Elective Cesarean Section or Not? Risk of Advance Maternal Age at First Birth

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Abstract. The existing literature suggests that the increase of cesarean section (c-section) is predominantly due to advanced maternal age (AMA), particularly in nulliparous women. We examined the association between AMA and elective c-section in primiparous women with singleton pregnancy. This study used data from the 2017 Indonesia Demographic and Health Survey (IDHS). Multinomial logistic regression was performed to examine the relationship between AMA and elective c-section. The final sample analysis comprises 4,988 observations. This study found that AMA at birth significantly associated with elective c-section among primiparous women with singleton pregnancy (RRR: 7.98; 95% CI 4.85-13.11). The possible explanation of this finding is pre-pregnancy morbidities, abnormal labor, and uterine dysfunction among the AMA group. Despite the comprehensive dataset, the study has limitations. The design does not allow for a causal interpretation of the associations studied. Further research through cohort studies including biological variables and maternal preferences are recommended.

Keyword: advanced maternal age, elective c-section, Indonesia

1 Introduction

The cesarean section is a surgical procedure to save a life when complications appear during pregnancy and delivery and became a reasonable alternative for vaginal delivery [1]. The global cesarean section rate is rising, including in Indonesia. Indonesia's cesarean section rate was 4.3% in 1997 and became 17% in 2017 [2].[2] The cesarean section is the most common surgical procedure performed among women [3]. The increasing cesarean section is partly because of the rising number of women requesting an elective cesarean section [4]. World Health Organization (WHO) suggested cesarean section limit rates at 15% in 1985, and it lowered to 10% in 2014. The proportion of cesarean section rate over the recommended threshold is not associated with maternal and newborn mortality [5].

Although cesarean section has some benefits for both mothers and children, this procedure is associated with immediate and late maternal and perinatal risks [6]. Direct adverse effects of the cesarean section include postpartum hemorrhage and the reduction of the immunity of infants. The cesarean section's late adverse effects also increase the risk of asthma, allergies, diabetes mellitus, cancer, and hematopoietic development problems [7], [8].[7] Women with cesarean section were more likely to receive blood transfusions, hysterectomy, and experience increased maternal mortality risk than women who gave vaginal birth[9]. From an economic perspective, cesarean section also significantly more expensive than vaginal delivery [10].

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The existing literature suggests that the increase of cesarean section is predominantly due to advanced maternal age, particularly in nulliparous women. Advanced maternal age is defined as childbearing in a woman over 35 years of age, and it is increasing globally [11]. [12]. Based on the 2017 IDHS, the median age at first birth for women aged 25-49 is 22.4 years. Social demographic and economic status also influence the age at first birth. The median age at first birth increases with education and wealth [13]. Women who are postponing their pregnancies until late in their productive life increased in most of the industrialized world, social, educational, and demographic changes [14].

Four indirect factors may influence maternal mortality and morbidity. Women face significantly heightened risks of pregnancy-related morbidity and mortality when they are "too young, too old, too frequent, or too many." Advanced maternal age will be increased the complications of pregnancy. Childbirth and infant outcomes were worse than the younger maternal age. Pregnancy in advanced maternal age is associated with increased risk of abortion, chromosomal abnormalities, maternal death, and complication. Also, perinatal morbidity and mortality, intrauterine fetal death (IUFD), and premature labor have increased significantly in women with advanced maternal age [15]. Advanced maternal age at birth is often cited as a reason for the rise in the cesarean section. However, it is not clear that the increasing cesarean section is caused by medical complications increasing with maternal age or maternal age per se. Health professionals' assumption of maternal age as a risk factor may lower the cesarean section threshold in advanced maternal age [14]. Primiparous women tend to have prolonged labor and delivery. Also, primiparous women were admitted earlier and more exposed to hospital intervention during labor and birth than multiparous women. We examined the association between advanced maternal age and elective cesarean section in primiparous women with singleton pregnancy.

2 Method

This study used data from the 2017 Indonesia Demographic and Health Survey (IDHS). The IDHS is a nationally representative cross-sectional survey that collects various demographic and health indicators on the individual and household-level. It is part of the worldwide Demographic and Health Survey (DHS) program and was conducted by the National Population and Family Planning Board (BKKBN) in collaboration with Statistics Indonesia (BPS) and the Ministry of Health (MoH) of Indonesia. The sampling frame for the 2017 IDHS used the updated list of households in the selected census blocks (CBs) taken from Indonesia's 2010 Population Census. A CB was a geographic area that contains 80–120 households selected through systematic sampling. Respondents were selected using two-stage stratified sampling. In the first stage, CBs were selected using probability proportional to size (PPS) from those CBs based on wealth index categories. Next, 25 households in each CB were randomly selected as respondents. More detailed information on the sampling methods has been described elsewhere [16].

This study's samples were primiparous women aged 15 – 49 years old who gave the singleton live birth five years before the survey. These samples were interviewed about the modes of delivery in their most recent birth. Respondents who answered did not know, or missing were excluded from the analysis, which is equivalent to 4,988 women. The dependent variable in this study is the mode of delivery. The delivery mode was divided into three categories, '0' if the delivery mode is vaginal delivery. Vaginal deliveries include normal deliveries, induction deliveries, and assisted deliveries with vacuum and forceps extraction. Value '1' if the mode of delivery is the emergency cesarean section, and '2' if the mode of

delivery is the elective cesarean section. The main exposure variable was maternal age categorized into two groups: ages lower than 35 years old and 35 years or older. The age group of lower than 35 years was used as the reference group, as it had the lowest risk profile.

We included several other variables as confounders: socio-demographic factors (residence, education level, working status, and economic status), obstetrics factors (pregnancy complication, antenatal care, birth weight, and children's sex), and health insurance ownership. We used descriptive statistics to summarize the characteristics of the study population. We summarized the categorical variables using frequencies with their associated percentages. We examined the relationship between explanatory variables and the outcome of interest using logistic regression. We employed multinomial logistic regression to estimate confounder-adjusted relative risk ratios (RRRs) with 95% confidence intervals (CIs). We put the variables on multivariate regression based on theoretical consideration. All statistical analyses were performed using Stata 15.1.

3 Result

The final sample analysis comprises 4,988 observations. This study found that almost one in five children (19.2%) was delivered by cesarean section. Of which, 15.1% was emergency cesarean section, and 4.1% was elective cesarean section. According to the maternal age group, this study found that the proportion of cesarian section increased with increasing of maternal age. More than one-fifth (21.8%) of women in advanced maternal age group have elective cesarean section.

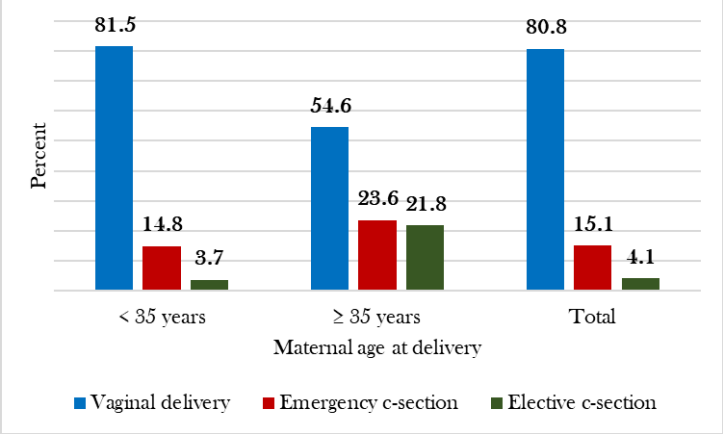

Fig. 1. Mode of delivery among final the sample analysis, Stratified by maternal age at delivery

Table 1 showed characteristics of the sample according to the mode of delivery. According to socio-demographic status, the proportion of elective cesarean section was higher in women who lived in urban (5.6%) than rural (2.7%), high education (9.2%), and from the richest economics status (8.3%). Women with pregnancy complications also had higher cesarean section proportion than women with healthy pregnancies.

Table 1. Background Characteristics of Women according to Mode of Delivery

Variable	Vaginal Birth	Emergency c-section	Elective c-section
	n (%)	n (%)	n (%)
Residence			
Urban	1,825 (75.4)	459 (19.0)	137 (5.6)
Rural	2,205 (85.9)	293 (11.4)	69 (2.7)
Maternal education			
Low	728 (90.6)	59 (7.3)	17 (2.1)
Middle	2,694 (81.9)	488 (14.8)	107 (3.3)
High	608 (67.9)	205 (22.9)	82 (9.2)
Working status			
Did not work	2,352 (83.1)	394 (13.9)	86 (3.0)
Work	1,678 (77.8)	358 (16.6)	120 (5.6)
Economic status			
Poorest	809 (91.2)	64 (7.2)	14 (1.6)
Poorer	890 (86.7)	114 (11.1)	22 (2.2)
Middle	939 (83.8)	149 (13.3)	33 (2.9)
Richer	770 (73.7)	214 (20.4)	62 (5.9)
Richest	622 (68.4)	211 (23.3)	75 (8.3)
Pregnancy complication			
None	3,408 (83.3)	538 (13.2)	144 (3.5)
Any	622 (69.3)	214 (23.9)	62 (6.9)
Antenatal care			
No K4	814 (87.3)	96 (10.3)	23 (2.4)
K4	3,216 (79.3)	656 (16.2)	183 (4.5)
Health Insurance			
No	1,823 (85.0)	271 (12.6)	51 (2.4)
Yes	2,207 (77.6)	481 (16.9)	155 (5.5)
Birth weight			
Normal	3,747 (81.0)	689 (14.9)	192 (4.1)
Low	283 (78.6)	63 (17.5)	14 (3.9)
Sex of child			
Male	2,037 (79.0)	427 (16.6)	114 (4.4)
Female	1,993 (82.7)	325 (13.5)	92 (3.8)
TOTAL	4030 (80.8)	752 (15.1)	206 (4.1)

Table 2 showed the association between maternal age at birth and elective cesarean section after adjusting for some potential confounders. This study found that advanced maternal age at birth was significantly associated with emergency and elective cesarean sections among

primiparous women with singleton pregnancy. Women with advanced maternal age at birth were seven times more likely to have elective cesarean section than younger ones. Furthermore, this study also found that the risk of emergency cesarean section increased in advanced maternal age at birth.

Table 2. Results of the multivariable logistic regression analysis

Variable	Emergency c-section		Elective c-section	
	RRR	95% CI	RRR	95% CI
Maternal age at birth				
≤ 35 years old	Reference		Reference	
> 35 years old	2.31***	(1.47-3.61)	7.98***	(4.85-13.11)
Residence				
Urban	1.27**	(1.06-1.52)	1.28	(0.91-1.80)
Rural	Reference		Reference	
Maternal education				
Low	Reference		Reference	
Middle	1.75***	(1.31-2.35)	1.28	(0.75-2.19)
High	2.39***	(1.69-3.37)	2.48**	(1.37-4.51)
Working status				
Did not work	Reference		Reference	
Work	0.98	(0.83-1.16)	1.19	(0.87-1.63)
Economic status				
Poorest	Reference		Reference	
Poorer	1.4*	(1.01-1.94)	1.33	(0.67-2.62)
Middle	1.54**	(1.12-2.13)	1.53	(0.80-2.94)
Richer	2.33***	(1.68-3.21)	2.79**	(1.48-5.28)
Richest	2.33***	(1.65-3.30)	2.77**	(1.42-5.41)
Pregnancy complication				
None	Reference		Reference	
Any	1.91***	(1.59-2.30)	1.93***	(1.39-2.66)
Antenatal care				
No K4	Reference		Reference	
K4	1.34*	(1.05-1.69)	1.28	(0.81-2.03)
Health Insurance				
No	Reference		Reference	
Yes	1.19*	(1.00-1.41)	1.83***	(1.30-2.56)
Birth weight				
Normal	Reference		Reference	
Low	1.18	(0.88-1.59)	0.9	(0.51-1.59)

Sex of child				
Male	1.26**	(1.07-1.48)	1.16	(0.87-1.55)
Female	Reference		Reference	

*p-value <0.05, **p-value < 0.01, *** p-value < 0.001

4 Discussion

Our analysis confirms the findings of other studies that advanced maternal age at childbirth is positively associated with the likelihood of both emergency and elective cesarean section. Our result is consistent with several previous studies reporting a significant association between advanced maternal age and cesarean section. Comprehensive adjustment for known confounders was conducted. Using this approach, we include some potential confounders in the final model. Timofeev et al. found that the cesarean section's risk increased in nulliparous women aged 40–45 years compared to women ages 25–29 years [17]. Moreover, Richard et al. found regardless of parity, cesarean section risk was increased with increasing maternal age [18].

A possible explanation of this finding is pre-pregnancy morbidities. The risk of many diseases increases with increased maternal age. Increased rates of chronic diseases among women at advanced maternal age may have contributed to higher cesarean birth rates in this group [15]. Uterine dysfunction is also mentioned as the cause of our result. Another possible explanation is that abnormal labor patterns reduced the efficiency of myometrial. The myometrium incompetency decreased the number of oxytocin receptors, which were argued as possible physiological factors for the increasing cesarean rate in advanced maternal age group [19]. Furthermore, dystocia and abnormal placental implantation increased in advanced maternal age were argued to increase cesarean section in this group [14].

In addition, maternal age alone may affect a physician's decision about the mode of delivery. "High-risk labeling" and maternal anxiety may influence the preferences of both women and obstetricians concerning the mode of delivery. It has been suggested that the surprisingly high risk of elective cesarean delivery among advanced maternal age is partly attributable to differences in care and maternal preference. However, previous studies showed that maternal request is not a prominent factor in increasing cesarean rates among women of all ages. Nevertheless, the fact might be different for women at advanced maternal age identified by their health care practitioners as high-risk pregnant women [20-22].

5 Conclusion

This study revealed that advanced maternal age was significantly associated with the elective cesarean section. This study contributed to the hypothesis of a strong association between increased maternal age and elective cesarean section. The association could not be explained by maternal comorbidities, biological factors such as uterine dysfunction, or artificial reproductive technologies due to infertility. This study also cannot explain the maternal reference. Due to these results, health workers should inform related risks to advanced maternal age women, including delivery by cesarean section. Close monitoring of women in this group must also be done to ensure both mother and baby's health, such as properly antenatal check-ups.

Ethical approval

The Institutional Review Board of Inner City Fund (*ICF*) International and ORC Macro (ICF IRB FWA0 0 0 0 0845) granted ethical approval for the 2017 IDHS. It adhered to the U.S. Department of Health and Human Services requirement to protect human subjects; the participants' information was kept anonymous.

Conflict of Interest

The authors declare no conflict of interest.

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