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Maternal and Neonatal Outcomes of High-Risk Pregnancies Identified through PMSMA in Rural West Bengal: A Longitudinal Study

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ABSTRACT

Background: High-risk pregnancies (HRPs) contribute significantly to maternal and neonatal morbidity and mortality. The *Pradhan Mantri Surakshit Matritva Abhiyan* (PMSMA) and its extended version aim to identify and manage HRPs through structured antenatal care, especially in underserved areas. Thus, present study was conducted to assess the clinico-social profile and evaluate maternal and neonatal outcomes among high-risk pregnant women registered under PMSMA in Budge-Budge II block, West Bengal.

Materials & Methods: A longitudinal observational study was conducted from January 2025 to July 2025, including 305 HRPs registered at PMSMA clinics. Participants were followed through delivery up to the 8th postnatal day. Data on socio-demographic, clinical risk factors, and outcomes were collected using a structured schedule. Coopland's high-risk pregnancy scoring system was used to categorize risk levels. Data were analysed using descriptive statistics and binary logistic regression.

Results: Teenage pregnancy (28.9%), early primigravida status (27.5%), and previous caesarean section (27.2%) were common risk factors. Severe-risk pregnancies (score ≥7) constituted 28% of cases. Poor neonatal outcomes were observed in 22.6%, and poor maternal outcomes in 21.6% of participants. Caesarean section rate was 84.9%, and live births occurred in 97.7% of cases. Severe-risk pregnancies showed a significant association with poor neonatal outcomes (OR: 7.01, 95% CI: 3.77–12.01) and poor maternal outcomes (OR: 3.92, 95% CI: 1.91–8.02).

Conclusion: Strengthening Extended PMSMA visits and referral linkages is essential to improve maternal and neonatal outcomes in rural settings.

Keywords: Pregnancy, High-Risk, Maternal Health Services, Pregnancy Outcome, India, Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA)

INTRODUCTION

Maternal and neonatal health remains a significant public health priority in India, with maternal mortality and neonatal mortality rates being crucial indicators of healthcare quality [1]. According to the Sample Registration System (SRS) Report 2021[2], India's maternal mortality rate has come down to 93 per lakh live births, and the neonatal mortality rate has come down

to 19 per 1,000 live births. While these figures indicate progress, India must continue to accelerate efforts to meet the Sustainable Development Goal (SDG) targets—which aim to reduce the maternal mortality rate to less than 70 per lakh live births and neonatal mortality rate to at least as low as 12 per 1,000 live births by 2030 [3].

High-risk pregnancy (HRP) is defined as one that is complicated by one or more factors that may adversely affect pregnancy outcomes—maternal, perinatal, or both [4]. These risk factors include extremes of maternal age, anaemia, gestational diabetes, hypertensive disorders, complications in previous pregnancies, multiple gestation, and pre-existing medical conditions [5]. HRPs contribute disproportionately to maternal and neonatal morbidity and mortality and thus require early identification and appropriate management.

To address this, the Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA) was launched by the Government of India with the goal of ensuring universal access to quality antenatal care. The program focuses on screening, detection and timely referral of high-risk pregnancies, especially in underserved areas, through fixed-day specialized ANC services provided by trained healthcare professionals and enables the management of complicated cases across all health centres [6]. Consequently, antenatal services become more accessible to pregnant women in all regions, including remote and rural areas, thereby promoting safe deliveries and healthier outcomes for both mothers and their babies by preventing complications associated with high-risk pregnancies.

The Extended PMSMA was implemented from 1st September 2022 to further strengthen the management of high-risk pregnancies and reduce maternal and neonatal mortality. Under this initiative, a pregnant woman categorised as HRP in course of routine screening at the PMSMA clinic by a MO/ OBGY specialist must receive 3 additional ANC visits for that HRP by MO/ OBGY specialist and they need to be mandatorily linked with nearest First Referral Units (FRUs) for ensuring a safe delivery and prompt management of complications if any [7].

Rural blocks of West Bengal present unique challenges in maternal healthcare, influenced by accessibility, continuity of care, and socio-economic conditions [8].

Identifying high-risk pregnancies through PMSMA is a critical step, but the continuum of care and final pregnancy outcomes (both maternal and neonatal) remain underexplored in this region [9]. National and state-level data suggest that many complications arise not from late identification alone but from missed opportunities for follow-up, incomplete Extended PMSMA visits, and delays in reaching higher-level facilities during emergencies. This highlights a critical evidence gap regarding whether the identification of HRPs under PMSMA is effectively complemented by the full continuum of care that is essential-regular extended visits, strengthened referral linkages, and timely access to obstetric specialist services-to ensure better maternal and neonatal outcomes in rural West Bengal.

This longitudinal study aimed to assess the clinico-social profile of high-risk pregnancies registered under the PMSMA program in the Budge-Budge II block of South 24 Parganas district, to evaluate their pregnancy outcomes (both maternal and neonatal) and to find out the association of identified risks with the pregnancy outcomes.

MATERIALS & METHODS

Study design and settings:

A descriptive observational study, longitudinal in design was done in Budge-Budge II block of South 24 Parganas, the rural field practice area for the Department of Community Medicine, Institute of Post Graduate Medical Education and Research (IPGME&R) from January 2025 to July 2025.

Study Participants and sampling:
All antenatal mothers identified as high-risk pregnancies from PMSMA clinic days in January, February, and March 2025 at CHC of Budge Budge II Block.

Inclusion criteria: All the pregnant women classified as high-risk based on PMSMA guidelines were included in the study.

Exclusion Criteria: Pregnant mothers who did not give informed consent to participate in the study and pregnancies lost to follow-up before delivery were excluded.
A complete enumeration technique was adopted. All high-risk pregnant women registered during three consecutive PMSMA clinic days (09/01/2025, 10/02/2025, and 09/03/2025) were included in the study. Thus, a total of 305 participants were enrolled.

Data collection tool and technique:
A predesigned, pretested and structured schedule comprising of: socio-demographic profile, Clinical profile, Obstetric history and antenatal findings, Delivery details and pregnancy outcomes (neonatal and maternal). Coopland's high-risk pregnancy scoring system [10] was applied for risk categorization of pregnancies as low, moderate, or severe risk.

Baseline assessment: At the time of high-risk pregnancy registration during PMSMA clinic visits, detailed baseline information was collected from each participant. This included socio-demographic characteristics (age, religion, education, family type, socio-economic class) and complete obstetric and medical history. Clinical findings such as hemoglobin level, blood pressure, gestational age, obstetric complications, and any pre-existing medical disorders were documented. Each participant's high-risk factors were systematically evaluated using the modified Coopland's high-risk pregnancy scoring system, which categorizes women into low, moderate, and severe risk groups based on weighted scoring of risk determinants.

Follow-up protocol: All enrolled participants were prospectively followed from the point of HRP identification throughout the remaining antenatal period. Follow-up was conducted during routine ANC visits as well as the mandated Extended PMSMA visits. At each visit, clinical status, fetal well-being, progression of risk factors, and compliance with referral advice were recorded. Any new complications, hospital admissions, or changes in risk categorization were documented.
Participants were further tracked through labour and delivery, and detailed delivery outcomes—including mode of delivery, intrapartum complications, maternal interventions, and neonatal status at birth—were recorded from facility registers and discharge summaries. Postnatal follow-up continued up to the 8th postpartum day through facility-based assessments or home visits to document maternal and neonatal outcomes, including documentation of delivery outcomes and any complications.

Operational definition:
***Poor neonatal outcome*:** Occurrence of any one or more of the following conditions: preterm birth (delivery before 37 completed weeks of gestation), stillbirth or spontaneous abortion, neonatal complications such as respiratory distress syndrome, birth asphyxia, sepsis, congenital anomalies, or neonatal jaundice requiring phototherapy, and early neonatal death (death within the first seven days of life) [10].
***Poor maternal outcome*:** presence of any of the following conditions in the postpartum period: postpartum haemorrhage (PPH), eclampsia, puerperal complications including puerperal sepsis, wound infection, or deep vein thrombosis, prolonged hospitalization exceeding seven days after delivery, or maternal near-miss events as

per the World Health Organization (WHO) criteria [11].

Statistical Analysis

Data were tabulated in Microsoft Office Excel 2021 and analyzed using the Statistical Package for the Social Sciences (SPSS for Windows, version 26.0, SPSS Inc., Chicago, Illinois, USA). Descriptive statistics were presented as frequency with percentage for categorical variables and mean with SD for continuous variables.

Binary logistic regression was performed (p value<0.05 was considered statistically significant) to assess associations between high-risk pregnancy severity and outcomes (maternal and neonatal).

Ethical Consideration

This study adhered to the ethical principles of the Declaration of Helsinki (2013 revision) for research involving human participants. Ethical norms related to autonomy, privacy, confidentiality, and voluntary participation were strictly followed. IEC approval was obtained from IPGME&R Institutional Ethics Committee (Approval No: IPGME&R/IEC/2025/0022). Written informed consent was taken from all participants prior to data collection. The study involved no invasive procedures, and no financial incentives were provided to participants. All data were anonymized and used exclusively for research purposes.

RESULT

A total of 305 high-risk pregnant women were included in the study. The mean (±SD) age of the participants was 25.8 (±4) years, with more than one fourth (27.5%) being younger than 20 years, over half (53.1%) aged between 20–30 years, 16.7% between 31–35 years, and 2.7% aged above 35 years. Near two third participants (62.0%) participants were Muslim while the remaining 38.0% were Hindu. Regarding educational status, 7.2% were illiterate or had non-formal education, 25.2% had completed primary schooling, 44.3% had attained middle school education, and 23.3% had studied up to secondary level or higher. Among husbands, 7.5% were illiterate or had non-formal education, 16.4% had completed primary, 48.9% middle school, and 27.3% secondary level or higher. Most of the participants (78.4%) lived in joint families, while 21.6% belonged to nuclear families. Socio-economically, based on the Modified BG Prasad Scale 2024, 14.1% of participants were from the upper-middle class (Class II), 29.8% from the middle class (Class III), 40.7% from the lower-middle class (Class IV), and 15.4% from the lower class (Class V).

Table 1 presents the distribution of study participants according the present pregnancy high-risk characteristics and their association with poor neonatal and maternal outcomes. Teenage pregnancy was the most common high-risk characteristic, affecting 28.9% of participants. Among them, 37.5% experienced poor neonatal outcomes, and 28.4% had poor maternal outcomes. Other common risk factors were early primigravida status (27.5%), previous caesarean section (27.2%), Severe anaemia (19.0%). Poor neonatal outcomes were notably higher in cases of twin pregnancy (71.4%), jaundice in pregnancy (66.7%), poly/oligohydramnios (54.5%), and pregnancy-induced hypertension (54.2%), indicating these conditions are associated with greater foetal risk. Similarly, poor maternal outcomes were frequently observed in jaundice in pregnancy (66.7%), twin pregnancy (57.1%), pregnancy-induced hypertension (41.7%), severe anaemia (36.2%), and thalassaemia (36.4%).

Table 1: Distribution of High-Risk Pregnant Women According to Present Pregnancy Risk Factors and Associated Maternal and Neonatal Outcomes (n=305)

Sl No.	High-risk characteristics	Number (%)	Poor Neonatal Outcome N (%)	Poor Maternal Outcome N (%)
1	Teenage Pregnancy	88 (28.9)	33 (37.5%)	25 (28.4%)
2	Early primigravida	84 (27.5)	31 (36.9%)	24 (28.6%)
3	Previous c-section	83 (27.2)	13 (15.7%)	16 (19.3%)
4	Severe anaemia	58 (19.0)	18 (31.0%)	21 (36.2%)
5	History of abortion/stillbirth	56 (18.3)	11 (19.6%)	12 (21.4%)
6	Hypothyroidism	53 (17.4)	16 (30.2%)	7 (13.2%)
7	Thalassaemia	44 (14.4)	17 (38.6%)	16 (36.4%)
8	PIH	24 (7.9)	13 (54.2%)	10 (41.7%)
9	Diabetes mellitus	19 (6.2)	6 (31.6%)	7 (36.8%)
10	Rh -ve blood group	18 (5.9)	7 (38.9%)	3 (16.7%)
11	Poly/oligohydramnios	11 (3.6)	6 (54.5%)	2 (18.2%)
12	Abnormal foetal presentation	9 (3.0)	3 (33.3%)	1 (11.1%)
13	Elderly primigravida	8 (2.6)	4 (50.0%)	2 (25.0%)
14	Twin pregnancy	7 (2.3)	5 (71.4%)	4 (57.1%)
15	Short stature	7 (2.3)	3 (42.9%)	1 (14.3%)
16	Jaundice in pregnancy	3 (1.0)	2 (66.7%)	2 (66.7%)
17	Congenital foetal anomaly	2 (0.7)	2 (100.0%)	1 (50.0%)

***Multiple Response**

High-risk pregnancy diagnosis was made in the second trimester for 36.7% and in third trimester for 63.3% of participants. Regarding Extended PMSMA visits, 61.0% completed three visits, while 29.5% completed two, and 9.5% attended only one session. Hospital admission for managing complication during pregnancy was required for 20.7% of participants. The caesarean section rate was remarkably high at 84.9%, while 13.8% had normal vaginal delivery and 1.3% required assisted vaginal delivery. Live births occurred in 97.7% of cases, still births occurred in 1.6% of cases, while abortion occurred in 0.7% of cases.

Based on modified Coopland's high-risk pregnancy scoring, participants were categorized into low-risk (39%), moderate-risk (33%), and severe-risk (28%) groups [Figure 1].

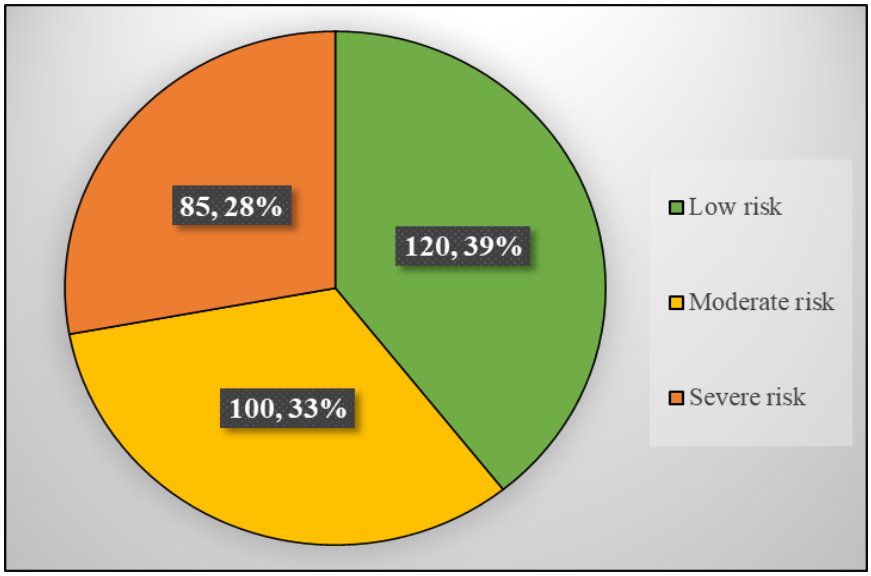

Fig 1: Pie diagram showing distribution of mothers based on modified Coopland's high risk pregnancy scoring(n=305)

Figure 2 shows that out of the 305 participants, poor neonatal outcomes were observed in 69 cases (22.6%). Among these poor outcomes reported causes were neonatal jaundice, abortions/stillbirth, foetal distress, birth asphyxia, neonatal sepsis, feeding difficulty, hypoglycaemia, early neonatal death.

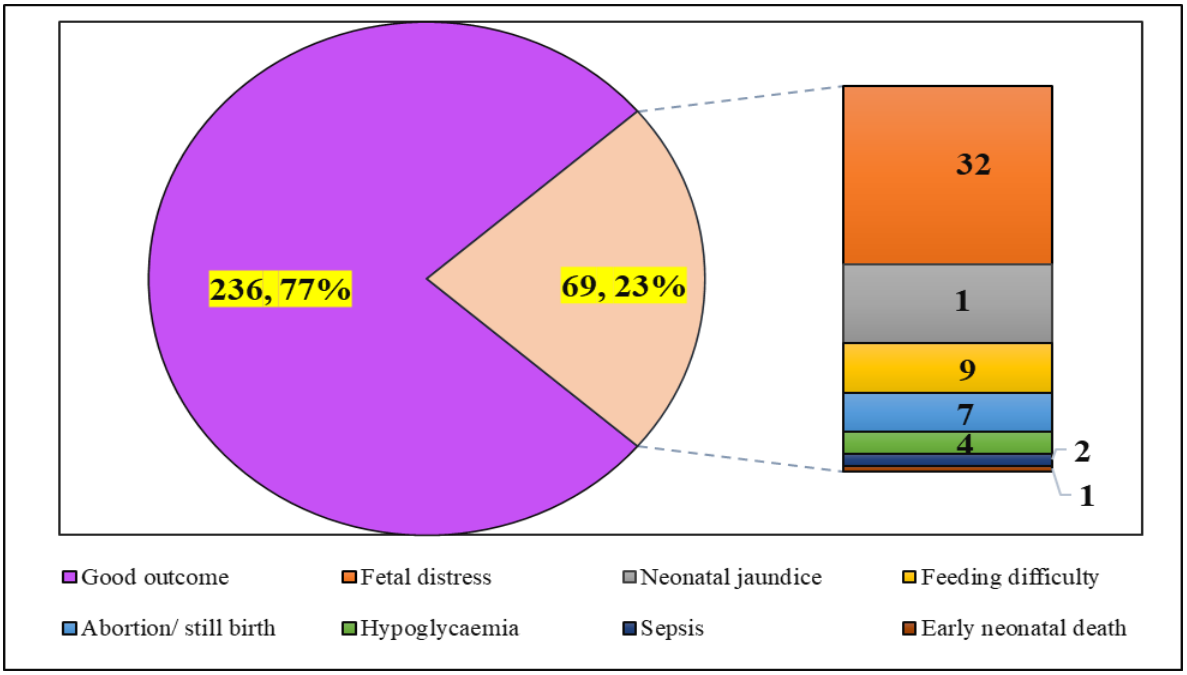

Fig 2: Bar of pie diagram showing distribution of high-risk pregnancies according to foetal/neonatal outcome (n=305)

Poor maternal outcomes were observed in 66 cases (21.6%) out of the 305 high-risk pregnancies. Among these, the most common complications included blood transfusion during delivery, maternal distress, eclampsia, and PPH. [Figure 3]

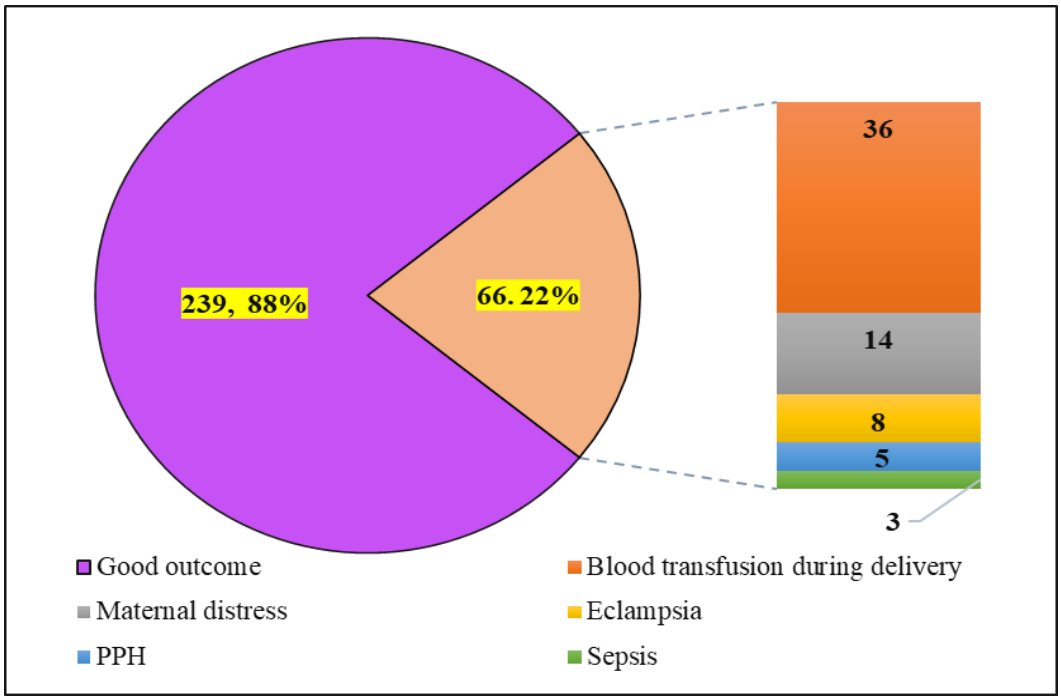

Fig 3: Bar of pie diagram showing distribution of high-risk pregnancies according to maternal outcome (n=305)

Binary logistic regression analysis revealed significant associations between high-risk pregnancy severity and outcomes. For neonatal outcomes, moderate-risk pregnancies showed 2.48 times higher odds of poor outcomes (OR: 2.48, 95% CI: 1.12-5.46, p=0.014), while severe-risk pregnancies had 7.01 times higher odds of poor neonatal outcomes (OR: 7.01, 95% CI: 3.77-12.01, p<0.001). [Table 2]

Table 2: Association of Neonatal outcome with high-risk pregnancy: binary logistic regression (n=305)

High-risk pregnancy	Neonatal outcome			OR	P value
	Good N (%)	Poor N (%)	Total N (%)		
Low	109 (90.8)	11 (9.2)	120 (100)	1	
Moderate	80 (80.0)	20 (20.0)	100 (100)	2.48 (1.12-5.46)	0.014
Severe	47 (55.3)	38 (44.7)	85 (100)	7.01 (3.77-12.01)	0.001

p value <0.05 was taken as significant, Model fitness information: Cox and Snell R- Square=0.41, Nagelkerke R-Square=0.47, Omnibus Test of Model coefficients were significant (p<0.001) and Hosmer-Lemeshow Goodness of Fit Test was not significant(p=0.070), suggesting a good fit of the model

Similarly, for maternal outcomes, moderate-risk pregnancies had 2.26 times higher odds of poor outcomes compared to low-risk pregnancies (OR: 2.26, 95% CI: 1.09-4.67, p=0.028). Severe-risk pregnancies demonstrated 3.92 times higher odds of poor maternal outcomes (OR: 3.92, 95% CI: 1.91-8.02, p<0.001). [Table 3]

Table 3: Association of Maternal outcome with high-risk pregnancy: binary logistic regression (n=305)

High-risk pregnancy	Maternal outcome			OR	P value
	Good N (%)	Poor N (%)	Total N (%)		
Low	106 (88.3)	14 (11.7)	120 (100)	1	
Moderate	77 (77.0)	23 (23.0)	100 (100)	2.26 (1.09-4.67)	0.028
Severe	56 (65.9)	29 (34.1)	85 (100)	3.92 (1.91-8.02)	0.001

p value <0.05 was taken as significant, Model fitness information: Cox and Snell R- Square=0.49, Nagelkerke R-Square=0.75, Omnibus Test of Model coefficients were significant (p<0.001) and Hosmer-Lemeshow Goodness of Fit Test was not significant(p=0.037), suggesting a good fit of the model

DISCUSSION

India has implemented multiple strategies to reduce maternal deaths. Early identification and appropriate care for high-risk mothers are crucial to lowering MMR and preventing complications during pregnancy and childbirth [12]. This longitudinal study in Budge-Budge II block, West Bengal, assessed outcomes of 305 HRPs registered under PMSMA, providing valuable insights into their clinico-social profile and perinatal outcomes, and enabling comparison with similar studies across India. The findings contribute to the growing evidence base on the effectiveness of PMSMA in real-world rural settings, where gaps in continuity of care often influence outcomes despite early risk detection.

Teenage pregnancy (28.9%) emerged as the main risk factor, similar to findings by Ibrahim M et al. [13] in rural Tamil Nadu (24.3%). This highlights persistent vulnerabilities among adolescents and underscores the importance of strengthening school-based reproductive health education, delaying age of marriage, and improving early antenatal registration. Previous caesarean section (27.2%) was another common risk factor, consistent with Jaideep KC et al. [14] in rural Karnataka (23.3%). This reflects rising caesarean trends even in rural settings and emphasizes the need for standardized labour monitoring protocols and decision-making tools to avoid unnecessary repeat caesareans.

Severe anaemia prevalence (19%) aligns with Pinar G et al. [15], emphasizing anaemia's role in adverse perinatal outcomes. Anaemia's association with high Coopland's scores further supports its significance as a modifiable risk factor that requires intensified nutritional counselling, iron supplementation, and monitoring. The high caesarean section rate observed in this

study (84.9%) parallels findings by Jadhao et al. [16] and Rupani SN et al. [17], suggesting a shift towards planned caesarean deliveries among HRPs. While this may reduce certain fetal risks, it also raises concerns regarding operative complications and the need for adequate surgical preparedness at peripheral facilities. In rural Purba Bardhaman, Hossain A et al. [18] documented hypothyroidism, prior caesarean, and PIH as leading HRP factors. In the present study, PIH, twin pregnancy, jaundice in pregnancy, and poly/oligohydramnios demonstrated strong associations with poor neonatal outcomes, including preterm births, birth asphyxia, and early neonatal complications. These findings reinforce that multiple gestation, maternal infections, and amniotic fluid abnormalities remain critical predictors of neonatal morbidity in rural populations.

We observed 97.3% live births, with poor neonatal and maternal outcomes in 22.6% and 21.6% of participants, respectively. Chate SU et al. [19] reported a slightly higher proportion of neonatal complications (29.5%) in rural Karnataka. Logistic regression in the present study demonstrated that severe-risk pregnancies had seven times higher odds of poor neonatal outcomes and nearly four times higher odds of adverse maternal outcomes. This reinforces the value of standardized risk scoring tools such as Coopland's, echoing the conclusions of Mandal et al. [20], and indicates the need for aggressive monitoring of women in the severe-risk category.

Only 61% of participants completed all three Extended PMSMA visits. This reflects a substantial gap in the continuum of care, which may partly explain the adverse maternal and neonatal outcomes observed. Similar gaps in follow-up and referral have been reported by Chate SU et al. [19], indicating common systemic barriers across rural India—such as transport limitations, socioeconomic constraints, and lack of awareness of the importance of specialist-led follow-up. Strengthening Extended PMSMA implementation, ensuring transport support, and improving ASHA-led birth preparedness counselling may help address these gaps.

Majella et al. [21] similarly reported that many high-risk pregnancies in rural Puducherry resulted in adverse outcomes despite early identification, largely due to inadequate follow-up and delayed referral—pattern that is similar to our study findings. They further emphasized the need for stronger referral linkages between primary and higher-level facilities, supporting our conclusion that incomplete Extended PMSMA follow-up and gaps in the continuum of care substantially affect pregnancy outcomes in rural settings.

Furthermore, the need for refining prognostication tools and integrating them into rural ANC workflows has been highlighted in recent literature. A recent study published by Rao et al. [22] evaluated prenatal prognostic indicators and validated a high-risk scoring model for predicting adverse pregnancy outcomes. Their findings support the integration of robust, evidence-based risk assessment tools into routine antenatal practice, which aligns with the current study's observations on the predictive value of Coopland's scoring system. Incorporating such validated models within PMSMA could further enhance early identification, targeted management, and referral of HRPs in rural settings.

CONCLUSION

This longitudinal study of 305 high-risk pregnancies under PMSMA found teenage pregnancy (28.9%) and previous caesarean section (27.2%) to be the most common risk factors. Poor neonatal outcomes occurred in 22.6% of cases, while poor maternal outcomes were seen in 21.6%. Neonatal complications were particularly frequent among mothers with twin pregnancies, jaundice in pregnancy, poly/oligohydramnios, and pregnancy-induced hypertension. Maternal complications were commonly associated with jaundice in pregnancy, twin pregnancies, pregnancy-induced hypertension, severe anaemia, and

thalassaemia. These findings underscore the importance of focused monitoring and individualized management for pregnancies with these specific risk factors.

While PMSMA program effectively identified high-risk pregnancies, gaps in continuity of care were evident. Thus, the study highlights the importance of 100% compliance with Extended PMSMA visits, especially for women in the severe-risk category. Uniform adoption of Coopland's scoring system across PMSMA clinics is recommended to ensure standardized risk classification. Strengthening the capacity of frontline workers like ANMs and ASHAs to recognize red flags and ensure timely referrals is also proposed to improve maternal and neonatal outcomes in rural areas.

Declaration by Authors:

Ethical Approval: Approved

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Conflict of Interest: The authors declare no conflict of interest.

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