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Assessment of Maternal Risk Factors in Preterm Labor in A Tertiary Care Hospital of Pakistan

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ABSTRACT

Preterm labor remains a major contributor to perinatal morbidity and mortality, particularly in low- and middle-income countries. Identification of maternal risk factors is essential for prevention, timely intervention, and improved pregnancy outcomes. **Objectives:** To determine the frequency of maternal risk factors associated with preterm labor in a tertiary care setting. **Methods:** A descriptive cross-sectional study was conducted at the Department of Obstetrics and Gynaecology, University of Lahore Teaching Hospital, from May 3, 2025, to August 2, 2025. A total of 155 multigravida women aged 20–40 years with gestational age <37 weeks, diagnosed with preterm labor, were included through non-probability consecutive sampling. Data were collected using a structured proforma and analyzed in SPSS version 25.0. Descriptive statistics were calculated, and stratification was done with the chi-square test, considering $p \leq 0.05$ as significant. **Results:** The mean maternal age was 31.03 ± 5.89 years, and mean gestational age at delivery was 33.88 ± 1.43 weeks. The most frequent maternal risk factors were vaginal discharge (46.5%), urinary tract infection (45.2%), anemia in pregnancy (39.4%), previous cesarean section (23.9%), and gestational hypertension (18.1%). A history of previous preterm birth was present in 12.9% of women, leaking per vagina in 11.6%, and placental abruption in 2.6%. **Conclusions:** Infections, particularly vaginal discharge and urinary tract infection, were the leading maternal risk factors associated with preterm labor in this population. Routine screening and prompt management of maternal infections, alongside targeted antenatal interventions, may help reduce the burden of preterm births.

INTRODUCTION

Preterm labor, characterized as the commencement of labor before 37 weeks of gestation, represents a critical public health concern on a global scale and is a predominant contributor to neonatal morbidity and mortality [1]. Annually, there are approximately 15 million (11.1%) preterm births out of all births worldwide, with 13.3% of these occurrences taking place in South Asia exclusively [2]. A multitude of elements have been recognized as contributing factors to the occurrence of preterm birth. Socio-demographic variables, including maternal ethnicity, advanced maternal age, and tobacco use, have been documented as significant risk factors for preterm delivery [3]. Several studies have consistently demonstrated associations between maternal characteristics and the risk of preterm birth. Factors such as low educational attainment, poor nutritional status, and limited access to antenatal care services have been shown to elevate the likelihood of preterm delivery [4]. Similarly, obstetric determinants, including primigravity, prior preterm birth, and a history of cesarean section, have been linked with increased susceptibility [5]. However, the relative importance of these factors can vary according to regional disparities in healthcare access, socioeconomic conditions, and infection prevalence, which underscores

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the necessity of context-specific investigations. The scarcity of multicenter or hospital-based studies in Pakistan that quantify these associations using robust data limits the translation of findings into targeted clinical or preventive strategies [6]. In addition, infections such as urinary tract infection and bacterial vaginosis have been implicated as key contributors to preterm labor, with evidence suggesting that untreated genital or urinary infections may account for nearly 40% of spontaneous preterm deliveries in low- and middle-income countries [7]. In Pakistan, limited research has systematically evaluated the combined contribution of maternal infections and metabolic conditions to preterm labor outcomes. A cross-sectional study from Karachi reported that urinary tract infections and anemia were among the top predictors of spontaneous preterm birth, emphasizing the preventable nature of these factors in low-resource hospital settings [8]. Similarly, a study from Peshawar found that socioeconomic status and antenatal care access strongly influenced preterm birth rates, underscoring the multifactorial nature of the condition in Pakistani women [9].

Despite the known global and regional risk factors, preterm labor remains a leading cause of neonatal morbidity and mortality in Pakistan, with limited data to inform context-specific prevention and management strategies. There is a scarcity of systematic, hospital-based studies in Pakistan that comprehensively evaluate maternal sociodemographic, obstetric, and infectious risk factors, highlighting the need for localized evidence to guide clinical and public health interventions. To identify and quantify maternal risk factors associated with preterm labor in a tertiary care hospital setting in Pakistan.

METHODS

This descriptive cross-sectional study was conducted at the Department of Obstetrics and Gynaecology, University of Lahore Teaching Hospital, from May 3, 2025, to August 2, 2025. A total of 155 pregnant women were included in the study, with the sample size calculated using a 95% confidence level, 5% margin of error, and an estimated frequency of prior preterm birth at 11.14% [8]. The ethical approval of the research was obtained from the Institutional Review Board of University College of Medicine and Dentistry (UCMD), Lahore (ERC/91/23/08). Informed written consent was obtained from all participants after fully explaining the purpose, procedures, voluntary nature of participation, the right to withdraw, and measures taken to ensure confidentiality. Data were collected prospectively using a structured proforma designed to capture all relevant variables. Information was obtained through direct interviews and review of antenatal and delivery records. Participants were followed from their first antenatal visit until delivery. Follow-ups were scheduled regularly to track antenatal care utilization, maternal health conditions, and pregnancy outcomes. A non-probability consecutive sampling technique was employed. Women aged 20 to 40 years, who were multigravida with parity of one or more and a gestational age of less than 37 weeks, were included if diagnosed with preterm labor based on clinical signs such as regular uterine contractions, vaginal discharge of mucus plug or bloody show, cervical changes on examination, or transvaginal ultrasound (Mindray DC-30 (Shenzhen Mindray Bio-Medical Electronics Co., Ltd. China) measurement of cervical length. Women with multiple pregnancies, pre-existing maternal comorbidities, known fetal abnormalities, or those who declined to give consent were excluded. Maternal age, education level, socioeconomic status, area of residence, and smoking status were recorded. The body mass index (BMI) was calculated using pre-pregnancy or early pregnancy measurements of weight and height. Besides documenting current pregnancy risk factors, the obstetric history was also documented, including prior preterm birth (delivery before 37 weeks) and previous cesarean section, based on medical records and patient history. The number of antenatal care (ANC) visits was also recorded to assess care utilization. Maternal hemoglobin readings were taken as part of the routine laboratory tests, as documented in the patient files. The cases of gestational hypertension were determined by checking the antenatal and admission blood pressure values. The diagnosis was presumed when women had new-onset hypertension after 20 weeks of gestational age, which was systolic blood pressure of 140 mmHg and/or diastolic blood pressure of 90mmHg, measured on two or more occasions. Cases that had documented hypertension and had neither proteinuria nor systemic features indicating preeclampsia were characterized as gestational hypertension. The measurements of blood pressure were taken with standard sphygmomanometers during routine antenatal visits or hospitalization. Primary data on vaginal discharge were measured via patient-reported symptoms and clinical examination outcomes that were made available by the attending obstetrician. The diagnosis of UTI has been made according to the regular findings of antenatal or admission urinalysis, which can be found in the medical record of the patient. The procedure of collecting and testing midstream urine was conducted in an aseptic manner and through the conventional hospital laboratory tests, such as urine dipstick and urine microscopes. Descriptive statistical methods were employed using SPSS version 25.0. For continuous variables like maternal age, gestational age at delivery, and number of antenatal care (ANC) visits, the

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mean and standard deviation were computed. Categorical variables, including previous preterm birth history, presence of urinary tract infection (UTI), anemia, hypertensive disorders, and vaginal leakage, were presented as frequencies and proportions. Data stratification was performed based on maternal age, parity, body mass index (BMI), smoking behavior, educational attainment, socioeconomic standing, and residential location. Post-stratification analysis was carried out using the chi-square test. Statistical significance was determined at a threshold of $p \leq 0.05$.

RESULTS

A little over half were aged 31–40 years (83 women, 53.5%), while 72 women (46.5%) were 20–30 years, with a mean age of 31.03 ± 5.89 years. Regarding BMI, 84 women (54.2%) had a normal BMI, 51 (32.9%) were overweight, and 20 (12.9%) were obese, giving a mean BMI of 25.31 ± 3.38 kg/m^2. Slightly more participants were multiparous (82, 52.9%) than nulliparous/primiparous (73, 47.1%). Education levels varied: 51 (32.9%) had secondary, 50 (32.2%) primary, 39 (25.2%) tertiary, and 15 (9.7%) no formal schooling. Socioeconomic status was predominantly low (80, 51.6%), followed by middle (52, 33.5%) and high (23, 14.9%). Residence was evenly distributed between urban (80, 51.6%) and rural (75, 48.4%). Only 1 woman (0.6%) reported smoking, while 154 (99.4%) were non-smokers. The average number of antenatal care (ANC) visits was 4.55 ± 2.27, and the mean gestational age at delivery was 33.88 ± 1.43 weeks, confirming the preterm status. All participants delivered preterm, confirming that the study population exclusively comprised women with preterm labor (Table 1).

Table 1: Frequency Distribution of Different Variables (n=155)

Variables		Frequency (%), Mean ± SD
Age Groups	20-30 Years	72 (46.5%)
	31-40 Years	83 (53.5%)
	Mean Age (Years)	31.03 ± 5.89
BMI	Normal	84 (54.2%)
	Overweight	51 (32.9%)
	Obese	20 (12.9%)
	Mean Weight (kg)	16.30 ± 6.85
	Mean Height (cm)	161.02 ± 5.77
	Mean BMI (kg/m^2)	25.31 ± 3.38
Parity	Nulliparous/Primiparous	73 (47.1%)
	Multiparous	82 (52.9%)
Educational Level	No Formal Education	15 (9.7%)
	Primary	50 (32.2%)
	Secondary	51 (32.9%)
	Tertiary	39 (25.2%)
Socio-Economic Status	Low	80 (51.6%)
	Middle	52 (33.5%)
	High	23 (14.9%)
Residence	Rural	75 (48.4%)
	Urban	80 (51.6%)
Smoking	Yes	1 (0.6%)
	No	154 (99.4%)
Mean Number of ANC Visits		4.55 ± 2.27
Gestational Age on Delivery / Preterm Labor (<37 Completed Weeks)		33.88 ± 1.43

The most prevalent issues were vaginal discharge in 72 women (46.5%) and urinary tract infection (UTI) in 70 women (45.2%). Anemia was also common, affecting 61 women (39.4%). A history of cesarean section was reported in 37 women (23.9%), and gestational hypertension in 28 (18.1%). Fewer women had a history of preterm birth (20, 12.9%), leaking per vagina (18, 11.6%), or placental abruption (4, 2.6%). These values suggest that infectious and hematological conditions were more frequent contributors to preterm labor than obstetric complications (Table 2).

Table 2: Frequency Distribution of Maternal Risk Factors in Preterm Labor

Maternal Risk Factors in Preterm Labor	Frequency (%)
Previous Preterm Birth	20 (12.9%)
Previous C-Section	37 (23.9%)
Gestational Hypertension	28 (18.1%)
Urinary Tract Infection	70 (45.2%)
Vaginal Discharge	72 (46.5%)
Leaking Per Vagina	18 (11.6%)
Anemia In Pregnancy	61 (39.4%)
Placental Abruption	4 (2.6%)

The analysis demonstrated that maternal risk factors for preterm labor—such as previous preterm birth, gestational hypertension, urinary tract infection, vaginal discharge, and anemia were evenly distributed across demographic and socio-environmental groups, with no statistically significant associations (all $p>0.05$). Demographically, older, multiparous, and obese women showed slightly higher frequencies of anemia and previous preterm birth, though these differences were not meaningful. Socio-environmental comparisons revealed marginally higher infection-related risks (UTI and vaginal discharge) among women of low socioeconomic status and rural residence, while gestational hypertension and anemia appeared more common in rural areas (Table 3).

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Table 3: Stratification of Maternal Risk Factors in Preterm Labor by Demographic Characteristics

Variables	Age (20–30 Years)	Age (31–40 Years)	Normal BMI	Overweight	Obese	Nulli/Primiparous	Multiparous	p-value
Previous Preterm Birth	11.1%	14.5%	14.3%	5.9%	25.0%	9.6%	15.9%	0.083–0.535
Gestational Hypertension	20.8%	15.7%	16.7%	21.6%	15.0%	21.9%	14.6%	0.239–0.719
Urinary Tract Infection	45.8%	44.6%	50.0%	37.3%	45.0%	46.6%	43.9%	0.353–0.876
Vaginal Discharge	47.2%	45.8%	50.0%	43.1%	40.0%	46.6%	46.3%	0.611–0.977
Anaemia In Pregnancy	33.3%	44.6%	38.1%	37.3%	50.0%	31.5%	46.3%	0.089–0.577

The relationship between maternal risk factors for preterm labor and socio-environmental characteristics, including socioeconomic status, residential setting, and smoking habits, has also been presented. Although none of the associations reached statistical significance ($p>0.05$), distinct patterns were evident. Women from low socioeconomic backgrounds and rural areas demonstrated slightly higher rates of urinary tract infections, vaginal discharge, and anemia, suggesting possible links to limited healthcare access, hygiene disparities, and nutritional deficiencies. Gestational hypertension was also more prevalent among rural women, indicating potential environmental or lifestyle influences. Due to the very small number of smokers in the sample, results related to smoking could not be generalized (Table 4).

Table 4: Stratification of Maternal Risk Factors in Preterm Labor by Socio-Environmental Characteristics

Variables	Low SES	Middle SES	High SES	Rural	Urban	Smokers	Non-Smokers	p-value
Previous Preterm Birth	12.5%	11.5%	17.4%	14.7%	11.3%	100.0%	12.3%	0.129–0.775
Gestational Hypertension	17.5%	21.2%	13.0%	25.3%	11.3%	100.0%	17.5%	0.085–0.689
Urinary Tract Infection	51.2%	40.4%	34.8%	45.3%	45.0%	100.0%	44.8%	0.262–0.967
Vaginal Discharge	50.0%	44.2%	39.1%	48.0%	45.0%	0.0%	46.8%	0.350–0.708
Anaemia In Pregnancy	36.3%	40.4%	47.8%	49.3%	30.0%	0.0%	39.6%	0.084–0.595

DISCUSSION

Preterm labor is a multifactorial condition with complex interactions between maternal, fetal, and environmental factors, and remains a leading cause of neonatal morbidity and mortality worldwide. In the present study, the most frequent maternal risk factors were vaginal discharge (46.5%), urinary tract infection (45.2%), anemia in pregnancy (39.4%), previous cesarean section (23.9%), gestational hypertension (18.1%), and previous preterm birth (12.9%), with less common findings including leaking per vagina (11.6%) and placental abruption (2.6%). These findings align with the consensus that infectious etiologies and maternal comorbidities play a major role in the pathophysiology of preterm labor. Vaginal discharge, which in this study was reported in nearly half of the cases, has been previously documented as a strong indicator of genital tract infections leading to inflammatory cascades that precipitate uterine activity. A study conducted in Sub-Saharan Africa reported abnormal vaginal discharge in 38% of women presenting with preterm labor, which is slightly lower than the proportion in the present study, possibly due to regional variations in microbiological flora and access to early antenatal screening [10]. Similarly, Etil *et al.* documented a prevalence of 41%, which is also comparable, supporting the argument that untreated vaginal infections remain a persistent problem in low-resource settings despite antenatal care programs [11]. Urinary tract infection was present in 45.2% of the current cohort, reinforcing its status as a significant preventable risk factor for preterm birth. Several studies have reported similar associations, with prevalence rates ranging from 25% to 50%. For instance, a tertiary care hospital study in Nigeria found UTIs in 42% of preterm labor cases, while a South African study reported a prevalence of 36% [10, 12]. This consistency suggests that asymptomatic bacteriuria screening should be emphasized as part of routine antenatal visits, especially given that timely treatment can significantly reduce preterm birth risk. Anemia in pregnancy, observed in 39.4% of our participants, mirrors the burden reported in other South Asian populations, where nutritional deficiencies and limited access to supplementation remain challenges. In a study from rural Pakistan, anemia was found in 34% of preterm deliveries [13], while an Ethiopian study reported a higher prevalence of 46% [14]. The slightly higher rate in Ethiopia may be due to concurrent high rates of malaria and hookworm infections, which exacerbate iron deficiency. The association between anemia and preterm labor is biologically plausible through mechanisms of impaired oxygen delivery to the placenta and altered maternal immune response, further justifying aggressive nutritional interventions in antenatal care protocols. A history of previous cesarean section was noted in 23.9% of participants. This is comparable to the 21% reported in a Saudi Arabian cohort, though higher than the 15% observed in a Ugandan study in a systematic review [15]. Scar tissue from prior cesarean deliveries can alter uterine

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contractility and cervical competence, predisposing to preterm labor. Given rising cesarean rates globally, this factor warrants careful risk stratification in subsequent pregnancies. Gestational hypertension was reported in 18.1% of our cases, aligning with prevalence rates of 16% to 20% in studies from China and India [16, 17]. Hypertensive disorders in pregnancy can trigger early delivery through iatrogenic intervention or spontaneous onset due to placental dysfunction. The similarity in rates across diverse populations highlights the universality of this risk and the need for robust antenatal blood pressure monitoring programs. Previous preterm birth, present in 12.9% of participants, is a well-established predictor of recurrence. Studies in Rwanda and Ethiopia have reported similar proportions, ranging from 10% to 15% [18, 19]. This reinforces the need for heightened surveillance and targeted preventive measures, such as progesterone supplementation and cervical length monitoring, in women with such a history. Leaking per vagina, recorded in 11.6% of cases, is a marker of preterm pre-labor rupture of membranes (PPROM). This finding is consistent with a Tanzanian study reporting PPROM in 13% of preterm cases. Prompt diagnosis and antibiotic prophylaxis in such cases can reduce neonatal morbidity by mitigating the risk of ascending infection [20]. Placental abruption was rare in this cohort (2.6%), similar to the 2–4% prevalence reported in large multicenter studies. Although infrequent, its occurrence carries a high risk of adverse maternal and fetal outcomes, often necessitating urgent delivery [21]. Comparable rates have been documented in regional studies; for instance, a tertiary hospital study in Karachi found placental abruption in 2.8% of preterm deliveries, primarily associated with hypertensive disorders and maternal anemia [22]. Likewise, a study from Dubai reported a 3.1% prevalence, with similar associations between abruption, preeclampsia, and poor antenatal care utilization [23]. These findings highlight that even though placental abruption is uncommon, its impact on perinatal morbidity and mortality remains substantial.

This study was conducted at a single center with a limited sample size, which may affect the generalizability of the findings. Additionally, it relies on retrospective data and self-reported history, which may introduce reporting or selection bias. Prospective multicenter studies are needed to validate risk factors and develop targeted interventions for preventing preterm labor in high-risk populations.

CONCLUSIONS

This study identified vaginal discharge (46.5%), urinary tract infection (45.2%), and anemia (39.4%) as the leading maternal risk factors associated with preterm labor, followed by previous cesarean section, gestational hypertension, and prior preterm birth. A large share of preterm births in Pakistan could be prevented through routine antenatal screening and management of maternal infections, anemia, and hypertension.

Authors' Contribution

Conceptualization: TY
Methodology: SA[1], SH, SA[2]
Formal analysis: SA
Writing and Drafting: AR, SK
Review and Editing: AR, TY, SA[1], SH, SK, SA[2]

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

All the authors declare no conflict of interest.

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