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Determinants of Maternal Mortality Rate in Grobogan

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Abstract

The maternal mortality rate is a reflective indicator of mother health statuses. The impact of the high maternal mortality rate also describes the poor degree of community health. This situation potentially degrades the economic growth and social levels at domestic, community, and national levels. This research analyzed the influential determinant of maternal mortality rate in Grobogan Regency. This quantitative research used an applied controlled-case study. The sample consisted of 36 cases with 36 and 72 controlled cases within a 1:2 ratio. The researcher used the total sampling technique to take the sample of the case group. On the other hand, the researchers simple random sampling technique to take the controlled-group sample. The independent variables were high-risk pregnancy, health care service access, and antenatal care with complications as the intervening variables; and maternal mortality as the dependent variable. The researchers used bivariate analysis with Chi-Square and multivariate analysis with the path analysis. The results showed the influences between high-risk pregnancy, antenatal care, and complication on maternal mortality rate. The researchers also found high-risk pregnancy influenced maternal mortality via complications.

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INTRODUCTION

The maternal mortality rate is a reflective indicator of mother health statuses, especially the mortality risk of pregnant and labor mothers. WHO explains that maternal mortality of mothers refers to mortality due to pregnancy or a maternal state within 42 days after the delivery. It happens due to all related matters to maternity and maternal management instead of unfortunate incidents and injuries (Kemenkes RI, 2014)

The maternal mortality rate became the predetermined target of the fifth development of the Millenium Development Goals, MDGs, to decrease the mortality rate of mothers until reaching a 75% of mother mortality rate from 1990 to 2015. MDGs ended in 2015. Then, the World Health Organization determined a new agenda to continue the development, to maintain the Sustainable Development Goals, SDGs. The targeted objective was to decrease the Maternal Mortality Rate globally until reaching a lower ratio of 70/100.000 life birth within 2030 (Jayanti et al., 2016).

WHO argues that the mother mortality rate is extremely high. Every day, 830 mothers in the world pass away due to pregnancy and delivery complications. In 2015, 303.000 mothers passed away during the pregnancy and the delivery. Most mortality rates of mothers, 99%, occur in developing countries. Mortality rates in developing countries, in 2015, were 239 mortality rates per 100.000 life birth. These rates were higher than in advanced countries, with 12 mortality rates per 100.000 life birth (WHO, 2014).

Based on the results of the Inter-Population Survey Census, SUPAS, in 2015, the maternal mortality rate in Indonesia was 305/100.000 life birth. The rate put Indonesia as the second-high rank country in terms of mortality rate in South-East Asia, after Laos with a mortality rate of 357 per 100.000. The maternal mortality rate of Indonesia was higher than the maternal mortality rates of Malaysia and Singapore. In 2015, Malaysia's live-birth-mortality rate of mothers was 24 per 100.000 while Singapore's was only 7 per 100.000 live births (Rochmatin, 2018).

In Indonesia, a percentage of 52.6% of mother and infant mortality rates were contributed from six provinces. They were Northern Sumatera, Southern Sumatera, Banten, West Java, East Java, and Central Java. In this case, Central Java had high infant and mother mortality rates (Nurmawati & Indrawati, 2018). The mother mortality rate in Central Java, in 2015, was 109.65 per 100.000 live births. In 2017, the mortality rate in Indonesia decreased to 88.05 per 100.000 live births. Then, in 2018, the rate lowered to 78.6 per 100.000 live births. The rate in 2017 did not meet the targeted objective of Sustainable Development Goals (SDGs), 70 per 100.000 live births (Dinkes Prov Jawa Tengah, 2018).

In Central Java, Grobogan Regency contributed the highest maternal mortality rate in 2018. In 2016, the maternal mortality rate of Grobogan regency was 127.18 per 100.000 live births with total cases of 28 cases. In 2017, the rate decreased to 83.52 per 100.000 live births with total cases of 18 cases. Then, the rate increased in 2018 to 31 cases. After that, in 2019, the rate increased to 36 cases (Dinkes Kabupaten Grobogan, 2017).

The predictors of mother mortality rates included hemorrhage (25%), infection or sepsis (15%), unsafe abortus (13%), eclampsia (12%), delayed parturition (8%), and other causes, such as embolism, ectopic pregnancy, and other anesthesia-related problems. Then, a third of the cases occurred due to indirect causes, such as pre-observed diseases or complications before the pregnancy and the delivery, such as malaria, AIDS, anemia, hypertension, diabetes mellitus, hepatitis, and heart disease (Fibriana & Azam, 2010). These matters worsen the pregnancy period and the delivery.

McCharty & Maine (1992) mention three influential factors of maternal mortality. The first factors, the close determinants, are pregnancy and complications during the pregnancy, the delivery, and the postpartum period. The second factor is the transitional determinant. This determinant refers to any close-direct influential factors, consisting of health statuses of mothers, reproduction statuses, health care service accesses, and health care user behaviors. The third factor is the outer determinant. This determinant includes cultural and economic factors, such as the mothers' statuses inside the families and communities (Yasril & Mahmudah, 2018).

The efforts to decrease the maternal mortality rate by the Central Java Government are realized in

Jateng Gayeng Nginceng Wong Meteng Program, 5NG. The program contains 4 phases, starting from pre-pregnancy, pregnancy, delivery, and postpartum phases. The first and second phases before pregnancy could lead to a stop or a delay. The stopped pregnancy occurs when the mothers are older than 35 years old. In this category, the mothers also have experience of giving birth. Then, the second category, the delay category, occurs if the mothers are younger than 20 years old. It happens because the women's health organs are not optimum. In the second phase of the pregnancy phase, the mothers' conditions can be detected, recorded, and reported in a system with information technology. The third phase, the delivery phase, refers to a giving-birth process of a mother that should be accompanied and monitored. Mothers with normal delivery should receive standardized health facilities. However, mothers with high risks of delivery should be referred to the hospital and must be monitored, diinceng, by Family Welfare Movement, Desa Wisma, and the surrounding community. In the fourth phase or postpartum phase, the mothers must receive postpartum care from the doctors, obstetricians, and nurses. The surrounding people, including the FWM, Desa Wisma, and the community must monitor the postpartum mothers. In this phase, the system records and monitors the postpartum mothers and the infants for the first 1000 days after the first day of the delivery(Dinkes Prov Jawa Tengah, 2017).

METHOD

This quantitative research used an applied controlled-case study. The sample consisted of 36 cases with 36 and 72 controlled cases within a 1:2 ratio. The inclusion criteria of the cases are maternal mortality in mothers living in Grobogan. The inclusion criteria of control cases for labor women that passed away on the same day or a day later after giving birth, living and staying in Grobogan regency, and were willing to join the research. The researcher used the total sampling technique to take the sample of the case group. On the other hand, the researchers simple random sampling technique to take the controlled-group sample. The researchers collected the data through interviews, questionnaires, and medical records.

The independent variables consisted of high-risk pregnancy, health care access, and ANC or antenatal care. Then, the intervening variables were complications and maternal mortality. These variables also functioned as dependent variables. The researchers used bivariate analysis with Chi-Square and multivariate analysis with the path analysis.

RESULTS AND DISCUSSION

The bivariate analysis result showed a p-value of 0.0001 < 0.05; CI (95%) = 8.01 until 83.65 for the pregnancy risk with mother mortality rate. The result indicated the significant influence between high-risk pregnancy and mother mortality rate.

Table 1. The Influence of High-Risk Pregnancy and Mother Mortality Rate

Pregnancy Risks	Mortality		OR	CI (95%)		P
	Cases	Control		Lower limit	Upper limit	
High	32 (65,3%)	17 (34,7%)	25.882	8.01	83.65	0.0001
Low	4 (6,8%)	55 (93,2%)				
Total	36 (33,3%)	72 (66,7%)				

Source: Primary data 2021

The path-analysis showed a positive influence and significant correlation between high-risk pregnancy and mother mortality rate with a p-value of 0.000 < 0.05. Mothers with high-risk pregnancies had the mortality log odd of -0.450, lower than those with low-risk pregnancies. This result indicated that low-risk pregnancy had a 0.45 higher risk of mortality. The path analysis showed the influence of high-risk pregnancy via complications on the maternal mortality rate. The result is observable from the indirect comparison value (-0.109) > the direct value (-0.450).

The correlated diseases with mortality included heart disease, depression, epilepsy, and

bronchial asthma. Chronic diseases, such as tuberculosis, heart disease, kidney disease, malaria, hepatitis, anemia, and malnutrition contributed to the mother mortality rate in developing countries (Sarwani & Nurlaela, 2013).

A study about mother mortality rate factors in Tigray, Ethiopia, found mothers medical history influenced the mortality rate mothers. Mothers with medical history had 5.58 times higher risks than those without medical history (Godefay et al., 2015). In this research, high-risk pregnancy made pregnant mothers have 25.89 higher risks of maternal mortality than those with lower-risk pregnancies.

Rajbanshi et al., (2020) with their study titled, "High-risk pregnancies and their association with severe maternal morbidity in Nepal: A prospective cohort study," found a high-mortality rate prevalence with a percentage of 14.4%. Based on the risk stratification with color labels, 7.5% of women were labeled red, 6.9% labeled yellow, 72.0% labeled green, and 13.6% labeled white. Women with high-risk pregnancies suffer a greater probability to develop comorbid, 4.2 times, during the delivery.

The risky and harmful factors of perinatal results included congenital anomaly, lower APGAR score, twin pregnancy, and amniotic fluid contamination. Although the rate of pregnancy complications is higher than the survey result in 2010, the perinatal and neonatal mortality rates kept decreasing, specifically observed in very premature births (Zhu et al., 2019).

Zhu et al., (2019) Found that complications of pregnancy included early premature rupture of membrane or PROM (8.9%), HDP (4.9%), anemia (7.6%), pre-eclampsia (4.3%), placenta previa (0.6%), hepatitis (4.0%), and diabetes (1.5%) from the total births. Women with pregnancy complications had higher and more significant rates of mortality during the delivery and neonatal mortality.

Mothers with delayed deliveries, during the age of 35 years old, had a higher chance to have premature birth with a lower born weight than mothers aged younger than 20 years old. The survey also showed less than 1% of all letterless mothers, those with educational backgrounds for more than 9 years, highly suffered from pregnancy complications. They were also being treated at third-level hospitals. Their amniotic fluid was contaminated. The other results showed these mothers had a premature delivery or very premature delivery compared to the mothers with lower educational backgrounds. However, mothers with more than 9 years of educational background did not experience c-section surgery, lower Apgar score, and neonatal mortality compared to mothers with lower educational backgrounds. The primary mortality cause related to high-risk pregnancy included embolism, amniotic fluid, pulmonary embolism, postpartum hemorrhage, stroke, and sepsis. Most mother mortality prevalences were reported from mothers that lived in villages. They had less than 9-year educational background. In this case, reports showed the mothers were treated at level I and II hospitals. Since the applied regulation of having two children, universally, in 2016, the government had to anticipate the mother mortality rate increase and pregnancy complications in the later years. This anticipation was important because most mothers would be in a delayed-childbearing period. A current survey showed the related incidents and perinatal results to pregnancy complications could be a future-comparative reference(Zhu et al., 2019).

The bivariate analysis result showed a p-value of 0.114> 0.05; CI (95%) = 0.83 until 16.51 for the health care service access toward mother mortality rate The result showed no influences between health care service toward mother mortality rate. The variables of health care service access, based on the path analysis, showed a lower indirect beta value than the direct beta value. The values indicated no influence between health care service access via complication toward maternal mortality rate.

Table 2. The Influence of Health Care Service Access on Mother Mortality Rate

Access	Mortality		OR	CI (95%)		P
	Cases	Cases		Lower limit	Upper limit	
Difficult	5 (62,5%)	3 (37,5%)	3.71	0.83	16.51	0.114
Easy	31 (31%)	69 (69%)				
Total	36 (33,3%)	72 (66,7%)				

Source: Primary data 2021

The health care service access consisted of the accessible route of the health care location. If the location was not strategic nor difficult to reach, the mothers would experience low health care service type and quality, and the information availability (Jayanti, 2016).

Comfort, Peterson & Hatt (2013) conducted a systematic review and found that financial problems influence immediate and punctual access to health care services.

From the review, the three-delay model was important for maternal mortality incidents. The first problematic delay was - being late in deciding to seek health care treatment during obstetric complications or emergency state situations. These situations occurred because the patients and the surrounding people did not recognize the obstetric complication indications. They were afraid of taking the mothers to the hospitals. They were worried that they could not afford to pay the cost. The other problem was - the nurses had to wait for the husbands or the patients' parents to approve the medical treatments. The second delay was - incapability to reach the health care facility immediately. This problem was also influenced by transportation facilities and infrastructures. Some villages had limited and poor transportation facilities and infrastructures. Moreover, the geographical hindrances also made it the patients difficult to reach the referred hospitals. The third delay was - incapability to receive medical aid at the referred health care services. Many women had to wait for hours at the health center because of poor staff management, payment policy, difficulty to get a blood transfusion, lack of adequate equipment and drugs, and lack of surgical room (Fibriana & Azam, 2010).

The Basic Health Research, Riskesdas, in 2013, found the distance to reach the health care service was classified into: less than 1 km, 1-5 km, and more than 5 Km. On the other hand, the covering distance period to reach the health care facility was measured in minutes. The distance-covering periods were categorized into ≤ 15 minutes, 16-30 minutes, 31-60 minutes, and > 60 minutes (Dari, 2018).

A study in Tlogowungu found the moderate category of using health care service and health care access (mileage, traveling period, transportation, and travel expense). The average mileage was 3 - 6.25 Km. and the average traveling period was 10 - 15 minutes. Then, the transportation type was the personal vehicle (Ulfa et al., 2017).

The Basic Health Research data in 2017 showed a significant correlation between mileage and traveling period to reach the maternity care service in the village. The data showed mothers with mileage shorter than 247 m tended to frequently visit the maternity care service. The visit score was 1.147 higher than mothers living farther than 247 m (Adriana et al., 2014).

A study at Adaut Public Health Center, Selaru District, Maluku Regency, Western Nusa Tenggara showed a positive correlation between mileage and traveling period toward the birth-waiting house uses. The study found the most dominant patients, 67 respondents (87.0%), that used the facility were 25Km away from the birth waiting for houses. The rate was higher than for those living closer than 25 Km, 10 respondents (13%). In terms of traveling speed, the birth-waiting house users mostly needed more than 60 minutes to reach, 56 respondents (72.7%). This rate was higher than respondents that needed 30-60 minutes to reach the facility, 21 respondents (27.3%)

Chalhoub and May (2018) (Sukoco & Suparmi, 2017) conducted research titled, "The Health Care System and Racial Disparities in Maternal Mortality," which explains that patients encounter difficulties to access health care services. Although the patients had health insurance, they had difficulties accessing qualified health care immediately. Many women, especially in villages and remote areas, did not have a physical connection with doctors or maternity clinics to deliver the baby. In some cases, they had the connections but the costs were expensive. Thus, pregnant mothers did not receive adequate care. The additional health accesses, such as specialists, nurses of reproduction health, and nurses of mental health are also important.

In many remote areas, the access to reach maternity clinics, OB-GYN facilities, and professional medics is very rare. Thus, women have difficulties accessing immediate prenatal care and determining the qualified prenatal care facilities for their children. For example, Washington DC recently closed two maternity clinics - the Providence Hospital and United Medical Center. These clinics

served women with lower incomes so that they had difficulties accessing maternity care and giving birth. This situation also endangered the routine treatment to maintain the pregnant mothers' health. Visiting the same health care providers made doctors capable of managing their health conditions and creating important interactions. Thus, the patients would receive qualified health care treatments. Large-scale hospital closures and a lack of public health care choices provided lower options for women (Chalhoub & May 2018).

In this research, the researchers did not find any influence between health care access toward the mother mortality rate since 92.6 respondents could access the health care service easily. Ulfa et al., (2018) found that healthcare access was not correlated to healthcare service use. The research results were consistent with current research results. The current research found no positive influence of low health care services uses on mortality rate. The researchers found health care services indirectly influenced the respondents' conditions. Thus, health care services did not influence maternal mortality rate.

The bivariate analysis result showed a p-value of 0.0001< 0.05; CI (95%) = 2.39 until 17.08 for ANC toward mother mortality rate The result indicated the significant influence between ANC and mother mortality rate. Poor and incomplete antenatal checkups increased mother mortality rate, 21.06 higher (p = 0.0001; CI 95% = 2.39 - 17.08). The variables of health care service access, based on the path analysis, showed a lower indirect beta value than the direct beta value. The values indicated no influence of ANC via complication on maternal mortality rate.

Table 3. The Influence of ANC and Mother Mortality Rate

ANC	Mother Mortality Rate		OR	CI (95%)		P
	Cases	Control		Lower limit	Upper limit	
Not standard	22 (81.5%)	5 (18,5%)	21.06	6.81	65.12	0.0001
Standard	14 (17.3%)	67 (82,7%)				
Total	36 (33,3%)	72 (66,7%)				

Source: Primary data 2021

Oyerinde, Bausement et al. also found the influence of lower antenatal care on mortality rate, 1.8 higher mortality risks. Astuti et al., (2017) found mothers with lower antenatal visits were susceptible to mortality risks, 5.4444 higher than those with higher antenatal visits. Yego et al. found that mothers without antenatal care visits had 4.1 higher maternal mortality risks.

Antenatal Care is a pregnancy checkup service for pregnant women with standardized visit frequency, at least 4 visits within a period of pregnancy. The visits should be done once in the first trimester, once in the second trimester, and twice in the third trimester (Yuni & Usa, 2017).

ANC is also useful to monitor the mothers' health and detect any pregnancy complications. ANC is also useful to build mother-health worker interaction. Thus, the health workers can provide health care service education for further follow-up, such as the delivery with medical workers and postpartum visits (Saptarini et al., 2013).

Poor and incomplete antenatal checkups increased mother mortality rate, 7.86 higher (p = 0.0001; CI 95% = 2.39 - 17.08). From 2007 to 2009, in Bulukumba Regency, many pregnant women did not participate in routine antenatal checkups. Their visits were lower than 4. This poor antenatal checkup had 4.57 higher mortality risks than those with routine antenatal visits and checkups. In a study in Southern Sumatra Province, mothers with lower antenatal care visits had 3.5 higher mortality risks than mothers that visited antenatal care more than four times (Aeni, 2013).

Bazar, (2016) also found in the case group a percentage of 64% of ANC visits less than four times. On the other hand, the control group had a percentage of 62.7% with 4 ANC visits. The researchers found a significant correlation between ANC visits and mother mortality rate (OR 2,98, p = 0,001). Pregnant mothers should prevent pregnancy complications during the delivery by checking up on the pregnancy at least four ANC visits during the pregnancy based on the applied standard of the

Health Department. The service realization during the first trimester, trimester I (16 weeks), was useful to prepare and detect early anemia. This service was also useful to prepare the delivery place, delivery helper, and delivery counseling for pregnant mothers. The realizations of the second and third-trimester services, II trimester (24-28 weeks), and III trimesters (28-36 weeks) were to manage the predicted complications (Rahmawati, 2016).

The antenatal risk screening process was more useful than routine ANC checkups. Early identification and routine-risk assessment system were also more useful than telling the service dates since the pregnant mothers' health fluctuated. The risk stratification ensures high-risk women receive immediate care and prevent worsening situations. A risk-assessment approach would require a protocol to manage risky conditions and a referral system. Future studies should use early-risk stratification for peripheral health institutions to study the reliability of the existing public health system (Rajbanshi et al., 2020).

The bivariate analysis result showed a p-value of 0.0001< 0.05; CI (95%) = 10.93 until 120.60 for complication toward mother mortality rate The result indicated the significant influence between complication and mother mortality rate.

Table 4. The Influence of Complication and Mother Mortality Rate

Complication	Mother Mortality Rate		OR	CI (95%)		P
	Cases	Control		Lower limit	Upper limit	
Exists	32 (71.1%)	13 (28.9%)	36.31	10.93	120.60	0.0001
Not exists	4 (17.3%)	59 (93.7%)				
Total	36 (33.3%)	72 (66.7%)				

Source: Primary data 2021

Severe pre-eclampsia becomes the greatest cause with a 30.5% mother mortality rate. Bazar, (2016) also found a percentage of 50% of mortality causes was pre-eclampsia.

Poor obstetric histories, such as the treated labor, hemorrhage, prolonged labor, and c-section wound influenced maternal mortality rates. Sarwani also found a significant correlation between delivery history and mother mortality rates. Mothers with delivery abnormality had 25.0 higher risks of mortality than those without delivery abnormality. The delivery abnormality suffered by those mothers were delayed delivery, labor pathogenesis, vacuum delivery, and caesarian delivery (Sarwani & Nurlaela, 2013).

The highest pregnancy complication of mother mortality rate is severe pre-eclampsia, 30.5%. Aeni (2013) also found two dominant pregnancy complications: pre-eclampsia and eclampsia. Some potential factors of increasing the pre-eclampsia and eclampsia prevalences include primigravida, pre-existing disease in pregnancy (kidney disease and hypertension), pregnancy with high-uterine stretch (caused by a high volume of amniotic fluid, multiple pregnancies, and larger fetus).

Stern et al., (2013) Found poor mental life quality in patients suffering from pre-eclampsia, p < 0.01, specifically those with severe pre-eclampsia (p<0,01). Mothers suffering from severe pre-eclampsia had lower results than those with mild pre-eclampsia, p = 0.003. Stern et al., (2013) found women with severe pre-eclampsia substantially had lower mental life quality.

The complications found in pregnant women and postpartum women contributed to the mother mortality rate with 36.31 higher risks, p = 0.00001; 95% CI = 10.93 - 120.60. Current research results were consistent with a study of mother mortality rates in the Cilacap Regency. The study found an OR value of 49.2 with p = 0.027. Another study with the same result was conducted at Dr. Mohammad Hoesin Hospital, Palembang. The research found an OR value of 8.50 with p = 0.001.

Astuti, Aziz, and Arya (2017), with their study titled, "maternal mortality risk factors in Dr. Hasan Sadikin General Hospital, Bandung in 2009-2013, found a percentage of 0.77% or 104 mother mortality rates of the total of 13.453 mother patients, from 2009 until 2013. The characteristics of both groups, the case and the control group, showed a correlation between pregnancy complication (p < 0.001), labor

complication ($p < 0.001$), postpartum complication ($p < 0.022$), age of the mother ($p < 0.001$), antenatal care ($p = 0.007$), the living place ($p = 0.049$), and mortality rate of mothers. On the other hand, the variables of parity and education did not indicate a significant correlation toward the mother mortality rate, $p > 0.05$. Mothers with complications during the pregnancy had a 6.368 higher risk of mortality rate than those without complications. Mothers with delivery complications had 5.083 higher mortality risks than those without complications. Mothers with neonatal complications had 4.382 higher mortality risks than those without complications. These findings supported the previous findings, showing the contribution of mother mortality rates due to obstetric complications, including pregnancy, delivery, and postpartum complications with a percentage of 75%. Mother mortality can be prevented with medical intervention.

In table 5, the path analysis showed a positive influence and significant correlation between high-risk pregnancy and mother mortality rate with a p-value of $0.015 < 0.05$. Mothers with high-risk pregnancies had the mortality log odd of -0.450, lower than those with low-risk pregnancies. Thus, mothers with low-risk pregnancies had a 0.45 mortality risk. The path analysis showed higher influences via complications on maternal mortality rate, observed from the indirect comparative value (-0.109), higher than the direct value (-0.450).

Table 5. The Direct Path Analysis Result

Dependent Variable	Independent Variable	R^2	Beta	t	P
Direct Influence					
Complication	← HR Pregnancy	0.171	-0.253	-2.470	0,015
	←Health care service access		-0.43	-0.479	0,633
	← ANC		0.258	2.483	0,015
Mother Mortality Rate	← HR Pregnancy	0.720	-0.450	-7.348	0.000
	←Health care service access		0.044	0.844	0.401
	← ANC		0.188	3.033	0.003
	← Complication		0.433	7.604	0.000

Source: Primary data (2021)

Table 6. The Indirect Path Analysis Result

Dependent Variable	Independent Variable	Beta	Conclusion
Mother Mortality Rate	← HR Pregnancy	-0.109	Ha accepted
	←Health care service access	-0.019	Ha denied
	← ANC	0.112	Ha denied

Source: Primary data (2021)

The variables of health care service access and ANC, based on the path analysis, showed a lower indirect beta value than the direct beta value. The values indicated no influence between health care service access and ANC via complication toward maternal mortality rate.

CONCLUSION

The high-risk pregnancy, ANC behavior, and complication influenced the maternal mortality rate in Grobogan. The health care service access did not influence the maternal mortality rate in Grobogan. The high-risk pregnancy influenced the maternal mortality rate moderated by complications in Grobogan. The health care service access did not influence the maternal mortality rate as moderated by complications in Grobogan.

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