**ORIGINAL ARTICLE**

# The Maternal Risk Factors for Preterm Birth in Universitas Airlangga Hospital Surabaya in 2017-2018

## Almira Maharani[1], Aditiawarman Aditiawarman[2], Widati Fatmaningrum[3]

[1]Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.

[2]Department of Obstetric and Gynecology, Faculty of Medicine, Universitas Airlangga/Dr. Soetomo General Hospital, Surabaya, Indonesia.

[3]Department of Public Health and Preventive Medicine, Universitas Airlangga, Surabaya, Indonesia.

## A B S T R A C T

**Introduction:** Preterm birth becomes a global problem due to its high rate of morbidity and mortality. In 2010, it is estimated approximately 15 premature birth cases per 100 lives birth in Indonesia. This study aimed to analyze the maternal risk factors towards preterm birth at Universitas Airlangga Hospital Surabaya in 2017-2018.

**Methods:** This was observational analytic study using case-control approach to observe 178 medical records at Universitas Airlangga Hospital Surabaya. The population of this study was women who had preterm and aterm birth. The sample consisted of case group and control group which were convenient to exclusion and inclusion criteria. Univariate analysis was used to observe the relationship between dependent and independent variable. The significance value was p ≤ 0.05. The data were analysed using SPSS.

**Results:** The research samples consisted of 89 case groups and 89 control groups. The case sample characteristic showed that 36% patients had overweight BMI; 62.9% patients had normal/hypotension; 69.7% patients gave birth to male baby; and 82% patients had no history of disease. There was no patient who used drugs and substance abuse (0%). Mothers aged 20 years old and older than 35 years old had OR = 2.13 (95% CI : 1.106-4.11) to become preterm birth. The primiparous women had risk for preterm birth 2.978 folds (95%, CI : 576-5.625) higher.

**Conclusion:** There was a relationship between maternal age and parity to preterm birth. There was no relationship between maternal education, maternal occupation, hemoglobin levels, history of obstetric complications, and multiple pregnancy to preterm birth.

## A R T I C L E I N F O

## Introduction

Preterm birth becomes a global problem due to its high rate of morbidity and mortality. According to World Health Organization (WHO) in 2018, pereterm birth rate in both Africa and South Asia were more than 60%.[1] Nowadays, Indonesia ranks the 5th place of the highest premature birth rate. In 2010, it is estimated approximately 15 premature birth cases per 100 live birth.[2] There are several factors that affect preterm delivery, such as idiopathic, iatrogenic, infection, multiple pregnancy, maternal factors, reproductive history, and sociodemographic.[2]

Premature infants have a high risk of mortality and morbidity. In 2015, it was considered that main causes of neonatal deaths in Indonesia were prematurity (35.5%), birth asphyxia (21.6%), and congenital anomalies (17.1%).[2] Preterm birth could be associated with seven developmental disabilities (cerebral palsy, autism spectrum disorder, intellectual disability, behavioral-conduct disorders, attention deficit hyperactivity disorder, learning disability) and other developmental delay.[3]

The high-risk maternal age might affect preterm birth due to the maternal-fetal competition for nutrients, the incomplete physical growth, and pregnancy-related hypertensive disorders.[4,5] Maternal education and occupation might be related to preterm birth. Both of these sociodemographic factors might induce preterm birth by stress-related pathological pathway.[6,7] Anemia causes preterm by increasing stress hormones, including norepinephrine and cortisol.[8] The history of obstetric complication such as recurrent preterm birth and abortions might cause cervical insufficiency and induce preterm birth.[9] Primiparity has a higher risk of pregnancy-induced hypertension.[10] Multiple pregnancy causes spontaneous preterm birth through several mechanisms, such as intrauterine infection, cervical insufficiency, and uterine stretch/distension.[11]

Some studies conducted in Indonesia had already found that sociodemographic, hemoglobin levels, previous obstetric history, parity, and multiple pregnancies might affect preterm birth.[12–16] This analysis has not been conducted for the last 3-5 years in Surabaya. This study aimed to identify and analyze the maternal risk factors towards preterm birth at Universitas Airlangga Hospital Surabaya. Hence, there would be feasibility to decrease and prevent preterm delivery incidence and morbidity if the risk factors were identified and detected earlier.

## Methods

This was an observational analytic study using case control approach to analyze the underlying risk factors of preterm birth. The independent variables were maternal age, maternal education, maternal occupation, haemoglobin levels, history of obstetric complications, parity, and multiple pregnancy. The dependent variable was preterm birth. The population of this study was women who gave birth before 37 weeks of pregnancy (preterm) and 37-40 weeks of pregnancy (at term) at Universitas Airlangga Hospital Surabaya in 2017-2018. This study was conducted from May 2019 to April 2020.

The study was approved by Ethical Committee of Universitas Airlangga Hospital Surabaya (number 188A/KEH/2019) with written consent to conduct data collection. The sampling technique used random sampling which obtained medical records from Universitas Airlangga Hospital Surabaya in 2017-2018 which fulfilled the inclusion and exclusion criteria. The inclusion criteria of case group were: a) Preterm birth cases <37 weeks; b) Spontaneous preterm birth cases; c) Willing to take part in the study. Meanwhile the exclusion criteria of case group were: a) The medical record could not be read due to incompleteness and damage; b) Iatrogenic preterm birth cases; c) Infection (genital, intrauterine, extrauterine/ systemic). However, the inclusion criteria of control group were: a) A term birth cases 37-40 weeks; b) Spontaneous delivery; c) Willing to take part in the study. The exclusion criteria of control group were: a) The medical record could not be read due to incompleteness and damage; b) Infection (genital, intrauterine, extrauterine/ systemic); c) A delivery with indicated termination.

By using Lameshow's formula, the total of the sample based on calculation was 178 samples consisted of 89 case groups and 89 control groups. The instruments of this study were medical record and registered data. Data collected was arranged in the form of a table by using Microsoft Excel 2019. All independent and dependent variables were documented, processed, and presented in the form of tables. The descriptive statistical analysis was performed on each variable in the form of mean, standard deviation, and median. Data analysis was performed by chi square test with a significance value of $p \leq 0.05$. The statistical analysis was calculated by SPSS.

## Results

### Sample Characteristics

Based on the collected data, the sample was characterized based on: maternal age, maternal education, maternal occupation, hemoglobin levels, parity, multiple pregnancy, body mass index, blood pressure, fetal sex, history of obstetric complication (previous abortion and preterm birth), history of the disease, and drugs/substance/smoke used. The study samples had a variation of the gestational period from 31 weeks to 40 weeks with average gestational period of 37 weeks.

Table 1. Sample characteristics of the patient who gave birth at term and preterm in Universitas Airlangga Hospital Surabaya in 2017-2018

| Characteristics | Preterm | Aterm |
|---|---|---|
| | n (%) | n (%) |
| **Body Mass Index** | | |
| Underweight (<18.5) | 9 (10.1) | 4 (4.5) |
| Normal (18.5-22.9) | 27 (30.3) | 26 (29.2) |
| Overweight (23-27.4) | 32 (36.0) | 24 (27.0) |
| Obese (≥27.5) | 21 (23.6) | 35 (39.3) |

| | | |
|---|---|---|
| **Blood Pressure** | | |
| Hypertension | 33 (37.1) | 24 (27.0) |
| Normal/Hypotension | 56 (62.9) | 65 (73.0) |
| **Fetal Sex** | | |
| Male | 62 (69.7) | 41 (46.1) |
| Female | 27 (30.3) | 48 (53.9) |
| **History of disease** | | |
| Yes | 16 (18) | 18 (20.2) |
| No | 73 (82) | 71 (79.8) |
| **Drugs and substances abuse (tobacco/ alcohol)** | | |
| Yes | 0 (0) | 2 (2.2) |
| No | 89 (100) | 87 (97.8) |

The average weight and height for the case group were 57.36 kg and 153.75 cm. Meanwhile, the average weight and height for the control group were 61.64 kg and 153.6 cm. The case group most likely had overweight body mass index, i.e. 36% (32 women). The control group most likely had obese body mass index, i.e. 39.3 % (35 women). The proportion of hypertension In the case group was higher than the proportion in the control group (37.1% and 27%). The male live birth in case group was higher than the proportion in the control group (69.7% and 46.1%). The women with history of disease in the case group had lower proportion than in the control group (18% and 20.2%). The proportion of women with drugs or substances abuse (tobacco/alcohol) in the case group was lower than the control group (0% and 2.2%).

**Univariate Analysis of the Sample**

Table 2. Sample analysis of the patient who gave birth at term and preterm in Universitas Airlangga Hospital Surabaya in 2017-2018

| Characteristics | Preterm N (%) | Aterm N (%) | p-value | Odds Ratio (95%CI) |
|---|---|---|---|---|
| **Maternal Age** | | | | |
| <20 or >35 years old | 34 (38.2) | 20 (22) | 0.0 | 2.13 (1.106-4.11) |
| 20-35 years old | 55 (61.8) | 69 (77) | | |
| **Maternal Education** | | | | |
| Low educational background | 26 (29) | 1 (18) | 0.16 | 1.883 (0.927-3.823) |
| Moderate to high educational background | 63 (7...) | 73 (82) | | |
| **Maternal Occupation** | | | | |
| Unemployment and housewife | 64 (7...9) | 52 (58...) | 0.0 | 1.822 (0.974-3.405) |
| Employee (private/government) or entrepreneur | 25 (21) | 37 (4...) | | |
| **Hemoglobin Levels** | | | | |
| Anemia | 13 (16...) | 22 (24...) | 0.1 | 1.91 (0.89-4.09) |
| Non-anemia | 76 (84) | 67 (75...) | | |
| **Previous obstetric history** | | | | |
| No complication | 78 (87.6) | 75 (84) | 0.6 | 1.324 (0.565-3.10) |
| With complication | 11 (12.4) | 14 (15) | | |
| **Parity** | | | | |
| Primiparity | 44 (4...) | 20 (22...) | 0.0 | 2.978 (1.576-5.625) |
| Multiparity | 45 (5...) | 67 (75.3) | | |
| **Multiple pregnancy** | | | | |
| Single | 87 (9...) | 89 (100) | 0.4 | - |
| Multiple/ gemelli | 2 (2...) | 0 | | |

Maternal age had an impact to preterm birth. The Chi-Square p-value was 0.034, which showed a significant relationship. The patients under 20 years old and above 35

years old might have 2.13 times higher of preterm birth risk compared to the low-risk maternal age (95%, CI: 1.106-4.11).

The patients with high educational background had a higher preterm birth percentage compared to the patients with low educational background (70.8% and 29.2%.). The Chi-Square p-value was 0.112, showing there was no significant relationship.

The patients who had no occupation (unemployment/housewife) also had a higher percentage of a preterm delivery compared to the patients who had an occupation (private employee/ government employee/ entrepreneur), namely 71.9% and 28.1%, respectively. The Chi-Square p-value was 0.084, meaning that the maternal occupation did not have a significant relationship to preterm birth.

From the sample analysis of the patient who had term and preterm birth as shown in Table 2, it was found that there was no significance relationship between hemoglobin levels to preterm birth since the p-value was 0.131. The non-anemia hemoglobin levels (≥11 gr/dl) patients had a higher preterm birth percentage, i.e. 85.4% compared to the patients with anemia hemoglobin levels (≤11 gr/dl ), i.e. 14.6%.

The patients with no history of obstetric complication (first pregnancy/aterm) had a higher preterm birth percentage, i.e. 87.6% compared to the patients with history of obstetric complication (abortion/preterm),i.e. 12.4%. The Chi-Square p-value was 0.666, meaning there was no significant relationship.

Primiparity was related factor to preterm birth. The Chi-Square p-value was 0.001, showing there was a significant difference. Primiparity might have 2.978 times higher for preterm birth (95%, CI: 1.576-5.625) compared to multiparity. The percentage of primiparity patient who had preterm birth was 49.4%. However, the percentage of multiparity patient who had preterm birth was 50.6%.

The patients with single pregnancy had a higher preterm birth percentage, i.e. 97.8% compared to the patients with multiple pregnancy/Gemelli/twin, i.e. 2.2%. The Chi-Square p-value was 0.477, showing there was no significant difference.

## Discussion

This study concluded maternal age as the risk factor for preterm birth at Universitas Airlangga Hospital Surabaya. A significant risk was found in patients younger than 20 years old or older than 35 years old (OR = 2.13). The number of preterm birth cases in those extreme ages (below 20 years old or above 35 years old) was higher. According to previous study, the pathophysiology which was related in young maternal age included impaired vascular adaptation and physical immaturity.[5] However, mothers aged above 40 years old increased risk of preterm birth, pregnancy-related hypertension, gestational diabetes mellitus, caesarian section, abnormal fetal presentation,

and fetal periventricular leukomalacia. Furthermore, older women have low levels of progesterone.[5]

Mothers aged 30-34 years old have the lowest risk of preterm birth. Younger-aged women (20-24 years old) have 1.09 times higher risk of spontaneous preterm birth. Moreover, older women (>40 years old) is related and have a significant risk of preterm birth, i.e. 1.20 times.[17] A significant risk was found in maternal age younger than 20 years old (AOR = 2.00) or ≥40 years old (AOR = 1.13).[18]The increased maternal age was followed by the risk of very preterm birth. It was found that adjusted ORs ranged from 1.18 to 1.28 at 30-34 years old, from 1.59 to 1.70 at 35-39 years-old, and from 1.97 to 2.40 at ≥40 years-old. Women aged 35 years old and older have a significant risk of very preterm birth in their first, second, or third births.[19]

The odd ratio of preterm birth among patients with junior senior high school and higher educational background was higher compared to patients with junior high school and lower educational background (OR = 1.883). The case group patients most likely had moderate to high educational background. From the data analysis using Chi-Square test, there was no relationship between maternal education and preterm birth at Universitas Airlangga Hospital Surabaya.

According to previous studies, late preterm birth is more likely to happen due to obstetrically-induced. The more educated women have more access to obstetrical services, obstetrical interventions, and elective cesarean sections. The risk preterm birth among women less than 12 years of education decreased slightly from 10.5% to 10.0%. Women with senior high school, diplomas, or greater educational backgrounds have a higher risk of preterm birth, increasing from 4.6% to 7.2%.[6]

The number of patients who had no occupation (unemployment/housewife) had higher risk of preterm birth than the patients who had occupation (employee/entrepreneur) (OR = 1.822). From the data analysis, maternal occupation was not related to preterm birth. The higher percentage of preterm birth was found in women with no occupation (unemployment/housewife) compared to women who had occupation (employee/ entrepreneur).

According to previous studies, employed women have a higher risk of preterm birth due to physical fatigue and emotional stress that cause premature rupture of membranes and induce preterm birth.[2] The new studies stated that unemployed women/housewife is more exposed by emotional stress and heavy physical work. The employed women group might have higher social economic status compared with the non-employed group. A good social-economic status might have a good outcome of pregnancy.[7]

Employed women had lower risk of preterm birth than unemployed women (OR = 0.86). Maternal education was related with maternal socioeconomic status. Furthermore, occupation was strongly associated with social position.[7] However, another study stated that women who work more

than 42 hours a week have a moderate excess risk of preterm birth (OR = 1.33). Women who work more than six hours a day (OR = 1.26) and women with low job satisfaction (OR = 1.27) have a lower risk of preterm birth.[19]

From this study, maternal hemoglobin levels were not related to preterm birth. The patients with hemoglobin levels below and equal to 11 gr/dl (anemia) had lower frequencies of preterm birth compared to the patients with hemoglobin levels above and equal to 11 gr/dl (non anemia). The odd ratio of non-anemia patients was higher than anemia patients (OR = 1.91).

According to the analytical study conducted in Jharkhand, anemia has a strong association with preterm birth. The risk of preterm birth might increase following the severity of anemia (OR = 3.42).[20] However, some recent studies concluded only anemia in the first or second trimester is related to low birth weight, preterm birth, and perinatal and neonatal mortality.[21] Hemoglobin levels which are equal and below 5 g/dl in the first trimester have a higher risk for preterm rupture of membrane that might induce preterm birth (HR = 3.3). Low hemoglobin level in the third trimester due to hemodilution was related to a reduced risk of spontaneous preterm labor. Moreover, only hemoglobin levels which are below and equal to 7 gr/dl in the late pregnancy were associated with and slightly increased risk of preterm birth.[22] Anemia iron deficiency in the third trimester might be associated with a lower risk of preterm birth (OR = 0.53).[22]

Correlating to the newest study, this study concluded that hemoglobin levels did not appear as the main risk factor for preterm birth at Universitas Airlangga Hospital Surabaya. However, the hemoglobin levels data was taken during the late pregnancy with hemoglobin levels cut off was below and equal to 11 gr/dl. In this trimester, it could be hard to identify the relationship between anemia and preterm birth due to hemodilution.

From the obtained data, the number of preterm birth cases in the patients with complications (abortion/preterm) was lower compared to the patients with no complications (first pregnancy/aterm). There was no relationship between obstetric history and preterm birth at Universitas Airlangga Hospital Surabaya. It was found that higher risk of preterm birth was in women with no complications (first pregnancy/aterm) in comparison with women with complications (abortion/ preterm) (OR = 1.324).

In this study, the history of obstetric complications was defined as a previous pregnancy complication, i.e. abortion/preterm birth. The recurrent preterm birth is related to the black race, short interpregnancy interval, illicit drug use, pre-existing and gestational hypertension, pre-existing diabetes, UTI, and cervical insufficiency. The spontaneous preterm birth that is induced by previous abortions might be caused by infection and vascular complications.[23]

However, due to some clinical interventions, it was found that no statistical difference in spontaneous preterm birth for women with previous spontaneous preterm birth ≥ 24 weeks. However, there was a significant decrease for women with prior second-trimester spontaneous preterm birth (15.4 and 43.2%). The decrease was found after adjusting for age and 17-hydroxyprogesterone caproate use.[10] It showed a significant reduction in high-risk singleton pregnancy that was screened for bacterial vaginosis by using Nugent score and clindamycin treatment (RR = 0.64).[24]

Previous induced abortion was not related to increased risk of preterm birth (OR = 0.80). According to epidemiological studies, endometritis due to the result of traumatic procedures might be responsible.[25] The risk of preterm birth after miscarriage was higher than induced abortion (RR = 0.85).[26] Women with previous abortion might have lower risk of preterm birth, i.e. 0.920 times. This reduction might happen due to the increase of woman's awareness in subsequently pregnancy.[27]

The higher number of preterm birth cases was found in primiparity patients compared to aterm birth. This study concluded that parity appeared as one of the risk factors of preterm birth at Universitas Airlangga Hospital Surabaya. Moreover, primiparity was a strongest risk factor with 2.978 times odds ratio.

Primiparity had a higher risk of pregnancy-induced hypertension, fetal distress, and oligohydramnios that might induce preterm birth. Preterm birth cases commonly happened in the first pregnancy.[10] The risk of preterm birth was found lower up to parity of four. The earlier findings were confirmed by a study in Abu Dhabi, which found no increase in preterm birth cases with parity of ten and higher compared to parity less than five.[2]

The percentage of single pregnancy patients was found higher in case group compared to multiple pregnancies patients. It was concluded that multiple pregnancy was not related to preterm birth at Universitas Airlangga Hospital Surabaya. According to another study, the complications which commonly happened in twin and triplet gestations were preterm birth (49%), gestational diabetes mellitus (13.3%), and premature rupture of membrane (4.8%). About 42% twin and all of the triplet pregnancies were terminated in preterm birth.[28]

According to a study conducted in Kosovo, the frequency of premature birth in twin pregnancy was very high. Approximately 63% of twin pregnancies were delivered before term and through caesarean section.[29] This study excluded the non-spontaneous preterm birth. However, gemelli is more likely to be delivered through caesarean section.

Some studies regarding clinical intervention of multiple gestations might show the reduced of preterm The screening of cervical length at mid-pregnancy might predict preterm birth and give preventive strategy. Women who have cervical length ≤25 mm in mid-semester might have a higher risk of preterm birth before 28 weeks. Pessary as the prevention might reduce spontaneous preterm delivery in women with a multiple pregnancy and short cervix (<25 mm) (RR = 0.41).[24] However, the reduction of preterm birth in multiple pregnancy was found by using tocolytic agent

for at least 48 hours among threatened preterm labor groups of 93.8%.[30]

## Conclusion

There was a relationship between maternal age and parity to preterm birth at Universitas Airlangga Hospital Surabaya. The patients younger than 20 years old and older than 35 years old might have 2.13 times higher of preterm birth compared to patients aged 20-35 years old. The primiparous patients might have 2.978 times higher of preterm birth than multiparous and became the strongest factor which had the highest risk of preterm birth. However, there was no relationship between maternal education, maternal occupation, hemoglobin levels, history of obstetric complications, and multiple pregnancy to preterm birth. Another maternal factor, fetal factor, and nutrition factor might be related and affect preterm cases. However, it was not observed in this study.

## Acknowledgments

## CONFLICT OF INTEREST

The author stated there is no conflict of interest in this study.

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