Healthcare Determinants and Dominant Factors of Maternal Mortality Ratio

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Abstract

Background: Maternal mortality remains a critical health challenge, particularly in resource-limited settings, where socio-economic and healthcare system factors exacerbate risks during pregnancy and childbirth. This study examines the dominant factors influencing maternal mortality in Suppa District, Pinrang Regency, Indonesia, focusing on variables such as antenatal care (ANC), delivery techniques, birth attendants, health service availability, accessibility, affordability, and acceptability. Methods: A cross-sectional study was conducted in 2024, involving 176 respondents. Data were collected through structured questionnaires and analyzed using Chi-square and multivariate tests to determine the relationships between maternal mortality and the studied variables. Independent variables included ANC, delivery techniques, birth attendants, and health service dimensions such as availability, accessibility, and affordability. Results: Findings indicated no significant correlation between antenatal care and maternal mortality (p = 0.141). However, significant relationships were observed between maternal mortality and delivery techniques (p = 0.007), birth attendants (p = 0.003), availability of health services (p = 0.008), accessibility (p = 0.003), and affordability (p = 0.005). Multivariate analysis identified affordability (p = 0.002), birth attendants (p=0.003), and accessibility (p = 0.005) as the most significant factors influencing maternal mortality. Barriers included limited healthcare infrastructure, inadequate supplies, and geographic challenges. Conclusion: Maternal mortality in Suppa District is influenced by affordability, accessibility, and the role of skilled birth attendants. Interventions should focus on improving healthcare accessibility, affordability, and resource availability while ensuring the presence of trained professionals during childbirth. Policymakers must prioritize strategies to address these determinants to reduce maternal mortality effectively and sustainably.

Keywords: Maternal mortality, Accessibility, Affordability, Birth attendants, Health services

Significance | This study determined the critical factors like accessibility, affordability, and birth practices affecting maternal mortality, emphasizing targeted interventions for prevention.

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Introduction

Maternal Mortality Ratio (MMR) remains a pressing global health challenge despite considerable progress over the years. As a core focus of the Sustainable Development Goals (SDGs), particularly Goal 3, which aims to ensure healthy lives and promote well-being for all at all ages, the reduction of MMR is prioritized. Target 3.1 of the SDGs specifically seeks to reduce the global MMR to fewer than 70 deaths per 100,000 live births by 2030 (Ayele et al., 2021). However, recent data indicate significant disparities in achieving this target, with considerable challenges persisting across regions. The World Health Organization (WHO) reported in 2020 that the global MMR stood at 223 deaths per 100,000 live births, with progress rates varying widely across different regions. For instance,

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the Southeast Asian region exhibited remarkable reductions during the Millennium Development Goals (MDGs) era, decreasing MMR from 372 per 100,000 live births in 2000 to 117 in 2020 (WHO, 2024). Despite these advancements, developing countries continue to experience a disproportionately high MMR of 440 per 100,000 live births, nearly 20 times higher than the rate observed in developed countries, which is approximately 20 per 100,000 live births (Stowman, 2023).

According to UNICEF, the annual number of maternal deaths globally declined from 451,000 in 2000 to 287,000 in 2020, a significant achievement given the rapid population growth in high-burden regions. Yet, approximately 800 women still die each day from pregnancy- or childbirth-related complications, equating to one death every two minutes (Andini & Aan Julia, 2022). The leading causes of maternal deaths include pre-existing medical conditions exacerbated by pregnancy, postpartum hemorrhage, hypertensive disorders such as pre-eclampsia, infections, and complications from unsafe abortions.

WHO and UNICEF emphasize that most maternal deaths are preventable with timely access to skilled healthcare providers and high-quality medical services. Antenatal care plays a crucial role in identifying high-risk pregnancies and ensuring safe childbirth, underscoring the importance of equitable access to health services, adequate resources, and well-trained personnel (WHO, Geneva, 2023). However, broader social determinants, including income, education, gender norms, and environmental factors, significantly influence maternal health outcomes. External issues, such as political instability and climate change, further compound the risks (Andini & Aan Julia, 2022).

The Southeast Asian region demonstrates stark disparities in maternal mortality among its countries. Indonesia, for example, ranks third in maternal deaths within the ASEAN region, with an MMR of 173 per 100,000 live births as of 2020 (Goodstats, 2023). Within Indonesia, regional variations are pronounced. For instance, Papua Province recorded the highest MMR at 565 per 100,000 live births in 2020, while West Kalimantan had the lowest at 246 per 100,000 live births (Badan Pusat Statistik Indonesia, 2020).

South Sulawesi Province, where the Pinrang Regency is located, mirrors these disparities. In 2020, the MMR in South Sulawesi was 133 per 100,000 live births, as reported by the South Sulawesi Provincial Health Office. Maternal deaths in this province have been attributed to inadequate prenatal care coverage, unequal access to skilled birth attendants, and systemic healthcare gaps (Kesehatan Dinas Provinsi Sulsel, 2020).

The maternal health improvement program in Pinrang Regency focuses on addressing these gaps. Despite its efforts, the MMR in Pinrang has shown an alarming upward trend. Data from the Pinrang Health Office indicate an increase in maternal deaths from 59 per 100,000 live births in 2018 to 154 per 100,000 live births in 2022. The highest maternal mortality rates were recorded in the Suppa District Health Center's catchment area (Dinas Kesehatan Kab. Pinrang, 2022).

Several factors contribute to the persistently high MMR in regions like Pinrang Regency. Medical complications, including postpartum hemorrhage, hypertensive disorders, and infections, are primary causes. Furthermore, social determinants such as low levels of education, inadequate health infrastructure, and unequal distribution of healthcare resources exacerbate the issue. Rural areas often face additional challenges, including cultural barriers, limited transportation options, and a lack of awareness about the importance of antenatal care.

In South Sulawesi, efforts to reduce MMR include the implementation of the Childbirth Planning and Complication Prevention Program (P4K), which focuses on early detection of health risks and the provision of emergency obstetric and neonatal care. However, achieving comprehensive antenatal care coverage remains a challenge. While 93.3% of pregnant women in Pinrang Regency received at least one antenatal visit (K4), this figure fell short of the target of 98.5% in 2019. Disparities in reporting and access to healthcare facilities contribute to these gaps (Dinas Kesehatan Kab. Pinrang, 2022).

Given the rising MMR in Pinrang Regency and the broader disparities across Indonesia, it is imperative to implement targeted interventions. Strengthening healthcare systems, improving access to skilled healthcare providers, and addressing social determinants of health are critical steps. Comprehensive community-based programs that raise awareness about maternal health risks and promote the importance of antenatal care can significantly impact outcomes. Additionally, addressing systemic issues such as healthcare funding and infrastructure development is essential to ensure equitable access to quality services.

This study aims to analyze the dominant factors contributing to maternal mortality in Pinrang Regency. By identifying the underlying causes and regional disparities, it seeks to provide actionable insights that can inform policies and programs aimed at reducing MMR. Addressing this pressing issue requires a multi-faceted approach that integrates medical, social, and systemic strategies, with the ultimate goal of achieving the SDG target of fewer than 70 maternal deaths per 100,000 live births by 2030.

2. Materials and Methods

2.1 Research Design

This study utilized a quantitative cross-sectional research design to explore factors influencing maternal mortality in the Suppa Public Health Center area, Pinrang Regency. Cross-sectional research is particularly effective for analyzing relationships between independent and dependent variables within the same period.

Independent variables in this study included parity, pregnancy spacing, medical history, antenatal care, delivery techniques, birth attendants, and dimensions of healthcare access (availability, affordability, accessibility, and acceptability). The dependent variable was the Maternal Mortality Ratio (MMR). Data were gathered through structured questionnaires and analyzed to identify correlations between these variables and maternal mortality (I Made Laut Mertha Jaya, 2023).

2.2 Population and Sample

The research population comprised pregnant women residing in the Suppa Public Health Center service area, totaling 315 individuals. A probability sampling technique using random sampling was employed to select participants. Random sampling ensures every individual in the population has an equal chance of being selected, thus minimizing bias (Sugiyono, 2018).

To determine the sample size, the Slovin formula was applied:

$$n = \frac{N}{1 + Ne^2}$$

Description :

n = Sample size

N = Population

e = Percentage of error tolerance 5% (0.05

$$n = \frac{315}{1 + 315\ (0{,}05)^2}$$

$$n = \frac{315}{1 + 315\ (0{,}0025)}$$

$$n = \frac{315}{1 + 0{,}7875}$$

$$n = \frac{315}{1{,}7875}$$

$n =$ **176 respondents**

2.4 *Data Collection*

Primary data were obtained directly through face-to-face interviews using structured questionnaires administered to pregnant women in their homes. Before participation, each respondent received a detailed explanation of the questionnaire and its objectives. The instrument underwent **validity and reliability testing** to ensure its robustness.

2.4.1 Validity Testing: The **Product Moment Correlation Test** was conducted with 36 respondents. The calculated r-value for all variables exceeded the r-table value of 0.329 (significance level of 5%), confirming the validity of the questionnaire.

2.4.2 Reliability Testing: Reliability was assessed using **Cronbach's alpha**, yielding a value of 0.744, which exceeded the r-table threshold of 0.329, indicating high reliability.

2.4.3 Secondary data were sourced from records maintained by the Pinrang Regency Health Office, South Sulawesi Provincial Health Office, and relevant libraries to supplement the study's findings.

2.5 Statistical Analysis

Statistical analysis was performed using the SPSS application, measuring both independent and dependent variables. univariate analysis was carried out to examine each variable from the research findings independently of other factors, by characterizing each variable and displaying the frequency distribution of the research variables in the form of statistics, tables, or graphs. Meanwhile, bivariate analysis was performed to analyze the relationship between the dependent variable and the independent variable by conducting a chi-square statistical test with a significance limit of α = 0.05. The null hypothesis is accepted if $\rho \geq 0.05$ and the null hypothesis is rejected if $\rho \leq 0.05$. The research data will be presented in the form of a frequency distribution table and narrative to discuss the results of the research that has been conducted. Multivariate analysis was performed to determine the effect of more than one independent variable on the dependent variable. The statistical analysis used was binary logistic regression analysis. If the Sig value <0.05, then partially there is a significant influence between the independent variable and the dependent variable. If the value obtained Sig > 0.05 then partially there is no significant influence between the independent variable and the dependent variable. The magnitude of the influence is indicated by the exp value (B) or also called the odds ratio (OR).

2.6 ***Ethical Considerations***

Ethical approval for this study was obtained from the Research Ethics Commission of the Faculty of Public Health, Hasanuddin University, Makassar (Approval No. 3402/UN4.14.1/TP.01.02/2024). Participants were informed about the study's purpose, and their consent was obtained prior to data collection. Data were collected confidentially, ensuring participants' privacy and anonymity.

3. Results

3.1 Univariate Analysis

The study included 176 pregnant women from the Suppa District, Pinrang Regency in 2024. The univariate analysis revealed that 105 respondents (59.7%) were at risk of maternal mortality. Parity at risk was identified in 108 respondents (61.4%), while pregnancy spacing posed a risk in 115 respondents (65.3%). Additionally, 108 respondents (61.4%) had a history of medical conditions, and 80 respondents (45.5%) reported incomplete antenatal care. Delivery techniques were non-spontaneous for 81 respondents (46.0%), and unsafe birth attendants were reported by 97 respondents (44.9%) (Figure 1).

In terms of healthcare services, 64 respondents (46.4%) experienced inadequate service availability, while 109 respondents (61.9%) faced challenges with accessibility. Health facilities were deemed less accessible by 91 respondents (51.7%), and 79 respondents (44.9%) received inadequate health services. These findings indicate that various factors contribute to the risk of maternal mortality in the study area.

3.2 Bivariate Analysis

The bivariate analysis examined the relationships between independent variables (e.g., parity, pregnancy spacing, medical history, antenatal care, delivery techniques, birth attendants, availability, accessibility, affordability, and acceptability) and the dependent variable, maternal mortality rate. Chi-square test results (p<0.05p < 0.05p<0.05) revealed significant relationships between maternal mortality and several variables. (Table 1).

In this case, the results of the chi square test (*p* Value <0.05) showed that there was a relationship between the mother's pregnancy spacing *(p = 0.004)*, medical history *(p = 0.004)*, delivery techniques *(p = 0.007)*, birth attendants *(p = 0.003)*, availability of health services *(p = 0.008)*, accessibility *(p = 0.003)*, and affordability *(p = 0.005)* to the maternal mortality rate. Conversely, no significant relationships were found between maternal mortality and parity (p=0.011p = 0.011p=0.011), antenatal care (p=0.141p = 0.141p=0.141), or receipt of health services (p=0.153p = 0.153p=0.153).

3.3 ***Multivariate Analysis***

Binary logistic regression analysis was used to assess the combined effect of multiple independent variables on maternal mortality. The Hosmer and Lemeshow test produced a significance value of 0.175 (p>0.05p > 0.05p>0.05), indicating that the logistic regression model was appropriate and fit the observational data (Table 2).

Among the ten variables analyzed, **affordability** emerged as the strongest predictor of maternal mortality with a significance value of 0.002. This was followed by **birth attendants** (p=0.003p = 0.003p=0.003) and **accessibility** (p=0.005p = 0.005p=0.005).

The Nagelkerke R^2 value of 0.413 indicated that the independent variables collectively accounted for 41.3% of the variation in maternal mortality. Additionally, the binary logistic regression model demonstrated an overall accuracy of 75.6%, underscoring the reliability of the analytical approach.

These findings highlight the critical role of affordability, access to skilled birth attendants, and healthcare accessibility in reducing maternal mortality risks in the study population.

4. Discussion

4.1 Relationship between Parity and Maternal Mortality Rate

Parity is the number of children born to a mother, ranging from the first child to the last child. The higher the parity of the mother, the greater the decreased reproductive system function which further affects the mother's health. According to the relevant book published (Walker, Robert E. Black Neff 2020) mothers with low parity check their pregnancies more often. Women with high parity are at risk of uterine atony, which if not treated properly will result in postpartum hemorrhage. High parity can put both the mother and the fetus at risk because frequent births weaken the uterus and increase the chance of difficulties for the mother during pregnancy or childbirth due to the uterine abdominal tissue. A woman who has had three or more pregnancies is more likely to have weak labor contractions (Amir & Yulianti, 2020).

According to the study's findings, 108 pregnant women (61.4%) were at risk for parity, while the remaining 68 pregnant women (38.6%) were not at risk. There is no correlation between parity and mortality in Suppa District, Pinrang Regency, according to the findings of the Chi Square test on parity, which yielded a p value = 0.011, or p <05. This is owing to the fact that many pregnant women have a history of more than three pregnancies, and some even become pregnant for the fifth time as a result of not utilizing contraception. Many people decided not to use contraception at all because the study's findings indicated that some people who utilized it still missed. However, local village midwives prefer to provide more supervision to pregnant women with a history of high parity (more than three births), and they are encouraged to check their pregnancy at a health service facility (health center) for additional monitoring in order to reduce the mother's mortality risk.

This study supports the findings obtained in the research conducted previously (Amir & Yulianti, 2020) that midwives, as frontline healthcare providers, provide more thorough prenatal care supervision to expectant mothers, particularly those who are first-time mothers and have high parity, in order to identify potential pregnancy complications early on that could affect delivery. In addition, fulfilling nutrition is very important for the health of pregnant women.

4.2 Relationship between Pregnancy Spacing and Maternal Mortality Rate

One of the variables that can affect the incidence of preeclampsia is the interval between pregnancies after delivery. Birth spacing of less than two years or less than optimum is associated with the highest percentage of maternal mortality and pregnancy problems. According to the National Population and Family Planning Agency's (BKKBN) recommendation, a birth spacing of more than two years allows the mother enough time to repair her uterus, allowing her to return to her pre-pregnancy state in terms of her physical, emotional, and financial well-being. If she becomes pregnant, this also lowers the risk of preeclampsia and other pregnancy complications (R & Hamzah, 2021). WHO recommends a pregnancy spacing of at least 2 years because pregnancy will affect the ability to absorb micronutrients and muscle mass in the mother's body. Meanwhile, a pregnancy spacing of more than 10 years indicates a failure to use contraception which is one of the causes of difficulty in childbirth and preeclampsia in pregnant women (Wahyuni et al., 2023).

According to the research findings, 61 individuals (34.7%) were not at risk, but 115 pregnant women (65.3%) were at pregnancy spacing at risk. There is a correlation between the pregnancy spacing and maternal mortality ratio in the Suppa District, Pinrang Regency, according to the findings of the Chi Square test on the pregnancy

interval, which yielded a p value = 0.004, or p <0.05. According to the findings obtained from the questionnaire distributed and the pregnancy history records in the KIA pink book, which researchers have examined directly with respondents, many pregnant women still have a pregnancy spacing of less than two years.

This study is in accordance with the previous study (Bauserman et al., 2021) that too close or too far pregnancy spacing increase the risk of maternal mortality. Mothers with short pregnancy spacing are 1.4 times more susceptible to death. Mothers with too short and too long pregnancy spacing have a higher risk of poor outcomes related to labor (obstructed labor, bleeding, high blood pressure disorders, fetal malposition, and infection), and poor outcomes for their babies such as death and premature birth.

4.3 Relationship between Medical History and Maternal Mortality Ratio

Medical history also indicates the health of pregnant women. Poor maternal health status greatly affects the child. According to UNICEF, almost 10,000 Indonesian women die every year due to pregnancy and childbirth problems (Muthoharoh, et al, 2016). One factor that contributes to obstetric problems is the mother's prenatal health. The amount of work required during pregnancy will be increased if the mother has a condition, which could result in disability or even death. In this case, the risk of death is 40 times higher for mothers with a history of illness (Metcalfe et al., 2018).

According to the study's findings, 108 pregnant women (61.4%) had a history of illness, whereas 68 individuals (38.6%) did not. There is a correlation between medical history and maternal mortality ratio in the Suppa District, Pinrang Regency, as found in the results of the Chi Square test on disease history, which yielded a p value of 0.004, or p<0.05. Pregnant women most frequently experience ulcers and hypertension as comorbidities. Mothers with hypertension are particularly vulnerable to problems including preeclampsia and elevated urine protein levels. According to the results of the study's medical history of pregnant women, some pregnant women still had a history of more than two abortions as well as malaria, cysts, and asthma in previous pregnancies. Pregnant women also frequently visited the health center, and during door-to-door surveys, respondents frequently complained of anemia, lack of appetite, and urine that was consistently positive +1 because of the pregnant women's excessive consumption of instant noodles and KEK, according to the KIA pink book.

This study is in line with the previous research (Agustina & Rahayu, 2022) that pregnancy and childbirth can pose major health risks, including for women who have no previous health problems. Only 10–12% of pregnancies are accompanied by disease or turn into pathological pregnancies, while 80–90% of pregnancies tend to proceed properly. In addition, it was also found that maternal illnesses increase the risk of death for mothers by about nine times (Jayanti et al., 2016). In Africa, anemia, HIV, and cardiovascular disease are the leading causes of maternal fatalities from indirect causes (Manyeh, et al 2018).

4.4 Relationship between Antenatal Care and Maternal Mortality Ratio

Antenatal care, or care given to expectant mothers prior to delivery, helps to promote healthy and favorable outcomes for both the mother and her unborn child by building trust, identifying potentially fatal complications, preparing for delivery, and educating the public about health issues. Preventing causes of morbidity and mortality in pregnant women and children is the goal of antenatal care exams. Between the time of contraception and the time of delivery, pregnant women receive ANC as a routine examination. The goal of antenatal care (ANC) is to prepare the mother and child as much as possible, keep them safe during pregnancy, labor, and the postpartum phase, and ensure that they are in a healthy, normal state both mentally and physically after giving birth (Zuchro et al., 2022). Pregnancy-related danger symptoms that go unnoticed because of sporadic ANC visits are one of the reasons raising the risk of maternal death.

Additionally, pregnant women's awareness of pregnancy danger symptoms is crucial for early detection. Therefore, it may be concluded that the occurrence of risk in pregnant women decreases with the mother's level of awareness of pregnancy danger symptoms, and vice versa (Retnaningtyas et al., 2022).

There is no significant correlation between antenatal care and maternal mortality ratio in the Suppa District, Pinrang Regency, according to the results of the Chi Square test on the antenatal care variable, which had a p value of 0.141. This is because of the numerous programs offered by the health office, health centers, and health posts or village health posts that support intensive examinations of pregnant women, including Pregnant Women's Classes, Health Operational Assistance (BOK), the introduction of Childbirth Insurance (Jampersal), and routine examinations that include the 5K (measure of height, weight, measurement of TFU, abdominal circumference, provision of TT immunization, and blood tablet or fe boosters).

This study supports the finding that more educated people tend to behave more logically (Zuchro et al., 2022). People with greater education will therefore be more open to new concepts. To preserve the health of both themselves and their unborn children, well-educated women will also routinely examine their pregnancies.

4.5 Relationship between Delivery Techniques and Maternal Mortality Ratio

One of the factors contributing to high maternal mortality ratio in delivery assist with standard delivery care is complications from conventional delivery techniques in pregnant women. From stage I to stage IV, standard delivery care is safe and hygienic (Suparti & Nur Fauziah, 2021). There are numerous potential complications during delivery, thus the occurrence of a normal delivery does not

imply that there are no issues. Conditions that directly interfere with birth and endanger both the mother and the fetus are known as delivery difficulties. Some of the complications that occur during delivery include premature rupture of membranes (PROM), preterm delivery, postmature pregnancy, malposition and malpresentation, preeclampsia and eclampsia, twin pregnancy (gemelli), and shoulder dystocia. This can cause high Maternal Mortality Ratio (MMR).

According to the study's findings, 95 respondents (54%) selected spontaneous delivery methods, whereas 81 respondents (46%) selected non-spontaneous delivery methods or a cesarean section. There is a correlation between delivery technique and maternal death ratio in the Suppa District, Pinrang Regency, according to the findings of the Chi Square test performed on the variable of delivery technique, which yielded a value of p = 0.007. This indicates that p>05. In this case, pregnant women in the Suppa region would rather give birth naturally since, in their opinion, discomfort associated with spontaneous or standard delivery methods is only experienced once, as opposed to the prolonged pain associated with non-spontaneous delivery methods (cesarean section). In actuality, if you give birth naturally, the discomfort of contractions till delivery is excruciating and lasts for 6 to 14 hours, sometimes even up to 24 hours, depending on the pregnant woman's condition. If this pain is not relieved, it will lead to a lengthy labor.

The findings of this study are consistent with the previous study (Istiana, et al, 2020) that perineal lacerations sustained during delivery might result in infection and hemorrhage, which is the cause of maternal death. The majority of women sustain birth canal injuries as a result of either spontaneous delivery, episiotomy procedures, or both. Approximately 85% of all vaginal births result in birth canal injuries or lacerations. The tissue or region that joins the anus and vagina is called the perineum. The pelvic muscles are attached to the perineum. The muscles that support the pelvic organs, from the vulva to the anus, are found on the pelvic floor. Hence, during labor, the perineum is crucial for women. The study's findings are also consistent with another study (Wika Hartanti, et al 2024))) that found that physical activity during pregnancy has a significant impact on the health of the unborn child in addition to being good for the mother. When the infant starts breathing on its own, oxygen will enter its bloodstream from the mother's and enter the baby's bloodstream through the placenta. Engaging in physical activity during pregnancy will raise the mother's blood oxygen levels, which will facilitate the baby's oxygen transfer across the placenta.

4.6 ***Relationship between Birth Attendants and Maternal Mortality Ratio***

In order to help couples avoid obstetric emergencies, professional health providers are better able to communicate health information to moms and serve as useful discussion partners. The management of obstetric difficulties and expertly aided childbirth are essential in addressing maternal mortality issues. In order to avoid and lower the incidence of morbidity to mortality, the idea of applying infection preventive measures must be maintained and enhanced in compliance with established protocols (Maharani et al., 2022).

There is a correlation between birth attendants and mortality ratio in Suppa District, Pinrang Regency, according to the findings of the *Chi Square test* on birth attendants, which yielded a p value = 0.003. A p<0.05 indicates that there is a relationship between the variables. According to the results, the majority of pregnant women in the study area would rather give birth to village midwives and the closest village midwife assistants than in a hospital. Some even receive regular assistance from traditional birth attendants using basic equipment because it is more convenient to call a midwife or traditional birth attendant to help with childbirth due to the long distance when seeking medical attention for an unexpected delivery.

However, according to the multivariate test results, the birth attendant is one of the factors that has the biggest impact, following the affordability variable (sig value = 0.003) and the accessibility variable. According to this study, close determinants accounted for the majority of postpartum deaths among moms who passed away and whose deliveries were facilitated by village midwives. A number of moms passed away before they had time to be referred to medical facilities for support. The majority of moms in this study were unaware of the postpartum examination (postpartum phase), and one woman passed away following childbirth while on route to a medical facility.

Previous research (Badariati, et al 2022) claimed that some maternal deaths are related to the inability of birth attendants to take action due to complications of childbirth, inadequate equipment and delays in emergency referrals. Therefore, experts (doctors, obgyn specialists, midwives, or skilled nurses) shall be available during the labor with the supporting facilities, medicines, and the ability to deal with unexpected complications.

4.7 Relationship between Availability and Maternal Mortality Rate

The availability of medications, various types of equipment, work equipment, and other facilities that serve as the primary tools or assistants in performing tasks are examples of assessment indicators that are included in the evaluation of the completeness of health service facilities. One element that promotes the use of health care is the availability of medical facilities (Dewi & Nurjannah, 2020).

According to the study's findings, of the 176 respondents, 112 (63.6%) said they were available, while 64 (36.4%) said that health services were not available. This is because pregnant women in the Suppa area require fewer medical supplies. Hence, inadequate infrastructure, restricted medication supply, inadequate storage facilities, transportation issues, and limited logistics are some of the

barriers to accessing health services in remote locations (Akhtar, et al 2023).

There are correlation between the availability of health services and maternal mortality ratio in Suppa District, Pinrang Regency, according to the results of the Chi Square test on the subject. The test yielded a value of $p = 0.008$, meaning that $p<05$ indicates that there is a relationship between the two. This is further concerning because the village's health centers and health posts are not operating, and there aren't many pharmacies or drug stores, which makes it difficult for everyone in the town, especially expectant mothers.

According to previous research (Nkosi, 2024) there is discontent with the operating hours of mobile health services are available. Since it was impossible to foresee when an illness might strike, most respondents believed that a weekly visit was insufficient. They made the case that mobile health services ought to make at least two or three weekly visits. The low rate of births in medical facilities is caused by a shortage of medical facilities (Syukaisih et al., 2022). Due to a lack of supplies and equipment, as well as a shortage of midwives, health centers or village health centers in fostered communities are unable to assist delivery in medical facilities.

4.8 Relationship between Accessibility and Maternal Mortality Rate

Accessibility can be defined as the degree of ease with which a population or community in the local area or its surroundings can reach a health service provider. Access to health services is regarded as a very fundamental right. By taking into account transportation infrastructure, journey time, distance, and cost, physical accessibility illustrates the relationship between the population seeking access to health services and their location (Kibret, et al 2022).

Based on the results of the Chi Square test that has been carried out on accessibility with maternal mortality ratio, the results obtained a value of $p = 0.003$ so that $p<0.05$ which means that there is a significant relationship between accessibility and maternal mortality ratio in Suppa District, Pinrang Regency. Meanwhile, based on the results of the multivariate test, it was found that access to services is one of the variables that has the greatest significant influence after the variables of affordability and birth attendants with a sig value = 0.005. This describes that accessibility is one of the causes of maternal mortality in Suppa District, Pinrang Regency because the location and distance from the village to the health center is quite far, as well as inadequate road access such as bad roads, winding roads and up mountains.

In line with research (Weraman, 2024) shows that access to primary health services has a significant impact on the level of health and welfare of rural communities. Geographical, economic, and vehicle barriers faced by the community or pregnant women limit them in obtaining health services, and of course have a negative impact on health. For this reason, it is necessary to improve access and quality of services.

4.9 Relationship between Affordability and Maternal Mortality Ratio

Affordability, sometimes referred to as a neighborhood or environmental unit, is defined as a physical setting with distinct borders and social facilities that are accessible to many locals at modest levels (Gunawan et al., 2023) (Gunawan et al., 2023).

Based on the results of the study, it was found that among 176 respondents involved, 91 people (51.7%) chose less affordable health services, while 85 people (48.3%) chose affordable ones. From the results of the Chi Square test conducted on the affordability of health services with maternal mortality ratio, the results obtained a p value = 0.005 so that $p<05$, indicating a relationship between the affordability of health services and maternal mortality ratio in Suppa District, Pinrang Regency. Meanwhile, based on the results of the multivariate test, the affordability variable has a sig value = 0.002 which indicates a very significant influence on maternal mortality ratio.

According to the study's findings, the majority of expectant mothers in Suppa District, Pinrang Regency, already have health insurance through BPJS; yet, they hardly ever use it until instructed to do so by a doctor or health center staff for regular prenatal checkups. A number of expectant mothers also expressed dissatisfaction with the distance to medical facilities, particularly primary services (health centers), the difficulty in paying for medications that were not available at the health center, the difficulty in using health insurance for the issue of ultrasound exams, which were still paid for but only performed once a week, and other issues.

This study is in line with research conducted previously (Putri et al., 2022) that the use of Health Insurance for pregnancy and childbirth check-ups was more widely used by mothers who had a family income of less than IDR 2,500,000 as many as 24 respondents compared to mothers who had a family income of more than IDR 2,500,000. This study also found that Health Insurance for pregnancy and childbirth check-ups was more widely used by mothers aged 21-27 years.

4.10 Relationship between Acceptability and Maternal Mortality Ratio

Acceptability is the degree to which the health services offered meet the needs, expectations, and values of the community they serve. How expectant mothers react and accept the medical interventions—such as prenatal care, delivery, and postpartum care—is referred to as acceptability. Acceptability is seen as a crucial element of the quality of health services since it can influence pregnant women's usage of those services, which can impact the health of the mother and the unborn child (Nyamtema, et al 2023).

There is no correlation between acceptability and maternal mortality ratio in Suppa District, Pinrang Regency, according to the

Table 1. Bivariate Analysis Results on Respondents' Distribution of Each Variable on Maternal Mortality Ratio in Suppa District Pinrang Regency 2024

Variable	Category	Maternal Mortality Ratio				Total	P value
		High		Low			
		N	%	n	%		
Parity	Risky	73	64.4	35	43.6	108	0.011
	Not Risky	32	40.6	36	27.4	68	
	Total	105	105.0	71	71.0	176	
Pregnancy Spacing	Risky	78	68.6	37	46.4	115	0.004
	Not Risky	27	40.6	34	27.4	61	
	Total	105	105.0	71	71.0	176	
Medical History	Has	74	64.4	34	43.6	108	0.004
	Doesn't Have	31	40.6	37	27.4	68	
	Total	105	105.0	71	71.0	176	
Antenal Care	Incomplete	53	47.7	27	32.3	80	0.141
	Complete	52	57.3	44	38.7	96	
	Total	105	105.0	71	71.0	176	
Delivery Technique	Spontaneous	66	56.7	29	38.3	95	0.007
	Unspontaneous	39	48.3	42	32.7	81	
	Total	105	105.0	71	71.0	176	
Birth Attendant	Safe	37	47.1	42	31.9	79	0.003
	Unsafe	68	57.9	29	39.1	97	
	Total	105	105.0	71	71.0	176	
Availability	Available	58	66.8	54	45.2	112	0.008
	Unavailable	47	38.2	17	25.8	64	
	Total	105	105.0	71	71.0	176	
Accessibility	Difficult	75	65.0	34	44.0	109	0.003
	Easy	30	40.0	37	27.0	67	
	Total	105	105.0	71	71.0	176	
Affordability	Affordable	41	50.7	44	34.3	85	0.005
	Not Affordable	64	54.3	27	36.7	91	
	Total	105	105.0	71	71.0	176	
Acceptability	Appropriate	42	47.1	37	31.9	79	0.153
	Less appropriate	63	57.9	34	39.1	97	
	Total	105	105.0	71	71.0	176	

Table 2. Multivariate Analysis Results

Independent Variables	*Sig. (Hosmer and Lemeshow Test)*	Sig.	Exp (B)	Negelkerke R Square	Overall Percentage (%)
Parity	0.175	.124	1.816	0.413	75.6
Pregnancy Spacing		.064	2.197		
Medical History		.008	3.143		
Antenatal Care		.780	.894		
Delivery Technique		.165	1.808		
Birth Assistant		.003	3.559		
Availability		.030	2.543		
Accessibility		.005	3.283		
Affordability		.002	3.399		
Acceptability		.035	2.439		

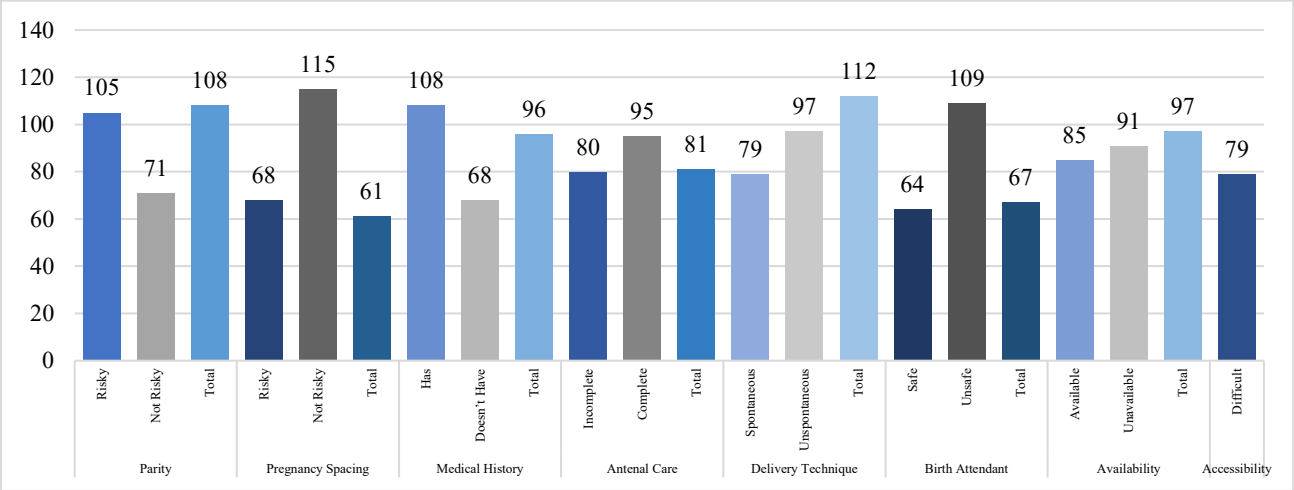

Figure 1. Graph of Univariate Analysis Results on Respondents' Distribution in Each Variable

findings of the *Chi Square* test performed on the acceptability variable, which yielded a *p* value of 0.141. This may not always be connected to the mother's opinion or acceptance of the services offered, but there are a number of factors that have a direct impact on maternal health outcomes. According to the study's findings, despite the fact that the medical facilities in the area are insufficient, many expectant mothers believe that the services are still quite adequate and feel at ease when using health center services. Respondents also think that health workers treat patients fairly, such as by giving them the correct queue number so that pregnant women do not have to wait too long to be examined.

This is in accordance with the previous research (Bucyibaruta et al., 2023) that the acceptability of maternal health services by women is influenced by a variety of circumstances during pregnancy and childbirth. However, the strategy can only be examined from a maternal health viewpoint because the idea of maternal health care acceptance has still not been defined precisely and is therefore challenging to evaluate.

One reason for this situation is because, even while mothers may have a positive view of the medical treatment they receive (showing a high level of acceptance), this does not guarantee that they will receive prompt and efficient medical attention. Because bad results, including maternal death, may result if the service is not backed by sufficient facilities and resources or if the right medical procedures are unavailable when needed. While the quality of medical care includes objective components like efficacy, safety, and efficiency of care, acceptability is primarily tied to the subjective parts of the patient's experience (Donabedian, 1996). Negative maternal health service receipt can occur when health service providers shout or show inappropriate behavior such as harassment, disrespect, indecency, cruelty or abuse towards patients (Liu K *et al.*, 2022).

5. Conclusion

This study concluded the significant factors influencing maternal mortality in Suppa District, Pinrang Regency. Affordability, accessibility, and birth attendants emerged as key determinants, with affordability being the most critical predictor. Despite improvements in maternal healthcare access, gaps persist, particularly in antenatal care, delivery techniques, and health service availability. The findings emphasize the need for targeted interventions, including enhancing healthcare affordability, ensuring skilled birth attendants, and improving accessibility to maternal health services. Strengthening these areas could significantly reduce maternal mortality risks and help achieve global health goals. A comprehensive approach addressing these challenges is essential for improving maternal health outcomes.

Author contributions

F.A. created study proposals, reviewed relevant literature, processed and visualized data. Q.A. served as a guide for the research's findings, discussions, and conclusions.

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Competing financial interests

The authors have no conflict of interest.

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