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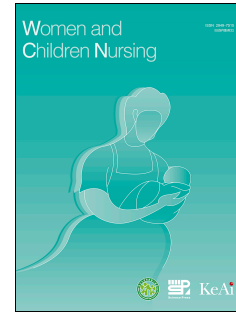
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# Journal Pre-proof

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## **Prevalence and Outcome of Puerperal Sepsis among Mothers in Nigeria: a five-year Retrospective Study**

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## **Prevalence and Outcome of Puerperal Sepsis among Mothers in Nigeria: a Five-year Retrospective Study**

### **Abstract**

**Background:** Puerperal sepsis is one of the leading causes of maternal illness and mortality in low- and middle-income countries, despite advances in diagnosis, antimicrobial therapy, and medical management.

**Aim:** This study aimed to assess the prevalence and outcomes of puerperal sepsis in tertiary hospitals in Ondo State, Nigeria.

**Methods:** This retrospective cross-sectional study was conducted at a tertiary hospital in Ondo State. Total enumerative sampling was used to select patients diagnosed with puerperal sepsis between 2016 and 2020. An adapted structured checklist was used to retrieve data from patients' medical records. Data analysis was performed using SPSS version 25. Descriptive and inferential statistics were used to analyze the results.

**Findings:** Out of 7980 obstetric cases managed during the study period, 156 patients had puerperal sepsis with a prevalence rate of 2%. The majority of patients were unregistered and were referred from other health facilities (94.2%). Other significant risk factors identified were postpartum hemorrhage (60.9%), prolonged labor (14.1%), premature rupture of membranes (19.9%), and lacerations (5.1%). Of the 156 patients diagnosed with puerperal sepsis, 151 (96.8%) were treated and discharged, while five (3.2%) died due to complications. Furthermore, a strong correlation was found between the mode of delivery and outcomes of puerperal sepsis ( $P = 0.03$ ).

**Conclusions:** Puerperal sepsis remains a major public health concern. Therefore, there is a need to promote prenatal care and ensure continuous supervision and monitoring of birthplaces/delivery centers in Nigeria.

**Keywords:** Prevalence; Risk factors; Outcome; Puerperal sepsis; Mothers

## 1. Introduction

Puerperal sepsis, occurring within the first six weeks after childbirth, is a critical health challenge faced by many women. It significantly contributes to maternal and neonatal morbidity and mortality, and is a prevalent cause of maternal admissions to critical care units. This is particularly true in sub-Saharan Africa, where limited access to healthcare facilities and skilled care exacerbates the problem [1]. Globally, more than 300,000 mothers die each year from preventable pregnancy-related complications, equating to approximately 830 deaths daily [2]. Notably, the majority of these deaths, nearly 86% or 254,000, occur in sub-Saharan Africa, with another significant portion, one-fifth or 58,000, occurring in Southern Asia [3]. These regions bear the highest maternal mortality burdens in the developing world.

Despite concerted global efforts to reduce maternal mortality, puerperal sepsis remains a significant cause of preventable death, accounting for 12% of maternal deaths worldwide. The WHO regions of Africa and Southeast Asia, along with low- and lower-middle-income countries, have the highest mortality rates from this infection [3]. Puerperal sepsis is defined as an infection of the genital tract occurring from the onset of labor or fetal membrane rupture up to the 42nd day post-delivery. It is characterized by at least two of the following symptoms: pelvic pain, fever, abnormal and foul-smelling vaginal discharge, or a delayed rate of involution [4]. Although advancements in aseptic practices, diagnostics, and antibiotic treatments have reduced the frequency of puerperal sepsis, approximately 6 million women still suffer from this condition annually, with approximately 77,000 deaths. This makes it the second and fifth leading causes of maternal death in resource-limited settings and globally, respectively [5,6].

The incidence and prevalence of puerperal sepsis vary significantly across regions; however, few studies have quantitatively assessed these metrics. For example, Wen et al. (2021) noted that in

the United States, sepsis complicated one out of every 3,333 deliveries and resulted in death in one out of every 105,384 deliveries [7]. Atlaw et al. (2019) reported a higher prevalence of 17.6% in Ethiopia [5], whereas Oranu et al. (2020) reported a lower prevalence of 1.7% in South-southern Nigeria [8]. Puerperal sepsis, a potentially deadly pregnancy-related condition, arises from various global risk factors, including poor hygiene during labor and delivery, prolonged labor, ruptured amniotic sacs, and substandard care within healthcare facilities. Contributing practices include repeated vaginal examinations, prolonged labor, and inadequate postpartum care [5]. Additionally, Oriji et al. (2021) in a five-year study from South-Southern Nigeria identified further risk factors such as poverty, unbooked status, prolonged rupture of fetal membranes, home delivery, anemia in pregnancy, Cesarean delivery, retained products of conception, chorioamnionitis, obstructed labor, manual removal of placenta, episiotomy, genital tract trauma, and harmful traditional birth practices, all exacerbating the risk of sepsis [9].

The importance of this review stems from the observation that most patients referred from mission homes, traditional birth attendants, and primary health centers in Ondo State develop puerperal sepsis with severe complications, ranging from septicemia to maternal death [10]. This high incidence among unbooked cases, those who have not received routine prenatal care, highlights a critical public health issue in local healthcare delivery systems. Ondo State, characterized by limited healthcare infrastructure and varying access to quality care, faces significant challenges that exacerbate the risk of maternal infections and complications. Therefore, this setting presents a crucial area for a detailed study of the dynamics and impact of puerperal sepsis in regions with similar healthcare constraints.

The uniqueness of this study lies in its five-year retrospective approach, designed specifically to probe the persistent issue of puerperal sepsis within the challenging healthcare environment of

Ondo State, Nigeria. By examining a comprehensive span of historical cases, this study not only aims to provide a detailed snapshot of the current situation but also to trace the evolution of this condition over time. This long-term perspective is rare in the existing research within this geographic region and is essential for identifying trends, shifts in healthcare practices, and the outcomes of maternal health interventions. The insights gained from this review are expected to inform effective strategies tailored to local realities, which could significantly improve maternal health outcomes in the state.

The primary objective of this study was to conduct a thorough five-year retrospective analysis of puerperal sepsis cases in tertiary hospitals in Ondo State. This comprehensive study will enable a deeper exploration of long-term patterns, variations in disease incidence, and the effectiveness of existing health policies on maternal health outcomes. This study aimed to address a substantial knowledge gap and offer region-specific insights that could guide the development of interventions and health policies tailored to local needs. By providing a robust foundation for enhancing maternal health practices, this study aimed to reduce the prevalence and severity of puerperal sepsis in this region, ultimately contributing to the broader goal of lowering maternal mortality rates in Nigeria.

## **2. Methods**

### ***2.1 Study Design and Settings***

This retrospective study was conducted in the Obstetrics/postnatal wards of the Federal Medical Center, Owo, and the University of Medical Sciences Teaching Hospital, Akure. These are the two main tertiary health facilities in Ondo State, Nigeria, which provide 24-hour services across all specialist areas. The study covered the period from January 1, 2016, to December 31, 2020, and



included patients referred from Traditional Birth Attendant Homes (TBA) and primary, and secondary healthcare facilities within the state and neighboring states.

## ***2.2 Study Population and Participants***

The study population comprised women who delivered at the aforementioned tertiary hospitals or were referred from other facilities within 42 days of delivery or abortion. The participants were women diagnosed with puerperal sepsis based on clinical features and investigations, including fever, foul-smelling vaginal discharge, uterine tenderness, and signs of severe infection such as peritonitis, pelvic abscess, shock, or multi-organ failure. Women who presented with fever after 42 days were excluded. The denominator for calculating the prevalence of puerperal sepsis included all women who delivered in these hospitals and those referred within the specified timeframe, regardless of their initial diagnosis at the time of admission.

## ***2.3 Method of Data Collection***

Data were collected retrospectively from the accident and emergency units and postnatal and labor wards. Patient records were reviewed from admission to discharge or death. A structured checklist, validated by a research supervisor and reproductive health experts, was used to gather data. The checklist was divided into three sections: Section A gathered sociodemographic characteristics from patient files; Section B collected obstetric history, including parity, place of delivery, and mode of delivery; and Section C recorded presenting complaints, risk factors, duration of symptoms, complications, investigations conducted, and outcomes.

## ***2.4 Data analysis***

Data obtained from the patients' case files were analyzed using IBM SPSS version 25. Descriptive and inferential statistics were used to present the analyzed data at a significance level of 0.05.

## ***2.5 Ethical Approval Statement***

Ethical approval for this study was obtained from the Federal Medical Center Owo Health Research Ethics Committee. The study protocol was reviewed and approved under protocol numbers FMC/OW/VOL. CXLI/197.

### **3. Results**

#### ***3.1 Socio-demographic variables and Obstetric characteristics of mothers with puerperal sepsis***

Table 1 presents the participants' sociodemographic characteristics. During the five years under review, 7,980 obstetric patients were seen, and 156 women in total were managed for puerperal infections. Participants' ages ranged from 18 to 40 years, with a mean age of  $30 \pm 5.55$  years, and 2.6% were teenage mothers. A higher proportion (32.1%) of participants attained a tertiary level of education. However, more than half (51.3%) were multiparous, and the majority (82.7%) had no history of abortion.

**Table 1: Socio-demographic and Obstetric characteristics of mothers with puerperal sepsis**

<b>Socio-demographic variables (N=156)</b>	<b>Frequency</b>	<b>Percent</b>	<b>Mean <math>\pm</math>SD</b>
<b>Age (years)</b>			
Teenage mothers (18 - 19)	4	2.6	30 $\pm$ 5.55
Young mothers (20 - 34)	118	75.6	
Elderly mothers (35 - 40)	34	21.8	
<b>Marital Status</b>			
Single	20	12.8	
Married	133	85.3	
Divorced	2	1.3	
Widow	1	0.6	
<b>Educational Status</b>			
Declined to answer	26	16.7	
No formal education	22	14.1	
Primary	9	5.8	
Secondary	49	31.4	
Tertiary	50	32.1	
<b>Employment status</b>			
Unemployed	22	14.1	
Civil servants	37	23.7	
Trading	50	32.1	
Artisan/farming	41	26.3	
<b>Self employed</b>	2	1.3	
<b>Private company worker</b>	2	1.3	
<b>Business</b>	2	1.3	
<b>Parity</b>			
Nulliparous	16	10.3	2 $\pm$ 1.52
Primiparous	45	28.8	
Multiparous	80	51.3	
<b>Grand multiparous</b>	15	9.6	
<b>Abortions</b>			
Nil	129	82.7	0.3 $\pm$ 0.63
One	19	12.2	
More than one	8	5.1	

Notes: PS = Puerperal Sepsis

### ***3.2 Events related to Participants' delivery***

Events related to the delivery of the participants are presented in Table 2. The results showed that the majority (94.2%) were referred from other health facilities. Further inquiries revealed that 88 (56.4%) participants were delivered by midwives, whereas 59 (37.8%) were delivered by doctors. Moreover, 107 (68.6%) had their delivery in the labor room, while 42 (26.9%) had their delivery in the theatre. The delivery method for most participants (62.2%) was spontaneous vaginal delivery, whereas 14 (9%) had assisted vaginal delivery. In addition, 45 (28.8%) patients had undergone a cesarean section.

**Table 2: Events related to the delivery of the participants**

<b>Events related to the delivery</b>	<b>Frequency</b>	<b>Percent/%</b>
<b>Referral</b>		
Referred	147	94.2
Not referred	9	5.8
<b>Place of delivery</b>		
Home	7	4.5
Hospital	147	94.2
Church	2	1.3
<b>Who took the delivery?</b>		
Relative/Neighbor	5	3.2
Self	1	0.6
Midwife/Nurse	88	56.4
CHO	3	1.9
Doctor	<b>59</b>	37.8
<b>Site of delivery</b>		
Bedroom	4	2.6
Siting room	3	1.9
Labour room	107	68.6
Theatre	42	26.9
<b>Mode of delivery</b>		
Spontaneous vaginal delivery	97	62.2
Assisted vaginal delivery	14	9
Caesarean section	45	28.8

### ***3.3 Prevalence of puerperal sepsis among mothers***

The total number of mothers diagnosed with puerperal sepsis is presented in Table 3. In 2016, a total of 2320 patients were attended, followed by 1400 in 2017, 1360 in 2018, 1700 in 2019, and 1200 in 2020. The prevalence rates were 1.7, 2.0, 2.0, 1.9, and 2.4 from 2016 to 2020, respectively, with the highest prevalence observed in 2020 at 2.4%.

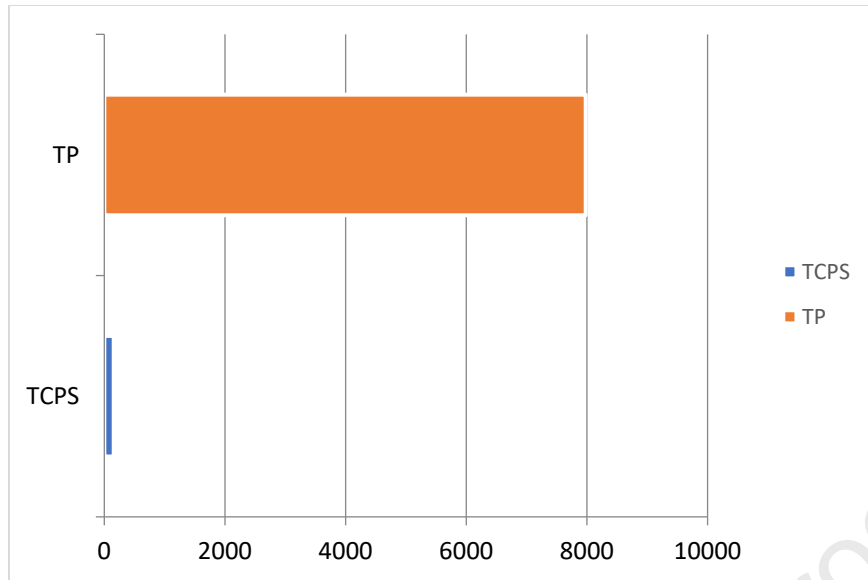
**Table 3: Prevalence of puerperal sepsis (N = 156, Overall PRV=2.0% from 2016 to 2020)**

<b>YEAR</b>	<b>TD</b>	<b>TPS</b>	<b>PRV (%)</b>
<b>2016</b>	2320	39	1.7
<b>2017</b>	1400	28	2.0
<b>2018</b>	1360	27	2.0
<b>2019</b>	1700	33	1.9
<b>2020</b>	1200	29	2.4

**Notes: TD – Total Delivery; TPSC – Total Puerperal Sepsis; PRV – Prevalence**

### ***3.4 The overall five-year prevalence of Puerperal Sepsis***

Figure 1 shows the prevalence of puerperal sepsis over the five years of the study. A total of 7980 (100%) women visited the postnatal wards over a period of five years (2016 – 2020), of which 156 (2%) had puerperal sepsis.



**Figure 1:** Total Prevalence of Puerperal sepsis (The overall five-year prevalence of Puerperal Sepsis)

Notes: TP (Total population); TCPS (Total Count of Puerperal Sepsis)

### ***3.5 Risk factors associated with puerperal sepsis among participants***

Table 4 shows the risk factors for developing puerperal infections among participants. The results show that postpartum hemorrhage (95, 60.9%) was the most common and significant risk factor, followed by premature rupture of membranes in 31 (19.9%), prolonged labor in 22 (14.1%), and lacerations in eight (5.1%) However, results showed that out of the 156 mothers with puerperal infections, the majority of participants 147 (94.2%) did not register for antenatal care.



**Table 4: Risk factors associated with puerperal sepsis among participants**

<b>Variables</b>	<b>Frequency</b>	<b>Percent</b>
<b>Risk factors associated with delivery</b>		
Prolong labour	22	14.1
Postpartum hemorrhage	95	60.9
Premature rupture of membrane	31	19.9
Lacerations	8	5.1
<b>Antenatal status</b>		
Booked		
< 2 antenatal attendances	2	1.3
>2 antenatal attendance	7	4.5
Unbooked	147	94.2

### ***3.6 Outcomes of puerperal sepsis***

Table 5 shows the outcomes of puerperal sepsis among the respondents. Results from the study showed that 156 mothers had puerperal sepsis, of which the majority (96.8%) were managed and discharged home, while five (3.2%) died from puerperal sepsis.

**Table 5: Outcomes of puerperal sepsis**

Outcome of puerperal sepsis	TP	TC (Frequency)	PRV (%)
Alive	156	151	96.8
Died		5	3.2

### 3.7 Association between mode of delivery and outcome of puerperal sepsis

Table 6 shows the association between the delivery method and the outcome of puerperal sepsis among mothers. The results showed that the delivery method was associated with the outcome of puerperal sepsis. This difference was found to be statistically significant (chi-square = 6.63; df = 2;  $P$ -value = 0.036).

**Table 6: Test for the association between mode of delivery and outcome (N=151)**

Mode of delivery	Outcome of puerperal sepsis		Chi-Sq	Df	P-value
	Alive	Died			
<b>Spontaneous vaginal delivery</b>	96	1			
	63.6%	20.0%			
<b>Assisted vaginal delivery</b>	14	0	6.63	2	0.036
	9.3%	0.0%			
<b>Cesarean section</b>	41	4			
	27.2%	80.0%			

#### 4. Discussion

This study aimed to evaluate the incidence, contributing variables, and prognosis of puerperal sepsis among mothers visiting tertiary healthcare institutions in Ondo State, Nigeria. Findings from this study showed that puerperal infection was more prevalent among mothers within the age range of 20-34 years (75.6%) and among multiparous mothers (51.3%) with tertiary education. However, this has implications for midwifery practice in the sense that the content and mode of antenatal and postnatal classes delivered to antenatal and postnatal women must be adequate. Midwives should identify the risk factors and disease conditions (such as premature rupture of membranes, urinary tract infections, and sexually transmitted diseases) that can predispose patients to puerperal sepsis and ensure prompt treatment. This finding is contrary to that of a previous study by Chepchirchie et al. (2017), who found that most participants with puerperal sepsis were primiparas who were young, inexperienced mothers with a low level of education [11]. The study population also shows that about 2.6% of the respondents with puerperal sepsis were teenage mothers. This may be because this age group may not be accustomed to the procedure, duration, and problems of labor.

A total of 7980 women were managed in the postnatal wards of tertiary health facilities over a period of five years (2016 – 2020), out of which, 156 mothers had puerperal sepsis, with an overall five-year prevalence of 2%. This value is higher in developed countries and certain geographical locations within the country. According to reports, its prevalence in the United Kingdom and the United States ranges from 0.2% to 0.6% (9). Meanwhile, various studies in Nigeria have reported higher prevalence; Bayelsa (1.44%), Sokoto (0.9%), Jigawa (1.89%), and Ogun (5.8%) [9,12-14]. However, the prevalence in our study is lower than the values from Lahore-Pakistan, (16.6%)

Ethiopia, (14.81%), Lusaka-Zambia (34.8%) India (2.5%), and Sudan (72.9%) [7,15-17]. Although these countries have a high maternal mortality ratio, similar findings from various geographical locations across the country with high prevalence include Port Harcourt (9.34%) and Joseph (16.7%) [9]. These differences in prevalence rates may indicate differences in patient background characteristics and health-seeking practices across various geographical areas.

Evidence from previous studies shows that the occurrence of sepsis within a few hours of giving birth may be exacerbated by hemorrhage, lacerations, numerous vaginal examinations, and the manner of delivery [18,19], This study confirms that the following are risk elements associated with puerperal sepsis: prolonged labor, hemorrhage, premature rupture of membranes, lacerations, and failure of patients to register for antenatal care (unbooked). This finding is in agreement with the results of previous studies [9,13]. Although most patients referred to as unbooked for antenatal care might have registered in various primary and secondary healthcare facilities. However, once the patients did not register in the tertiary health facilities referred to, they are usually tagged as “unbooked” for antenatal patients. The majority of the respondents in this study were referrals from neighboring health facilities such as primary health centers, traditional/faith-based homes, and general hospitals. The data showed that most of the respondents (94%) delivered in hospitals (probably due to various complications), and that their deliveries were attended by skilled birth attendants, including nurses (56.4%) and doctors (37.8%), indicating that puerperal sepsis might have occurred as a result of nosocomial infections at the place of delivery, probably because of poor aseptic techniques. This is evidence of the status of healthcare facilities in low- and middle-income countries such as Nigeria. This finding aligns with the results of Oriji et al. 2021 [9] and contradicts the findings of other studies [18, 20-21] that found that puerperal sepsis was more prevalent among patients with home births than hospital delivery. Meanwhile, evidence shows a

significant correlation between puerperal sepsis and nosocomial infections, as well as an increase in antibiotic resistance, which is an important concern for overwhelmed healthcare systems [11,22].

Furthermore, out of the 156 mothers with puerperal sepsis managed, our study reported five maternal deaths (0.03%). Although puerperal sepsis represents 11% of the global causes of maternal mortality, data from this study show that most cases of puerperal sepsis were referred cases from the neighboring primary, secondary, mission/traditional birth attendants (TBA) homes. This may be attributed to the three delays associated with maternal mortality: 1) delay in deciding to seek care, 2) delay in reaching a healthcare facility, and 3) delay in receiving care. However, Mgawadere et al. (2017), opined that the majority of these women try to reach health services when an emergency occurs, but delays in receiving care have always been a major source of problems. This may be due to the fact that most tertiary health institutions are fee-paying health facilities where patients have to pay for medications and other commodities needed to provide care, and in a situation where there is poor socio-economic status, there is a tendency for maternal mortality or severe morbidity [23].

## **5. Conclusion**

The conclusions drawn from this study highlight a relatively high prevalence of puerperal sepsis, with identified risk factors including postpartum hemorrhage, premature rupture of membranes, prolonged labor, and unbooked antenatal care. To mitigate the maternal burden of puerperal infections, it is crucial to implement effective preventive measures during normal delivery, cesarean section, and the postpartum period. Midwives play a pivotal role in ensuring the adoption of appropriate infection prevention protocols, such as minimizing unnecessary vaginal examinations. Furthermore, comprehensive health education regarding puerperal sepsis should be integrated into antenatal classes.

Innovative recommendations should be made to enhance the global applicability of these findings. First, leveraging digital health technologies, such as mobile apps or telemedicine, can facilitate the remote monitoring of postpartum mothers, enabling the early detection of potential complications, such as puerperal sepsis. Additionally, implementing standardized protocols for antenatal care across different healthcare settings can ensure consistent education on infection prevention strategies.

Moreover, community-based interventions involving trained community health workers could enhance awareness of puerperal sepsis and promote early healthcare-seeking behaviors among pregnant women. These workers could also play a vital role in providing culturally sensitive health education and support to expectant mothers, thereby reducing the incidence of infection through targeted outreach. Furthermore, integrating quality improvement initiatives within healthcare facilities can optimize infection prevention practices during both routine delivery and emergency obstetric care. This can include regular audits of infection control measures, ensuring adherence to best practices, and fostering a culture of continuous improvement among healthcare providers.

### ***Implications for Nursing Education, Practice, and Research***

Given the high prevalence of puerperal sepsis in this State, it is crucial to take the following actions:

- Midwives and nurses should actively create public awareness about puerperal sepsis and emphasize the importance of proper hand hygiene and personal care among nursing mothers.
- Skilled birth attendants, particularly midwives, must ensure the consistent application of aseptic techniques during labor and delivery to prevent infections.
- Nurse and midwife managers should enforce the effective use of the World Health Organization (WHO) guidelines on the prevention and treatment of puerperal sepsis across primary, secondary, and tertiary health institutions.

To further analyze the risk factors and improve understanding:

- It is recommended that quantitative research be conducted to assess the awareness of postnatal mothers regarding the prevention of puerperal sepsis.
- Comparative and regression statistical studies should be performed, particularly using data from those without puerperal sepsis among the total population, to identify and compare the risk factors and better understand the implications for prevention strategies.

### **Declaration of interests**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### **Ethical statement**

The patient consent and ethical approval has been received. The authors confirm the compliance with all relevant ethical regulations.

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**Declaration of interests**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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