

## The Decomposition of Socioeconomic Factors in Inequality in Preterm Birth; the Results of a Cohort Study Based on the Concentration Index Approach

Ashraf Direkvand-Moghadam<sup>1</sup>, Safoura Taheri<sup>2</sup>, \*Yousef Veisani<sup>3</sup>

<sup>1</sup>MSc, Mphil, PhD in Reproductive Health, Department of Midwifery, Faculty of Nursing and Midwifery, Psychosocial Injuries Research Center, Ilam University of Medical Sciences, Ilam, Iran. <sup>2</sup>Assistant Professor in Reproductive Health, Department of Midwifery, School of Nursing and Midwifery, Ayatollah Taleghani Hospital, Ilam University of Medical Sciences, Ilam, Iran. <sup>3</sup>MSc, Mphil, PhD in Epidemiology, Psychosocial Injuries Research Center, Ilam University of Medical Sciences, Ilam, Iran.

### Abstract

**Background:** Preterm labor is a crucial factor in neonatal morbidity and mortality. The present study aims to investigate the effects of Socioeconomic Status (SES) on preterm birth and to decompose the main inequalities affecting preterm birth.

**Materials and Methods:** In a cohort study in 2017, 458 pregnant women in Ilam, Iran, were followed from the 20th gestational week up to the labor. All participants were followed up according to the Prenatal Care Schedule approved by the Ministry of Health of the Islamic Republic of Iran from the beginning to the end of the study. The results of participants' laboratory tests were collected based on the records from their pregnancy documents. A code was inserted in the prenatal care booklet of each participant for exchanging information between the researcher and participants. The Concentration Index (CI) was used to determine inequality. The Inequality Index was decomposed to find out the main sources of inequality in preterm infants. Distributive Analysis Stata Package was used for estimating CI.

**Results:** Of the total of 458 participants, 12% had preterm labor. The number of male newborns was 219 (47.8%). Also, the prevalence of preterm labor was more in mothers aged 20 to 31 years ( $p < 0.001$ ), housewives ( $p=0.037$ ), and women with lower socioeconomic status ( $p < 0.001$ ). The socioeconomic contributors to inequality were the mother's age ( $p=0.008$ ), father's age ( $p=0.005$ ), father's education ( $p=0.003$ ), and father's job ( $p < 0.001$ ). The main factors of inequality were mother's age (8%), father's age (3%), father's education (5%), and father's job (25%).

**Conclusion:** Overall, 12% of our study population had preterm labor. Preterm birth was significantly more observed among mothers of lower socioeconomic status. Some SES, including the mother's age, father's age, father's education, and father's job, were important factors in preterm inequality among Iranian mothers.

**Key Words:** Concentration index, Inequality, Preterm, Socio-Demographic Status.

\*Please cite this article as: Direkvand-Moghadam A, Taheri S, Veisani Y. The Decomposition of Socioeconomic Factors in Inequality in Preterm Birth; the Results of a Cohort Study Based on the Concentration Index Approach. Int J Pediatr 2020; 8(11): 12431-438. DOI: [10.22038/ijp.2020.45958.3746](https://doi.org/10.22038/ijp.2020.45958.3746)

### \*Corresponding Author:

Dr Yousef Veisani, MSc, MPhil, Ph.D. of Epidemiology, Psychosocial Injuries Research Center, Ilam University of Medical Sciences, Ilam, Iran. Ilam-Iran I.R. PO Box: 69311-63545

Email: [yousefveisani@yahoo.com](mailto:yousefveisani@yahoo.com)

Received date: Feb.14, 2020; Accepted date: Apr. 22, 2020

## 1- INTRODUCTION

According to the World Health Organization (WHO), preterm labor is defined as the termination of pregnancy before the end of the 37th week of gestation or less than 295 days from the last menstrual period. The global prevalence of preterm birth is 9-12% (1). Preterm labor is the most important factor in neonatal morbidity and mortality worldwide. According to the statistics released in 2016, complications of preterm birth are the most common causes of death in children younger than five years (2). It is estimated that 75% of neonatal deaths have occurred during the first week of life. Preterm birth complications occur not only in the neonatal period, but adults who were born preterm also have an increased risk of medical conditions including: hypertension, mental health disorders, chronic respiratory disease, and neurological and learning disabilities (3).

According to WHO, 17% of all deaths in children under five years are attributed to prematurity (4). Also, the prevalence of preterm labor has been increased from 36% in 1990 to 43% in 2011(5). Numerous factors, including maternal age, primiparous births, Preterm Rupture Of Membrane (PROM), previous preterm birth, previous cesarean section, pre-eclampsia, and antepartum hemorrhage have been reported as risk factors for preterm labor (6). However, the etiology of preterm labor is often multifactorial and not well understood.

The Socio-Demographic Status (SES) has also been introduced as one of the effective factors on the prevalence and outcomes of preterm labor (7-9). Different results have been obtained related to SES and preterm mothers (9, 10). It is also well known that obstetric interventions in preterm labor, including maternal complications due to pre-eclampsia, placental abruption, growth restriction, and fetal compromise are risk factors for

spontaneous preterm birth in older mothers (11). The relationship between paternal age, mother's job (12), family income (11), and preterm labor has been reported in previous studies. Considering the relationship between preterm birth and neonatal mortality and long-term morbidity, identifying the risk factors of preterm labor is necessary. The present study investigated the prevalence and decomposition of socioeconomic factors of inequality in preterm birth.

## 2- MATERIALS AND METHODS

### 2-1. Study design and population

A cohort study was carried out to investigate the effects of SES on preterm birth and also to decompose the main inequalities determinant on preterm birth. The study was conducted among 458 pregnant women from the 20th week of gestational age up to the time of labor. All participants were referred to the Mostafa Khomeini Hospital, the only maternity hospital in Ilam, Iran, in 2017. The sample size was calculated based on the prevalence of preterm labor (10%) in previous studies (13), and other considerations in estimating the sample size in cohort studies.

### 2-2. Method

The participants were divided into two groups based on the gestational age: one group was consisted of the full-term labor with GA of more than 37 weeks, and the other consisted of either spontaneous preterm labor or compulsory terminated pregnancies before the end of the 37th week of LMP. The preterm labor included several sub-groups of  $GA \leq 28$  weeks, 29 to 32, and 33 to 37 weeks (14).

### 2-3. Measuring tool

A questionnaire was made by researchers and used to collect the data. The validity of the questionnaire was confirmed by the content validity method and approved by

an expert panel. All the required information on socioeconomic status and medical and fertility history of mothers were collected by this questionnaire. The participants' laboratory test results were collected based on their pregnancy documents. A code was inserted in the prenatal care booklet of each participant for exchanging information between the researcher and participants.

#### **2-4. Intervention**

All participants were followed up according to the Prenatal Care Schedule, approved by the Ministry of Health of the Islamic Republic of Iran from the beginning to the end of the study.

#### **2-5. Ethical consideration**

The study was approved by the Ethics Committee of Ilam University of Medical Sciences, Iran. All participants were free to accept or refuse to participate in the study. Only the required information were collected by anonymous questionnaires (ID-Cod: 953006/70).

#### **2-6. Inclusion and exclusion criteria**

The inclusion criteria were the gestational age of more than 20 weeks from the Last Menstrual Period (LMP) and ultrasonography confirmation of the first trimester. The exclusion criteria were any maternal genetic or medical disorder that could lead to a compulsory early termination of pregnancy and exposure to sudden and severe maternal stress during pregnancy.

#### **2-7. Data Analyses**

The concentration index (CI) was used to determine the inequality (15). The inequality index was decomposed to find

out the main sources of inequality in preterm infants. All  $p$  values  $< 0.05$  were considered statistically significant. Distributive Analysis Stata Package (DASP) was used for estimating CI. Data were analyzed by state computer software version 12 (StataCorp, College Station, TX, USA).

### **3- RESULTS**

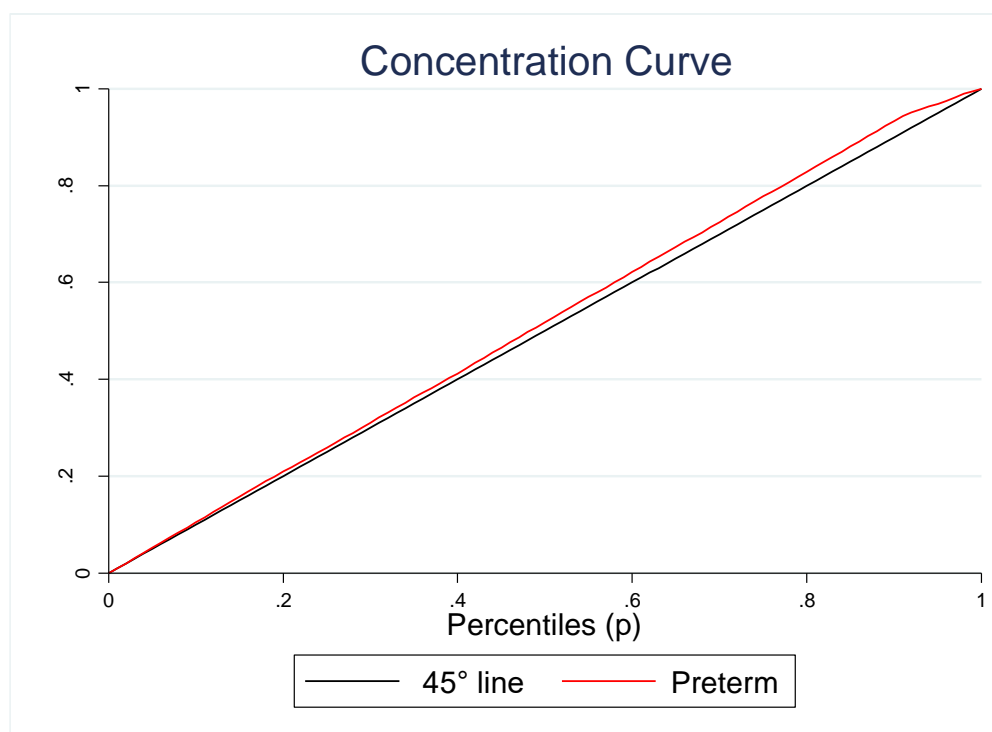
A total of 458 participants were divided into two groups to investigate the effects of socioeconomic factors on preterm labor. From among the participants, 402 (88%) had full-term labor with a GA of more than 37 weeks that take part in full-term. In preterm births, 53 of mothers had a GA between 29 to 32 weeks, and 3 had a  $GA \leq 28$  weeks that take part in preterm. Of all newborns, 219 were male (47.8%), and 239 were female (52.2%). The majority of mothers were 21 to 30 years old (255 or 55.6%), and 317 (69.2%) of them were housewives. Regarding gender, the ratio of male preterm infants (76.8) was more than females (23.2), ( $p < 0.001$ ).

Preterm labor is more prevalent in mothers aged 20 to 31 years (75.0) ( $p < 0.001$ ), and housewives (46.4) ( $p=0.037$ ). Higher rates of preterm labor were observed in lower socioeconomic groups ( $p < 0.001$ ). Overall, 54 (96.4%) of preterm labors occurred in mothers from the first three levels of socioeconomic status (**Table.1**).

The socioeconomic inequality curve for preterm labor is shown in **Figure.1**. The CI for preterm labor was -0.019 (95% CI; -0.032, -0.006); therefore, the results show inequality in preterm labor due to the socioeconomic status (**Figure.1**).

**Table-1:** characteristics of infants according to preterm and full-term outcome of delivery.

Variables	Preterm (n=56)	Full-term, (n=402)	P-value*
<b>Gender</b>			
Male	43 (76.8)	176 (43.8)	<0.001
Female	13 (23.2)	226 (56.2)	
<b>Mother Age</b>			
21-30	42 (75.0)	213 (53.0)	<0.001
31-40	14 (25.0)	189 (47.0)	
<b>Mothers Job</b>			
Housewife	26 (46.4)	291 (72.4)	0.037
Marketer	4 (7.1)	62 (15.4)	
Non-government employees	0 (0.0)	24 (6.0)	
Government employees	26 (46.4)	25 (6.2)	
<b>Status of house ownership</b>			
Yes	51 (91.1)	263 (65.4)	<0.001
No	5 (8.9)	139 (34.6)	
<b>Socioeconomic Status</b>			
Lowest	2 (3.57)	62 (15.42)	<0.001
Second-to-lowest	19 (33.93)	315 (72.93)	
Middle	33 (58.93)	19 (4.73)	
Second-to-highest	1 (1.79)	0 (0.0)	
Highest	1 (1.79)	6 (1.49)	



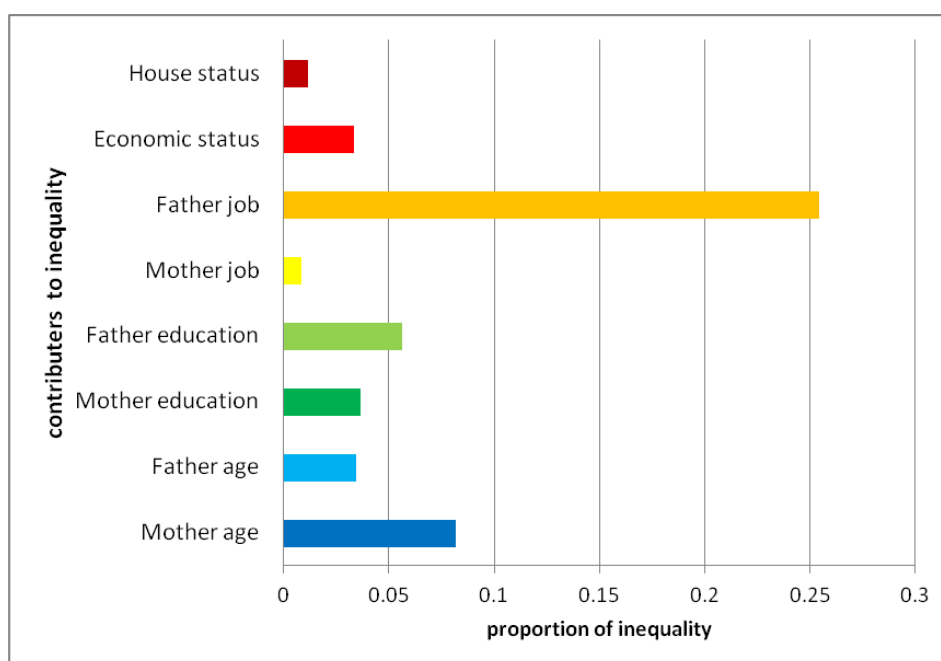
**Fig.1:** Concentration curve preterm according to main socioeconomic contributors.

The CI has been decomposed to investigate the main socioeconomic contributors to inequality in preterm labor. The important socioeconomic contributors to inequality were the mother's age ( $p=0.008$ ), father's age ( $p=0.005$ ), father's

education ( $p=0.003$ ), and father's job ( $p<0.001$ ) (**Table.2**). According to CI decomposition, the main sources of inequality were mother's age (8%), father's age (3%), father's education (5%), and father's job (25%) (**Figure.2**).

**Table 2:** The main socioeconomic contributors to preterm according to decomposing of inequality line.

Variables	Preterm birth				
	t-value	P- value	Elasticity	Concentration index	Contributions
Mother age	2.64	0.008	0.30	-0.01	0.081
Father age	-2.80	0.005	-0.39	-0.02	0.034
Mother education	-1.53	0.128	-0.08	0.08	0.036
Father education	2.96	0.003	0.11	0.09	0.056
Mother job	-0.25	0.802	-0.00	0.16	0.008
Father job	-4.37	0.000	-0.11	0.15	0.254
Economic status	1.36	0.173	0.22	0.03	0.033
House status	-1.30	0.194	-0.029	-0.05	0.011
Residual	16.04	0.000	0.000	-	0.480
Total					1.00



**Fig.2:** Proportion of inequality by socioeconomic contributions.

#### 4- DISCUSSION

Every year, approximately 15 million preterm births occur worldwide (16). One million infants die every year from complications of preterm birth (17). Due to the urgency of preterm labor and its negative economic and social effects, the present study was conducted to evaluate the socioeconomic contributors to preterm labor in Ilam, Iran (2017). A large number of preterm labor (5 -18%) has also been reported in different countries (18). In our study, 402 (88%) of all participants had full-term, and 56 (12%) had preterm labor. So far, many suggestions have been made regarding the contributing factors to preterm labor. Maternal medical problems and congenital malformations have been suggested as the most important causes of preterm labor (19). About two thirds of all preterm labors in our study occurred in the case of housewives. Another Iranian study has confirmed that being a housewife is a positive contributor to the measured inequalities in preterm labor (12).

Based on our results, the age of both parents is an important socioeconomic contributor to inequality in preterm labor as inequality was more observed in older age groups. Previous studies have found higher rates of preterm labor among adolescent mothers. This higher rate may be due to increased sexually transmitted diseases, higher prevalence of substance abuse, lack of preconception counseling, and incomplete physical development of mothers (20, 21). However, in another study, older women ( $\geq 40$  years) had a greater risk of spontaneous preterm birth compared to women aged 20 to 24 years (11). According to CI decomposition, fathers' education and job are other main sources of inequality as a higher inequality was observed when fathers had lower education and income. Occupation and education are contributing factors to Iranian SES, while several studies have confirmed the relationship between SES

and preterm labor (11, 20, 22). An extensive cohort study, including 132,714 singleton deliveries in Nova Scotia, reported that the prevalence of preterm births is significantly higher among women in lowest-income families compared to those with the highest income (11). Although there are conflicts regarding the role of some SES, such as the mother's education in preterm labor (11), there is an agreement on the higher prevalence of preterm labor among the poorer populations (20).

##### 4-1. Study Limitations

The present study was conducted only on mothers who resided in the provincial capital of Ilam. Because of the different economic and social conditions in different cities in Ilam province, the results of this study cannot be generalized to the whole province.

#### 5- CONCLUSION

The prevalence of preterm birth was reported in 12% of participants. According to our results, preterm birth is significantly more prevalent among disadvantaged mothers. Some SES, including the mother's age, father's age, father's education, and father's job are important factors contributing to preterm inequality in Iranian mothers. Policymakers should provide more comprehensive mother and child health programs for these sensitive groups.

**6- CONFLICT OF INTEREST:** None.

#### 7- ACKNOWLEDGEMENT

We thank Ilam University of Medical Sciences, participants, coordinators and data reviewers who assisted in this study. This study was supported by Ilam University of Medical Sciences (NO. 953006/70).

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