



## Analysis of Risk Factors Associated with Maternal Mortality for the Period of 2022-2023 in City X

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### Abstract

Maternal mortality rate as an indicator of The maternal mortality rate is an indicator of the nation's health status and a component of the development index and quality of life for a long time. MMR in South Kalimantan in 2023 was recorded as 145 deaths per 100,000 KH. X is the city that has the highest MMR in the last two years, namely 131 per 1000,000 KH in 2022 and 131 per 1000,000 KH in 2022 and 145 per 100,000 KH in 2023. To determine the relationship between age, parity, medical history, education level, income, family support and mortality, education, income, family support with maternal mortality in the period 2022-2023 in X City. This study used a case control design. The research subjects consisted of 87 respondents in the working area of the X City Health Office. X city. Data analysis chi square test and multiple logistic regression test. The results of the study The results showed that the most dominant variables associated with maternal mortality in X City is the most dominant in sequentially starting from the most dominant is the history of disease (10.234), age (7.757), parity (6.327), family support (4.874), income (1.309), and education level (1.206). (1,206). There is an association between age, parity, history of illness, and, family support but no association of education level and income with maternal mortality for the period 2022-2023 in X City.

## Introduction

Maternal death according to the World Health Organization (WHO) is defined as maternal death that occurs during pregnancy or during the 42 days from the termination of the pregnancy, but not caused by accident or chance. (WHO, 2024). Maternal mortality is a major health problem in Indonesia. This is because the MMR in Indonesia is quite high compared to countries in Southeast Asia, which is 197 deaths per 100,000 KH. (WHO, 2021).

Based on Maternal Perinatal Deat Notification (MPDN) data or recording and reporting of MMR and IMR in Indonesia in 2023, it states that the number of maternal deaths in 2022 reached 4005 and increased in 2023 to 4129 maternal deaths. The maternal mortality rate in South Kalimantan in 2023 was recorded at 145 deaths per 100,000 KH. Looking at the MMR in 13 districts/cities, Banjarmasin City has the highest MMR in the last two years, namely 131 per 1000,000 KH in 2022 and 145 per 100,000 KH in 2023 (Banjaramasin City Health Office, 2023).

There are several theories related to maternal mortality, such as McCarthy and Maine's (1992) conceptual framework of maternal mortality, which includes 3 components in the process of maternal mortality: near determinants, intermediate determinants, and distant determinants.

Near determinants are determinants that have a relationship with pregnancy and complications during pregnancy, antepartum, and postpartum including bleeding, infection, eclampsia, partus stuck, abortion, and ruputra uteri (Bazirete et al., 2020). 28.9% of maternal deaths occurred during pregnancy, 44.7% occurred during labor, and 26.3% occurred during postpartum. Intermediate determinants are determinants that are directly related to immediate determinants such as maternal health status, reproductive status, access to health services, use of health services, and other unexpected factors. Distant determinants are determinants that are not directly related to near determinants such as socio-economic factors (McCarthy & Maine, 1992).

Some studies that show the influence of age, parity, medical history, education level, income, and family support on the incidence of maternal mortality include research by Rahmadhanti & Siyam (2023) on age and medical history, Sari et al. (2023) on parity, Sunarti & Nur (2023) on education level, Wilda et al (2019) on income, and Neneng et al (2023) on family support. Maternal death cases based on Naila's research (2019) show 28.9% occurred during pregnancy, 44.7% occurred during labor and 26.3% during postpartum (Rahmadhanti & Siyam, 2023; Sari et al., 2023).

Based on this description, this study needs to be carried out with the aim of analyzing the risk factors associated with the incidence of maternal mortality in City X for the period 2022 - 2023.

## Methods

This type of research is analytical observational with a case control survey approach with a sample of 29 case samples and 58 control group samples using proportionate random sampling technique. This research was conducted in X City. The research was conducted for 1 month. This research has obtained Ethical Clearance. Data collection was done directly to the respondents. The independent variables in this study were age, parity, medical history, education level, income, and family support with the incidence of maternal mortality in City X for the period 2022-2023. The dependent variable in this study is the incidence of maternal mortality. The test used was logistic regression test at 95% confidence level ( $\alpha = 0.05$ ). The instrument used was a questionnaire.

## Results and Discussion

### Univariate Analysis Results

Research on the Evaluation of Sectio Cesaria Response Time to maternal and neonatal outcomes in patients with Severe Pre-eclampsia Eclampsia at Sitti Khadijah 1 Hospital Makassar City period 2019-2023 was conducted with observational research methods with cross sectional techniques used were totally sampling where the entire population was used as a sample in accordance with the inclusion criteria and exclusion criteria the number of samples obtained in the study was 56 samples. With the following characteristics:

Table 1. Univariate Analysis on the Characteristics of Respondents Based on Age, Parity, Medical History, Education Level, Income, and Family Support with the Incidence of Maternal Mortality in City X for the Period 2022 - 2023

Variables	Case		Control	
	F	%	F	%
Age				
At Risk	23	79,3	14	24,1
Not at risk	6	20,7	44	75,9
<b>Total</b>	<b>29</b>	<b>100,0</b>	<b>58</b>	<b>100,0</b>
Parity				
At Risk	19	65,5	11	19,0

Not at risk	10	34,5	47	81,0
<b>Total</b>	<b>29</b>	<b>100,0</b>	<b>58</b>	<b>100,0</b>
Disease History				
Own	23	79,3	12	20,6
Do not have	6	20,7	46	79,4
<b>Total</b>	<b>29</b>	<b>100,0</b>	<b>58</b>	<b>100,0</b>
Education Level				
Low	19	65,5	27	46,6
High	10	34,5	31	53,4
<b>Total</b>	<b>29</b>	<b>100,0</b>	<b>58</b>	<b>100,0</b>
Revenue				
Low	14	48,3	15	25,9
Medium	11	37,9	32	55,2
High	4	13,8	11	19,0
<b>Total</b>	<b>29</b>	<b>100,0</b>	<b>58</b>	<b>100,0</b>
Family Support				
Low	20	69,0	19	32,8
High	9	31,0	39	67,2
<b>Total</b>	<b>29</b>	<b>100,0</b>	<b>58</b>	<b>100,0</b>
Incidence of Maternal Mortality				
Yes	29	100,0		
No			58	100,0
<b>Total</b>	<b>29</b>	<b>100,0</b>	<b>58</b>	<b>100,0</b>

Source: Data Primer, 2024

Based on table 1, it is known that the age of respondents in the case group is more at risk (79.3%) compared to respondents who are classified as not at risk. Conversely, in the control group, the age of respondents who were classified as not at risk (75.9%) was smaller than the age at risk. Parity of respondents in the case group was greater at risk than those not at risk (65.5%), while in the control group, 19.0% were respondents with parity at risk.

Table 2. Bivariate and Multivariate

Age	Incidence of Death on Mom				Total		P-value	OR
	Yes		No		N	%		
	N	%	N	%				
At Risk	23	79,3	14	24,1	37	42,5	0,000	12,048
Not at Risk	6	20,7	44	75,9	50	57,5		
<b>Total</b>	<b>29</b>	<b>100,0</b>	<b>58</b>	<b>100,0</b>	<b>87</b>	<b>100,0</b>		

Source: Data Primer, 2024

Based on chi square testing, the p value = 0.000 can be concluded that the relationship between age and the incidence of maternal mortality in the period 2022-2023 in City X.

Table 3. Association between Parity Risk and Maternal Mortality

Parity	Incidence of Death on Mom				Total		P-value	OR
	Yes		No		N	%		
	N	%	N	%				
At Risk	19	65,5	11	19,0	30	34,5	0,000	8,118
Not at Risk	10	34,5	47	81,0	57	65,5		

<b>Total</b>	<b>29</b>	<b>100,0</b>	<b>58</b>	<b>100,0</b>	<b>87</b>	<b>100,0</b>		
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Source: Data Primer, 2024

Based on chi square testing, the p value = 0.000, which can be concluded that there is a relationship between parity and the incidence of maternal mortality in the 2022-2023 period in City X.

Table 4. Association Between Disease History and Maternal Mortality

Disease History	Incidence of Death on Mom				Total		P-value	OR
	Yes		No		N	%		
	N	%	N	%				
Own	23	79,3	12	20,7	35	40,2	0,000	14,694
Do not have	6	20,7	46	79,3	52	59,8		
<b>Total</b>	<b>29</b>	<b>100,0</b>	<b>58</b>	<b>100,0</b>	<b>87</b>	<b>100,0</b>		

Source: Data Primer, 2024

Based on chi square testing, the p value = 0.000, which can be concluded that there is a relationship between disease history and the incidence of maternal mortality in the 2022-2023 period in X City.

Table 5. Association between Education Level and Maternal Mortality

Education Level	Incidence of Death on Mom				Total		P-value	OR
	Yes		No		N	%		
	N	%	N	%				
Low	19	65,5	27	46,6	46	52,9	0,149	2,181
High	10	34,5	31	53,4	41	47,1		
<b>Total</b>	<b>29</b>	<b>100,0</b>	<b>58</b>	<b>100,0</b>	<b>87</b>	<b>100,0</b>		

Source: Data Primer, 2024

Based on chi square testing, the p value = 0.149, which can be concluded that there is no relationship between education level and the incidence of maternal mortality in the 2022-2023 period in City X.

Table 6. Association between Revenue Level and Maternal Mortality

Revenue	Incidence of Death on Mom				Total		P-value	OR
	Yes		No		N	%		
	N	%	N	%				
Low	14	48,3	15	25,9	29	33,3	0,112	-
Medium	11	37,9	32	55,1	43	49,4		
High	4	13,8	11	19,0	15	17,3		

Source: Data Primer, 2024

Based on chi square testing, the p value = 0.112, which can be concluded that there is no relationship between income and the incidence of maternal mortality in the 2022-2023 period in X City.

Table 7. Association between Family Support and Maternal Mortality

Family Support	Incidence of Death on Mom				Total		P-value	OR
	Yes		No		N	%		
	N	%	N	%				

Low	20	69,0	19	32,8	39	44,8	0,003	4,561
High	9	31,0	39	67,2	48	55,2		
<b>Total</b>	<b>29</b>	<b>100,0</b>	<b>58</b>	<b>100,0</b>	<b>87</b>	<b>100,0</b>		

Source: Data Primer, 2024

Based on chi square testing, the p value = 0.003, which can be concluded that there is a relationship between family support and the incidence of maternal mortality in the 2022-2023 period in X City.

### Univariate Analysis Results

Table 8. Multivariate Analysis Results

Variables	B	Wald	Sig	Exp(B)	95% CI
Age	2,049	7,525	0,006	7,757	1,795 - 33,524
Parity	1,845	6,513	0,011	6,327	1,534 - 26,094
Disease History	2,326	8,465	0,004	10,234	2,136 - 49,027
Education Level	0,187	,068	0,794	1,206	0,296 - 4,911
Revenue	0,269	,251	0,616	1,309	0,456 - 3,756
Family Support	1,584	4,858	0,028	4,874	1,192 - 19,934

\*Statistically significant (p<0.05)

Source: Data Primer, 2024

The multiple logistic regression analysis that has been conducted and presented in table 4.9 states that the variables of age, parity, history of illness, and family support have a significant relationship with the incidence of maternal mortality. Meanwhile, when viewed from the B value indicated by the value of Exponent Beta (EXP B) the variables of age, parity, history of illness, and family support have a relationship with the incidence of maternal mortality. Meanwhile, education level and income have no relationship. The resulting B value is positive. In mothers with age not at risk has a value of 7.757 times the incidence of death in mothers, parity is not at risk has a value of 6.327 times the incidence of death, in mothers who do not have a history of disease has a value of 10.234 times the incidence of death, and high family support has a value of 4.874 times the incidence of death.

Based on this study, it can be seen that the most dominant variables associated with maternal mortality in the 2022-2023 period in City X in order from the most dominant are history of illness, age, parity, family support, income, and education level.

### Relationship between Age Factor and Maternal Mortality for the Period 2022-2023 in City X

Based on the results of the study, it is known that the results of statistical tests using the chi square test obtained a p value of 0.000 (<0.05) so that Ho is rejected, which means that there is a relationship between maternal age during pregnancy and maternal mortality in Banjarmasin City in 2022-2023, then the Odds Ratio (OR) value shows that mothers with non-risk age have a 12.048 times greater chance of not having a death event compared to mothers who have a risky age.

The results of this study showed that the incidence of maternal deaths occurred more in the age group of respondents who were at risk, namely 23 people (79.3%) compared to those who were not at risk. Conversely, there were no maternal deaths in the age group of respondents who were not at risk, namely 44 people (75.9%) (Utami, 2020).

This study is in line with research conducted by Rahmadhanti & Siyam (2023) that there is a relationship between age and the incidence of maternal mortality in Grobogan Regency. Age

is an important part of reproductive status. Age is related to an increase or decrease in body function that affects a person's health status. A good age for pregnancy is 20-35 years (Rahmadhanti & Siyam, 2023).

The age of mothers who give birth less than 20 years or also more than 35 years is very risky for labor problems and even maternal mortality problems. This problem is greater than the age of mothers who give birth in the age range of 20-35 years. The age of the mother who gives birth at an age that is too young or too old is considered very important and determines the prognosis of labor, because it can carry a lot of risk. Not all mothers with an age of less than 20 years or more than 35 years are certain to experience problems, but in some women with a young age the reproductive organs are still not so perfect and the function of hormones related to labor is also not perfect (Jayanti & Wibowo, 2016; Kurniati, 2021).

### **The Relationship between Parity and Maternal Mortality for the Period 2022-2023 in City X**

Based on the results of the study, it is known that the results of statistical tests using the chi square test obtained a p value of 0.000 ( $<0.05$ ) so that  $H_0$  is rejected, which means that there is a relationship between parity and the incidence of maternal mortality in Banjarmasin City in 2022-2023, then the Odds Ratio (OR) value shows that mothers with non-risky parity have a 8.118 times greater chance of not having a mortality event compared to mothers who have risky parity (Dasarie et al., 2023).

This study is in line with research conducted by Kasmara (2021) there is a relationship between parity and the incidence of maternal mortality at RSU Sundari Medan in 2019 and research conducted by Jayanti & Wibowo (2016) there is a relationship between parity and the incidence of maternal mortality at PMB Sari Surabaya (Jayanti & Wibowo, 2016; Kasmara, 2021).

Pregnant women with primipara (women who give birth to a live baby for the first time) because they have never given birth before, the possibility of abnormalities and complications is quite large. Whereas those who have parity 4 times or more, may experience health problems, laxity in the uterine wall so that they are at risk of fetal abnormality, latitudinal labor, uterine rupture, undeveloped labor and postpartum hemorrhage. In addition, pregnant women who have more than four children will also increase the risk to the mother and baby, especially when the distance between pregnancies is less than two years, so the mother will be weak due to frequent pregnancy, childbirth, breastfeeding, and caring for her children, resulting in various problems (Kurniati, 2021).

### **Relationship between Disease History and Maternal Mortality for the Period 2022-2023 in City X**

Based on the results of the research from the bivariate analysis seen from table 4.5, it shows that there is a history of disease with maternal mortality with a Pvalue (0.000)  $<0.05$  and OR of 14.694. The results showed that the incidence of maternal mortality in mothers who had a history of disease was 79.3%. Conversely, the incidence of maternal mortality in mothers who did not have was 79.3%.

This study is in line with research conducted by Rohati & Siregar (2023) there is a relationship between disease history and the incidence of maternal mortality during pregnancy, childbirth and postpartum in Depok City and research conducted by Rusmitawati et al. (2021) there is a relationship between disease history and the incidence of maternal mortality at the Balen Health Center, Bojonegoro Regency (Basyiar et al., 2021).

One of the factors predisposing to maternal mortality is a history of diseases such as a history of hypertension, previous vascular hypertensive disease, or essential hypertension (Phoswa & Khaliq, 2021). Hypertension suffered before pregnancy results in disruption/damage to

important organs of the body. Pregnancy itself makes weight gain so that it can cause more severe disorders/damage, which is shown by edema and proteinuria (Utami, 2020).

Supported by research by Garovic et al. (2022) that a history of hypertension is the most severe risk factor because hypertension that has been suffered before pregnancy will result in disruption or damage to important organs in the body and plus pregnancy which makes an increase in body weight so that it causes more severe disruption or damage with edema and urine protein (Dasarie et al., 2023).

### **Relationship between Education Level and Maternal Mortality for the Period 2022-2023 in City X**

Based on the results of the bivariate analysis seen from table 4.6, it shows that there is no relationship between education level and maternal mortality with a Pvalue (0.149) > 0.05 and OR of 2.181. The results showed that the incidence of maternal mortality at a low education level was 65.5%. Conversely, the incidence of maternal mortality at a high education level was 34.5%.

This study is in line with research conducted by Abera et al. (2019) there is no relationship between the education level of pregnant women and antenatal care visits at the Balla Health Center, Balla District, Mamasa Regency, and this study is also in line with research conducted by (Basyiar et al., 2021) where the incidence of maternal mortality has no direct relationship with education (Basyiar et al., 2021). Education is a process through teaching or training that can improve the mental, emotional and intellectual development of individuals. With high education, pregnant women will find it easier to face and overcome any psychological and physiological changes during pregnancy due to a high understanding of the health information obtained and will also increase the desire to conduct pregnancy checks for the health of the mother and baby in the womb fold (Apriani et al., 2021).

There is no relationship between education level and the incidence of maternal mortality because the proportion of coverage of Antenatal Care visits that are not achieved between low education levels is not much different from pregnant women with higher education levels, as well as the proportion of coverage of Antenatal Care visits that are achieved between pregnant women with low education is not much different from pregnant women who have a high level of education, this shows that highly educated mothers do not always behave positively, and mothers with low education do not always behave negatively (Andini, 2020).

### **The Relationship between Income and Maternal Mortality for the Period 2022-2023 in City X**

Based on the results of the bivariate analysis seen from table 4.7, it shows that there is no relationship between income and maternal mortality with a Pvalue (0.112) > 0.05. The results showed that the incidence of maternal mortality in low income was 48.3%. Conversely, the incidence of maternal deaths in high income was 13.8% (Ananda, 2020).

Income determines the pattern of what food is purchased, the higher the income, the more the expenditure for shopping. An increase in household income, especially for poor households, can improve nutritional status, because the increase in income allows them to buy better quality and quantity of food (Picchioni et al., 2022). Economic circumstances are an important factor in determining the amount and type of goods or food available in the household. The higher the income, the higher the total expenditure and food expenditure (Haribowo et al., 2022). Thus income is the factor that most determines the quality and quantity of food. In this study, income level was not associated with the incidence of maternal mortality because although respondents had low family income, they had sufficient knowledge about nutritious food so that there was a balance between food input and food needs needed by the body, while respondents who had

low income experienced death because they were unable to fulfill their nutritional intake (Andini, 2020).

### **The Relationship between Family Support and Maternal Mortality for the Period 2022-2023 in X City**

Based on the results of the bivariate analysis, table 4.8 shows the relationship between family support and maternal mortality with a Pvalue (0.003) <0.05 and OR of 12.048. The results showed that the incidence of maternal mortality in low family support was 69%. Conversely, the incidence of maternal mortality in high family support was 31%.

This study is in line with research conducted by Rustikayanti & Rahayu (2020) there is a relationship between family support and the incidence of death in the Cimanggung Health Center working area and research conducted by Siauta et al. (2023) there is a relationship between family support and the incidence of death in Mekar Jaya Village, Campaka Health Center Working Area Kab. Cianjur Prov. West Java.

The participation and support of the family in the form of attention, especially in pregnancy issues concerning the health of the mother and fetus. The attention given by the family can build the emotional stability of pregnant women and as motivation. This is in accordance with the theory (Li et al., 2019) that family support is a process of relationship between the family and the social environment. At all stages, family social support is able to function with a variety of intelligence and reason, so that it will improve their health and adaptation in life. The family is the main support system in providing direct care in every state of health in their family members (Ameis et al., 2020). Providing support for one of the family members is very important in the healing and recovery process of the patient, especially family support both emotionally, appreciation, instrumental, and informational (Aeni, 2013).

### **Dominant Factors Associated with Maternal Mortality for the Period 2022-2023 in City X**

The value of B is positive in the history of disease variable. The magnitude of the relationship is shown by the Exponent Beta (EXP B) value of the history of disease variable of 2.326, meaning that the incidence of maternal mortality with a history of disease will be 2.326 times more related.

Based on this study, it appears that the most dominant variable associated with the incidence of maternal mortality is history of illness. Maternal death is a complex event caused by various causes that can be divided into near, intermediate, and distant determinants. Near determinants that are directly related to maternal mortality are obstetric disorders such as bleeding, preeclampsia/eclampsia, and infections or diseases suffered by the mother before or during pregnancy that can worsen pregnancy conditions such as heart disease, malaria, tuberculosis, kidney disease, and acquired immunodeficiency syndrome. Near determinants are directly influenced by intermediate determinants related to health factors, such as maternal health status, reproductive status, access to health services, and health facility use behavior.

The distant determinants are related to demographic and sociocultural factors. Low public awareness about maternal health, poor women's empowerment, educational background, family socioeconomic, community and political environment, and policies are indirectly thought to play a role in increasing maternal mortality. Some factors that potentially increase the prevalence of preeclampsia/eclampsia are first-time pregnancy (primigravida), history of pre-pregnancy illness (kidney disease and high blood pressure), pregnancy with higher uterine strain (pregnancy with too much amniotic fluid, multiple pregnancy, and pregnancy with large fetus). Observation of the prevalence of preeclampsia/eclampsia in the case group found that most of the sample became pregnant at the age of > 35 years which is at risk. Research in Finland, women who become pregnant at the age of more than 35 years have a 1.5 times greater

chance of experiencing preeclampsia than pregnant women under 35 years old Jayanti & Wibowo, 2016).

## Conclusion

There is an association between age, medical history, parity and family support with the incidence of maternal mortality in 2022-2023 in X City. There is no association between education level and income with the incidence of maternal mortality in 2022-2023 in City X. And among all the independent variables, history of illness is the most dominant factor associated with the incidence of maternal mortality in the period 2022-2023 in City X.

## Suggestion

This study is expected to make the institution where the research was conducted to further improve complete knowledge from a variety of accurate information related to the incidence of maternal mortality. to be more active in socializing or providing education, namely in providing health promotion and information about maternal mortality to the community by straightening out different information in the community. Early detection of risk factors and potential obstetric complications, especially complications of pregnancy and childbirth so that optimal prevention efforts can be made. For other researchers who are interested in similar studies, especially the incidence of maternal mortality, it is advisable to conduct research with different methods to dig deeper so that other factors associated with the incidence of maternal mortality can be known.

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