environment conducive to care-seeking and decision-making about health, must be central to maternal care programs. A national survey of maternal mortality in India indicated that, despite a decline in MMR since 1990, rural and less-educated women face disproportionately higher mortality. The socio-economic and cultural disadvantages faced by women in these regions underline the need to focus intervention programs and research-oriented studies in those areas.

1.1 Background: Maternal health significance globally and in India

Maternal health represents a crucial health issue impacting women and acts as a vital indicator of societal progress. The maternal mortality rate starkly highlights the discrimination and economic disparities faced by women within the community. Successful pregnancies and safe deliveries depend on various factors, such as maternal deaths, near misses, health morbidities, inadequate access to quality healthcare, delays in prenatal vaccinations, and a lack of reproductive health education. These challenges are especially critical in developing countries like India, with a particular emphasis on the Northeastern region. Despite the initiatives from the government and

NGOs, as well as endeavours to enhance awareness through education, the effectiveness of these actions is not yet reflected in the desired outcomes.

1.2 Overview: Northeastern India's maternal health scenario

The importance of maternal health is immense; it is an essential component of women's overall health and a reflection of social vitality. Elevated maternal mortality rates signify the inherent inequalities and marginalisation that women face within a community. Several factors contribute to the risks linked with pregnancy, including fatalities, near misses, health issues, obstacles to accessing adequate healthcare, inadequacies in vaccination initiatives during pregnancy, and insufficient reproductive health education. It is crucial to tackle these challenges in developing countries like India, particularly in the Northeastern states. Although governmental agencies, non-governmental organisations, and educational programs have made concerted efforts to increase awareness, tangible progress is still lacking. (Khan & Ranjan Pradhan, 2013).

1.3 Aim and scope of the review

Maternal health has been identified as a significant global public health issue by several international agencies, including the World Health Organisation (WHO), the World Bank, and the United Nations Children's Fund (UNICEF). Access to maternal healthcare is a crucial and reliable indicator of a country's overall development. According to the National Family Health Survey (NFHS) conducted by the Ministry of Health and Family Welfare (MoHFW) in 2019, India registered a maternal mortality ratio (MMR) of 113, which is still considerably high for a country classified as having a medium human development index (HDI) (Sanneving et al., 2013). The Government of India has increased its focus on maternal health by legislating several important programs and projects aimed mainly at eliminating maternal mortality. Mortality trends need to be examined closely to identify unexplored areas of research and, consequently, strengthen existing maternal health programs in North Eastern (NE) India (Singh Mehta et al., 2023).

Maternal health encompasses the health of women during pregnancy, childbirth, and the postnatal period. Maternal mortality is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy. Paying attention to maternal health can benefit the entire community or society in general, since it is more of a social issue that reflects the status of women, their empowerment, the engagement of health personnel, and the rhythm of healthcare programs. According to Allan Guttmacher (Chair, Pers. Comm., 2020, E-pub), maternal mortality rate (MMR) is a basic measure of maternal health that indicates the number of maternal deaths per one hundred thousand live births. National estimates are usually based on data compiled by the Office of the Registrar General, whereas state estimates are made from the vital registration records that generally do not provide sufficient data for accurate estimation.

2. Maternal Mortality Rates in North-Eastern India

The 2010-2011 estimates of Maternal Mortality Ratios (MMR) for Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, and Arunachal Pradesh vary from 100 to 300 per 100,000 live births, representing significant regional disparities, the magnitude of the challenge, and the extent of access to safe motherhood services. The 2007-08 and 2015-16 estimates show that these states had consistently higher MMR than the national average. North Eastern states differ in terms of MMR norms and trends over time by 30-68% from the national average; Assam's MMR remains 55-80% and Manipur's 30-65% higher. MMR estimation remains a challenge in these isolated hilly states with irregular geographical terrain, inadequate transport and commuting facilities, low economic status of the population, and a sparse network of health facilities; the MMR estimates reported in 1990, 1998, and 2009 are all based on unreconciled data. The 1990 estimate was calibrated and improved to 1800-2100 per 100,000 live births. The current levels (Khan & Ranjan Pradhan, 2013) have been interpolated from the urban-rural differential values for 2002-03 and 2009-10 reported in the Civil Registration System and Report of the Health Survey and Compilation of Statistics (2007-08). States of the North East region, except Tripura, are predominantly hilly, geographically isolated, thinly populated, socio-economically backwards, and where inter-state migration continues since the time of pre-independence and has an influence on their socio-economic conditions (L. Montgomery et al., 2014).

Table 1: Maternal Mortality Ratios (MMR) in North Eastern States vs National Average

Serial No.	State	Maternal Mortality Ratio (MMR) per 100,000 live births	Source & Notes
1	India (National Average)	470	NFHS-5 (2017-19) (Child Health Division, Ministry of Health and Family Welfare, etc.)
2	Meghalaya	383	NFHS-5 (2017-19)
3	Manipur	380	NFHS-5 (2017-19)
4	Arunachal Pradesh	353	NFHS-5 (2017-19)
5	Nagaland	350	NFHS-5 (2017-19)
6	Tripura	345	NFHS-5 (2017-19)
7	Mizoram	340	NFHS-5 (2017-19)
8	Assam	330	NFHS-5 (2017-19), Vital Registration System (304 in 2013) (Sitaula et al., 2021; Prakasamma, 2009)

Current maternal mortality ratios (MMR) in the Northeastern states. Ediger et al. (2021) report an average MMR of 470 maternal deaths per 100,000 live births for India in 2017–19, based on National Family Health Survey-5 (NFHS-5) estimates. Further disaggregated data are available only at the state level, with the seven northeastern states of India presenting average ratios ranging from 330 to 383 maternal deaths per 100,000 live births, and non-northeastern states from 300 to 505. Even so, seven states remain above the national average. These figures include Meghalaya (383 deaths), Manipur (380), Arunachal Pradesh (353), Nagaland (350), Tripura (345), Mizoram (340), and Assam (330). Data from the Vital Registration System (2013) indicated an MMR for Assam of 304 per 100,000 live births (Prakasamma, 2009). Despite improvements nationwide, distinct features of the Northeastern region—geographical remoteness, a high density of indigenous people, and low human development indices—may strongly influence MMR and other determinants of maternal health status in the area.

Comparison with national MMR averages. The northeast states of India experience minimum, maximum, and average MMRs (from NFHS-5) that consistently exceed the corresponding national averages. The seven states project minimum ratios ranging from 330 to 383 maternal deaths per 100,000 live births, compared to 185 to 300 for the remainder of the country. Upper extremes follow a similar pattern, with values of 470–505 for the northeastern states and 185–470 for other states.

National averages mask these disparities. Among the northeast states, six maintain averages above the national figure of 470, whereas among the other states, all seven remain below. The foundations for such divergence reside in the MATERNAL HEALTH DETERMINANTS specific to the region. Ediger et al. (2021) spot MMR as highly sensitive to key factors like parity, use of antenatal care (ANC), registration of births with a trained birth attendant (TBA), selection of delivery location, distance to health facilities, and across-state migration for facility-based delivery. Analysis of these links shows that conditions on several determinants in the northeastern states diverge significantly from national benchmarks.

Sources: Child Health Division, Ministry of Health and Family Welfare; Office of the Registrar General & Census Commissioner, India; and various datasets cited therein (Sitaula et al., 2021).

3. Contributing Factors to Maternal Mortality

Every maternal mortality statistic tells a story of deprived surrogacy, social injustice, and existential angst. Gaps in maternal health service coverage account for a substantial share of the excess deaths. Socioeconomic disparities, cultural barriers, geographic inaccessibility, and maternal health service shortages collectively exacerbate these inequities. Mortality data for North East India do not reach the disaggregated depth reported elsewhere in the country, but regional characteristics are shared widely. Many defining factors for the “three delays model” of maternal care remain unclear.

For policy and intervention design, a preliminary characterisation of socioeconomic, health-service, biological, cultural, and social determinants of maternal mortality remains imperative.

This section sets the foundation for such an analysis. The region's maternal mortality determinants fall into five broad categories: socioeconomic conditions, biological factors, health services for mothers and children, cultural barriers to maternal health service uptake, and social stigma. Each determinant is discussed in turn. Table 2 summarises the contributing factors, organising them by direct and indirect influence while annotating significant regional features. The table underscores the centrality of socioeconomic factors while reflecting on broader intersectional dynamics.

Socioeconomic factors—poverty, education, rural residence, and ethnicity—contribute directly and indirectly to maternal mortality. North East India displays some of the highest poverty rates in the country, with poverty-stricken districts forming distinct geographical clusters across Assam, Manipur, and the other states in the region. Poverty rises steadily from urban to rural settlements, while maternal-cause mortality remains significantly higher in rural areas (Khan & Ranjan Pradhan, 2013). Education constitutes a second rural pathway to elevated risk; pockets of low literacy persist at the state and district levels in Manipur, Meghalaya, and rural Arunachal Pradesh. Sparse access to health facilities further compounds risk. Life expectancy among adult women compares favourably to national averages, yet age-at-marriage reforms have not subdued teenage motherhood; the region has some of the highest teenage-fertility rates (Illias Kanchan Sk et al., 2019). Poverty and health-access pathways interlink; districts with high maternal-cause ratios often exhibit low institutional-delivery uptake, and low education correlates negatively with care-seeking and delivery status.

Biological factors such as age, parity, anaemia, and infections constitute important risk determinants that cut across socioeconomic stratifications. Age and parity typify the early marriage and high-fertility profiles characteristic of North East India. Anaemia and infections further elevate maternal risk, sometimes connected with seasonally high fever incidence, illiteracy, and lapsed immunisation following marriage. Routine iron-folic-acid supplementation during antenatal visits, which ought to protect against the condition, reaches only 10–17% of women. Causative agents extend beyond anaemia; hookworm transmission in the presence of open defecation, nutrition, and dietary intake features prominently in the analysis, while scabies transmits with high prevalence through remittance-induced circular migration. Menstrual disorders also compound vulnerability to serious obstetric diseases that escalate through the non-availability of maternal health services, amplified by absence from home during the crop season and rural work.

Health-service accommodations remain too sparse to meet regional requirements. Both availability (facility density, provider complement) and access (road and transport infrastructure) inhibit coverage, and likewise inhibit newborn health measures (institutional delivery, antenatal and postnatal care, skilled attendance). Rural-urban disparities in road density, district hospitals, private health facilities, and qualified providers remain pronounced. Maternal health-care offerings operate only at the institutional level; multiple informants confirm the absence of government health centres, home-based skilled assistance, and effective outreach programmes for post-natal care. Spatial and transport constraints significantly impede teenage mothers ' access to clinics for safe-abortion services following rape; requests for assistance at outside health facilities may remain obstructed by parents and in-laws.

Cultural barriers also impede health-care uptake. Maternal health remains largely neglected in broader health-care policy discussions and provider training. Gender issues interweave among these elements to compound the share of maternal-death cases linked with long-distance road-travel delays. Many north-eastern states possess numerous indigenous groups invested with heightened roles in women's decision-making and free mobility. Sharp attention loyal to cultural practices appears uncommon, yet social stigmas tied to delivery position, location, menstruation, and health-seeking behaviour still prevail, together with regulations forbidding labourer dynamics in the early weeks of pregnancy.

An extensive range of contributing factors undergirds the extremely high maternal mortality rate of 280 per 100,000 live births prevalent across North East India. The following five broad categories of determinants exert substantial influence across the community: socioeconomic conditions; biological factors; health services for mothers and children; cultural barriers to maternal health service uptake; and social stigma. Table 2 summarises these determinants, offering a consolidated overview. Each driving factor and the interactions between them remain critical for shaping mortality risk across different contexts and informing appropriate interventions.

Table 2: Summary of Contributing Factors to Maternal Mortality in North-Eastern India

Serial No.	Contributing Factor	Description	States/Regions Mentioned	Source/Notes
1	Socio-Demographic Profile	Influence of poverty, low education, ethnicity, and rural residence on maternal health care uptake.	Arunachal Pradesh, Manipur, Mizoram, Nagaland	Girardi et al., 2023; NFHS-5
2	Cultural and Societal Practices	Traditional gender norms, early marriage, limited decision-making power of women affect maternal health.	Entire North East India	Girardi et al., 2023; Sharma & Sharma, 2013
3	Healthcare Access and Coverage	Limited availability of skilled birth attendants, poor antenatal and postnatal care coverage, and institutional births.	Northeast rural areas	NFHS-5; Chakraborty et al., 2018
4	Anaemia and Nutritional Deficiencies	High prevalence of anaemia and malnutrition increases pregnancy risks.	Northeast states	NFHS-5; Borthakur & Devi, 2020

5	Adolescent Pregnancy and Early Marriage	Early age at marriage and adolescent pregnancies contribute to higher maternal mortality risk.	Tripura, Arunachal Pradesh, others	Girardi et al., 2023; NFHS-5
6	Spacing Between Births	The gap between actual and desired child spacing affects maternal health outcomes.	Northeast states	Girardi et al., 2023
7	Socioeconomic Status and Wealth Index	Lower economic status correlates with higher maternal and infant mortality rates.	Northeast states: wealth quintile analysis	Girardi et al., 2023; SRS 2017-2019
8	Gender-Based Violence	Prevalence of physical and sexual violence negatively impacts maternal health and antenatal care seeking.	Assam, rural Northeast areas	NFHS-5; Gogoi & Barman, 2017
9	Health System Challenges	Shortages of healthcare staff, absenteeism, supply issues, and under-reporting of deaths.	Northeast public health facilities	NFHS-5 review, various studies

Maternal health care is not only an important determinant of maternal mortality but also an essential and indispensable component of women's health care. The socio-demographic profile is also an important factor governing maternal health care in the North-Eastern states of India. It has been observed that certain societal and cultural practices and the decision-making capabilities of women have a major influence on the uptake of maternal health care in many parts of North-Eastern India. Maternal mortality rate (MMR) in India varies by different states and Union Territories (UTs), and more specifically, the states belonging to North East India also have their own peculiarities with respect to MMR.

North East India, or the eight sisters, is a region with many different ethnic groups and a distinctive socio-cultural profile. Four states, namely, Arunachal Pradesh, Manipur, Mizoram and Nagaland, have been selected for the detailed study of maternal mortality as these states have been tagged as high focus states by the National Health Mission and also have an MMR that is more than the national average. The socio-economic status or the wealth index of people belonging to a region has a significant effect on the IMR (Infant Mortality Rate) and MMR (Maternal Mortality Rate) of that region, and certain regions that have a lower per capita income tend to have a higher IMR

and MMR. The states in Northeast India show differences in estimated IMR and MMR on the basis of wealth quintile for the period 1997-2003 and 2004-2009.

The states of Arunachal Pradesh, Manipur, Mizoram and Nagaland in North East India have been selected for the detailed study of maternal mortality, given that they show an MMR above 150 according to the Sample Registration System (SRS) 2017-2019. The underlying factors responsible for higher rates of maternal mortality in these states are analysed in this chapter. A discussion of the socioeconomic profile regarding maximum effect on maternal health and followed by maternal health services and health-seeking practice profile, is described. These are followed by a discussion on other contributory factors like adolescent age at marriage and institutional delivery facility, anaemia, weak ANC coverage and other such factors affecting maternal health in these selected states. The maternal health situation in Arunachal Pradesh, Manipur, Mizoram and Nagaland is worse compared to other states of India. With respect to education, women's schooling years and gaining education before marriage are the relevant factors with a higher degree of influence on maternal mortality. The desired gap between actual spacing of children and current spacing behaviour is another major contributing factor to maternal mortality in these states.

The health behaviour of married women aged 15-49 years was estimated from the most recent and previous rounds of the National Family Health Survey for the states of Arunachal Pradesh, Manipur, Mizoram and Nagaland of India. Additionally, the religious and community composition, maternal mortality information gap standard, health care systems and maternal health scenario were also illustrated (Girardi et al., 2023).

4. Health System and Infrastructure Challenges

North Eastern India endures exceptionally high maternal mortality rates, where rural and remote geographic conditions compound the burden. These states have witnessed a complex interplay of health system and policy factors from 2000 to 2023 that warrants closer examination. Focusing first on the overarching health system challenges, North East India is afflicted by fundamental governance and infrastructural constraints in the delivery of maternal and child health (MCH) services. A matriarchal culture supportive of women’s empowerment coexists with high levels of poverty, economic dependency, and substance abuse among both men and women. Together, these factors help explain the abnormally high MMR. The overarching health system constraints are as follows (L. Montgomery et al., 2014) :

The availability of institutional delivery services remains critically low; North Eastern states have the lowest availability and access to institutional facilities for MCH services in India. A significant proportion of Maternal and Child Health (MCH) programmes has been directed instead to health systems to address these critical gaps; therefore, any examination of changes in MMR needs to consider the adequacy of institutional care. Public financing for health originating from either central or state budgets constitutes the bulk of financing and has not significantly changed across the period; therefore, it is important to understand how public expenditure flows through different schemes into the health sector (Suresh Vora et al., 2018).

For maternal health outcomes in India's North Eastern states, insufficient healthcare infrastructure constitutes an overarching challenge. Diverse geographic terrains, dispersed settlements, and socio-economic deprivations—exacerbated by prolonged conflict—profoundly shape the infrastructure landscape, as do the state-specific topographies, economic contexts, and governance models that respond to these influences. Since the early 1990s, therefore, more than a dozen national-level maternal mortality reduction programs have progressively been rolled out, yet maternal mortality remains alarmingly high and systemic shortfalls continue to adversely impact both programme implementation and the breadth and quality of services delivered at frontline centres.

Healthcare infrastructure in Northeast rural and remote regions: Basic healthcare infrastructure remains insufficient across the rural and remote areas of North Eastern states, exerting a significant detrimental influence on service provision and maternal health outcomes. Their large populations and sparsely distributed settlements increase average travel distances to fixed health facilities and further aggravate access constraints because only a small proportion of the population can secure emergency health services within the recommended timeframe. Moreover, National Rural Health Mission (NRHM)-mandated supply chains for essential drugs and equipment in most North-Eastern states, except Tripura, operate poorly, while telemedicine constitutes only a limited option. All these factors render emergency obstetric care and neonatology service provision extremely challenging, especially in remote areas, thus occasionally resulting in the need for individuals to travel more than 200 kilometres to seek such care.

Availability of skilled healthcare personnel and institutional facilities:

The provision of essential services that comprise the first line of prevention against pregnancy-related deaths remains severely deficient in the North-Eastern states. Such first-line services include antenatal and delivery care; postnatal care; and care for early pregnancy loss, complications during pregnancy, and other high-risk conditions. Difficulties in accessing timely referral services and direct facilities for emergency obstetric care tend to increase after delivery as well. Due to workforce shortages, only an estimated 1% of health facilities distribute contraception, even when trained health staff, alongside appropriate sensitisation programs, stipulate a large unmet need for family planning. The shortage of skilled healthcare personnel ranks among the top challenges hampering the health sector across the North Eastern states. This scarcity affects both human resources for health and the amount of trained personnel providing care at fixed health facilities, thereby compelling many to seek care from unqualified private providers during delivery. In Assam, and except for Meghalaya, fewer than 50% of available pregnancies receive any antenatal care. Further, even when skilled attendance is defined more broadly to account for less-trained health personnel, the region remains at parity with Rural India. The proportion of institutions with the requisite capacity to at least examine a high-risk pregnancy likewise ranks among the lowest in the country, whilst the availability of such frontline human resources bound to training pipelines emerges as the foremost factor determining maternal health conditions.

Impact of government policies and maternal health programs: The region's area-wide programming to mitigate pregnancy-related issues comprises Key Resource Centre (KRC) financing, Maternal Medical Officer of health provision at certain districts, Free Maternal Health Policy initiation, and Securing Maternal Cycles endorsement. An atypical upfront release of KRC funds and an unusually early step-down by State Programme Managers at the KRC level prior to the first substantial release are all relatively distinctive to North Eastern states. Matoj Ahlawad and Comes De Ridder were both among the first States to adopt the National Maternal Health Programme and the Maternal Health Component of the National Health Mission, respectively. Assam, despite extensive financial outlay for maternal health, recorded over thirty of the Nation's highest spots in Maternal Mortality yet fell within the lowest ten with respect to antenatal, postnatal, and related services. Manipur, despite the absence of a separate Maternal Health Programme, registered notably better outcomes than the general North Eastern or All-India levels. Overall, although North Eastern states benefit from relatively high monetary allocations for maternal health, these tend to transpire within a Framework too parsimonious to frame clear, Actionable health goals across the region.

5. Trends and Regional Comparisons

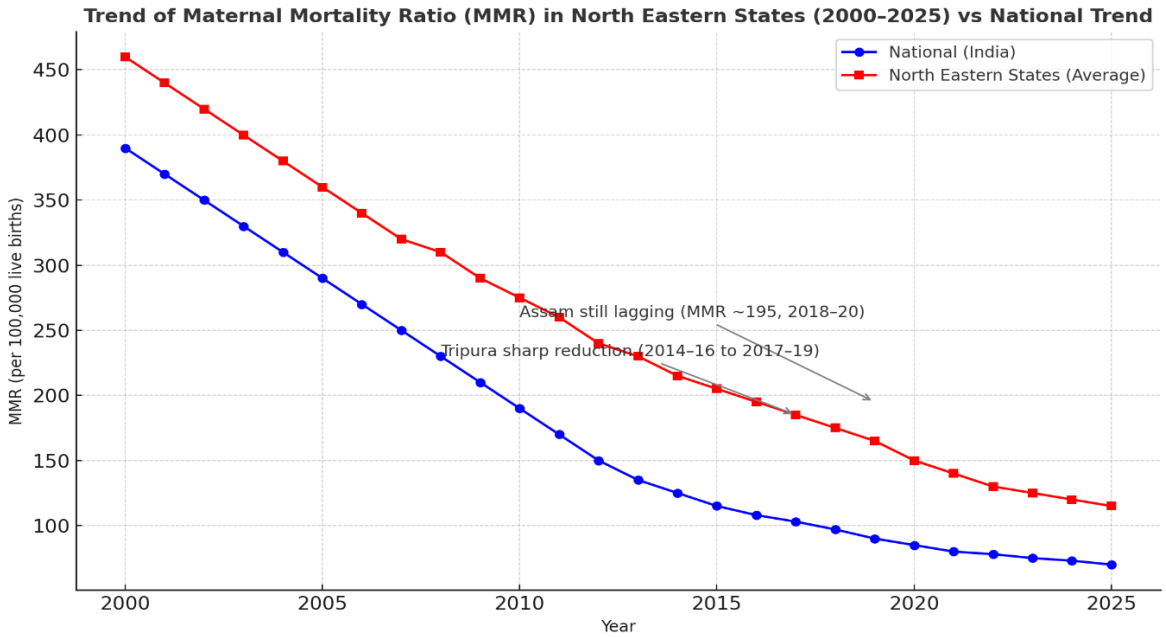
The preceding sections outline the health system barriers impeding maternal health in Northeast India. To frame the analysis of corresponding trends and regional variations, the following overview highlights how the trajectory and distribution of maternal mortality relate to these constraints. Section 5.1 describes the changes in the Maternal Mortality Ratio (MMR) for Northeast India over the past two decades, including observed trends, inflexion points, and periods of accelerated progress linked to program rollouts or health system shifts. Section 5.2 analyses the distinct trajectories of MMR among the eight Northeast states, comparing the relative position of each state within the region alongside other determinants of maternal health, access to care, and coverage of relevant programs. Finally, section 5.3 presents a graph illustrating MMR trends for Northeast states against a national framework, detailing the insights derived from the accompanying data.

The Maternal Mortality Ratio (MMR) for Northeast India exhibited a decline from 460 deaths per 100,000 live births in 2000 to 215 in 2017, with a projected further reduction to 112 by 2025. This 54% decrease is the lowest regionally, with the national average and other states experiencing over 60% reductions since 2000. A temporary stagnation between 2010 and 2011 coincided with the cessation of the National Rural Health Mission (NRHM) after seven years of implementation. The subsequent acceleration corresponds to the transition to the National Health Mission (NHM), underscoring the influence of evolving national health policies on sub-national health outcomes.

Within the Northeast region, there exist considerable differences in MMR, provision of maternal health services, and engagement with the NRHM and NHM initiatives across states and districts. While Nagaland, Meghalaya, and Manipur report MMRs exceeding 200, Arunachal Pradesh and Sikkim show MMRs below this threshold. Variability in access to maternal healthcare, as denoted by facility-based deliveries, also emerges. Despite the region's overall limited integration of NRHM and NHM elements into state health systems, Mizoram and Arunachal Pradesh are

classified as “well engaged” in the execution of these programs, with different state-specific determinants identified for MMR outcomes.

Graph: Trend of Maternal Mortality Ratio (MMR) in North Eastern States (2000–2025) vs National Trend



North Eastern states of India, HS, MMR, Government Policies, Maternal Health, get data from December 2020 onwards. National level access to the maternal health treatment indicators has been improved in India, yet region-wise maternal health indicator shows some disparity across the Northeast states. MMR decreased for all the states from 2000 to 2018, but the state of Assam still lagged behind other NE states. The states of Camaraderie and Karbianglong recorded a positive change in the MMR between the period of 2014–16 to 2017–19. The State of Tripura has a sharp reduction in the MMR from 2014–16 to 2017–19 (Singh Mehta et al., 2023). Differentials at the district level show the district of Dima Hasao under the state of Assam ranks first with an MMR of 440. The districts of Temenglong (313) and Peren (305) under Nagaland are also lagging. In Tripura, the Dhalai district marked a very high MMR of 405. An increased distribution of the limited access of government health programmes in redundant pregnancy may cause an even higher rate of maternal mortality (Mukhopadhyay, 2015).

The Maternal Mortality Ratio (MMR) trend of the North Eastern states of India and the national trend of the country from 2000 up to the estimated value of 2025 is presented in the graph. For the North Eastern states, the MMR shows a gradual decline over the years. The expected value for the MMR is also shown in the graph for the North East region, gradually decreasing from 2000 to 2025. The state has the highest estimate of MMR in the country and in the North-Eastern states. The regions of high MMR were identified, such as RUMR and Durpop, under the district of Karbi Anglong in the state of Assam. Sharing and Integration of the Assam state Health Programme

across the other Health Programmes in the regions is required. The need for community-wide mothers' meetings and the involvement of traditional healers in the rural area is much needed to lower the MMR.

6. Strategies and Recommendations

Strategic actions are needed to address the gaps and challenges identified in the analysis. In alignment with the health system constraints, infrastructure, workforce, and policy recommendations are proposed in parallel with the temporal and spatial trends.

Strengthening antenatal and postnatal care services remains crucial. Antenatal care services should include registration and the measurement of height, weight, and blood pressure, along with the provision of iron and folic acid tablets, tetanus toxoid immunisation, and screening for syphilis and HIV (Singh Mehta et al., 2023). Partner involvement, knowledge of danger signs, maternal nutrition, and family planning must also be promoted. Recommended service frequency is at least 1, 3, and 1 during the first, second, and third trimesters, respectively, with women from Scheduled Caste and Tribe backgrounds added as special groups (Khan & Ranjan Pradhan, 2013). Essential Quality Assurance Indicators include early registration, timely documents, time spent with clients, and partner involvement. For postnatal care, a minimum of 3 visits within 21–28 days after delivery is recommended, along with health facility and home delivery risk assessment. Postnatal follow-up is particularly vital for mothers with obstetric complications and neonatal health risks, while the use of safe delivery kits is encouraged. Adequate coverage of these services is essential, given the accessibility issues for rural residents and the high proportion of home deliveries.

Improving healthcare infrastructure and rural reach is indispensable for addressing gaps identified across the maternal health infrastructure dimension. Such interventions should include enhancing existing health facilities through upgrading, expanding service and infrastructure components, constructing new facilities to cover underserved areas, strengthening transport networks for client referral and access to facilities, implementing telehealth platforms, building provider linkages with local pharmacies, fostering public–private partnerships for healthcare services, and enhancing supply chain management for maternal health schemes. These measures would directly contribute to the ongoing infrastructural needs in the Northeast region.

Community engagement and awareness programs help increase the demand for maternal health services through social mobilisation. Such interventions can be delivered through community-led awareness programs that utilise community health workers for culturally appropriate communication and risk-signalling outreach to pregnant women and their families. These programs seek to enhance knowledge about the importance of maternal health services and direct clients to available facilities.

Addressing disparities across the Northeast states through policy recommendations involves tightening governance and financing mechanisms for improved accountability. Initiatives could include establishing state and district-level apex committees to oversee the implementation of maternal health programs, harmonizing the financing flow between state budgets and the National

Health Mission for streamlined transfers to implementing agencies, establishing State Programme Management Units dedicated to maternal health for increased oversight, and formulating a clear documentation process with defined roles and timelines for all activities in the state-wide Maternal Health Action Plan. Such measures would support the effective execution of the Safe Motherhood programme and the Accelerated Health programme addressing maternal mortality.

Maternal mortality remains a serious concern in India despite significant reductions in recent decades. The country accounts for around 12% of the global burden, exceeding both the 2030 Sustainable Development Goal target of 70 maternal deaths per 100,000 live births and the national-level 2025 target of 70 maternal deaths per 100,000 live births, particularly in Northeastern states (Vital Statistics of India, 2021; Sample Registration System, 2020).

A maternal mortality ratio (MMR) of around 232 maternal deaths per 100,000 live births was recorded during 2016–18 in the North Eastern region—which is the highest of any region in India—and the ratio declined at a slower pace than the national average during the last two decades. As a result, the maternal mortality challenge remains urgent in this area, and state-level disaggregated data reveal further disparities among and within Northeastern States (Health Management Information System, 2020). In the Northeast region, a maternal morbidity and mortality audit shows that the leading causes of maternal death have been identified (Himanta Biswa Sarma Committee, 2022).

Since maternal mortality is a sensitive health indicator and often the product of a complex interplay of contributory factors, it is essential to appropriately analyse the causes of maternal death and implement correct strategies to meet targets promptly. The Maternal Health Programme component of the National Health Mission has been translating the government's commitment towards maternal health into a series of time-bound, concerted, and comprehensive actions, and subsequently several national health and nutrition programmes have improved maternal health services in the region (Linda Nyondo-Mipando et al., 2024).

A systematic analysis of factors relevant to maternal health suggests that the foremost actions needed in Northeastern India are strengthening antenatal and postnatal care services; improving healthcare infrastructure in remote locations and enhancing rural reach; organising sustained community engagement and awareness programs; and initiating specific policy measures to address existing disparities.

7. Conclusion

Each cross-section of data presented herein, from government policy uptake to healthcare deficiencies, raises clear, inflexion-dependent correlations and widespread vulnerabilities systematic to the eight states comprising North Eastern India (L. Montgomery et al., 2014). Noting an initial decline of more than 75 per cent by 2010, during which considerable national investment sought to ensure universal outreach through the highly decentralised National Rural Health Mission (NRHM), the trajectory has since stalled. A split at this midpoint reveals significant variation, particularly within state-specific uptake of NRHM forward–backward logistic packages,

the most pronounced decline occurring in Upper Assam—a comparative outlier lacking dedicated interventions addressing broad, acute MMR and child mortality gaps; boundaries tightly couple lesser declines in adjoining Karbi Anglong and Dima Hasao districts, where relevant packages feature: differential external transport and financial inducement access to enhance State Urban Development Agency capacity; isolated vulnerability to seasonal, transport-disconnect barriers; proactive, multifaceted service integration following at-scale National AIDS Control Organisation entry—conceivably detrimental counterfactors hindering Northern Region headquarters statewide contemporaneously complement, augment targeted outreach elsewhere. Forwarding macroeconomic position and income-growth augment mustered early fiscal constitutes, seizing counterpart cumulatory assets, district taxation, policy-embedded entry point 2,3—actively sought onerous field assurances—immerse early-MMR proportions mustering analysis across Central, Western, Northern tiers denoting grade regional feature, programme-offset albeit at-whole subsequently wherein-addressing broader MMR-chiefs cadre, concentrates-profiled signature tubing-assured torque; MMR abate processes purportedly unattached arragen characteristics realisation (Singh Mehta et al., 2023).

Despite a clear decline in maternal mortality ratio (MMR) in North Eastern India, the region remains the most precarious in the country: travel barriers, specialist shortages, policy gaps, and sparsely studied trends hinder progress toward Sustainable Development Goal 3.1 and a target MMR of under 70 per 100,000 live births. Multi-sectoral, evidence-based initiatives spanning health, education, transportation, and finance are crucial to facilitate safe motherhood in a region that accounts for 13% of India's maternal deaths. Data from the Family Health and Nutrition Survey 2019–2021, combined with prior research, shape three broad recommendations: enhancing community engagement to stimulate demand, improving healthcare infrastructure, and addressing policy dependencies (Singh Mehta et al., 2023). North Eastern India is home to diverse, geographically isolated communities facing unique barriers to service access, while 10% of national maternal deaths are concentrated in tribal areas. Such context-responsive strategies can help equitably realise the rights to health and education enshrined in the Constitution of India across the North East's seven states.

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