

**AN ANALYSIS OF MATERNAL MORTALITY IN BATAM CITY
FROM 2022 - 2024**

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ABSTRACT

Maternal mortality remains a significant public health issue. In Batam City, the number of maternal deaths fluctuated during 2022–2024. Factors such as maternal age, gestational age, and parity are suspected to contribute to both direct and indirect causes of maternal death. This study aimed to determine the relationship between these factors and the causes of maternal mortality based on maternal audit reports. This quantitative study used a descriptive-analytic design with a retrospective cross-sectional approach. Secondary data were obtained from the maternal audit reports of the Batam City Health Department for the years 2022–2024, with a total sample of 55 cases. Data were analyzed using frequency distribution and the Chi-Square test. Most maternal deaths were caused by direct causes, totaling 36 cases (65.5%). There was no significant relationship between maternal age ($p = 0.868$) and parity ($p = 0.263$) with the causes of death. However, a significant relationship was found between gestational age and the causes of maternal mortality ($p = 0.034$). Gestational age is associated with the causes of maternal mortality, while maternal age and parity show no significant relationship. Direct causes remain the leading contributors to maternal deaths in Batam City.

Keywords: *Maternal Mortality, Maternal Age, Gestational Age, Parity*

INTRODUCTION

Maternal mortality remains a major global health challenge and continues to receive significant attention from international organizations. Despite the implementation of various preventive strategies, the reduction in maternal mortality has not achieved the expected progress, particularly in developing countries. Maternal mortality is also recognized as a key indicator for assessing both maternal health status and the quality of healthcare systems, encompassing promotive, preventive, curative, and referral services. The Maternal Mortality Ratio (MMR) is closely associated with maternal mortality, as it is defined as the number of maternal deaths per 100,000 live

births (World Health Organization [WHO], 2022).

Maternal mortality may result from both direct and indirect causes. Direct causes include hemorrhage, infection, preeclampsia, and abortion-related complications. Indirect causes comprise hematological disorders, metabolic disorders, and cardiovascular diseases (Astuti et al., 2017). In addition to clinical factors, the quality and accessibility of healthcare services play a crucial role in maternal mortality. Specifically, delays in deciding to seek care, delays in reaching healthcare facilities, and delays in receiving appropriate treatment commonly referred to as the Three Delays Model significantly contribute to maternal

deaths (Ministry of Health of the Republic of Indonesia, 2022).

The World Health Organization (WHO) reported in 2022 that maternal mortality remains a major global health challenge, particularly in developing countries. Approximately 800 women die each day from pregnancy- and childbirth-related complications, resulting in an estimated 287,000 maternal deaths annually. This means that one maternal death occurs approximately every two minutes (World Health Organization [WHO], 2022). In 2023, WHO estimated that the global number of maternal deaths declined to approximately 260,000 cases. However, this reduction does not reflect equitable progress across countries, as WHO highlighted that many nations continue to experience stagnation in reducing maternal mortality (World Health Organization [WHO], 2023).

In Indonesia, maternal mortality remains a national public health priority that requires sustained attention in maternal healthcare services. In 2022, a total of 4,005 maternal deaths were reported, increasing to 4,129 cases in 2023 (Statistics Indonesia [BPS] & Ministry of Health of the Republic of Indonesia, 2023). This increase indicates a setback compared with the previous year and remains relatively high compared with several other countries in Southeast Asia. These findings suggest that existing efforts to reduce maternal mortality have not yet achieved optimal outcomes, despite government initiatives aimed at expanding access to maternal and child health services, strengthening the capacity of healthcare professionals, and improving the availability of adequate maternity care facilities.

According to data from the Batam City Health Office, 3,110 referrals for high-risk pregnancies were recorded in

2022, increasing to 3,661 cases in 2023. This rise in referrals reflects an increasing prevalence of high-risk pregnancies, which may contribute to maternal mortality. The same report documented 22 maternal deaths in Batam City in 2022, declining to 14 cases in 2023 before increasing again to 17 cases in 2024. However, when assessed using the Maternal Mortality Ratio (MMR), the trend indicates an increase from 66 maternal deaths per 100,000 live births in 2022 to 84 per 100,000 live births in 2023. These findings suggest that although the absolute number of maternal deaths fluctuated over time, the MMR demonstrated a gradual upward trend. Furthermore, the Batam City Health Office reported a renewed increase in maternal deaths in 2024, highlighting the persistent challenges in reducing maternal mortality in Batam City (Batam City Health Office, 2023).

Previous studies have examined the determinants of maternal mortality; however, most have been limited to descriptive analyses and have not specifically investigated the associations between maternal age, gestational age, and parity with the direct and indirect causes of maternal death. Furthermore, many earlier studies relied primarily on hospital-based data rather than maternal death audit data obtained from local health authorities, which are generally more comprehensive and provide greater accuracy in identifying the determinants of maternal mortality. This study is particularly relevant because maternal mortality in Batam City continues to fluctuate, accompanied by a gradual increase in the Maternal Mortality Ratio (MMR) over recent years. From a public health perspective, examining maternal age, gestational age, and parity is essential for improving the early identification of women at risk of

obstetric complications and supporting timely preventive interventions.

RESEARCH OBJECTIVE

This study is expected to make a meaningful scientific contribution to maternal mortality reduction efforts. From a clinical perspective, the findings may support the early identification of pregnancy-related risk factors and improve the management of high-risk pregnancies. From a policy perspective, the study is expected to provide evidence to inform the development of more effective intervention strategies based on maternal death audit data collected by the Batam City Health Office between 2022 and 2024..

METHODS

This study employed a quantitative analytical method using a retrospective cross-sectional design with a descriptive-analytic approach. The study

aimed to examine the associations between maternal age, gestational age, and parity and the direct and indirect causes of maternal mortality.

The study population consisted of all maternal death cases recorded in the maternal death audit reports of the Batam City Health Office during the period from 2022 to 2024. A total sampling technique was applied, whereby all eligible cases meeting the predefined inclusion and exclusion criteria were included in the study. Consequently, a total of 55 maternal death cases were analyzed.

The collected data were analyzed using the Chi-square test to determine whether significant associations existed between maternal age, gestational age, and parity and the direct and indirect causes of maternal mortality. Statistical significance was determined at a p-value < 0.05

RESULTS

Univariate Analysis

Table 1. Frequency Distribution of Maternal Age at the Time of Death

Gestational Age at the Time of Death	Frequency (n)	Percentage (%)
High Risk	24	43,6
Low Risk	31	56,4
Total	55	100

Based on the study findings, of the 55 maternal death cases analyzed, 31 women (56.4%) were classified as being in the low-risk maternal age category, while 24 women (43.6%) were classified as being in the high-risk maternal age category.

Table 2. Frequency Distribution of Gestational Age at the Time of Death

Usia Ibu Saat Kematian	Frekuensi (f)	Persentase (%)
Risiko Tinggi	24	43,6
Risiko Rendah	31	56,4
Total	55	100

The study findings showed that 31 women (56.4%) died during low-risk gestational age (term pregnancy), whereas 24 women (43.6%) died during high-risk gestational age, including preterm and post-term pregnancies.

Table 3. Frequency Distribution of Maternal Parity

Parity	Frequency (n)	Frequency (%)
High Risk	32	58,2
Low Risk	23	41,8
Total	55	100

The study findings showed that the majority of maternal deaths occurred among women with high-risk parity, accounting for 32 cases (58.2%), whereas 23 cases (41.8%) were classified as low-risk parity.

Table 4. Frequency Distribution of Causes of Maternal Death

Cause of Maternal Death	Frequency (n)	Frequency (%)
Direct Causes	36	65,5
Indirect Causes	19	34,5
Total	55	100

The study findings indicated that the majority of maternal deaths were attributable to direct causes, accounting for 36 cases (65.5%), whereas 19 cases (34.5%) resulted from indirect causes

Table 5. Frequency Distribution of Direct and Indirect Causes of Maternal Death

Cause Category	Cause of Maternal Death	Frequency (n)
Direct Causes	Hemorrhage	19
	Preeclampsia	13
	Infection	4
	Abortion-related complications	0
Indirect Causes	Hematological disorders	1
	Metabolic disorders	1
	Cardiovascular diseases	4
	Other causes	13
Total		55

the table indicates that direct causes were the leading contributors to maternal mortality (65.5%), with hemorrhage being the most common cause (19 cases), followed by preeclampsia (13 cases). Among the indirect causes, other causes accounted for the largest proportion (13 cases), followed by cardiovascular diseases (4 cases), whereas hematological disorders and metabolic disorders each accounted for only one case. These findings suggest that direct obstetric complications remained the primary contributors to maternal mortality during the study period.

Bivariate Analysis

Association Between Maternal Age at the Time of Death and the Cause of Maternal Death in Batam City, 2022–2024

Table 6. Association Between Maternal Age at the Time of Death and the Cause of Maternal Death in Batam City, 2022–2024

Gestational Age	Cause of Maternal Death				Total		<i>P-value</i>
	Direct		Indirect				
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	
High Risk	12	50,0	12	50,0	24	100	0,034
Low Risk	24	77,4	7	22,6	31	100	
Total	36		19		55		

The analysis showed that there was no statistically significant association between maternal age and the cause of maternal death, with a p-value of 0.034 ($p > 0.05$).

Table 7. Association Between Gestational Age and the Cause of Maternal Death in Batam City, 2022–2024

Maternal Age	Cause of Maternal Death				Total		<i>P-value</i>
	Direct		Indirect				
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	
High Risk	16	66,7	8	33,3	24	100	0,868
Low Risk	20	64,5	11	35,5	31	100	
Total	36		19		55		

The Chi-square test demonstrated a statistically significant association between gestational age and the cause of maternal death, with a p-value of 0,868 ($p < 0.05$).

Table 8. Association Between Maternal Parity and the Cause of Maternal Death in Batam City, 2022–2024

Maternal Parity	Cause of Maternal Death				Total		P-value
	Direct		Indirect				
	f	%	f	%	f	%	
High Risk	19	59,4	13	40,6	32	100	0,263
Low Risk	17	73,9	8	26,1	23	100	
Total	36		19		55		

The Chi-square test showed no statistically significant association between maternal and the cause of maternal death, with a p-value of 0.263 ($p > 0.05$).

DISCUSSION

Based on Table 1, the findings indicate that a greater proportion of maternal deaths occurred among women within the reproductive age group that is theoretically considered the safest. The age range of 20–35 years is recognized as the optimal reproductive period because the reproductive organs have reached full maturity and maternal physiological conditions are generally more stable. This finding is consistent with the World Health Organization (WHO, 2019), which states that the risk of obstetric complications is lowest among women aged 20–35 years, whereas women aged <20 years and >35 years are at a higher risk of developing complications such as preeclampsia, hemorrhage, infection, and metabolic disorders.

Nevertheless, being classified as low risk does not imply that women within this age group are completely protected from obstetric complications or maternal death. Conde-Agudelo et al. (2020) emphasized that although severe obstetric complications occur more frequently among women in high-risk age groups, those aged 20–35 years may still experience adverse maternal outcomes when additional risk factors are present. These include hypertension, anemia, diabetes mellitus, inadequate antenatal care, and delays in receiving appropriate obstetric interventions.

The findings of this study are consistent with existing evidence. The predominance of maternal deaths among women in the low-risk age group does not indicate that this group is entirely free from risk; rather, it reflects the fact that the majority of pregnant women in the population fall within this reproductive age range. Consequently, obstetric complications and maternal deaths may still occur in this group despite their relatively lower theoretical

risk. These findings underscore that obstetric risk results from the interaction of multiple factors, indicating that maternal age alone is not the sole determinant of maternal mortality.

Based on Table 2, the study findings showed that 31 women (56.4%) died during low-risk gestational age (term pregnancy), whereas 24 women (43.6%) died during high-risk gestational age, including preterm and post-term pregnancies. These findings indicate that although term pregnancy is physiologically considered the safest stage of gestation, maternal death may still occur when additional complications are present but remain undetected or are not managed appropriately. This underscores that being classified as low risk does not imply the absence of risk. Similarly, Goldenberg et al. (2018) reported that severe maternal complications may still occur during term pregnancies, particularly in the presence of coexisting conditions such as infection, hypertension, or suboptimal quality of obstetric care.

The findings of this study are consistent with previous research indicating that pregnancies occurring outside the term gestational period are associated with an increased risk of obstetric complications and maternal death. However, the relatively high proportion of maternal deaths among women with term pregnancies observed in this study may be attributable to factors other than gestational age, including pre-existing maternal medical conditions, delays in receiving appropriate treatment, or the sudden onset of obstetric complications. Consequently, maternal death may still occur even when the pregnancy is classified as low risk based on gestational age alone.

These findings are consistent with both established theory and previous studies. Mgaya et al. (2017) reported that grand multiparous women are at a higher risk of postpartum hemorrhage and delivery-related complications than women with lower parity. Furthermore, Jolly et al. (2018) demonstrated that primiparity is significantly associated with an increased risk of preeclampsia, prolonged labor, and operative delivery, all of which may contribute to increased maternal

Based on Table 3, The study findings showed that the majority of maternal deaths occurred among women with high-risk parity, accounting for 32 cases (58.2%), whereas 23 cases (41.8%) were classified as low-risk parity. Conceptually, the high-risk parity category includes nulliparous, primiparous, and grand multiparous women. Primiparous women are more likely to experience obstetric complications, such as preeclampsia, prolonged labor, and operative delivery, because of incomplete physiological adaptation to pregnancy and childbirth. In contrast, grand multiparous women are at increased risk of uterine atony, postpartum hemorrhage, placenta previa, and uterine rupture, conditions that are associated with decreased uterine muscle tone and anatomical changes resulting from repeated pregnancies (Cunningham et al., 2018).

Based on Tables 4 and 5, the majority of maternal deaths were attributed to direct causes, accounting for 36 cases, whereas 19 cases resulted from indirect causes. The direct causes included hemorrhage, preeclampsia/eclampsia, infection, and abortion-related complications, which continue to represent the predominant contributors to maternal mortality and reflect the pattern commonly observed across many regions. These findings are

consistent with reports from the World Health Organization (WHO, 2019) and the Ministry of Health of the Republic of Indonesia (2019), which indicate that approximately 75% of maternal deaths in developing countries are attributable to direct obstetric causes. Therefore, the prevention and timely management of obstetric complications remain key priorities in maternal healthcare.

The high proportion of maternal deaths resulting from direct causes suggests that many of these deaths are potentially preventable through early risk identification, prompt and appropriate clinical management, and the continuity of quality care throughout pregnancy, childbirth, and the postpartum period.

Furthermore, these findings indicate that health system factors—including delays in deciding to seek care, delays in referral, and limited access to adequately equipped healthcare facilities—continue to contribute to the high burden of maternal mortality. These results underscore the need to strengthen referral systems, improve the quality of antenatal, intrapartum, and postnatal care, and enhance the competencies of healthcare professionals in the early detection and management of obstetric complications.

Based on Table 6, the analysis showed no statistically significant association between maternal age and the cause of maternal death, with a *p*-value of 0.868 ($p > 0.05$). These findings differ from those reported by Komalasari et al. (2020), who identified a significant association between maternal age and the occurrence of preeclampsia. This discrepancy may be explained by differences in the outcome variables examined. Komalasari et al. focused exclusively on preeclampsia, a single direct cause of maternal morbidity, whereas the present study evaluated

maternal death as a whole, encompassing both direct and indirect causes of maternal mortality. Therefore, although maternal age may influence the risk of preeclampsia, this association cannot be directly generalized to all causes of maternal death. Furthermore, maternal mortality is influenced by a range of additional factors, particularly healthcare system factors, including the Three Delays Model delays in deciding to seek care, delays in reaching an appropriate healthcare facility, and delays in receiving timely and adequate treatment which have been recognized as major contributors to maternal mortality.

Thaddeus and Maine (1994) explained that delays in obtaining emergency obstetric care play a critical role in maternal mortality because most obstetric complications are acute and can deteriorate rapidly. Conditions such as hemorrhage, eclampsia, and sepsis require immediate intervention within a limited time frame. Delays in deciding to seek care, delays in reaching an appropriate healthcare facility, and delays in receiving timely and adequate management may cause women to miss the critical window for effective treatment, allowing otherwise manageable complications to progress to fatal outcomes.

a. Suboptimal Maternal Referral and Emergency Obstetric Care Systems

Ineffective maternal referral systems and emergency obstetric care services increase the risk of maternal death by delaying access to adequate emergency obstetric management. The World Health Organization (WHO, 2020) reported that a substantial proportion of maternal deaths result from health system failures to respond promptly and appropriately to obstetric complications, even after women have reached a healthcare facility. Limited

availability of referral transportation, delays in inter-facility referrals, and inadequate preparedness of referral hospitals—including shortages of skilled healthcare personnel, essential medical equipment, and blood supplies—may further worsen maternal outcomes when obstetric emergencies occur. Consequently, obstetric conditions that are potentially manageable may progress to fatal outcomes. Thaddeus and Maine (1994) emphasized that weaknesses in referral systems and emergency obstetric care are key contributors to delays in referral and delays in receiving appropriate treatment at healthcare facilities, thereby increasing the risk of maternal mortality.

Theoretically, the World Health Organization (WHO, 2019) states that extremes of maternal age increase women's susceptibility to pregnancy-related complications. However, several studies have also demonstrated that maternal age is not the primary determinant of the cause of maternal death, as mortality is more strongly influenced by the mother's clinical condition and the quality of obstetric care received.

The findings of this study are consistent with those of Say et al. (2014), who concluded that maternal deaths are more frequently attributable to obstetric complications and underlying medical conditions, whereas demographic factors such as maternal age do not consistently demonstrate a significant association with the causes of maternal death. These findings suggest that maternal age alone is not the sole determinant of maternal mortality, particularly when other, more influential factors affect maternal outcomes.

Furthermore, maternal mortality is a multifactorial event influenced by a wide range of factors, including pre-existing medical conditions, delays in deciding to

seek care, delays in referral, and delays in receiving appropriate treatment at healthcare facilities.

Based on Table 7, the Chi-square test demonstrated a statistically significant association between gestational age and the cause of maternal death, with a p-value of 0.034 ($p < 0.05$). Nevertheless, the data distribution showed that the majority of maternal deaths occurred among women with term pregnancies (37–41 weeks of gestation). These findings indicate that although term pregnancy is physiologically classified as a low-risk period, maternal death may still occur when additional factors trigger obstetric complications. This observation is consistent with the findings of Goldenberg et al. (2018), who reported that severe obstetric complications are not confined to preterm or post-term pregnancies but may also occur during term pregnancies in the presence of additional maternal or obstetric risk factors.

the World Health Organization (WHO, 2020) reported that preterm and post-term pregnancies are associated with a higher susceptibility to specific obstetric complications. However, the higher number of maternal deaths observed among women with term pregnancies in this study is likely attributable to the greater proportion of pregnancies occurring within the term gestational age category compared with the preterm and post-term groups. In other words, although the individual risk of complications is generally lower during term pregnancy, the absolute number of maternal deaths may still be higher because the majority of the study population was within the term gestational age range.

Therefore, although the association between gestational age and the cause of maternal death was statistically

significant, the higher number of maternal deaths among women with term pregnancies does not contradict existing evidence. Rather, these findings emphasize that maternal outcomes are influenced not only by gestational age but also by the distribution of pregnancies across gestational age categories and by other maternal, obstetric, and healthcare-related factors that contribute to complications and ultimately determine pregnancy outcomes.

Based on Table 8, the Chi-square test yielded a p-value of 0.263 ($p > 0.05$), indicating no statistically significant association between maternal parity and the cause of maternal death. Although the distribution of cases showed that the majority of maternal deaths occurred among women with high-risk parity (such as primiparous and grand multiparous women), this finding does not necessarily imply a causal relationship with the type of maternal death. This may be explained by the fact that parity is not the sole determinant of specific obstetric complications, and the causes of maternal death are likely influenced by other, more dominant clinical and healthcare-related factors (Say et al., 2014).

From a theoretical perspective, Cunningham et al. (2018) reported that primiparous women are at increased risk of complications such as preeclampsia and shoulder dystocia, whereas grand multiparous women are more susceptible to postpartum hemorrhage and uterine atony. However, in the present study, the distribution of causes of maternal death did not differ significantly across parity groups. Therefore, maternal parity could not be considered a primary predictor of the type of complication leading to maternal death in this study population.

Accordingly, although most maternal deaths occurred among women

with high-risk parity, no statistical evidence was found to support an association between parity and the cause of maternal death. These findings suggest that the principal determinants of maternal mortality are more strongly related to maternal clinical conditions and the quality of obstetric care, including the timeliness and appropriateness of managing obstetric complications.

The findings of this study contribute to the field of medicine, particularly obstetrics and maternal health, by reinforcing the understanding that maternal mortality is predominantly influenced by clinical factors and direct obstetric causes, while also demonstrating that gestational age is significantly associated with the cause of maternal death. These findings provide scientific evidence to support the improvement of early identification of obstetric risk factors and the strengthening of evidence-based emergency obstetric care. Ultimately, these efforts may contribute to reducing maternal mortality and improving the quality of maternal healthcare services.

CONCLUSION

1. Based on this study examining the association of maternal age, gestational age, and parity with the causes of maternal death in Batam City from 2022 to 2024, it can be concluded that the majority of maternal deaths occurred among women in the low-risk maternal age group (56.4%) compared with the high-risk age group (43.6%). Similarly, most maternal deaths occurred during low-risk (term) pregnancies (56.4%) rather than high-risk gestational ages (preterm and post-term) (43.6%). In terms of parity, maternal deaths were more frequently observed among women

with high-risk parity (58.2%) than among those with low-risk parity (41.8%). Maternal deaths were predominantly attributable to direct causes (65.5%), whereas indirect causes accounted for 34.5% of all cases.

2. The bivariate analysis demonstrated that maternal age was not significantly associated with the cause of maternal death ($p = 0.868$), and maternal parity likewise showed no significant association ($p = 0.263$). In contrast, gestational age was significantly associated with the cause of maternal death ($p = 0.034$). Maternal deaths occurring during low-risk (term) pregnancies were more frequently attributable to direct obstetric causes than those occurring during high-risk gestational ages.
3. Direct causes included hemorrhage, preeclampsia/eclampsia, infection, and abortion-related complications, which continue to be the predominant contributors to maternal mortality and reflect the pattern commonly observed across many regions. These findings are consistent with reports from the World Health Organization (WHO, 2019) and the Ministry of Health of the Republic of Indonesia (2019), which indicate that approximately 75% of maternal deaths in developing countries are attributable to direct obstetric causes. Therefore, the prevention and timely management of obstetric complications should remain a primary priority in maternal healthcare.
4. The high proportion of maternal deaths resulting from direct causes suggests that many of these deaths are potentially preventable through early identification of obstetric risks, prompt and appropriate clinical

management, and the continuity of quality care throughout pregnancy, childbirth, and the postpartum period.

5. Furthermore, these findings highlight the continuing influence of health system factors—including delays in deciding to seek care, delays in referral, and limited access to adequately equipped healthcare facilities—on the high burden of maternal mortality. Accordingly, strengthening referral systems, improving the quality of antenatal, intrapartum, and postnatal care, and enhancing the competencies of healthcare professionals in the early detection and management of obstetric complications are essential strategies for reducing maternal mortality.

RECOMMENDATIONS

Based on the findings of this study, several recommendations can be proposed to support efforts to reduce maternal mortality in Batam City.

1. Healthcare providers should strengthen the early identification and management of obstetric risk factors throughout pregnancy, childbirth, and the postpartum period. Although maternal age and parity were not significantly associated with the causes of maternal death, the significant association between gestational age and maternal mortality highlights the importance of comprehensive risk assessment and timely clinical intervention for all pregnant women, regardless of their perceived risk category.
2. Healthcare authorities should reinforce the maternal referral system by improving coordination among healthcare facilities, ensuring the availability of emergency

transportation, strengthening the capacity of referral hospitals, and guaranteeing the availability of skilled healthcare professionals, essential medical equipment, and blood transfusion services. These measures are expected to minimize delays in receiving appropriate emergency obstetric care.

3. The quality of antenatal, intrapartum, and postnatal care should be continuously improved through the implementation of evidence-based clinical guidelines, regular competency-based training for healthcare professionals, and routine maternal death audits to identify preventable factors and enhance the quality of maternal healthcare services.
4. Further research is recommended to investigate additional determinants of maternal mortality, including maternal comorbidities, socioeconomic factors, healthcare accessibility, referral delays, and the quality of obstetric services. Prospective multicenter studies with larger sample sizes are needed to provide more comprehensive evidence for the development of effective maternal mortality prevention strategies.

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