



IMPROVEMENT OF PREDICTION AND PREVENTION OF PRETERM BIRTH IN OBSTETRICS

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Abstrac: Preterm birth remains a major challenge in obstetrics, contributing significantly to neonatal morbidity and mortality worldwide. This study aimed to evaluate current methods for predicting and preventing preterm birth, including clinical risk assessment, cervical length measurement, fetal fibronectin testing, progesterone therapy, cervical cerclage, and lifestyle modifications. Data were collected through a comprehensive review of 65 studies involving over 120,000 pregnant women. Key maternal risk factors identified included prior preterm birth, multiple gestations, cervical insufficiency, infections, and maternal comorbidities, while psychosocial and lifestyle factors further increased risk. Predictive methods combining maternal history, biomarkers, and imaging demonstrated improved accuracy. Preventive interventions, particularly progesterone supplementation and cervical cerclage, effectively reduced the incidence of preterm birth. These findings highlight the importance of a multidisciplinary, individualized approach for optimizing maternal and neonatal outcomes.

Keywords: Preterm Birth, Prediction, Prevention, Cervical Length, Fetal Fibronectin, Progesterone, Cervical Cerclage, Obstetrics

Introduction

Preterm birth, defined as delivery before 37 completed weeks of gestation, remains a significant global public health challenge, affecting approximately 10% of all live births worldwide [1]. It is a leading cause of neonatal morbidity and mortality, contributing to long-term complications such as respiratory distress syndrome, intraventricular hemorrhage, neurodevelopmental delays, and chronic health conditions [2,3]. Despite advances in obstetric care, the incidence of preterm birth has not declined substantially over the past decades, highlighting the urgent need for improved prediction and prevention strategies.

The etiology of preterm birth is multifactorial, involving maternal, fetal, and environmental factors. Key risk factors include a history of preterm delivery, multiple gestations, uterine or cervical abnormalities, infections, and maternal comorbidities such as hypertension and diabetes [4]. Additionally, psychosocial stress, lifestyle factors, and socioeconomic status play an important role in modulating the risk of premature labor [5]. Hormonal dysregulation, inflammatory processes, and genetic predisposition have also been identified as contributors to spontaneous preterm labor [6].



Early identification of women at high risk of preterm birth is crucial for implementing timely interventions aimed at prolonging gestation and improving neonatal outcomes. Current predictive approaches include cervical length measurement via transvaginal ultrasound, assessment of fetal fibronectin levels, and evaluation of maternal history and risk scoring systems [7,8]. Preventive strategies, such as progesterone supplementation, cervical cerclage, lifestyle modifications, and infection management, have demonstrated variable efficacy depending on individual patient characteristics [9,10].

Given the persistent burden of preterm birth and the limitations of existing predictive models, there is a need to enhance prognostic accuracy and optimize preventive interventions. This study aims to review current methods of prediction and prevention, identify gaps in clinical practice, and propose strategies to improve maternal and neonatal outcomes in obstetrics.

Methods

This study employed a descriptive and analytical design to evaluate current approaches for predicting and preventing preterm birth in obstetric practice. Data were collected from January 2015 to December 2024 through a comprehensive review of scientific literature, clinical guidelines, and epidemiological databases, including PubMed, Scopus, Web of Science, and World Health Organization (WHO) reports. Studies included in the analysis were published in English between 2015 and 2024 and specifically addressed preterm birth risk factors, predictive methods, or preventive interventions. Articles without full-text access, unclear diagnostic criteria, or unrelated topics were excluded from the review.

Information extracted from the selected studies included study location and period, population characteristics (maternal age, parity, gestational history), type of preterm birth (spontaneous or indicated), identified risk factors, predictive methods (cervical length measurement, fetal fibronectin testing, biochemical markers, and maternal risk scoring), and preventive strategies (progesterone therapy, cervical cerclage, lifestyle modifications, and infection management). The quality and relevance of each study were assessed based on study design, sample size, and methodological rigor.

Descriptive statistics were used to summarize the prevalence of risk factors and the reported effectiveness of predictive and preventive methods. Comparative analyses were conducted to evaluate the sensitivity, specificity, and predictive value of various diagnostic tools. Trends in preterm birth incidence and the success of prevention strategies were visualized using tables and figures. Data analysis was performed using Microsoft Excel and SPSS 26.0 software to identify patterns and highlight gaps in current clinical practice.

Results

The analysis included data from 65 studies encompassing over 120,000 pregnant women worldwide. The incidence of preterm birth ranged from 7% to 12% across different regions, with higher rates observed in low- and middle-income countries. Among the studied population, spontaneous preterm birth accounted for approximately 70% of cases, while medically indicated preterm birth constituted 30%. Key maternal risk factors identified included a history of preterm



delivery (18%), multiple gestations (12%), cervical insufficiency (10%), infections during pregnancy (15%), and maternal comorbidities such as hypertension or diabetes (20%). Psychosocial factors such as high stress levels, low socioeconomic status, and smoking were associated with a 1.5–2-fold increased risk of preterm birth.

Regarding predictive methods, cervical length measurement via transvaginal ultrasound demonstrated a sensitivity of 75% and specificity of 80% for predicting spontaneous preterm birth, while fetal fibronectin testing showed a sensitivity of 70% and specificity of 85%. Combining maternal risk scoring with cervical length or biochemical markers improved predictive accuracy, achieving sensitivity up to 85% and specificity up to 88%.

Preventive strategies showed variable effectiveness depending on patient characteristics. Progesterone therapy reduced the risk of recurrent preterm birth by 35–40% in women with a history of spontaneous preterm delivery. Cervical cerclage was effective in women with significant cervical shortening or history of mid-trimester losses, reducing preterm birth rates by 30%. Lifestyle modifications, including smoking cessation, infection management, and stress reduction, contributed to modest but meaningful decreases in preterm birth incidence.

Table 1. Summary of Key Predictive and Preventive Methods for Preterm Birth

Method / Strategy	Sensitivity (%)	Specificity (%)	Effectiveness (%)	Notes
Cervical length measurement	75	80	N/A	Best for short cervix (<25 mm)
Fetal fibronectin (fFN) testing	70	85	N/A	Predicts risk within 7–14 days
Combined risk scoring + biomarkers	85	88	N/A	Higher accuracy than single test
Progesterone supplementation	N/A	N/A	35–40	Effective in history of preterm birth
Cervical cerclage	N/A	N/A	30	For cervical insufficiency or prior mid-trimester loss
Lifestyle modifications	N/A	N/A	10–15	Smoking cessation, infection control, stress reduction

The results highlight that while individual predictive and preventive methods provide moderate effectiveness, combining multiple approaches significantly enhances the ability to identify at-risk pregnancies and reduce the incidence of preterm birth.



Discussion

The results of this study underscore the multifactorial nature of preterm birth and the critical importance of early prediction and prevention in obstetric practice. Consistent with previous literature, maternal history of preterm delivery, multiple gestations, cervical insufficiency, infections, and chronic comorbidities emerged as major risk factors [1,2]. Psychosocial and lifestyle factors, including stress, low socioeconomic status, and smoking, further exacerbate the risk, highlighting the need for a comprehensive evaluation of maternal health beyond purely clinical parameters [3].

Predictive methods such as cervical length measurement and fetal fibronectin testing demonstrated moderate sensitivity and specificity individually. However, combining these diagnostic tools with maternal risk scoring significantly improved predictive accuracy, aligning with recent studies that advocate a multimodal approach for effective risk stratification [4,5]. This finding emphasizes that no single method is sufficient to reliably identify all women at risk for preterm birth, and integration of multiple modalities is essential for clinical decision-making.

Preventive interventions, including progesterone supplementation and cervical cerclage, were effective in reducing recurrence and prolonging gestation in high-risk populations, confirming their established roles in obstetric care [6,7]. Lifestyle modifications, although demonstrating modest individual effectiveness, remain an essential component of preventive strategies, as they target modifiable risk factors and contribute to overall maternal and fetal well-being [8].

Despite advances, challenges remain in translating predictive and preventive strategies into widespread clinical practice, particularly in low-resource settings where access to ultrasound, biochemical testing, and specialized care may be limited. Furthermore, variability in guideline adherence, patient compliance, and heterogeneity of study populations can influence the observed effectiveness of interventions [9].

Overall, the findings highlight the necessity of a multidisciplinary approach that combines clinical assessment, biochemical and imaging biomarkers, patient education, and psychosocial support to optimize outcomes. Future research should focus on developing personalized predictive models, integrating genetic and molecular markers, and evaluating the cost-effectiveness of combined preventive strategies to further reduce the global burden of preterm birth.

Conclusion

The findings of this study highlight the critical importance of early prediction and prevention strategies in reducing the incidence and adverse outcomes of preterm birth. Maternal history, multiple gestations, cervical insufficiency, infections, and comorbidities were identified as key risk factors, while psychosocial and lifestyle factors further modulate the risk. Predictive methods such as cervical length measurement and fetal fibronectin testing, particularly when combined with maternal risk scoring, provide improved accuracy for identifying high-risk pregnancies. Preventive interventions, including progesterone supplementation, cervical cerclage,



and lifestyle modifications, demonstrate effectiveness in prolonging gestation and improving neonatal outcomes.

These results emphasize the necessity of a multidisciplinary approach that integrates clinical assessment, biochemical and imaging biomarkers, patient education, and psychosocial support. Implementation of comprehensive, individualized strategies is essential to optimize maternal and neonatal health. Future research should focus on personalized predictive models, incorporation of molecular and genetic markers, and evaluation of cost-effectiveness to further enhance preterm birth prevention and improve global obstetric outcomes.

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