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Socioeconomic Risk Factors for Preterm Birth in Manipur, Northeast India: A Community-Based Study

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Abstract

Background Preterm birth (PTB) is one of the world's leading health concerns, affecting both the mother and the children. This study was undertaken to determine the prevalence and socioeconomic factors associated with PTB among the Meitei women of Manipur.

Materials and Methods A community-based cross-sectional study was conducted in postpartum Meitei women of Manipur. Participants were 126 postpartum women that gave birth to a singleton live-born infant and were classified as women giving birth before 37 weeks of gestation (PTB) and women giving birth at ≥37 weeks (term). Data were compared using univariate analysis, and the association of socioeconomic factors with PTB was determined through multivariate logistic regression using Statistical Package for Social Sciences 25 version software program, and statistical significance was taken at a p-value < 0.05.

Results The overall prevalence of PTB is 23.01%, of which 13.79% are of extremely preterm. This study revealed a significant association of PTB with mother's occupation (adjusted odds ratio [AOR] = 4.46, 95% confidence interval [CI]: 1.40–14.26, $p = 0.012$), tobacco consumption during pregnancy (AOR = 2.90, 95% CI: 1.01–8.33, $p = 0.048$), having family history of PTB (AOR = 3.14, 95% CI: 1.09–9.04, $p = 0.034$), and early age at menarche (AOR = 4.26, 95% CI: 1.49–12.12, $p = 0.007$).

Conclusion The study highlights the high prevalence of PTB and its association with various socioeconomic factors. Such community-specific studies should be performed to understand the differential risk factors of PTB to control premature death in under 5 years children and to promote women's reproductive health.

Key Words
- Meitei
- preterm birth
- menarche
- tobacco consumption
- socioeconomic

Introduction

Preterm birth (PTB), <37 weeks of gestation, is one of the world's leading causes of death in children under 5 years of age. It increases the risk of high mortality and lifelong impairment.[1] It is estimated to be a risk factor in at least 50% of all neonatal deaths.[2] More than 60% of the total PTBs occur in Africa and South Asia. In low-income countries, 12% of babies are born too early, which is comparatively higher than in high-income countries (9%). Studies reported an increasing trend in PTB rates over the past two decades, specifically from low- and middle-income countries.[3] In India, the prevalence of PTB varies significantly from 6.1% in Maharashtra to 28.25% in Tamil Nadu.[4,5] India contributes 23.4% of the global PTB.[6] The PTB affects both the mother and the children with an increased risk of developing short- and long-term chronic noncommunicable diseases.[7] Identifying the causes of PTB is one of the major areas of research to

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prevent PTB and its associated adverse health outcomes. The occurrence of PTB has been linked with multiple factors such as genetic, pregnancy-induced chronic diseases (hypertension, diabetes), infections, early induced labor, multiple gestations, anemia, antenatal care visits, age at menarche, etc.[8] Moreover, socioeconomic factors of the mother are associated with the occurrence of PTB, including less maternal income, low level of education, occupation, early childbearing, smoking, and place of residence.[9–12] However, ethnic differences in the causation of PTB remain. Thus, identifying women at high risk of PTB at an early pregnancy stage may allow timely intervention against PTB and future life-threatening health events.[13]

The epidemiology of PTB has not been explored in most of the Indian population. Moreover, existing studies are concentrated only in some specific states, with limited studies predicting risk factors contributing to PTB.[8] However, studies on PTB have been lacking among the Northeast Indian populations. A limited study has been performed reporting the association of PTB with maternal low hemoglobin levels during pregnancy and also claimed risk of low birth weight among PTB babies.[14] Thus, a preliminary study was conducted to determine the prevalence and correlate PTB with socioeconomic factors among the Meitei women of Manipur, Northeast India, to understand the population-specific PTB prognosis.

Materials and Methods

Design, Population, and Setting of the Study

A community-based cross-sectional study was conducted among the postpartum Meitei women of Manipur, Northeast India. Women from the Meitei ethnic group, with an East Asian Ancestry, residing in urban and rural areas were recruited in the present study from October 2019 to January 2020. In this study, two districts, Imphal East and Imphal West, were selected considering the poor reproductive health conditions per the reports of the National Family Health Survey, Manipur. The highest burden of anemia and increased rate of early childbearing age were reported in Imphal West. In contrast, Imphal East reports the worst performing district for inadequate antenatal care during the first trimester.[15]

Postpartum women that gave birth to a singleton live-born infant and women who are residing permanently in the area and willing to participate in the study were included in the present study. Women with twin pregnancies, cognitive and physical limitations, and those unwilling to participate were excluded from the study.

Variables

All the information was collected through a structured interview schedule consisting of questions on socioeconomic characteristics such as age at conception, gestational age, educational level, occupation, income, place of residence, and social category (unreserved or schedule caste) were assessed after obtaining informed written consent. Information on mother menarche age (<13 years or ≥ 13 years), antenatal care visit (less than four visits and four or more visits), family history of PTB (either maternal or paternal), and tobacco consumption/chewing during pregnancy was also obtained through the interview. Data on the mother's age at conception were obtained with childbearing ages of <20 years and ≥ 20 years. Regarding maternal occupational status, women with no current occupation but managing household affairs and doing housework were categorized as housewives, while women engaged as artisans, laborers, manual work, and physical exertion-related work as full-time workers.

Data Analysis

The data collected were initially transferred to MS Excel software and coded, and further statistical analyses were performed using Statistical Package for Social Sciences 25 version. The prevalence of PTB was calculated in the studied community. Univariate analysis was performed to determine the association of socioeconomic variables with PTB. The significant variables as observed in the univariate analysis were further adjusted to perform the multivariate analysis using logistic regression. Statistical significance was taken based on a p-value <0.05.

Results

The overall prevalence of PTB was 23.01%. Of the different types of PTB, moderate-to-late preterm comprised 55.17%, very preterm 31.03%, and extremely preterm 13.79%. Socioeconomic characteristics revealed that mothers with a monthly income of less than 10,000 rupees were significantly more common in the preterm group than in the term group (41.37 vs. 20.61%, $p = 0.024$). Low-income mothers were 2.7 (odds ratio [OR] = 2.72, 95% confidence interval [CI]: 1.12–6.60, $p = 0.024$) times more likely to experience PTB than high-income mothers.

Similarly, full-time working women were found quite frequently in the preterm group than in the term group (41.37 vs. 18.55%), with 3.10 times more likely to deliver PTB than the housewife mothers (OR = 3.10, 95% CI: 1.26–7.61, $p = 0.011$). Moreover, mothers who consumed tobacco were more likely to experience PTB than those who did not (OR = 3.03, 95% CI: 1.28–7.15, $p = 0.01$). Regarding the educational level, there were significantly more women with illiteracy and elementary education in the preterm group than in the term group (65.52 vs. 43.29%, $p = 0.036$). Mothers with a family history of PTB were 2.84 times more likely to give preterm delivery than their counterparts (OR = 2.84, 95% CI: 1.20–6.72, $p = 0.015$). The proportion of mothers with early menarche was significantly higher among the preterm groups than in the term group (55.17 vs. 29.89%, $p = 0.013$). The analysis also showed that the chances of giving PTB were significantly higher among the mothers who visited fewer antenatal check-ups during pregnancy than those with adequate antenatal care (ANC) visits (51.72 vs. 28.86%, $p = 0.023$). Most of the mothers delivering PTB children resided in rural areas (86.20%) and had early childbearing age (34.48%) than the mothers who gave term birth.

However, no statistically significant difference was observed between the two groups ($p > 0.05$). The social category of the mother did not show any significant differences between the unreserved category and schedule caste group with respect to PTB ($p = 0.372$; ►**Table 1**).

We further performed multivariate analysis using logistic regression to investigate which socioeconomic factors were the best predictors of PTB after adjusting the factors like the mother's income, education, occupation, tobacco consumption, antenatal care, age at menarche, and family history of PTB (►**Table 2**). The most significant risk observed in the study was the mother's occupation; full-time workers showed greater odds of having PTB (adjusted odds ratio [AOR] = 4.46, 95% CI: 1.40–14.26, $p = 0.012$) compared with housewife mothers. Early age at menarche revealed a significant association with PTB, with 4.26 times more likely to

Table 1 Distribution of socioeconomic characteristics of Meitei women in preterm and term groups

Socioeconomic characteristics	Birth				*p*-Value OR CI
	Preterm (29, 23.01%)		Full-term (97, 76.9%)		
	No.	%	No.	%	
Mother's income (per month)					
Less than 10,000	12	41.37	20	20.61	$p = 0.024$ OR = 2.72 CI = 1.12–6.60
More than 10,000	17	58.62	77	79.38	
Mother's occupation					
Housewives	17	58.62	79	81.44	$p = 0.011$ OR= 3.10 CI = 1.26–7.61
Full time workers	12	41.37	18	18.55	
Tobacco consumption (during pregnancy)					
No	11	37.93	63	64.94	$p = 0.010$ OR = 3.03 CI = 1.28–7.15
Yes	18	62.06	34	35.05	
Level of education					
Illiterate and elementary	19	65.52	42	43.29	$p = 0.036$ OR = 0.40 CI = 0.17–0.95
Higher secondary and above	10	34.48	55	56.70	
Age at menarche					
Less than 13 y	16	55.17	29	29.89	$p = 0.013$ OR = 0.35 CI = 0.15–0.81
More than 13 y	13	44.83	68	70.10	
Childbearing age					
< 20 y	10	34.48	23	23.71	$p = 0.247$ OR = 1.69 CI = 0.69–4.15
≥ 20 y	19	65.51	74	76.28	
Social category					
Unreserved	20	68.96	58	59.79	$p = 0.372$ OR = 0.67 CI = 0.28–1.62
Scheduled caste	9	31.03	39	40.20	
Place of residence					
Rural	25	86.20	67	71.27	$p = 0.102$ OR = 2.54 CI = 0.81–7.96
Urban	4	13.79	30	30.92	
Antenatal care (ANC)					
Less than four visits	15	51.72	28	28.86	0.023 OR = 0.38 CI = 0.16–0.89
More than four visits	14	48.27	69	71.13	
Family history of preterm births					
No	15	51.72	73	75.25	0.015 OR = 2.84 CI = 1.20–6.72
Yes	14	48.27	24	24.74	

Abbreviations: CI, confidence interval; OR, odds ratio.

Table 2 Association between socioeconomic factors and PTB in multivariable logistic regression analysis

Socioeconomic characteristics	OR[a] 95% CI	*p*-Value
Mother's income		
More than 10,000	Ref	$p = 0.022$
Less than 10,000	0.28(0.10–0.84)	
Mother's occupation		
Housewives	Ref	$p = 0.012$
Full time workers	4.46(1.40–14.26)	
Tobacco consumption		
No	Ref	$p = 0.048$
Yes	2.90(1.01–8.33)	
Level of education		
Higher secondary and above	Ref	$p = 0.116$
Illiterate and elementary	2.30(0.81–6.51)	
Antenatal care (ANC)		
More than four visits	Ref	$p = 0.169$
Less than four visits	2.05(0.74–5.73)	
Family history of preterm birth		
No	Ref	$p = 0.034$
Yes	3.14(1.09–9.04)	
Age at menarche		
More than 13 y	Ref	
Less than 13 y	4.26(1.49–12.12)	$p = 0.007$

Abbreviations: CI, confidence interval; OR, odds ratio; PTB, preterm birth.

[a]Adjusted for mother's income, occupation, tobacco consumption, level of education, age at menarche, antenatal care, and family history of preterm births.

deliver preterm (AOR = 4.26, 95% CI: 1.49–12.12, $p = 0.007$). The present study also found that those with a family history of PTB had a threefold increased risk of delivering PTB (AOR = 3.14, 95% CI: 1.09–9.04, $p = 0.034$). Women who consumed tobacco during pregnancy were 2.90 times more likely to experience delivering PTB than mothers who did not with a statically borderline significant difference (AOR = 2.90, 95% CI: 1.01–8.33, $p = 0.048$). Notwithstanding this, women with less than four antenatal visits and those with lower educational levels showed a more than twofold increased risk of giving PTB. However, both predictors were statically insignificant after adjusting the risk factors in multivariate logistic regression analysis ($p > 0.05$).

Discussion

PTB is considered one of the major health issues of birth outcomes throughout the world, which is also the leading cause of death in children under 5 years of age. More than 15 million babies are born preterm yearly, accounting for approximately more than 1 in every 10 babies. The PTB rate has increased specifically in low- and middle-income countries in the last two decades. Previous studies reported that there is a lack of reliable information on the prevalence of PTB in most of the developing country.[3,16] In India, studies on PTB are mainly concentrated in some specific states. The present findings showed a high prevalence of PTB, 23.01%, higher than the global prevalence across 184 countries ranging from 5 to 18%.[16] The PTB rate is also found to be higher than in other studies reported from Zimbabwe, Malawi, and Kenya.[17–19] In India, studies on PTB report varied prevalence rates across different geographical regions.[12] The current finding also reports higher rates of PTB than previous studies as reported from Gujarat (9.0%), Maharashtra (6.1%), and Tamil Nadu (5.6%).[5,20,21] Although the high prevalence of PTB in the present study is in accordance with some groups of the Indian population, it suggests a high prevalence of PTB in the Indian population.[4,11,12] Of the overall prevalence of PTB, 13.79% are extremely preterm. Such a high alarming prevalence of PTB highlights the need for urgent attention, monitoring, regulation, and intervention of PTB at the population level throughout the country. It will become one of India's major public health burdens if not intervened in time.

Regarding the risk factors of PTB, previous studies have identified several potential predictors of PTB.[8] The current study shows a significant association between a mother's income and PTB occurrence. It supports previous studies in which mother with low monthly income was more likely to give birth to preterm infants.[22] However, the inconsistent finding was also reported from Qatar, suggesting no positive association between a mother's low income and the occurrence of PTB.[9] The education level of mothers has an impact on their pregnancy outcomes. It is claimed that the mother's education level was a strong predictor of PTB. In the study, mothers with lower educational levels have more than twofold increased risk of delivering PTB babies (AOR = 2.30 95% CI: 0.81–6.51). However, it does not reveal statistical significance ($p = 0.116$). It could be because of the lack of proper educational awareness on maternal health and related pregnancy outcomes among the term group with higher education levels. It is explained by the constitution of 23.63% of mothers reporting inadequate antenatal care visits among the term mothers with higher secondary and above education levels. No association between the mother's education level and PTB is supported by the previous studies.[9,23] However, different studies also reported inconsistent results suggesting the mother's lower education level is one of the strong predictors of PTB.[24,25] It suggests that educational awareness of maternal health and pregnancy outcomes could be a strong predictive factor of PTB than mothers' education level, particularly in rural populations of low-middle-developing countries.

It is claimed that the mother's occupation can predict an increased risk for PTB. Women who performed intensive work during pregnancy had a fivefold increased risk of having a PTB (AOR = 5.37, 95% CI: 1.39–20.68).[23] This claim is supported by the present study in which women in full-

time work were more likely to give PTB than housewife mothers (AOR = 4.46, 95% CI:1.40–14.26). Studies conducted in Iran and Italy have also reported consistent findings with the present study where heavy working women during pregnancy increase the risk of PTB.[26,27]

Regarding unhealthy lifestyles, tobacco consumption before or during pregnancy showed a more than twofold increased risk of PTB in the present study (AOR = 2.90, 95% CI: 1.01–8.33, $p = 0.048$). It is consistent with the study reporting high odds as seven times more likely to deliver PTB among the mothers consuming tobacco than the nonuser mothers (OR = 7.08, 95% CI: 4.14–12.14).[28] Such a significant positive association between tobacco consumption and preterm delivery is further strengthened by the reports of systematic and meta-analysis studies among pregnant women in India.[29] The study reveals maternal tobacco use during pregnancy increases the risk for PTB with a 1.39 pooled odds ratio.

Of the different predictors of PTB, age at menarche has been investigated to predict the risk of preterm delivery. Various PTB studies across the world report significant associations between preterm delivery and mother's menarche onset age. This study reports a significant association between early menarcheal age (mean age 11.5 ± 1.37) and PTB. Women who had menarcheal age less than 13 years of age are found to have a 4.26-fold increased risk of preterm delivery among the studied Meitei women population (AOR = 4.26, 95% CI: 1.49–12.12, $p = 0.007$). A study on 11,016 Chinese women from the Healthy Baby Cohort between 2012 and 2014 also claims a significant association between age at menarche with PTB (OR = 1.67, 95% CI: 1.18–2.36).[13] No significant association between PTB and age at menarche is also reported in some studies.[30] So far, there is no concrete evidence, to our best knowledge, on the occurrence of preterm delivery due to early age at menarche among the Indian population. This is the first study that reports the risk of preterm delivery in women with an early menarcheal age among the northeast Indian population. It needs to be validated in other Indian populations to establish menarcheal age as one of the potential predictors of PTB.

Receiving antenatal health care services by a mother, particularly during pregnancy, immensely improves overall pregnancy outcomes. Therefore, inadequate antenatal care visits become another vital risk factor for PTB. In the present study, mothers who had inadequate ANC visits were more likely to deliver preterm when compared with those mothers with adequate ANC visits ($p = 0.023$). However, after adjusting all the significant confounding factors, no significant positive association was observed between inadequate ANC visits and preterm delivery. Similarly, there is no substantial correlation between PTB and the number of ANC visits from the Gambia and the Belgian population.[31,32] However, another study claims a significant positive association between inadequate ANC visits of the mothers during pregnancy with PTB (AOR = 1.90, 95% CI: 1.13–3.18).[31,33] It is further supported by other research findings reporting less than four ANC visits during pregnancy were significantly associated with an increased risk of delivering PTB compared with adequate ANC visits.[24,34]

Different studies have investigated the association between a mother's family history of PTB and the risk of preterm delivery. In the study, mothers with a family history of preterm delivery have a threefold higher risk of PTB than their counterparts (AOR = 3.14, 95% CI: 1.09–9.04). It signifies that women with a family history of PTB either in maternal or paternal (or both) are at higher risk of preterm delivery. Such a positive association is supported by other studies reporting a positive association between a mother's family history of PTB and a higher risk of delivering preterm babies (adjusted relative risk [aRR] = 1.44, 95% CI: 1.22–1.97).[34,35] Such significant positive association results highlight that PTB runs in families. Moreover, it signifies the inheritance and genetic influence on the duration of gestation, causing the risk of PTB.

Different studies suggest a significant positive association between maternal childbearing age and preterm delivery. The risk of PTB increases significantly among teenage mothers or young maternal age groups.[5,24] Mothers less than 20 years were significantly associated with a high risk of PTB.[9] However, the present study does not find any significant association between childbearing age and preterm delivery. The study supports such inconsistent findings performed in the Bangladesh population in which women aged <20 years were protective against PTB.[36] Moreover, a longitudinal cohort study also reveals a reduced risk of preterm delivery among Canadian mothers aged 30 to 34 years.[37] Such discrepancy in the results could be addressed by conducting population-specific studies on the differences in PTB risks, such as sociodemographic factors among different ethnic groups.

In the present study, no significant association was found between the mother's residence and delivering preterm. This finding agrees with similar studies suggesting no effect of the mother's place of residence on PTB.[38] In contrast, a cross-sectional study in Uttar Pradesh reported a significant positive association where women residing in rural areas are more likely to give PTB compared with urban residents.[11] Inconsistent findings are also reported that urban resident women had an increased risk of delivering preterm.[39] Such discrepancy might be due to better and easily accessible maternal health services in urban areas, which increases PTB risk in rural residents. On the contrary, the high prevalence and increased risk of having PTB among urban residents might be due to the differential socioeconomic status and lifestyles.[34]

Strengths and Limitations

The present study reveals both strengths and limitations. This study is the outcome of a community-based study performed through a household survey that minimizes the selection bias observed in the hospital-based study. This study is the outcome of preliminary work and the first attempt among the Meitei women of Manipur to determine population-specific socioeconomic risk factors of PTB. We failed to incorporate a large sample size and some of the risk factors of PTB, such as previous PTB, pregnancy-induced hypertension, gestational diabetes, infection during

pregnancy, and threatened abortion. It could be the main limitation of the present study. Despite this limitation, the present study addresses the high prevalence of PTB and the significant impact of socioeconomic factors on maternal birth outcomes among Manipur Meitei women, particularly in Northeast India.

Conclusion

The Meitei women of Manipur, Northeast India, have a comparatively higher prevalence of PTB. Moreover, the present study highlights the significant correlations between the mother's socioeconomic factors and PTB. It is a need to understand the differential socioeconomic patterning with maternal health outcomes and the mechanism underlying such inequalities. Therefore, studies on PTB should focus on modifiable socioeconomic predictors to propose early implementation of preventive interventions among pregnant women who are at high risk for preterm delivery. Such community-specific studies may help prevent preterm delivery and later risk of cardiometabolic health problems in mothers. The present study is of the initial research; more in-depth large population-specific studies covering different risk factors will be needed to replicate and validate the results to develop population-specific interventional strategies.

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Conflict of Interest
None declared.

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