

## ARTICLE

# Maternal complications and risk factors for mortality

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## Abstract

**Background:** Maternal mortality could be prevented through early detection, including the period preceding pregnancy. Women of childbearing age are faced with extreme uncertainties, hence the purpose of this study was to analyse maternal complications and the possible high-risk factors connected to maternal mortality.

**Design and methods:** A case-control study was used to study the causes of maternal mortalities amongst pregnant, delivering, and postpartum mothers between 2017 and 2018. A total sample size of 48 samples was selected through simple random sampling.

**Results:** The result of logistic regression analysis showed nutritional status, prominence of anemia, history of illness, age, antenatal care ANC examination, method of delivery, late referral, occupational status, as well as postpartum complications, as the most influencing risk factors. This very high significance for maternal mortality was based on the chi-square value of 109.431 (p equal to 0.000), and R square (0.897).

**Conclusions:** In conclusion, the potential risk factors of maternal mortality include nutritional status, state of anemia, history of illness, age, ANC examination, delivery method, late referral, occupational status, and pregnancy complications, which is specifically the most dominant factor.

## Introduction

Every year, an estimate of 358,000 maternal mortalities is recorded worldwide, with about 99% cases occurring in poor developing countries, and 67% reported in a group of eleven countries, which include Indonesia. Moreover there has been an upsurge in the Maternal Mortality Rate (MMR) of East Java from 91.00 to 91.92 per 100,000 live births in 2017 and 2018, respectively. Laksono and Rachmawati reported on 10 preventable cases out of 19, if recognized prior to the onset of pregnancy. These include women of childbearing age with high risk of being in the unmet need group, consisting of heart disease, breast cancer, HIV/hepatitis, etc.<sup>1-4</sup>

Higher risks of maternal mortality were influenced by factors

include low education, lack of prenatal visits, caesarean delivery, haemorrhage, and hypertension. Early screening is expected to reduce maternal mortality rates.<sup>3</sup> The purpose of this research, therefore, was to analyze the high-risk factors and complications associated with maternal mortality, and to also identify fit/final models with the capacity to predict maternal complications.

## Design and methods

A case-control study was used to study the causes of maternal mortalities amongst pregnant, delivering, and postpartum mothers between 2017 and 2018. A total sample size of 48 cases was selected through simple random sampling.<sup>5</sup> This study used primary data obtained through interviews and the observation of family members, while discussions regarding the control group were conducted with midwives assisting in the childbirth process. Conversely, the secondary data were obtained from the records on maternal mortalities and antenatal records (KMS), verbal autopsy (OVM), and any other relevant literature.<sup>6-9</sup> The analytical methods used linear logistic regression.

## Results and Discussions

The result from Table 1 suggested anemia as the leading cause of complications, which was diagnosed in 14 women (14.3%). This was followed by labor issues resulting from late referral, reported in 13 (13.3%) cases, and the most significant determinant was that a majority were working mothers, consisting of 71 women (72.4%). The results of the Mantel–Haenszel test indicated the characteristics of nutritional status, state of anemia, history of illness, age, ANC examination, method of delivery, late referral and working status as risk factors in maternal mortality (Table 2).<sup>10,11</sup> Table 3 showed complication in pregnancy as the most dominant factor influencing maternal mortality. This was based on the fact that affected mothers had a 0.3% higher risk of death than others.<sup>12-14</sup> The logistic regression analysis (Table 4) attributed a high significance to the model incorporating the influence of

### Significance for public health

*An upsurge in the maternal mortality rate of East Java indicates maternal health status in this particular area. Reducing maternal mortality is challenging due to the fact that 99% of maternal mortality occur in low-middle income countries. However, maternal mortality is preventable through early detection of complications and adequate treatment. This study highlights the potential risk factors of maternal mortality, which include nutritional status, state of anemia, history of illness, age, antenatal care (ANC) examination, delivery method, late referral, occupational status, and pregnancy complications.*

**Table 1. Risk factors for maternal mortality.**

Risk factors	Criteria	N=98	Percentage (%)
Nutritional status	Good nutrition	73	74.5
	Chronic energy deficiency	25	25.5
Anemia status	No anemia	84	85.7
	Anemia	14	14.3
History of illness	No history of illness	68	69.4
	With history of illness	30	30.6
Age	Normal (20–35 years old )	76	77.6
	Risky (<20 years and >35 years old)	22	22.4
Parity	Not risky (2–4)	77	78.6
	Risky	21	21.4
Pregnancy distance	Not risky (>2 years )	79	80.6
	Risky (<2 years )	19	19.4
ANC examination	Good (>4 times)	68	69.4
	Not good (<4 times)	30	30.6
Childbirth helper	Health workers	98	100.0
	Non–health workers	0	0.0
How to give birth	Spontaneous	86	87.8
	With action	12	12.2
Late referrals	Not late	85	86.7
	Late	13	13.3
Mother's education	High school and college	86	87.8
	Below middle school	12	12.2
Occupational status	Working	71	72.4
	Does not work	27	27.6
Place of incident	House	56	57.1
	Public Health Center	0	0.0
	Hospital	42	42.9

**Table 2. Relationship between risk factors and maternal mortality.**

Maternal risk factors	Criteria	Maternal mortality		Odds ratio (95% CI)	R value
		Yes (%)	No (%)		
Nutritional status	Good nutrition	47 (94.0%)	26 (54.2%)	13.256 ** (3.620-48.540)	0.457
	Chronic energy deficiency	3 (6.0%)	22 (45.8%)		
Anemia status	No anemia	48 (96.0%)	36 (75.0%)	8.000 ** (1.684-37.997)	0.300
	Anemia	2 (4.0%)	12 (25.0%)		
History of illness	No history of illness	47 (94.0%)	21 (43.8%)	20.143 ** (5.495-73.337)	0.545
	With history of illness	3 (6.0%)	27 (56.2%)		
Age	Normal (20–35 years old )	43 (86.0%)	33 (68.8%)	2.792 * (1.022-7.630)	0.207
	Risky (<20 years and >35 years old)	7 (14.0%)	15 (31.2%)		
Parity	Not risky (2–4)	42 (84.0%)	35 (72.9%)	1.950 (0.726-5.239)	0.135
	Risky	8 (16.0%)	13 (27.1%)		
Pregnancy distance	Not risky (> 2 years old)	43 (86.0%)	36 (75.0%)	2.048 (0.730 – 5.747)	0.139
	Risky (<2 years )	7 (14.0%)	12 (25.0%)		
ANC examination	Good (>4 times)	48 (96.0%)	20 (41.7%)	33.600 ** (7.302-154.620)	0.589
	Not good (<4 times)	2 (4.0%)	28 (58.3%)		
Childbirth helper	Health workers	50 (51.0%)	48 (48.0%)	0	0
	Non–health workers	0 (0%)	0 (0%)		
How to give birth	Spontaneous	48 (96.0%)	38 (79.2%)	6.316 ** (1.305-30.562)	0.257
	With action	2 (4.0%)	10 (20.8%)		
Late referrals	Not late	48 (96.0%)	37 (77.1%)	7.135 ** (1.490-34.175)	0.279
	Late	2 (4.0%)	11 (22.9%)		
Mother's education	High school and college	45 (90%)	41 (85.4%)	1.537 (0.452-5.221)	0.070
	Junior high school	5 (10%)	7 (14.6%)		
Working status	Working	45 (90%)	26 (54.2%)	7.615 ** (2.575-22.525)	0.401
	Not working	5 (10%)	22 (45.8%)		

**Table 3. Maternal complications and mortality.**

Types of maternal complications	Maternal mortality		Odds ratio (95% CI)	R value
	Yes (%)	No (%)		
No complications	48 (96.0%)	0 (0.0%)	540.5 ** (58.195-5020.006)	0.900
Pregnancy complications	2 (4.0%)	8 (16.7%)		
Labor complications	0 (0.0%)	12 (25.0%)		
Postpartum complications	0 (0.0%)	28 (58.3%)		

**Table 4. Partial Test Results in Logistic Regression.**

Risk factors	B	P value	Exp (B)	95% CI	
				Lower	Upper
Nutritional status (1)	-2.704	0.119	0.067	0.002	2.010
State_of_anemia (1)	-1.152	0.646	0.316	0.002	43.382
History of illness (1)	-2.485	0.132	0.083	0.003	2.111
Age (1)	-0.615	0.628	0.541	0.045	6.478
Anc examination (1)	-0.644	0.657	0.525	0.031	8.989
Delivery method (1)	-1.807	0.536	0.164	0.001	49.991
Late_referral (1)	-1.748	0.453	0.174	0.002	16.726
Complications		0.002			
Complications (1)	-5.797	0.001	0.003 **	0.000	0.080
Complications (2)	-0.282	0.877	0.754	0.021	26.612
Complications (3)	-0.735	0.644	0.479	0.021	10.827
Constant	11.826	0.020	136814.258		

nutritional status, state of anemia, disease history, age, ANC examination, delivery method, late referral, occupational status, and postpartum complications with maternal mortality, based on the chi-square value of 109.431 ( $p=0.000$ ). Furthermore, an Nagelkerke R square of 0.897 was also estimated, indicating that 89.7% of cases were explained by the model variables, while the remaining 11.3% is due to other factors outside the scope of this research.<sup>15-17</sup> Meanwhile, a reference to the African governments affiliated the reduction of maternal mortality with an improvement in the upstream predictors, including poor maternal health, poverty, inequality,<sup>14</sup> and access to quality health services.<sup>18-20</sup>

The prevention of pregnancy complications is actually possible through early detection, conducted by regular and quality examinations, especially for high-risk pregnancies.<sup>21</sup> This is one of the programs practiced in the Public Health Center, although in a simple way, due to the fact that all pregnancies are basically risky, hence early intervention is important for everyone.<sup>22,23</sup>

The occurrence of high maternal mortality rate in Indonesia is suggestive of low quality health services, and this is assumed impossible to reduce without an effective referral system, especially in cases with complications.<sup>24,25</sup> Instances where death results from illnesses suffered prior to pregnancy are basically preventable with early detection. This has not been of major concern to health workers conducting antenatal examinations.<sup>26</sup> However,

an observation of the antenatal records (KMS) in the case group findings suggested the absence of any disease history in most deceased patients, while interviews with family and OVM observations showed otherwise.<sup>27</sup> The results of a research conducted in Madagascar associated some community practices, including women's wages and literacy with reduced maternal mortality. In addition, the other factors include the regular creation of time for hospital visits, and adopting treatment regimen for malaria and tuberculosis.<sup>25</sup> Meanwhile, there has been an increase in wages and also the level of education by the Indonesian government, hence pregnant women become more aware of the importance of antenatal care and, while delivery is mainly performed at home as a result of sociocultural and religious preferences. However, it also is possible to fight maternal mortality in this region with while recognizing the values and beliefs of women and families.<sup>28-30</sup>

## Conclusions

In conclusion, the potential risk factors of maternal mortality include nutritional status, state of anemia, history of illness, age, ANC examination, delivery method, late referral, occupational status, and pregnancy complications, which is specifically the most dominant factor.

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## References

1. East Java Health Service. Health profile book. Surabaya: East Java Health Office; 2017.
2. Laksono AD, Rachmawati T. Midwife Acceptability in Implementation of Labor Warranty Policy in the District Mojokerto. Buletin Penelitian Sistem Kesehatan 2013;16:341-9.
3. Bauserman M, Lokangaka A, Thorsten V, et al. Risk factors for maternal death and trends in maternal mortality in low- and middle-income countries: A prospective longitudinal cohort analysis. *Reprod Health* 2015; 12:S5.
4. English FA, Kenny LC, McCarthy FP. Risk factors and effective management of preeclampsia. *Integr Blood Press Control* 2015;8:7-12
5. Kasparis I, Andreou E, Phillips PC. Nonparametric predictive regression. *J Econom* 2015;185:468-94.
6. Baschat AA. First-trimester screening for pre-eclampsia: moving from personalized risk prediction to prevention. *Ultrasound Obstet Gynecol* 2015;45:119-29.
7. Cunningham GF, Leveno KJ, Bloom SL, et al. *Williams Obstetric* Jakarta: EGC; 2013.
8. Davies L, McDonald S. *Pemeriksaan kesehatan bayi: Pendekatan multidimensi*. Jakarta: EGC; 2011.
9. Rush D. Nutrition and maternal mortality in the developing world. *Am J Clin Nutr* 2000;72:212S-240S.
10. Bartsch E, Medcalf KE, Park AL, et al. High Risk of Pre-eclampsia Identification Group. Clinical risk factors for pre-eclampsia determined in early pregnancy: systematic review and meta-analysis of large cohort studies. *BMJ* 2016;353:i1753.
11. Aksornphusitaphong A, Phupong V. Risk factors of early and late onset pre-eclampsia. *J Obstet Gynaecol Res* 2013;39:627-31.
12. Kilpatrick SJ, Prentice P, Jones RL, et al. Reducing Maternal Deaths Through State Maternal Mortality Review. *J Women's Health* 2012;21:905-9.
13. Duckitt K, Harrington D. Risk factors for pre-eclampsia at antenatal booking: Systematic review of controlled studies. *BMJ* 2005;330:565.
14. Hobel CJ, Hyvarinen MA, Okada DM, et al. Prenatal and intrapartum high-risk screening. *Am J Obstet Gynecol* 1973;117:1-9.
15. Wallis AB. Addressing gaps in maternal, neonatal, and child health for achieving SDG 2030 in West Africa. *Maternal and Newborn Health* 2018;22:9.
16. McCall SJ, Nair M, Knight M. Factors associated with maternal mortality at advanced maternal age: A population-based case-control study. *BJOG* 2016;124:1225-33.
17. Medforth J, Battersby S, Evans M, et al. *Kebidanan Oxford dari bidan untuk bidan*. Jakarta: EGC; 2013.
18. Hernandez JC, Moser CM. Community level risk factors for maternal mortality in Madagascar. *Afr J Reprod Health* 2013;17:118.
19. Azubuke SO, Odagwe NO. Effect of free maternal health services on maternal mortality: An experience from Niger Delta, Nigeria. *CHRISMED J Health Res* 2015;2:309-15.
20. Abubakar S, Adamu D, Hamza R, et al. Determinants of home delivery among women attending antenatal care in Bagway Town, Kano Nigeria. *Afr J Reprod Health* 2017;21:73-79.
21. Nyflot L, Sitras V. Strategies To Reduce Global Maternal Mortality. *Obstet Gynaecol* 2018;97:639-40.
22. Hirshberg AMD, Srinivas SK. Epidemiology of Maternal Morbidity and Mortality. *Semin Perinatol* 2017;41:332-7.
23. Ozimek JA, Kilpatrick SJ. Maternal Mortality in the Twenty-First Century. *Obstet Gynecol Clin North Am* 2018;45:175-86.
24. Howell AE. Reducing Disparities in Severe Maternal Morbidity and Mortality. *Clin Obstet Gynecol* 2018;61:387-99.
25. Geller SE, Koch AR, Garland CE, et al. A Global of View of Severe Maternal Morbidity: Moving Beyond Maternal Mortality. *Reprod Health* 2018;15:98.
26. MacDorman MF, Declercq E, Thoma ME. Trends in Maternal Mortality by Sociodemographic Characteristics and Cause of Death in 27 States and the District of Columbia. *Obstet Gynecol*. 2017;129:811-8.
27. Main EK. Reducing Maternal Mortality and Severe Maternal Morbidity Through State-based Quality Improvement Initiatives. *Clin Obstet Gynecol* 2018;61:319-31.
28. Thaddeus S, Maine D. Too Far To Walk: Maternal Mortality in Context. *Soc Sci Med* 1994;38:1091-110.
29. Harville EW, Apolzan JW, Bazzano LA. Maternal Pre Pregnancy Cardiovascular Risk Factors and Offspring and Grandoffspring Helath: Bogalusa Daughters. *Int J Env Res and Public Health* 2019;16:15.
30. Nankali A, Malek-Khosravi Sh, Zangeneh M, et al. Maternal complications associated with severe preeclampsia. *J Obstet Gynaecol India* 2013;63:112-5.