Association between high-risk pregnancy and mode of delivery in Kalibaru

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ABSTRACT

High-risk pregnancy is a critical public health concern associated with increased maternal and neonatal morbidity and mortality, particularly in developing regions such as Banyuwangi, Indonesia. The Kalibaru area reported the highest number of pregnant women with complications in 2024. This study aims to examine the relationship between high-risk pregnancy status and mode of delivery in Kalibaru, addressing a gap in literature regarding their association. A retrospective cross-sectional study was conducted using secondary data from 762 postpartum mothers in Kalibaru. A total of 262 samples were selected using Slovin's formula with a 5% margin of error and simple random sampling. Eligibility criteria included complete medical records from women who delivered in Kalibaru in 2024. Data were anonymized and analyzed using the Chi-Square test to determine the association between high-risk pregnancy status (categorized as high-risk or not) and delivery method (vaginal or cesarean section). Among the 262 respondents, 198 (75.6%) had high-risk pregnancies and delivered via cesarean section (CS), while 64 (24.4%) had spontaneous vaginal births. The Chi-Square test showed a statistically significant association between high-risk pregnancy and cesarean delivery ($p = 0.000$). Odds ratio analysis revealed that high-risk pregnant women were 63.68 times more likely to undergo cesarean section (OR = 63.677; 95% CI: 9.108–445.161) compared to non-high-risk women. Key risk factors contributing to the increased likelihood of cesarean delivery included maternal age <20 or >35 years, height ≤145 cm, low parity, and prior cesarean history. These findings highlight the importance of early detection and comprehensive risk assessment during antenatal care to reduce medically unnecessary cesarean sections. Implementation of routine pregnancy risk screening using tools such as the Poedji Rochyati Scorecard (KSPR), along with strengthening referral systems and public education, is essential for improving maternal outcomes in high-risk pregnancies.

1. Introduction

High-risk pregnancy is defined as a gestational state in which the expectant mother has a greater potential for complications than in normal pregnancy, due to maternal medical conditions, obstetric factors, or socioeconomic influences. Complications arising from high-risk pregnancies are a major contributor to increased maternal and neonatal morbidity and mortality (Muñoz-Saá et al. 2024; Sinaga 2022).

The maternal mortality rate (MMR) in Indonesia and East Java were 4,482 and 499 per 100,000 live births for each in 2023. Specifically in Banyuwangi, the MMR was 135 per 100,000 live births, with 28 reported maternal deaths. This high figure is largely attributed to undetected or poorly managed high-risk pregnancies. Preliminary data indicate that Kalibaru reported the highest number

of pregnant women with complications, totaling 173 cases (Marsay, Manderson, and Subramaney 2017; Phommachanh et al. 2019).

High-risk pregnancies require close monitoring and comprehensive management due to the increased likelihood of complications for both mother and fetus. Previous studies categorize contributing factors into maternal factors (e.g., age and poor obstetric history), comorbidities (e.g., chronic hypertension, preeclampsia, gestational diabetes, and anemia), socioeconomic status (e.g., low education and limited healthcare access), and lifestyle like smoking habits, the intake of alcoholic beverages, and unsupportive living conditions) (Braggion et al. 2023; Pavlidou et al. 2023).

High-risk pregnancy significantly contributes to elevated rates of maternal and neonatal morbidity and mortality. One of its most common consequences is an increase in CS deliveries. Conditions such as preeclampsia, gestational diabetes, multiple pregnancies, and abnormal fetal presentations often indicate surgical intervention to ensure maternal and fetal safety. While cesarean delivery can be life-saving, its rising prevalence also increases the risk of postoperative complications such as infection, hemorrhage, and delayed recovery. Additionally, future pregnancies may be affected by conditions like placenta previa or placenta accreta (Aziato and Omenyo 2018; Bi et al. 2021; Thornton, Browne, and Ramphul 2020).

Early detection of high-risk pregnancy constitutes a crucial approach for diminishing the rates of maternal and neonatal complications and death. Risk factors-such as extreme maternal age, high or low parity, poor obstetric history, comorbidities like hypertension or diabetes, and low socioeconomic status should be identified early for timely intervention. Regular and comprehensive antenatal care, including laboratory screening and ultrasonography, plays a crucial role in the early detection of abnormalities. Healthcare workers must conduct holistic and continuous risk assessments to develop appropriate care plans. The implementation of an effective tiered referral system is also critical, particularly in resource-limited settings. The Indonesian government recommends using the Poedji Rochyati Score Card (KSPR) for early identification and comprehensive management of high-risk pregnancies to reduce unnecessary cesarean sections and minimize protracted risks for mother and children (Bi et al. 2021; Sarina et al. 2023).

Analyzed childbirth with high-risk factors due to maternal age in Patas Village; however, the study did not specifically examine the relationship between high-risk pregnancies and types of delivery (spontaneous versus cesarean section). Although numerous studies have addressed high-risk pregnancies, the specific association between maternal risk status and mode of delivery remains underexplored. According to the Banyuwangi Health Profile, Kalibaru has the highest number of pregnant women with complications in the Banyuwangi region. Therefore, this study aims to address the research gap by identifying and verifying the relationship between high-risk pregnancy status and types of delivery in the Kalibaru area (Hidayati, Setyorini, and Afrian Nuari 2018; Sethi et al. 2019; Woollett et al. 2021).

2. Method

This study employed a retrospective design using a cross-sectional method with a population of 762 postpartum mothers in Kalibaru in 2024. The inclusion criteria were: (1) postpartum mothers with complete medical records and (2) those who delivered in the Kalibaru area. The exclusion criterion was: (1) postpartum mothers whose medical records could not be accessed due to specific restrictions.

The sampling frame consisted of all maternal medical records documented in Kalibaru throughout 2024. The sampling technique used was simple random sampling. After collecting all records that met the inclusion criteria, each was assigned a sequential number. The sample size was determined using the Slovin formula, considering that the total population size was known and detailed proportions of the characteristics were unavailable. Slovin's formula provides a simple yet efficient approach to obtain a representative sample size, with a 5% margin of error. This method has also been widely applied in similar public health studies, making it appropriate and relevant for this research context. Based on the Slovin formula, the final sample consisted of 262 respondents.

Subsequently, samples were selected randomly through manual drawing (lottery method) to generate random numbers. The list was sorted based on these random numbers, and a total of 262 records were selected. This technique was chosen to ensure that every population member had an equal chance of being selected, enhancing the objectivity of the results and minimizing selection bias.

This study did not require ethical clearance, as it used secondary data from medical records without any patient identifiers and did not involve direct intervention or interaction with study subjects. All data analyzed were anonymized and obtained with written permission from the relevant health institution. The researchers adhered strictly to principles of confidentiality, privacy, and research ethics in accordance with applicable guidelines.

Data collection was conducted using a checklist. The relationship between pregnancy risk status and mode of delivery was analyzed using the Chi-Square test with the assistance of SPSS version 25, as both variables were categorical. Pregnancy risk status was classified as high risk and not high risk, while delivery methods were categorized into vaginal delivery and cesarean section. The Chi-Square test was deemed appropriate to determine whether a statistically significant association existed between the two nominal variables.

3. Results and Discussion

3.1. Univariate Analysis

Table 1. Characteritics of Mothers Giving Birth in Kalibaru

No	Variable	Category	Frequency	Percentage (%)
1	Age	< 20 years	175	66.8%
		20–35 years	17	6.5%
		> 35 years	70	26.7%
2	Height	≤ 145 cm	185	70.6%
		≥ 145 cm	77	29.4%
3	Parity	Primigravida	127	48.5%
		Multigravida	63	24%
		Grand Multipara	72	27.5%
4	Cesarean History	Yes	143	54.6%
		No	119	45.4%

The majority of respondents were under 20 years of age (66.8%), followed by those older than 35 (26.7%). Most had a height ≤145 cm (70.6%). Primigravidas comprised the largest parity group (48.5%). Additionally, more than half had a history of cesarean delivery (54.6%).

Table 2. Mode of Delivery in Kalibaru

No	Delivery Mode	Frequency	Percentage (%)
1	Spontaneous	64	24.4%
2	Cesarean	198	75.6%
	Total	**262**	**100%**

The majority (75.6%) underwent cesarean delivery, while only 24.4% had spontaneous births.

3.2. Bivariate Analysis

Table 3. Cross-Tabulation of the Association Between High-Risk Pregancy and Delivery Method in Kalibaru

No	High-Risk Pregnancy	Frequency	Percentage (%)	*p*-value
1	Yes (RISTI)	198	75.6%	
2	No	64	24.4%	0.000
	Total	**262**	**100%**	

Chi-square test $p = 0.000$ (< 0.05), denoting a significant association between high-risk pregnancy and cesarean delivery.

Table 4. Odds Ratio of Delivery Type by Pregnancy Risk Status

No	Delivery Type	Odds Ratio (OR)	95% Confidence Interval (CI)
1	Normal Delivery	0.005	0.001 – 0.036
2	Cesarean Section (CS)	63.677	9.108 – 445.161
	Number of Valid Cases	**262**	

The odds ratio analysis revealed that pregnant women classified as high-risk (RISTI) were significantly more likely to undergo cesarean section deliveries compared to those without high-risk

status. Specifically, the odds of cesarean delivery among high-risk women were 63.68 times greater than for women without high-risk status (OR = 63.677; 95% CI: 9.108–445.161), indicating a strong and statistically significant association between pregnancy risk status and delivery method. Conversely, the likelihood of vaginal delivery among high-risk women was markedly lower, with an odds ratio of 0.005 (OR = 0.005; 95% CI: 0.001–0.036) compared to non-high-risk women. These findings underscore the significant impact of pregnancy risk status on the mode of delivery, emphasizing the increased propensity for surgical intervention among high-risk pregnancies.

Results of this study revealed a significant association between high-risk pregnancy status and the mode of delivery. The majority of women classified as having high-risk pregnancies underwent cesarean section (75.6%), whereas most women without identified risk factors delivered spontaneously (24.4%). The Chi-Square test yielded a *p*-value of 0.000 ($p < 0.05$), indicating a statistically significant relationship between pregnancy risk status and delivery method. This finding is further supported by an odds ratio of 63.677, suggesting that pregnant women categorized as high-risk were approximately 63 times more likely to undergo cesarean delivery compared to those with low-risk pregnancies.

A longstanding association exists between maternal height and the propensity for operative birth. A study by Arendt *et al.* (2018) found individuals with a stature under 145 cm exhibited double the likelihood of requiring CS relative to their counterparts with a height of at least 170 cm. It is likely due to cephalopelvic disproportion (CPD), where a narrow pelvic structure hinders the process of vaginal delivery. Similar findings were reported in India, where women whose stature was 120 cm exhibited a five-fold increased likelihood of undergoing CS than those measuring 150 cm. Marbaniang *et al.* (2022) further supported this by showing that women under 150 cm were nearly twice as likely to deliver via CS than those above 160 cm. These findings emphasize the importance of considering maternal physical characteristics as predictors for operative interventions (Arendt et al. 2018; Marbaniang et al. 2022; Muñoz-Saá et al. 2024)

Maternal age is another key factor influencing delivery mode. Women aged 35+ years are at a greater risk of perinatal complications such as preeclampsia, gestational diabetes, and fetal growth restriction, often resulting in the need for CS. A study by Braggion *et al.* (2023) revealed that women aged >35 years demonstrated a two-fold increased likelihood of undergoing those aged 20–24 years. Conversely, maternal age below 20 is also associated with a higher risk of labor complications due to biological and psychological immaturity. Furthermore, individuals aged 40 years and above face an even greater risk of CS. Bergholt *et al.* (2020) reported that among nulliparous women undergoing labor induction, the CS rate increased from 14.0% in women aged <20 to 39.9% in those aged ≥40. This trend may reflect reduced tissue elasticity and increased comorbidities at advanced maternal ages (Bergholt et al. 2020; Braggion et al. 2023; Nedberg et al. 2020; Rydahl et al. 2019).

A prior CS history is a strong predictor of the delivery method in subsequent pregnancies. Although vaginal birth after cesarean (VBAC) remains an option, its success depends on several factors including the indication for the previous CS, interpregnancy interval, and the availability of appropriate healthcare facilities. In many developing countries, limited access to trial of labor after cesarean (TOLAC) services leads to repeated CS deliveries. According to the ACOG (2019) guidelines, the success of TOLAC is influenced by interpregnancy spacing, the number of previous CS deliveries, and prior indications. Nonetheless, a previous CS remains the most common reason for repeat procedures, primarily to prevent uterine rupture. Pavlidou *et al.* (2023) emphasized the importance of comprehensive evaluation before determining the mode of delivery in women with a prior CS (ACOG 2019; Chen et al. 2021; Landon 2024; Pavlidou et al. 2023).

Parity, or the number of previous births, also influences uterine contractility and labor efficiency. Nulliparous or primiparous women are more likely to experience prolonged or non-progressive labor, which is a common indication for operative intervention. In contrast, multiparous women generally undergo smoother labor, unless additional risk factors are present. Rady (2018) found that primiparous women were more likely to require operative interventions such as induction, vacuum extraction, and CS. Sun *et al.* (2020) similarly reported that primiparous women were more likely to undergo operative deliveries, especially when accompanied by other risk factors such as advanced maternal age or macrosomia (Rady 2018; Sun et al. 2020).

The interaction of these risk factors can substantially increase the likelihood of operative delivery. For instance, a primiparous woman aged >35 years and shorter than 145 cm may face a significantly

elevated cumulative risk for CS. Therefore, a holistic risk assessment approach during pregnancy is essential to ensure a safe and effective delivery plan. It is important to note that these factors not only reflect clinical concerns but also intersect with sociodemographic conditions and healthcare accessibility. Women of short stature or younger age may belong to lower socioeconomic groups with limited access to optimal antenatal care, further compounding their pregnancy risk (Irwinda et al. 2021; Patamasingh Na Ayudhaya et al. 2024).

While CS can be life-saving in many circumstances, the global rise in unnecessary CS procedures remains a public health concern. Comprehensive risk assessment is essential to balance medical necessity with the avoidance of overmedicalization. Predictive tools such as the Bishop score, clinical pelvic evaluation, and intrapartum monitoring can support evidence-based decision-making. Strengthening antenatal care systems and equipping healthcare providers to manage high-risk pregnancies should be prioritized. Moreover, educating pregnant women about the consequences of delivery choices is vital, enabling them to participate actively in shared decision-making, especially those with a previous CS or low parity.

4. Conclusion

The findings of this study demonstrate a significant association between high-risk pregnancy status and the type of delivery undergone by pregnant women in Kalibaru. Pregnant women with high-risk pregnancies were more likely to undergo CS compared to spontaneous vaginal delivery. Contributing factors included maternal age under 20 or over 35 years, height ≤145 cm, low parity, and a history of previous cesarean section, all of which played a critical role in the increased rate of operative deliveries.

These findings underscore the importance of early detection and intensive monitoring of high-risk pregnant women to prevent delivery complications and reduce the rate of medically unnecessary cesarean sections. Promotive and preventive efforts within antenatal care services, including comprehensive risk assessments and reproductive health education, are essential to improving maternal and neonatal health outcomes.

It is recommended that community health centers (Puskesmas) and primary healthcare facilities consistently implement pregnancy risk screening using tools such as the Poedji Rochyati Scorecard (KSPR) from the early stages of pregnancy. Local governments should strengthen tiered referral systems and enhance the capacity of healthcare workers in managing high-risk pregnancies. Moreover, integrated counseling policies targeting adolescent girls and prospective mothers should be developed to reduce the incidence of pregnancies at suboptimal reproductive ages and to foster public awareness regarding the importance of regular and well-planned antenatal care.

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