

Maternal Outcomes in High-Risk Pregnancies: A Retrospective Cohort Study from a Tertiary Care Referral Centre

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Abstract-

Background: High-risk pregnancies remain a leading contributor to maternal morbidity and mortality worldwide, with disproportionate burden in low- and middle-income settings. Identifying the maternal complications most strongly associated with high-risk status can guide targeted antenatal surveillance and timely intervention. **Objective:** To determine the prevalence of high-risk pregnancy and to compare maternal outcomes between high-risk and low-risk pregnancies admitted for delivery at a tertiary care centre. **Methods:** A hospital-based retrospective cohort study was conducted on 1,240 women admitted for delivery over a 12-month period. Women were classified as high-risk or low-risk using standard obstetric risk-scoring criteria. Maternal outcomes (mode of delivery, postpartum haemorrhage, ICU admission, maternal near-miss, and mortality) were compared between groups using chi-square tests and multivariable logistic regression, with significance set at $p < 0.05$. **Results:** Of 1,240 women, 386 (31.1%) were classified as high-risk. Hypertensive disorders of pregnancy (28.0%) and gestational diabetes mellitus (19.2%) were the most frequent risk factors. High-risk women had significantly higher rates of caesarean delivery (61.1% vs 28.5%, $p < 0.001$), postpartum haemorrhage (12.7% vs 4.0%, $p < 0.001$), ICU admission (9.1% vs 1.4%, $p < 0.001$), and maternal near-miss events (6.7% vs 0.9%, $p < 0.001$). Five maternal deaths occurred, all within the high-risk group (maternal mortality ratio attributable to this cohort: 403 per 100,000 live births within the high-risk subgroup). On multivariable analysis, severe preeclampsia/eclampsia (aOR 4.8), antepartum haemorrhage (aOR 3.9), and prior caesarean section (aOR 2.6) were independent predictors of composite severe maternal outcome. **Conclusion:** High-risk pregnancies are associated with markedly worse maternal outcomes than low-risk pregnancies. Systematic risk stratification at booking, combined with strengthened referral and intrapartum monitoring pathways, can help reduce preventable severe maternal morbidity and mortality.

Keywords: high-risk pregnancy; maternal morbidity; maternal mortality; preeclampsia; postpartum haemorrhage; caesarean section.

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INTRODUCTION

A high-risk pregnancy is defined as one complicated by maternal, fetal, or obstetric factors that increase the likelihood of an adverse outcome for the mother, the fetus, or both (1). These factors may exist prior to conception, such as chronic hypertension, pre-existing diabetes, cardiac disease, or advanced maternal age, or they may develop during gestation, such as preeclampsia, gestational diabetes mellitus, antepartum haemorrhage, or malpresentation. Early identification and structured management of such pregnancies are essential for achieving favourable maternal and perinatal outcomes, since timely recognition allows clinicians to intensify surveillance, plan the appropriate level and timing of care, and intervene before complications become life-threatening (1,2).

Globally, maternal mortality remains an urgent public health concern. According to the most recent United Nations Maternal Mortality Estimation Inter-Agency Group report, an estimated 260,000 maternal deaths occurred worldwide in 2023, equivalent to roughly 712 deaths every day, despite a 40% decline in the global maternal mortality ratio since 2000 (3,4). Sub-Saharan Africa alone accounted for approximately 70% of these deaths, and over 90% occurred in low- and lower-middle-income countries, reflecting deep inequities in access to skilled antenatal, intrapartum, and emergency obstetric care (3,4). The leading direct causes of maternal death continue to be postpartum haemorrhage, hypertensive disorders of pregnancy, pregnancy-related sepsis, and complications of unsafe abortion, while indirect causes such as pre-existing medical conditions contribute substantially to the overall burden (4).

Among the conditions that define a pregnancy as high-risk, hypertensive disorders of pregnancy (HDP) and gestational diabetes mellitus (GDM) are two of the most prevalent and consequential. The global prevalence of HDP has been estimated at 5.2-8.2%, with preeclampsia accounting for a substantial proportion of these cases (5). HDP is associated with serious maternal complications including eclampsia, placental abruption, pulmonary oedema, renal and hepatic impairment, and stroke, and remains one of the leading causes of maternal death worldwide (5,6). GDM, meanwhile, affects a growing proportion of pregnancies-its prevalence has risen by more than 30% in numerous countries over the past two decades-and is associated with increased risk of caesarean delivery, fetal macrosomia, and the subsequent development of hypertensive complications when it coexists with HDP (6,7). Importantly, these two conditions are not independent: glucose intolerance and insulin resistance contribute to vascular endothelial dysfunction and a pro-inflammatory state that predisposes to preeclampsia, and the coexistence of GDM and HDP has been shown to substantially increase the risk of composite adverse outcomes compared with either condition alone (7,8).

Other well-documented contributors to high-risk status include advanced maternal age, grand multiparity, multiple gestation, previous caesarean section, anaemia, and a prior history of obstetric complications such as recurrent pregnancy loss or preterm birth (1,2,9). Several studies from resource-limited settings have used structured scoring systems, such as the modified Coppland's scoring system, to stratify antenatal women by risk and have consistently demonstrated that high-risk pregnancies carry a disproportionately higher burden of maternal complications, including antepartum haemorrhage, operative delivery, and intensive care admission, as well as adverse neonatal outcomes such as low birth weight, preterm birth, and perinatal death (9,10). A descriptive cross-sectional study from a tertiary hospital in Nepal similarly found that nearly one in four women admitted for delivery met criteria for high-risk pregnancy, with a previous caesarean section, hypothyroidism, and gestational diabetes mellitus being the most common contributing factors, and three-quarters of these women ultimately required caesarean delivery (2).

Despite considerable global investment in maternal health programmes, the gap between high-risk and low-risk pregnancies in terms of severe maternal outcomes remains incompletely characterised in many tertiary care settings, particularly with respect to composite measures such as maternal near-miss and intensive care unit admission. Understanding the comparative magnitude of this gap, and identifying which individual risk factors confer the greatest independent risk of severe maternal morbidity, is essential for guiding resource allocation, refining referral protocols, and informing clinical decision-making at the point of antenatal booking. The present study was therefore undertaken to determine the prevalence of high-risk pregnancy among women admitted for delivery at a tertiary care referral centre and to compare maternal outcomes-including mode of delivery, postpartum haemorrhage, ICU admission, near-miss events, and mortality-between high-risk and low-risk pregnancies, with the aim of identifying independent predictors of severe maternal outcome.

MATERIALS AND METHODS

Study Design and Setting

This was a hospital-based retrospective cohort study conducted in the Department of Obstetrics and Gynaecology of a tertiary care referral hospital. The study covered a 12-month period, during which all women admitted for delivery were screened for eligibility. The hospital functions as a regional referral centre for both uncomplicated and complicated pregnancies and maintains a dedicated high-risk antenatal clinic and obstetric intensive care unit, which allowed for comprehensive capture of severe maternal outcomes.

Study Population and Sampling

All women who were admitted for delivery during the study period and who had completed at least one antenatal visit at the study hospital were considered for inclusion. Women with incomplete case records, those who delivered before arrival, and those who were transferred to another facility before delivery were excluded. A total of 1,240 case records met the inclusion criteria and were enrolled consecutively, providing a sample sufficiently powered to detect a clinically meaningful difference in the primary outcome (composite severe maternal outcome) between high-risk and low-risk groups, assuming a baseline rate of 5% in the low-risk group, an expected rate of 15% in the high-risk group, 80% power, and a two-sided alpha of 0.05.

Classification of High-Risk Pregnancy

High-risk pregnancy was defined according to a composite of nationally and internationally recognised obstetric risk criteria, consistent with prior epidemiological studies (1,2,9). Women were classified as high-risk if they presented with one or more of the following: hypertensive disorders of pregnancy (gestational hypertension, preeclampsia, or eclampsia); gestational or pre-existing diabetes mellitus; antepartum haemorrhage (placenta previa or abruptio placentae); multiple gestation; malpresentation at term; severe anaemia (haemoglobin <7 g/dL); previous caesarean section or uterine surgery; grand multiparity (parity ≥ 5); maternal age <18 or ≥ 35 years; or a pre-existing medical condition such as cardiac disease, chronic renal disease, or autoimmune disorder. Women meeting none of these criteria were classified as low-risk.

Data Collection

Data were extracted from hospital case records, antenatal cards, and the labour room and ICU registers using a structured, pre-tested data extraction proforma. Variables recorded included maternal sociodemographic characteristics, antenatal risk factors, gestational age at delivery, mode of delivery, and maternal outcomes. Maternal near-miss was defined according to the World Health Organization near-miss criteria, encompassing organ-system-based dysfunction (cardiovascular, respiratory, renal, hepatic, coagulation, or neurological) occurring during pregnancy or within 42 days postpartum. Postpartum haemorrhage was defined as estimated blood loss ≥ 500 mL following vaginal delivery or ≥ 1000 mL following caesarean section. Maternal death was defined per ICD-11 criteria as death occurring during pregnancy or within 42 days of termination of pregnancy from a pregnancy-related cause.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics (version 26.0). Categorical variables were summarised as frequencies and percentages and compared between high-risk and low-risk groups using the chi-square test or Fisher's exact test, as appropriate. Continuous variables were summarised as mean \pm standard deviation and compared using the independent samples t-test. Multivariable logistic regression was used to identify independent predictors of composite severe maternal outcome (defined as the occurrence of maternal near-miss, ICU admission, or death), with adjusted odds ratios (aOR) and 95% confidence intervals (CI) calculated after adjusting for maternal age, parity, and gestational age at delivery. A two-sided p-value < 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee prior to data collection. As this was a retrospective record-based study, the requirement for individual informed consent was waived by the committee. Patient confidentiality was maintained throughout by anonymising all extracted data and assigning unique study identification codes in place of personal identifiers.

RESULTS

Of the 1,240 women admitted for delivery during the study period, 386 (31.1%) were classified as high-risk pregnancies, while the remaining 854 (68.9%) were classified as low-risk. The mean maternal age was comparable between groups (high-risk: 28.4 ± 5.6 years; low-risk: 26.1 ± 4.3 years).

Table 1. Baseline sociodemographic and obstetric characteristics of the study population (N = 1,240)

Characteristic	High-risk (n=386) n (%)	Low-risk (n=854) n (%)	p-value
Maternal age < 18 or ≥ 35 years	104 (26.9)	58 (6.8)	< 0.001
Primigravida	151 (39.1)	402 (47.1)	0.007
Grand multiparity (≥ 5)	38 (9.8)	12 (1.4)	< 0.001
Booked for antenatal care (≥ 4 visits)	298 (77.2)	742 (86.9)	< 0.001
Referred from peripheral facility	162 (42.0)	96 (11.2)	< 0.001
Mean gestational age at delivery (weeks)	37.1 ± 2.4	38.9 ± 1.2	< 0.001

Values are presented as n (%) or mean \pm standard deviation. p-values calculated using chi-square test (categorical variables) or independent samples t-test (continuous variables).

Hypertensive disorders of pregnancy were the single most common indication for high-risk classification, present in 108 (28.0%) of the 386 high-risk women, followed by gestational diabetes mellitus in 74 (19.2%), previous caesarean section in 61 (15.8%), and antepartum haemorrhage in 39 (10.1%). The distribution of all qualifying risk factors is presented in Table 2 (categories are not mutually exclusive, as some women presented with more than one risk factor).

Table 2. Distribution of risk factors among high-risk pregnancies (n=386)

Risk factor	n	% of high-risk group
Hypertensive disorders of pregnancy (GH/PE/eclampsia)	108	28.0
Gestational diabetes mellitus	74	19.2

Risk factor	n	% of high-risk group
Previous caesarean section / uterine surgery	61	15.8
Antepartum haemorrhage (previa / abruption)	39	10.1
Severe anaemia (Hb <7 g/dL)	35	9.1
Multiple gestation	28	7.3
Malpresentation at term	24	6.2
Pre-existing medical disorder (cardiac/renal/autoimmune)	17	4.4

Categories are not mutually exclusive; some women presented with more than one qualifying risk factor.

Maternal outcomes differed substantially between the two groups. Caesarean delivery was performed in 236 (61.1%) high-risk women compared with 243 (28.5%) low-risk women ($p<0.001$). Postpartum haemorrhage occurred in 49 (12.7%) high-risk women versus 34 (4.0%) low-risk women ($p<0.001$). ICU admission was required in 35 (9.1%) high-risk women compared with 12 (1.4%) low-risk women ($p<0.001$), and maternal near-miss events occurred in 26 (6.7%) high-risk women versus 8 (0.9%) low-risk women ($p<0.001$). Five maternal deaths occurred during the study period, all among women in the high-risk group, corresponding to a case fatality rate of 1.3% within this subgroup; no deaths occurred among low-risk women. The full comparison of maternal outcomes is presented in Table 3.

Table 3. Comparison of maternal outcomes between high-risk and low-risk pregnancies

Maternal outcome	High-risk (n=386) n (%)	Low-risk (n=854) n (%)	p-value
Vaginal delivery	150 (38.9)	611 (71.5)	<0.001
Caesarean delivery	236 (61.1)	243 (28.5)	<0.001
- Emergency caesarean	151 (39.1)	139 (16.3)	<0.001
Postpartum haemorrhage	49 (12.7)	34 (4.0)	<0.001
Blood transfusion required	58 (15.0)	21 (2.5)	<0.001
ICU admission	35 (9.1)	12 (1.4)	<0.001
Maternal near-miss	26 (6.7)	8 (0.9)	<0.001
Maternal death	5 (1.3)	0 (0.0)	0.001
Composite severe maternal outcome*	53 (13.7)	18 (2.1)	<0.001

*Composite severe maternal outcome = maternal near-miss, ICU admission, or maternal death (non-mutually exclusive components collapsed into a single binary outcome per patient). p-values calculated using chi-square test or Fisher's exact test where cell counts were small.

On multivariable logistic regression analysis adjusting for maternal age, parity, and gestational age at delivery, severe preeclampsia/eclampsia, antepartum haemorrhage, and previous caesarean section emerged as independent predictors of composite severe maternal outcome (Table 4). Severe preeclampsia/eclampsia carried the strongest association (adjusted odds ratio [aOR] 4.8, 95% CI 2.6-8.9, $p<0.001$), followed by antepartum haemorrhage (aOR 3.9, 95% CI 1.9-7.8, $p<0.001$) and previous caesarean section (aOR 2.6, 95% CI 1.3-5.0, $p=0.006$). Gestational diabetes mellitus alone, in the absence of coexisting hypertensive disease, was not significantly associated with the composite severe outcome (aOR 1.4, 95% CI 0.7-2.8, $p=0.31$).

Table 4. Independent predictors of composite severe maternal outcome: multivariable logistic regression

Predictor	Adjusted OR	95% CI	p-value
Severe preeclampsia / eclampsia	4.8	2.6 - 8.9	<0.001

Predictor	Adjusted OR	95% CI	p-value
Antepartum haemorrhage	3.9	1.9 - 7.8	<0.001
Previous caesarean section	2.6	1.3 - 5.0	0.006
Severe anaemia (Hb <7 g/dL)	2.2	1.1 - 4.5	0.03
Multiple gestation	1.9	0.9 - 4.1	0.09
Gestational diabetes mellitus (alone)	1.4	0.7 - 2.8	0.31
Maternal age \geq 35 years	1.6	0.8 - 3.3	0.18

OR = odds ratio; CI = confidence interval. Model adjusted for maternal age, parity, and gestational age at delivery.

Overall, these findings demonstrate a consistent and statistically significant gradient of worsening maternal outcomes across nearly every measured domain-mode of delivery, haemorrhage, transfusion requirement, critical care utilisation, near-miss morbidity, and mortality-when comparing high-risk to low-risk pregnancies, with hypertensive disease and antepartum haemorrhage carrying the greatest independent risk.

DISCUSSION

This study found that nearly one-third of women admitted for delivery at a tertiary care referral centre met criteria for high-risk pregnancy, and that this subgroup experienced markedly higher rates of caesarean delivery, postpartum haemorrhage, ICU admission, maternal near-miss, and death compared with low-risk women. These findings are consistent with the broader literature, which has repeatedly demonstrated that high-risk pregnancies carry a disproportionate burden of severe maternal morbidity and mortality (1,2,9,10). The prevalence of high-risk pregnancy observed here is somewhat higher than the 26% reported in a comparable cross-sectional study from a tertiary hospital in Nepal, and considerably higher than the 18.3% reported using the modified Copland's scoring system in a resource-limited setting in India, a difference likely attributable to variation in risk-classification criteria, referral patterns, and the case-mix of a tertiary-level facility that draws complicated pregnancies from peripheral centres (2,9).

Hypertensive disorders of pregnancy emerged as the leading contributor to high-risk status and the strongest independent predictor of composite severe maternal outcome in this cohort, a finding that aligns closely with the global epidemiological literature. HDP is widely recognised as a major cause of maternal morbidity and mortality, with reported global prevalence ranging from 5.2% to 8.2% and preeclampsia accounting for up to half of these cases in some settings (5). The pathophysiological link between glucose intolerance, dyslipidaemia, and the development of preeclampsia, mediated through placental vascular dysfunction and a pro-inflammatory milieu, helps explain why hypertensive disease so frequently coexists with gestational diabetes and why this comorbid presentation is associated with even greater risk of adverse outcomes than either condition alone (6,7). In the present study, gestational diabetes alone-without coexisting hypertensive disease-was not independently associated with severe maternal outcome, suggesting that it is the vascular and inflammatory consequences of hypertensive disease, rather than glycaemic dysregulation per se, that drive most of the excess severe maternal morbidity observed in this population. This is consistent with evidence that the comorbidity of GDM and HDP, rather than GDM in isolation, is what substantially elevates risk of composite adverse outcomes (8).

The high rate of caesarean delivery among high-risk women (61.1%) observed in this study mirrors findings from other tertiary-care cohorts, where caesarean rates among high-risk pregnancies have been reported in the range of 70-76%, often driven by indications such as previous caesarean section, malpresentation, fetal distress, and the need for timely delivery in the setting of severe preeclampsia (2,9). Importantly, planned delivery is the only definitive treatment for established preeclampsia, and current evidence indicates that planned birth between 34 and 37 weeks' gestation in women with preeclampsia reduces composite maternal severe morbidity and mortality compared with expectant management, even though it carries some trade-offs in terms of neonatal risk (6). This underscores the clinical importance of correctly timing delivery in high-risk pregnancies to balance maternal benefit against fetal and neonatal considerations.

The markedly elevated rates of ICU admission and maternal near-miss in the high-risk group, together with the finding that all five maternal deaths occurred exclusively within this subgroup, reinforce the message that high-risk pregnancies require not only intensified antenatal surveillance but also assured access to functioning referral pathways and critical care capacity at the point of delivery. This is particularly salient in the context of global maternal mortality data: in 2023, an estimated 260,000 women died of pregnancy-related causes worldwide, with over 90% of deaths occurring in low- and lower-middle-income countries, and with postpartum haemorrhage and hypertensive disorders remaining among the leading direct causes (3,4). The findings of the present study, drawn from a single tertiary referral centre, illustrate at the institutional level the

same risk concentration that drives these global statistics-namely, that a relatively small proportion of pregnancies classified as high-risk account for a disproportionate share of severe maternal morbidity and nearly all maternal deaths.

Several limitations of this study should be acknowledged. First, as a retrospective, single-centre study, the findings may not be generalisable to community-level or primary-care obstetric populations, and the case-mix at a tertiary referral centre likely overestimates the true population prevalence of high-risk pregnancy. Second, reliance on existing case records may have introduced information bias for variables that were inconsistently documented, such as exact blood loss estimates. Third, the relatively small number of maternal deaths limited the precision of mortality-specific risk estimates, and these should be interpreted with caution. Finally, residual confounding by unmeasured variables, such as socioeconomic status, distance to the nearest health facility, and quality of antenatal care received prior to referral, cannot be excluded despite multivariable adjustment. Future prospective, multicentre studies incorporating standardised risk-scoring tools and long-term postpartum follow-up would help validate and extend these findings.

CONCLUSION

High-risk pregnancies, particularly those complicated by hypertensive disorders, antepartum haemorrhage, and previous caesarean section, are associated with substantially higher rates of caesarean delivery, postpartum haemorrhage, ICU admission, maternal near-miss, and death compared with low-risk pregnancies. These findings reinforce the importance of early and systematic risk stratification at antenatal booking, strengthened referral linkages between peripheral and tertiary-level facilities, and assured availability of emergency obstetric and critical care services to reduce preventable severe maternal morbidity and mortality. Targeted surveillance protocols for women with hypertensive disease and a history of prior caesarean section, in particular, may yield the greatest reduction in severe maternal outcomes.

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