

Stillbirth Rate, Feto-Maternal Characteristics and Geographical Distribution at a Tertiary Care Centre in Assam: A Hospital-Based Retrospective Cross-Sectional Study

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ABSTRACT

Background: The global burden of stillbirths is a significant public health concern, with an estimated 1.9 million babies stillborn annually. India faces a remarkably severe crisis with 397,300 stillbirths reported in 2021. The objectives were to determine the stillbirth rate, analyse feto-maternal characteristics and geographical distribution of stillbirth in a tertiary care centre in Assam.

Methodology: A retrospective cross-sectional study recruiting 506 subjects, using hospital records at Obstetrics and Gynaecology Department, Gauhati Medical College and Hospital (GMCH), Assam in the year 2024. Inclusion criteria were stillbirths ≥ 28 weeks or ≥ 1000 gm birth weight, as per WHO definition. Analysis was done by summarising categorical variables as proportions and percentages. Chi-Square test was used to analyse relationship between district distribution and type of stillbirth.

Results: The stillbirth rate was 37.72/1000 births. Of the 506 women, 38 had some pre-existing chronic illnesses, such as chronic hypertension (n=3), diabetes mellitus (n=9), thyroid disorder (n=11) uterine anomaly (n=4), systemic lupus erythematosus (SLE) and heart disease (n=4). The most common cause according to ReCoDe classification was fetal growth restriction (FGR) (n= 124). Most women were of rural residence (n= 415, 82.01%) and maximum referrals were from Kamrup Rural. No significant statistical relation was seen between district distribution and type of stillbirth.

Conclusions: Despite improving government healthcare measures, the stillbirth rate has not declined substantially, highlighting gaps in maternal and perinatal care. Understanding stillbirth rates and their geographical distribution can help identify high-risk areas, guide targeted interventions, and improve healthcare delivery.

Keywords: Stillbirth, Perinatal Mortality, Stillbirth rate, Fetal growth restriction, Geographic distribution

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INTRODUCTION

The global burden of stillbirths is a significant public health concern, with an estimated 1.9 million babies stillborn annually.[1] In 2014, the World Health Assembly endorsed Every Newborn Action Plan (ENAP) which includes a global target of 12 or fewer third trimester (late) stillbirths per 1,000 total births in every country by 2030.[2] "Under the India Newborn Action Plan (INAP), the government has also set a target of fewer than ten neonatal deaths per 1000 live births by 2030." [3]

Since 2000, the stillbirth rate has reduced by over a third; however, progress has slowed, and many deaths result from preventable causes. In India, the problem is especially concerning, with 397,300 stillbirths at >28 weeks reported in 2021. The country has consistently ranked first in absolute stillbirth numbers for over two decades.[4,5] Despite progress-with the stillbirth rate declining from 29.6 per 1000 births (2000) to 13.9 per 1000 births (2019)-the burden remains high.[6]

The World Health Organization (WHO) identifies stillbirth as a key indicator of perinatal healthcare quality. According to WHO, a baby who dies after 28 weeks of pregnancy, but before or during birth, is classified as a stillbirth.[7] A large portion of these stillbirths take place during the process of labour. Most of the deaths maybe prevented by ensuring access to emergency services and improving the quality of care. The most common causes of stillbirth are labour complications, multiple gestation, placental complications - abruption, placenta previa, insufficient blood flow, fetal genetic problems and congenital anomalies, infection in the pregnant woman, umbilical cord accidents, hypertensive disorders of pregnancy and medical disorders in pregnancy.[8,9]

As a tertiary care centre, our hospital handles a significant proportion of Assam's stillbirth cases. However, despite improved government healthcare measures, the stillbirth rate has not declined substantially. Many cases present with IUFD or in unsalvageable conditions due to late detection of risk factors or delayed referral, highlighting gaps in maternal and perinatal care. This study has been carried out in the hope to identify the most pressing risk factors and causes of stillbirth. Understanding stillbirth rates and their geographical distribution can help identify high-risk areas, guide targeted interventions, and improve healthcare delivery.

The primary objective was to determine the stillbirth rate in a tertiary care centre in Assam. The secondary objectives were to analyse maternal and fetal characteristics influencing the stillbirth rate, apply the ReCoDe classification to identify the most common causes of stillbirth, and identify high-risk areas of Assam by assessing the district- and block-wise distribution of patient referrals.

MATERIALS AND METHODS

The study was a retrospective cross-sectional study conducted using hospital records from the Department

of Obstetrics and Gynaecology at Gauhati Medical College and Hospital, Assam. The study was done after taking ethical clearance (190/2007/Pt-II/ June 2025/6) in June 2025, recruiting 506 subjects who has stillbirth in the year 2024 at the hospital.

Inclusion criteria for the study were stillbirths ≥ 28 weeks or ≥ 1000 gm birth weight, as per WHO definition.[7,10] All patients admitted at the hospital with antenatal stillbirth or who had intrapartum stillbirth were included in the study. The Ethical Committee of Gauhati Medical College and Hospital approved the study on June, 2025 (190/2007/Pt-II/ June 2025/6). The exclusion criterion was initially taken as incomplete records. However, complete records of all 506 subjects with stillbirth were found in the birth registers and MRD of the hospital. Therefore, no case was excluded.

Patient records and birth registers were thoroughly analysed. Socio-demographic factors - age, gravida, antenatal care, past medical conditions, address (block, district) were noted. Gestational age was estimated according to last menstrual period (LMP) or ultrasonography (USG). In case, birthweight was <1kg at >28 weeks or patient gives history of irregular menstrual cycles, gestational age was confirmed using 1st trimester USG. Data regarding character of stillbirth like gestational age, birthweight, number of fetuses, gender, presence of small for gestational age (SGA), antepartum and intrapartum stillbirth were also noted. According to RCOG Green-top guidelines, definition of SGA refers to a fetus with a predicted weight or an abdominal circumference (AC) measurement less than the 10th centile.[11] SGA was determined using the Intergrowth - 21st charts.[12] Preventable and non-preventable causes of death were identified (Table S1) and classification was done according to ReCoDe (Relevant Condition at Death).[13] ReCoDe classification can have primary and secondary cause of stillbirth. In our study only primary cause has been taken into consideration which is the most relevant cause at birth.

The demographic profile of the subjects was analysed and factors like distance travelled and time taken to reach the hospital were identified. The districts with maximum referrals were also identified.

The data obtained was entered into Microsoft Excel Worksheet version 2021 and analysed using Microsoft Excel 2016 and IBM SPSS. The categorical variables were summarized as proportions and percentages. Pearson Chi-Square test was used to analyse relationship between Rural/Urban Residence, Preventable/Non-Preventable Cause, Gravida and Timing of stillbirth (Antepartum vs Intrapartum).

RESULTS

After screening the patient records, a total of 506 subjects with stillbirths were included in the study. The total number of deliveries conducted at the hospital in the year 2024 was 13171 and total births, including multife-

tal pregnancies, livebirths and stillbirths was 13414. Therefore, the stillbirth rate was 37.72. The different maternal characteristics have been summarized in the Table 1. The minimum age included in the study was 18 years and the maximum was 46 years. Most of the subjects were in the age group of 18 to 27 years (n=312). Out of the 506 subjects, 180 were primigravidae and 326 were multigravida. Most patients in the study group, i.e. 96.84% received antenatal care at primary, secondary or tertiary health care centres (n = 490). Of the 506 women with stillbirths, 38 women had some pre-existing chronic illnesses, such as chronic hypertension (n=3), diabetes mellitus (n=9), hyperthyroidism (n=3), hypothyroidism (n=8), uterine anomaly (n=4), systemic lupus erythematosus (SLE) (n=1), chronic kidney disease (n=1), chronic liver disease (n=1), seizure disorder (n=1), heart disease (n=4), maternal infection (n=2) and psychiatric illness (n=1). There were 63 cases of anemia (12.45%), 110 cases of hypertensive disorders of pregnancy (21.74%), 76 cases of antepartum haemorrhage (15%) and 20 case of gestational diabetes mellitus. (3.95%).

Table 2 includes characteristics of stillbirths such as gestational age distribution, birthweight, number of fetuses, gender, presence of fetal growth restriction (FGR), antepartum and intrapartum stillbirth. Most of the stillbirths were found in the gestational age of 33 to 37+6 weeks (n = 213). Multifetal pregnancy was found to be rare and all of them were twin gestations (n= 8). There were 238 female babies, 263 male babies and 5 were found to have ambiguous genitalia. Most of the stillbirths were diagnosed antenatally (n=390). There were 116 intrapartum stillbirths. Presentation was cephalic in 476 subjects. There were 243 stillbirths in the birth weight range of 1500 to 2500 grams. Birth weight was <10th centile in 124 babies, thus 24.50% stillbirths were small for gestational age. The cause of death for each stillbirth was determined using the ReCoDe classification. The findings are summarized in Table 3. The most common cause was found to be FGR (n= 124, 24.50%) followed by hypertensive disorders of pregnancy (n=72, 14.23%). Other noticeable causes were placenta previa, birth asphyxia and oligohydramnios standing at 7.31%, 9.68% and 4.74 % respectively. However, for 19.56% cases, a certain cause of death could not be identified. Thorough scrutiny of the patient records showed 389 stillbirths were from preventable causes.

On analysis of the sociodemographic factors, most women were found to be of rural residence (n= 415, 82.01%). Maximum patients with antenatal stillbirth or in conditions leading to intrapartum stillbirth were referred from Kamrup Rural district (n=129) (Figure 1). Blocks with the most referrals are Hajo, Kharupetia, Sipajhar, Sonapur, Boko, Chayagaon and Tamulpur. Most of the subjects (n=404) travelled a distance of 100 Km to reach our tertiary care centre and the time taken was about 1 hour 30 minutes to 2 hours. 7 patients were from different states - Arunachal Pradesh (n=1), Bihar (n=2), Meghalaya (n=3) and West Bengal (n=1).

Of the 506 stillbirths, 415 (82.0%) occurred among rural residents and 91 (18.0%) among urban residents. Antepartum stillbirths constituted 77.3% of rural cases and 75.8% of urban cases.

Table 1: Maternal Characteristics

Variable	Frequency (%)
Age (Years)	
18 - 27	312 (61.66)
28 - 37	183 (36.17)
38 - 47	11 (2.17)
Gravida	
Primigravida	180 (35.57)
Multigravida	326 (64.43)
Antenatal care	
Yes	490 (96.84)
No	16 (3.16)
Maternal Illness	38 (7.51)
Chronic Hypertension	3 (0.59)
Diabetes Mellitus	9 (1.78)
Thyroid Diseases	11 (2.17)
Uterine Anomaly	4 (0.79)
SLE	1 (0.2)
Chronic kidney disease	1 (0.2)
Chronic liver disease	1 (0.2)
Heart Disease	4 (0.79)
Maternal infection	2 (0.39)
Seizure Disorder	1 (0.2)
Psychiatric Illness	1 (0.2)
Diseases Related to Pregnancy	
Anemia	63 (12.45)
Hypertensive Disorders of Pregnancy	110 (21.74)
Gestational Diabetes Mellitus	20 (3.95)
Antepartum Haemorrhage	76 (15)

Table 2: Stillbirth Characteristics

Variable	Frequency (%)
Gestational Age Distribution (Weeks)	
28 - 32	162 (32.01)
33 - 37	214 (42.09)
38 - 42	123 (24.31)
>42	7 (1.38)
Birth Weight (Gram)	
500 - 1500	178 (34.91)
1500 - 2500	243 (47.93)
2500 - 3500	82 (16.57)
3500 - 4500	3 (0.59)
Small for gestational age (<10th Percentile)	124 (24.5)
Number of Fetus	
Singleton	498 (98.42)
Twins	8 (1.58)
Sex of Fetus	
Male	263 (51.98)
Female	238 (47.03)
Ambiguous	5 (0.99)
Timing of Stillbirth	
Antepartum	390 (77.07)
Intrapartum	116 (22.92)
Gross Appearance of Fetus	
Fresh	116 (22.93)
Macerated	390 (77.07)
Presentation of fetus	
Cephalic	476 (94.07)
Breech	23 (4.55)
Transverse	7 (1.38)

Table 3: Distribution according to ReCoDe[13] (n=506)

Condition	Frequency (%)
Group A: Fetus	
Lethal Congenital anomaly	17 (3.36)
Infection	1 (0.19)
Non-Immune Hydrops	6 (1.18)
Isoimmunization	0 (0)
Fetomaternal Haemorrhage	0 (0)
Twin - Twin transfusion	2 (0.39)
Fetal growth restriction	124 (24.5)
Group B: Umbilical cord	
Prolapse	6 (1.18)
Constricting loop/ Knot	2 (0.39)
Velamentous Insertion	0 (0)
Other	0 (0)
Group C: Placental	
Abruption	23 (4.55)
Placenta Previa	37 (7.31)
3. Vasa Previa	0 (0)
Placental Insufficiency	2 (0.39)
Other (Placental Hemangioma)	1 (0.19)
Group D: Amniotic fluid	
Chorioamnionitis	1 (0.19)
Oligohydramnios	24 (4.74)
Polyhydramnios	4 (0.79)
Group E: Uterus	
Rupture	6 (1.18)
Uterine Anomaly	1 (0.19)
Other (Obstructed labour)	2 (0.39)
Group F: Mother	
Diabetes (GDM - 9, T2DM - 7)	16 (3.16)
Thyroid Disorders	0 (0)
Essential hypertension	2 (0.39)
Hypertensive Disorders of Pregnancy	72 (14.23)
SLE or APLA	1 (0.19)
Cholestasis	6 (1.18)
Drug misuse	0 (0)
Other - Heart disease	1 (0.19)
Group G: Intrapartum	
Birth Asphyxia	49 (9.68)
Birth Trauma (Shoulder Dystocia)	1 (0.19)
Group H: Trauma	0 (0)
Group I: Unclassified	
Unidentified	99 (19.56)

Statistical analysis of subgroups such as timing of stillbirth with rural/urban residence, preventable/non preventable cause, gravida and ReCoDe subtypes was done. There was no statistically significant association between location and the timing of stillbirth (Pearson $\chi^2 = 0.098$, $df = 1$, $p = 0.754$). Among antepartum stillbirths, 286 (73.3%) were classified as preventable, compared with 103 (88.8%) of intrapartum stillbirths (Table 4). The association between the timing of stillbirth and preventability was statistically significant ($\chi^2 = 12.021$, $df = 1$, $p < 0.001$), indicating that intrapartum stillbirths were more likely to be preventable. Antepartum stillbirths accounted for 76.1% of cases in multigravida women and 78.9% in primigravida women. There was no statistically significant association between gravida and the timing of stillbirth ($p = 0.471$). There was a statistically significant association between ReCoDe classification and the timing of stillbirth (Pearson $\chi^2 = 86.25$, $df = 25$, $p < 0.001$) (Table 4).

DISCUSSION

In this study still birth rate (SBR) was found to be 37.72/1000 births. This SBR is much higher than the national rate of 13.9⁶ and SBR of 7 as per the SRS 2023 report.[14] However, it was comparable to a study done by Singh A and Kumar M (Lady Hardinge Medical College, 2019) which reported SBR of 29.15/1000 births.[15] Konda KR et al[16] (Assam Medical College and Hospital, 2022) reported a SBR of 52.41/1000 births and Kothiyal S et al[17] (Queen Mary, King George Medical College and University, Lucknow, 2018) reported a SBR of 78.30/ 1000 births.

The higher SBR can be attributed to the fact that most of the cases are referred from peripheral hospitals with antenatal stillbirth (n = 390) or due to late referral in conditions which are unsalvageable. In our study, in subjects with birth weight <1Kg, the gestational age was reconfirmed with ultrasound reports.

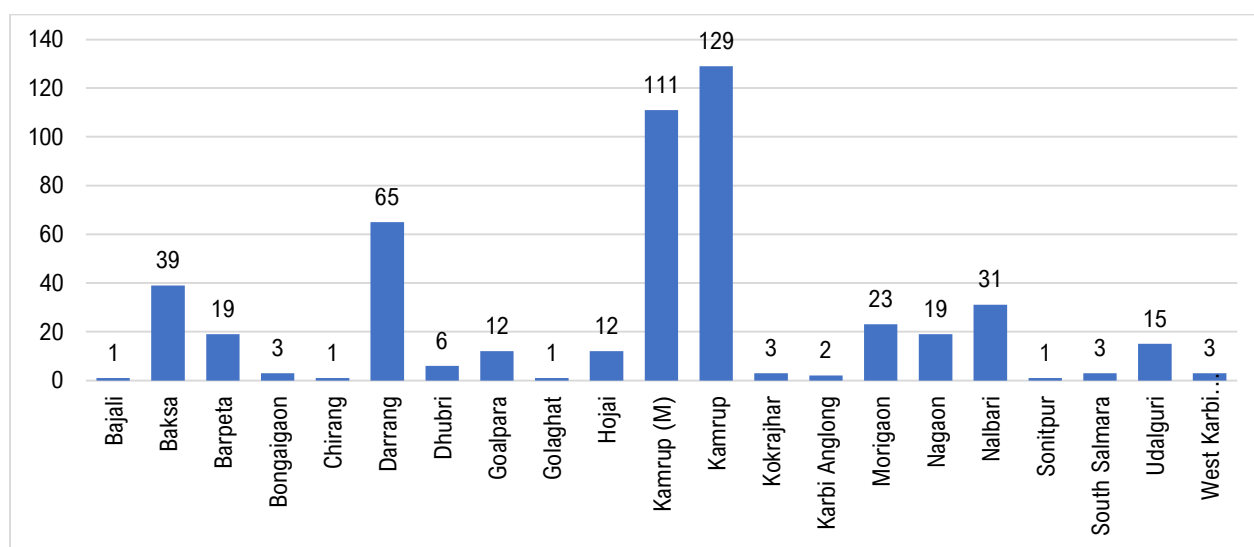
**Figure 1: District wise distribution of Stillbirth**

Table 4: Timing of stillbirth, ReCoDe Subtype and Preventability

ReCoDe	Antepartum	Intrapartum	Total	Preventability (Yes/No)
A1	9	8	17	No
A2.1	1	0	1	No
A3	4	2	6	Yes
A4	0	0	0	-
A5	0	0	0	-
A6	0	2	2	Yes
A7	103	21	124	Yes
B1	2	4	6	Yes
B2	2	0	2	Yes
B3	0	0	0	-
B4	0	0	0	-
C1	13	10	23	Yes
C2	25	12	37	Yes
C3	0	0	0	-
C4	1	1	2	Yes
C5	0	1	1	Yes
D1	1	0	1	Yes
D2	17	7	24	Yes
D3	2	2	4	Yes
E1	4	2	6	Yes
E2	1	0	1	Yes
E3	2	0	2	Yes
F1	16	0	16	Yes
F2	0	0	0	Yes
F3	2	0	2	Yes
F4	58	14	72	Yes
F5	1	0	1	Yes
F6	6	0	6	Yes
F7	0	0	0	-
F8	1	0	1	Yes
G1	24	25	49	Yes
G2	1	0	1	Yes
H	0	0	0	-
I	94	5	99	No
Total	390	116	506	-

But in most peripheral hospitals these stillbirths maybe reported as abortions, leading to under-reporting and misclassification of stillbirths. In a study by Zadey S et al[18], the under reporting of stillbirth in SRS and NFHS was highlighted and the need for awareness of data availability and variations across sources and geographic regions. Data from HMIS 2019-20 showed that all north-eastern states of India had SBR less than the study SBR.[19] (Table S2)

Most patients, 96.84%, received antenatal care. This is higher than NFHS 6 report which states 65.2% women in India had 4 or more ANC visits.[20] Despite this the birth outcomes were unfavourable. Quality of care in most developing and under developed countries is lagging. Identification of high-risk conditions, adequate facilities to handle them or early referral to tertiary care centres is the need of the hour.

On analysis of the sociodemographic factors, most women were found to be of rural residence. (n= 415, 82.01%) Most of the subjects (n=404, 79.84%) travelled a distance of 100 Kms to reach our tertiary care centre and the time taken was about 1 hour 30 minutes to 2

hours. Konda KR et al[16] also reported that 62.36% of the subject were from rural place of residence. The study by Altijani N et al[21] reported a high incidence of stillbirth (87.4%) among rural population. Building a strong referral system and assurance of quality of care at even the most peripheral hospitals can lead to a decrease in the SBR. Association between maternal age and SBR was also comparable with the study by Altijani N et al[21] (maternal age <25 years (aOR 1.29, 95% CI 1.21 to 1.37). In our study most of the stillbirth were in women <27 years of age. Similar relation was also seen between multigravida and stillbirth. Altijani et al found that multigravida had a higher odd of suffering from stillbirth. (aOR 3.06, 95% CI 2.42 to 3.86) Thus, extremes of ages and higher order birth may be seen as significant risk factors for stillbirth.

The study also highlights that 389 out of the 506 stillbirths were from preventable causes. The importance of periodic mass education about adequate antenatal check - up, deworming, Iron supplementation, nutrition, immunisation, maternal conditions such as anaemia, preeclampsia and their danger signs cannot be emphasised more. Conditions such as placenta previa, FGR, oligohydramnios, polyhydramnios can be detected by ultrasound. According to NFHS 5, the proportion of pregnancies with an ultrasound test increased from 61 percent to 78 percent from 2015-16 to 2019-21.[22] These findings indicate the need for ultrasound facilities at rural as well as urban health centres.

The most concerning cause in the study was birth asphyxia (n = 49). This indicates the need for better monitoring of mothers during intrapartum period as suggested by the statistically significant association between timing of stillbirth and preventability. Training, regular audits and OSCE for all medical staff may improve the quality of care at hospitals. There is a need for screening methods for preeclampsia, DIPSI at healthcare facilities for early identification of risk factors.

A meta-analysis by Mondal D et al[23] also reported about 10% higher risk of stillbirth in males. The findings in our study (238 female, 263 male) were similar. This finding is also comparable to the study done by Konda KR et al.[16] However, the cause behind higher stillbirth rates in male fetuses is not entirely understood. Gender predisposition may be due to some underlying genetic condition which highlights the need for genetic studies. Also, in 99 cases cause could not be identified and there were 17 cases of lethal congenital anomalies. This could be due to lack of prenatal genetic diagnosis and low autopsy rates.

STRENGTHS

This study was conducted to identify the districts at high risk for stillbirth. Usually, the districts with big tertiary care centres have a higher stillbirth rate. This has been seen to occur due to the high number of referrals that the hospitals receive. To identify the actual causes of stillbirth and form better healthcare policies, we need to

identify the high-risk districts and blocks of the state. The focus should be on both better quality of care in tertiary hospitals and the strengthening of peripheral hospitals.

LIMITATIONS

The study included subjects belonging mostly to the districts of Lower and Middle Assam. To get a clearer picture of the stillbirth rates in Assam, a larger population needs to be studied. Selection bias inherent to conducting the study at a single tertiary referral centre may have resulted in an over presentation of referred high-risk cases. Gestational age dating may not always be precise as patients sometimes do not recall their last menstrual period (LMP) correctly. Information bias due to reliance on case records may be present. The absence of a control group prevented the assessment of causal association between risk factors and stillbirth. Also, there is a lack of autopsy/genetic confirmation for cause of death, affecting ReCoDe classification accuracy.

CONCLUSION

The findings of this study underscore the considerable gap that remains in achieving the targets set by INAP and elucidates that most of the stillbirths are from preventable causes. Furthermore, our findings highlight the need for investigation into intrapartum stillbirths and the quality of obstetric care provided during labour to improve maternal and neonatal outcomes. Strengthening the referral system, educating the masses, and training medical staff about the causes and preventive measures can take us a long way. By sharing these findings with the medical fraternity and policymakers, strategic changes can be made to improve healthcare delivery and reduce the burden of stillbirth in India.

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Availability of data: The data that support the findings of this study are available from the corresponding author on reasonable request.

Declaration of Non-use of generative AI Tools: Generative AI was used to improve language refinement and the readability of the of the manuscript. The authors reviewed the output and take full responsibility for the content of this publication.

List of Abbreviations:

Abbreviation	Full Form
AC	Abdominal Circumference
AMCH	Assam Medical College and Hospital
ANC	Antenatal Care
aOR	Adjusted Odds Ratio
APH	Antepartum Haemorrhage
CI	Confidence Interval
DIPSI	Diabetes in Pregnancy Study Group India
ENAP	Every Newborn Action Plan
FGR	Fetal Growth Restriction
GDM	Gestational Diabetes Mellitus
GMCH	Gauhati Medical College and Hospital
HMIS	Health Management Information System
INAP	India Newborn Action Plan
IUFD	Intrauterine Fetal Death
LMP	Last Menstrual Period
MRD	Medical Records Department
NFHS	National Family Health Survey
OSCE	Objective Structured Clinical Examination
RCOG	Royal College of Obstetricians and Gynaecologists
ReCoDe	Relevant Condition at Death
SBR	Stillbirth Rate
SGA	Small for Gestational Age
SLE	Systemic Lupus Erythematosus
SPSS	Statistical Package for the Social Sciences
SRS	Sample Registration System
T2DM	Type 2 Diabetes Mellitus
USG	Ultrasonography
WHO	World Health Organization

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Supplementary Appendix

Table S1: List of Preventable and Non-Preventable Causes of Death

Preventable	Non - Preventable
1. Diagnosable/treatable maternal infection like maternal syphilis, vaccine preventable infections.	1. Lethal structural or chromosomal anomaly
2. Placental malfunction as evidenced by fetal growth restriction, placental insufficiency.	2. Fetal infection that was not generally preventable or was not able to be diagnosed before the fetal death
3. Pre-eclampsia/eclampsia	3. Stillbirths with no obvious symptoms or findings to alert the clinician about potential demise
4. Placental abruption or placenta previa	
5. Treatable maternal medical disease such as diabetes	
6. Umbilical cord accident	
7. Stillbirths due to events related to labour (Birth asphyxia, trauma, rupture)	

Table S2: SBR of Northeastern states of India as per HMIS 2019-20

State	Stillbirth Rate (SBR)
Arunachal Pradesh	12.1
Assam	21.1
Manipur	4
Meghalaya	22.3
Mizoram	7.6
Nagaland	14.9
Sikkim	15.7
Tripura	16.6