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Prevalence and factors associated with neonatal sepsis in Mali: a cross-sectional study

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ABSTRACT

Objective This study aimed to assess the prevalence and risk factors for neonatal sepsis among neonates admitted to selected health facilities in the Bamako district and Koulikoro region in Mali.

Design This is a prospective cross-sectional study. Data were analyses using bivariate and multivariate logistic regression.

Setting This facility-based study was conducted in four health facilities consisting of two hospitals and two reference health centres in Mali.

Participants The study participants comprised 795 randomly selected neonates and their indexed mother.

Outcome measures The primary outcome of the study was the prevalence of sepsis in the considered health facilities. The other variables of interest were risk factors for sepsis.

Results The prevalence of neonatal sepsis among the study population was 21.00%. More than 74% of sepsis cases were early onset (<72 hours). Neonatal age <7 days (AOR=2.79, 95% CI 1.59 to 4.89, p=0.000), low birth weight <2500 g (AOR=2.88, 95% CI 1.41 to 5.86, p=0.003), Apgar score <7 (AOR=4.03, 95% CI 3.09 to 5.24, p=0.000), mother with no education (AOR=2.24, 95% CI 1.15 to 4.33, p=0.02), maternal fever (AOR=2.31, 95% CI 1.53 to 3.53, p=0.000), prolonged rupture of membranes (AOR=1.87, 95% CI 1.01 to 3.54, p=0.04) and prolonged labour (AOR=2, 95% CI 1.03 to 3.88, p=0.04) were significantly associated with neonatal sepsis.

Conclusion The prevalence of sepsis in Mali is still high. Given the country's current security context, the findings in this study can support prevention activities, particularly given the limited resources available. It is essential to facilitate antenatal and postnatal visits, to promote in-facility births and rigorous monitoring of neonates at high risk of sepsis. Furthermore, it would be beneficial for future research on neonatal sepsis to include neonates born at home.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The study was prospective and included health facilities (hospitals and health centres) at different levels of the healthcare system.
⇒ The study used data from a multitude of health facilities.
⇒ The majority of sepsis cases were identified based on clinical signs, without laboratory confirmation.
⇒ The participants were selected from health facilities, and neonates with sepsis who did not attend health facilities could not be included, potentially reducing the generalisability of the results.

INTRODUCTION

Reducing maternal and newborn mortality and morbidity is an essential element of Goal 3 of the United Nations Sustainable Development Goals. As reported by the WHO, four million neonates die annually within the first 4 weeks of life, with 75% of these deaths occurring within the first week.[1] Neonatal sepsis contributes substantially to this morbidity and mortality and is a major global public health challenge.[2–5]

Neonatal sepsis is defined as a systemic infection that occurs within the first 28 days after birth. It represents the third-most prevalent direct cause of neonatal death, accounting for approximately 26% of the neonatal deaths globally.[6–10] In low and middle income countries, including Mali, it is the leading cause of neonatal mortality and responsible for over half of all neonatal deaths.[11–14]

Neonatal sepsis is classified into two subtypes: early and late onset based on the onset time. Early onset sepsis (EOS), when symptoms appear within the first 72 hours after birth, and late onset sepsis (LOS), when symptoms occur after 72 hours after birth.[15] EOS is generally caused by micro-organisms acquired before and during delivery (maternal fetal infection), whereas LOS is due to organisms acquired after delivery from the environment (community or nosocomial sources).[16 17]

The prevalence of neonatal sepsis varies from country to country. A systematic review in East Africa on neonatal sepsis showed a

prevalence of 29.7%.[18] In other African countries, the estimated prevalence was 55% in Nigeria,[15] 49.8% in Tanzania,[19] 79% in Ethiopia,[5] 20% in South Africa[20] and 21.80% in Uganda.[21]

The risk factors for neonatal sepsis in sub-Saharan Africa are low birth weight, resuscitation, low Apgar score at 1 min, prematurity, male sex, prolonged labour, meconium-stained amniotic fluid, preterm rupture of membranes, multiple digital vaginal exams and intrapartum maternal fever.[22] The main factors associated with a reduction in morbidity and mortality are prevention, knowledge of risk factors, early recognition of signs and prompt and appropriate management of cases.[10 23 24] The knowledge of the risk factors serves as a basis for developing management guidelines and prevention strategies. Although there is a multitude of publications on neonatal sepsis and its factors associated in sub-Saharan African, a key necessity in developing targeted strategies, this cannot be said about Mali. A comprehensive understanding of the common risk factors associated with neonatal sepsis in Mali is crucial for facilitating early diagnosis and treatment of the diseases and could guide public health actions to combat neonatal sepsis.

In 2017, Mali participated in the Global Maternal Sepsis Study (GLOSS), a research initiative conducted by the WHO in 52 countries worldwide.[10] The study's objective was to develop diagnostic criteria, assess the prevalence of maternal sepsis and evaluate the management of newborns born to suspected or confirmed women with sepsis. However, the study did not identify the risk factors associated with sepsis in Mali, which is necessary for the implementation of effective prevention strategies.

Besides the lack of data to guide actions to combat neonatal sepsis, Mali is going through a politico-security crisis since 2012, which has further reduced access to healthcare services. Hence, access to and supply of maternal and neonatal health services have been reduced along with a deterioration of care quality,[23–27] likely resulting in an increase in diseases among the population, including an increase in sepsis episodes among newborns.

Also, in a context where part of the national health budget has been redirected to other priority sectors such as security, it would be useful to know what factors are associated with neonatal sepsis.[28] The results of this study could guide policymakers in planning preventive measures to reduce sepsis risk in neonates. The aim of this study was therefore to estimate the prevalence of neonatal sepsis in two regions in Mali and identify factors associated with the disease.

METHODS

Study setting

The study was carried out in the Gabriel Touré Teaching Hospital (GTTH) (GPS: 12.650874,–7.995945) and the Commune V referral health centre, Bamako (GPS: 12.668744,–7.953923); Kati hospital (GPS: 12.746667,–8.071389) and the Kalabancoro reference health centre, Koulikoro region (GPS: 12.574063011624562,–8.03179311730654). The referral health centres are first-line referral health facilities, Kati hospital is a second-level referral facility and the GTTH; a third-level referral facility.

Study design and participants

This cross-sectional study was conducted from December 2022 to January 2023 to assess the prevalence and risks factors associated with neonatal sepsis. The study population comprised neonates and their mothers admitted to selected health facilities' paediatric and gynaecological wards. Neonates with incomplete patient chart information those who were admitted without their mothers were excluded from the study.

Sampling techniques

The health facilities were purposively selected. The GTTH is the largest hospital in Bamako, where the majority of cases of serious maternal and neonatal infections are referred. The Commune V and Kalabancoro Referral Health Centres and the Kati Hospital were included in the previous WHO GLOSS.[10]

The sampling frame included all neonates admitted to the different facilities. A systematic random sampling was used for the selection of the neonates and their index mothers. Neonates admitted to paediatrics or neonates born to mothers with sepsis, who were admitted to gynaecology, were systematically included in the study from December 2022 to January 2023 until the sample size was reached. Participants was included in order of their admission in the selected four health facilities' paediatric and gynaecological ward.

Sample size calculation

The sample size for this study was calculated using a single population proportion formula.[29] Using the reported proportion of neonatal sepsis of 29.7% in East Africa and a 95% CI, a 3.5% marginal error, a minimum sample size of 722 was estimated of which 10% attrition was added to obtain a final sample size of 795 neonates and their indexed mothers.[18]

Study variables

Outcome variable: neonatal sepsis

The diagnosis of neonatal sepsis was based on clinical signs and/or biological blood test. A neonate is considered to have sepsis if he/she presented with at least two of the following signs: temperature above 37.5°C, temperature below 35.5°C, convulsions, fast breathing (>60 breaths/min), intense chest tightness, lethargy, swollen nose, grunting, bulging fontanel, pus draining from the ear, umbilical redness extending to the skin, sensation of cold (due to previous history), numerous or severe skin pustules, difficulty to wake up, cannot be soothed in an hour, less normal movements, unable to feed and unable to attach to the breast or suckle.[6 21 30]

Predictors variables

The independent variables included neonates' sociodemographic and clinical characteristics and maternal sociodemographic, obstetric, socioeconomic and cultural characteristics. Neonate sociodemographic characteristics included gestational age (<37 or ≥37 weeks), age of neonate (<7 or ≥7 days), sex of neonate (male or female), birth weight (<2.5 kg or ≥2.5 kg), Apgar score (<7 or ≥7) and consumption of foods other than breast milk. Maternal sociodemographic, obstetric, socioeconomic and cultural characteristics included maternal age, marital status, maternal education, gestity, parity, history of antenatal care, current pregnancy status, urinary tract infection, intrapartum fever, genital bleeding during pregnancy, duration of labour, prolonged rupture of membranes, per vaginal examination, HIV status, mode of delivery, financial accessibility, father's financial support, traditional treatment of the newborn's umbilicus, using of traditional nappies on the newborn and handwashing before handling the newborn.[31–33]

Data collection tool and procedure

Data were collected using a questionnaire (online supplemental file 1) and checklists on the Kobocollect application. The questionnaire was developed based on a review of literature and[4 5 33 34] was pretested and subsequent correction made where necessary. For the validation of the tool, a pretest was done on 5% of the total sample size in the Commune VI referral health centre in Bamako among neonates and their mothers; then corrections were made before the start of data collection. The questionnaire has sections on sociodemographic characteristics, maternal factors and neonatal factors. It was developed in French, then translated to the local language (Bambara) and back translated to French to ensure consistency.

Data were collected by four pairs of interviewers, who were doctors or final-year medical students. Two public health doctors supervised the data collection. Prior to the data collection, interviewers and supervisors were trained for 3 days on data-collection approach and tools.

Data quality assurance and control

Data quality was monitored at each stage of the study process. First, during the development of the questionnaire in Kobocollect, by predefining response modalities to minimise errors and avoid inconsistencies such as entering outliers.

Data analysis

Data were checked for completeness and consistencies, cleaned and then exported to STATA V.17 for analysis (StataCorp, College Station, TX). Descriptive statistics were used to describe and summarise the data. A binary logistic regression analysis was used to determine the association between study variables. Variables with a p value ≤0.25 were entered into the multivariate logistic regression model to identify the risk factors associated with neonatal sepsis.

Table 1 Sociodemographic characteristics of neonates

Variables	N	%
Gestational age (weeks)		
≥37	652	82.01
<37	143	17.99
Age of neonate (days)		
≥7	689	86.67
< 7	106	13.33
Sex of neonate		
Female	371	46.67
Male	424	53.33
Birth weight (kg)		
≥2.500	628	78.99
<2.500	167	21.01
Apgar score at 5 min		
≥7	637	80.13
< 7	158	19.87
Consumption of foods other than breast milk		
No	590	74.21
Yes	205	25.79

Sociodemographic, obstetric, socioeconomic and cultural characteristics of mothers.

Collinearity between the independent variables was checked before adjusting the final model. The Hosmer-Lemeshow test was used to verify the final model's goodness of fit. To identify factors associated with neonatal sepsis, a crude and adjusted OR with a 95% CI was calculated. Variables with a p value <0.05 in the multivariate analysis were considered statistically significant.

Patient and public involvement

The patient and the public were not involved in the design, development, analysis and dissemination of this study.

RESULTS

Sociodemographic and clinical characteristics of neonates

795 neonates with a mean age (±SD) of 3.95±5.82 days with their indexed mothers took part in the study. The majority (n=689/795; 86.67%) were aged <7 days and 424/795 (53.33%) were males. Most of them (n=637/795, 80.13%) had an Apgar score of ≥7 at 5 min. 143 neonates (n=143/795; 17.99%) were born premature and the majority (n=628/795; 78.99%) had a birth weight >2.500 kg (table 1).

The mean (±SD) age of mothers was 26.4±6.5 years with the majority, 351 (44.15%), within the age group of 25–34 years. Most of the mothers, 768 (96.60%), were married and 336 (42.26%) of them had no formal education. Almost all the women attended antenatal care service (ANC) 774 (97.36), with 543 (70.16%) attending more

Table 2 Maternal sociodemographic, obstetric, socioeconomic and cultural characteristics

Variables	(n)	(%)
Maternal age (years)		
15–24	339	42.64
25–34	351	44.15
≥35	105	13.21
Marital status		
Married	768	96.60
Single	24	3.02
Others*	3	0.38
Maternal education		
No formal education	336	42.26
Primary	168	21.13
Secondary	161	20.25
Higher	130	16.35
Gestity		
<3 pregnancies	484	60.88
≥3 pregnancies	311	39.12
Parity		
<3 children	496	62.39
≥3 children	299	37.61
ANC		
Yes	774	97.36
No	21	2.64
Number		
≥4	543	70.16
<4	231	29.84
Current pregnancy status		
Unique	726	91.32
Multiple	69	8.68
UTI/STI		
No	613	77.11
Yes	182	22.89
Intrapartum fever		
No	603	75.85
Yes	192	24.15
Bleeding during pregnancy		
No	754	94.84
Yes	41	5.16
Prolonged labour		
No <12	709	89.18
Yes ≥12	86	10.82
Prolonged rupture of membrane		
No <12	717	90.19
Yes ≥12	78	9.81
Per vaginal examination		
<5	608	76.48
≥5	187	23.52
HIV status		
Positive	9	1.13
Negative	480	60.38
Unknown	306	38.49
Mode of delivery		
Spontaneous vaginal delivery	546	68.68
Instrumental vaginal delivery	13	1.63
Caesarean section	236	29.69
Financial accessibility		
Yes	747	93.96
No	48	6.04
Financial support from father		
Yes	759	95.47
No	36	4.53
Traditional treatment on the umbilicus of newborn (shea butter)		
No	354	44.53
Yes	441	55.47
Using fabrics as nappies for newborn		
No	453	56.98
Yes	342	43.02
Washing mother's hands before handling baby		
No	597	75.09
Yes	198	24.91

*Others: widowed, divorced.
ANC, ante natal care; HIV, human immunodeficiency virus; STI, sexually transmitted infection; UTI, urinary tract infection.

than 3 ANC sessions. 41 (5.16%) of the mothers experienced bleeding throughout pregnancy, with 182 (23%) having a history of urinary tract infections during the pregnancy of the indexed neonate. Most, 546 (68.68%), of the births of the neonates were through spontaneous vaginal delivery. Around 441 (55.47%) of the mothers used shea butter as a cultural practice on the umbilicus of the neonates (table 2).

Prevalence of neonatal sepsis

Of the 795 neonates who took part in the study, 167 (21.00%) were clinically diagnosed of neonatal sepsis (figure 1). Of these, 74.25% (124/167) presented with EOS with 25.75% presenting with LOS.

Neonatal and maternal characteristics associated with neonatal sepsis

Neonatal factors associated with neonatal sepsis

In bivariate logistic regression analysis to determine variables associated with neonatal sepsis, gestational age <37 weeks, the age of neonate <7 days, birth weights <2.500, Apgar score at 5 min and consumption of foods other

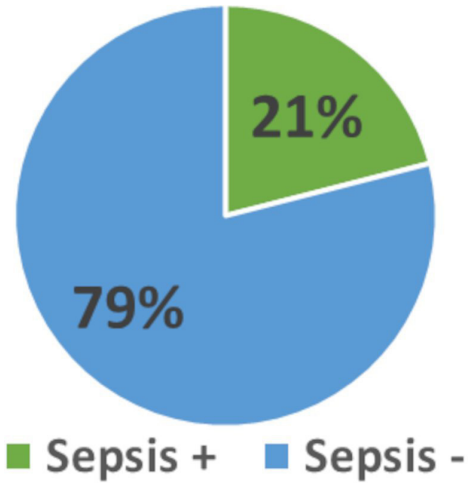

Figure 1 Prevalence of neonatal sepsis among the study participants.

than breast milk were candidates for the multivariate logistic regression analyses. However, in the multivariate logistic regression analyses, the following neonatal factors remained significantly associated with neonatal sepsis: age of neonate <7 days, birth weight <2.500 kg Apgar score at 5 min.

Moreover, neonates aged between 0 and 7 days demonstrated a 2.8-fold increased likelihood of developing neonatal sepsis in comparison to those aged between 8 and 28 days (AOR=2.79, 95% CI 1.59 to 4.89). Similarly, neonates with a birth weight of less than 2.500 kg exhibited a 2.9-fold increased likelihood of developing sepsis in comparison to those with a birth weight of more than 2.500 kg (AOR=2.88, 95% CI 1.41 to 5.86). Similarly, neonates with an APGAR score of less than 7 at 5 min exhibited a 4-fold increased likelihood of developing neonatal sepsis in comparison to neonates with an APGAR score of 7 or above (AOR=4.03, 95% CI 3.09 to 5.24) (table 3).

Maternal characteristics associated with neonatal sepsis

The bivariate logistic regression analysis revealed that maternal age ≥35 years (OR=1.84, 95% CI 1.12 to 3.03, p=0.01), gestity >3 (OR=1.87, 95% CI 1.30 to 2.68, p=0.001), parity >3 (OR=1.77, 95% CI 1.25 to 2.50, p=0.000), mothers with no formal education (OR=3.41, 95% CI 1.86 to 6.23, p=0.000), multiple pregnancy (OR=1.87, 95% CI 1.1 to 3.21, p=0.02), urinary track infection (UTI) (OR=1.66, 95% CI 1.13 to 2.44, p=0.009), intrapartum fever (OR=2.69; 95% CI 1.86 to 3.88, p=0.000), bleeding during pregnancy (OR=2.28, 95% CI 1.18 to 4.42, p=0.014), hand washing with soap before handling baby (OR=0.46, 95% CI 0.29 to 0.73, p=0.001), prolonged rupture of membranes (OR=4.07, 95% CI 2.51 to 6.60; p=0.000) and prolonged labour (OR=3.98, 95% CI 2.50 to 6.34, p=0.000) were statistically significant predictors of neonatal sepsis.

The logistic regression was used to adjust for all variables with a p value <0.20. However, when variables were adjusted, as a result, neonates of mothers with no formal

Table 3 Neonatal factors associated with neonatal sepsis in those admitted in the district of Bamako and the region of Koulikoro, 2023 (n=795)

	Neonatal sepsis					
Variables	**Yes N (%)**	**No N (%)**	**COR (95% CI)**	**P value**	**AOR**	**P value**
Gestational age (weeks)						
≥37	109 (16.72)	543 (83.28)	1			
<37	58 (40.56)	85 (59.44)	3.39 (2.29–5.03)	0.000	0.82 (0.38 to 1.75)	0.61
Age of neonate (days)						
>7	34 (32.08)	72 (67.92)	1			
<7	133 (19.30)	556 (80.70)	1.97 (1.25–3.09)	0.003	2.79 (1.59 to 4.89)	0.000
Sex of neonate						
Female	76 (20.49)	295 (79.51)	1			
Male	91 (21.46)	333 (78.54)	0.94 (0.76–1.32)	0.73		
Birth weight (kg)						
>2.500	98 (15.61)	530 (84.39)	1			
<2.500	69 (41.32)	98 (58.68)	3.80 (2.61–5.54)	0.000	2.88 (1.41 to 5.86)	0.003
Apgar score at 5 min						
>7	65 (10.20)	572 (89.80)	1			
<7	48 (71.64)	19 (28.36)	4.34 (3.38–5.56)	0.000	4.03 (3.09 to 5.24)	0.000
Consumption of foods other than breast milk						
No	137 (23.22)	453 (76.78)	1			
Yes	30 (14.63)	175 (85.37)	0.56 (0.36–0.87)	0.010	0.47 (0.28 to 0.82)	0.008

education were 2 times likely to develop sepsis compared with neonates whose mothers had a higher level of education (AOR=2.24, 95% CI 1.15 to 4.33). Neonates born to mothers who had a history of fever during labour were 2.31 times more likely to develop sepsis than those born to mothers with no history of fever during pregnancy (AOR=2.31, 95% CI 1.52 to 3.53). Neonates of mothers who had a prolonged rupture of membranes were 2 times more likely to develop sepsis compared with those without prolonged rupture of membranes (AOR=1.87, 95% CI 1.01 to 3.54). Neonates born to mothers who had prolonged labour were 2 times more likely to develop sepsis compared with neonates whose mothers did not have prolonged labour (AOR=2, 95% CI 1.03 to 3.88) (table 4).

DISCUSSION

This study highlights the considerable risk of neonatal sepsis in Mali, a health problem that is underdocumented in the country. The study revealed that out of 10 newborns, 2 develop sepsis with three-quarters of these neonatal sepsis cases occurring within the first 7 days following birth. Maternal and neonatal factors with neonatal age <7 days, neonate with birth weight <2.500, Apgar score <7, mother's education level, maternal fever, prolonged rupture of membranes and prolonged labour are significantly associated with neonatal sepsis.

The prevalence of sepsis in our study (21.00%) was comparable to other studies carried out in different countries: a prevalence of 20.5% in South Africa[20] and 26.1% in Ethiopia,[35] 21.8% in Uganda[36] but was higher than those reported in Nigeria with 12.37%,[16] Mexico with 4.3%[37] and Ghana with 17.3%.[34] The possible explanation for this disparity could be due to the differences across study settings, accessibility and setup of countries' health systems.

In the current study, among neonates diagnosed with sepsis, 74.25% presented with early-onset neonatal sepsis. Such a burden aligns with those reported in Ethiopia (76.8%),[17] Mexico (75.3%)[37] and Nigeria (78.2%).[15] This high burden of EOS could be due to organisms associated with the female genital tract having urinary infection, if untreated during the third-trimester pregnancy and the colonisation of the birth canal by the infectious agent during labour. The high burden of sepsis among neonates is also probably favoured by inadequate medical monitoring of these neonates over the first days following their birth. Appropriate neonatal medical monitoring would require adequate equipment and availability of care providers; however, in resource-limited countries such as Mali, health facilities still face material and human health resources. Ensuring availability of appropriate equipment and skilled staff to ensure close quality medical monitoring of neonates over the first 7 days following birth (early case management) could contribute to reduce the prevalence of neonatal sepsis.

Neonates who are aged from 0 to 7 days were 2.8 times more likely to develop neonatal sepsis. Similar findings have been reported by previous studies in north and southwest Ethiopia,[17 35] Nigeria[15] and Tanzania.[19] This could be explained by the fact that the newborn is already in contact with the infectious agent before being born, and then presents these signs directly after delivery. Neonates are very sensitive to different infection agents during the early period due to weakened immunity.

The birth weight less than 2.500 kg was a risk factors for neonatal sepsis in this study. Our result was consistent with studies conducted in Nagpur, India,[38] in Gondar, Ethiopia,[30] in Oromia, Ethiopia[31] and in Winneba, Ghana.[9] Higher risk of sepsis among low birthweight neonates could be linked to the structural and functional immaturity of the neonates' organs and the weakness of his/her immune system.

Regarding the Apgar score, our finding is comparable with studies from Ethiopia,[39] Tanzania[40] and Indonesia.[41] Asphyxia causes immunological aggression, and resuscitation procedures after birth asphyxia tends to expose neonates to pathogenic microbes.[42]

Intrapartum fever was a predictor of neonatal sepsis in this study. Similar findings were also observed in Ethiopia[31] and India.[38] Intrapartum fever is an indicator of local or systemic infections such as chorioamniotitis or urinary tract infection. Such infections are often transmitted to the newborn in utero or during passage through the birth canal, and they frequently manifest as EOS.

The odds of sepsis among neonates from mothers who had attended less than 4 ANC were 2 times higher compared with those whose mothers who had attended 4 or more ANC. This finding is congruent with studies conducted in India[38] and Ethiopia.[43] Women who benefit from complete ANC may have a better understanding and medical management of the risk factors for sepsis.

Care provided to mothers during pregnancy and delivery (vaccination, vaginal swabs, intrapartum antibiotic therapy) can make a significant contribution to the prevention of early neonatal sepsis by influencing risk factors such as low birth weight, low Apgar score and maternal fever. It will therefore be important to achieve quality antenatal care in order to prevent early neonatal sepsis.

This study's strength lies in its inclusion of hospitals and health centres at various levels of the healthcare system in Mali, as well as its use of data from numerous health facilities. However, potential limitations warrant consideration. Primarily, the majority of sepsis cases were identified based on clinical signs without laboratory confirmation, which may have introduced bias. Additionally, the study participants were selected from health facilities, and neonates with sepsis who did not attend health facilities could not be included, potentially reducing the generalisability of the results.

Table 4 Maternal demographic and clinical characteristics associated with neonatal sepsis in the district of Bamako and the region of Koulikoro, 2023 (n=795)

	Neonatal sepsis					
Variables	**Yes N (%)**	**No N (%)**	**COR (95% CI)**	**P value**	**AOR (95% CI)**	**P value**
Maternal age (years)						
15–24	65 (19.17)	274 (80.83)	1			
25–34	70 (19.94)	281 (80.06)	1.05 (0.72 to 1.53)	0.79	0.98 (0.59 to 1.62)	0.95
≥35	32 (30.48)	73 (69.52)	1.84 (1.12 to 3.03)	0.01	1.18 (0.59 to 2.360	0.63
Maternal education						
Higher	14 (10.77)	116 (89.2)	1			
No formal education	98 (29.17)	238 (70.83)	3.41 (1.86 to 6.23)	0.000	2.24 (1.15 to 4.33)	0.02
Primary	32 (19.05)	136 (80.95)	1.94 (0.99 to 3.82)	0.05	1.29 (0.69 to 2.69)	0.49
Secondary	23 (14.29)	138 (85.71)	1.38 (0.67 to 2.80)	0.37	1.12 (0.53 to 2.36)	0.76
Gestity						
<3 pregnancies	82 (26.37)	229 (73.63)	1			
≥3 pregnancies	85 (17.56)	399 (82.44)	1.87 (1.30 to 2.68)	0.001	0.96 (0.32 to 3.00)	0.97
Parity						
<3 children	86 (17.34)	410 (82.66)	1			
≥ 3 children	81 (27.09)	218 (72.91)	1.77 (1.25 to 2.50)	0.000	1.51 (0.49 to 4.70)	0.46
Current pregnancy status						
Unique	145 (19.97)	581 (80.03)	1			
Multiple	22 (31.88)	47 (68.12)	1.87 (1.1 to 3.21)	0.02	1.76 (0.94 to 3.28)	0.07
UTI/STI						
No	116 (18.92)	497 (81.08)	1			
Yes	51 (28.02)	131 (71.98)	1.66 (1.13 to 2.44)	0.009	1.51 (0.98 to 2.33)	0.06
Intrapartum fever						
No	100 (16.58)	503 (83.42)	1			
Yes	67 (34.90)	125 (65.10)	2.69 (1.86 to 3.88)	0.000	2.31 (1.52 to 3.53)	0.000
Bleeding during pregnancy						
No	152 (20.16)	602 (79.84)	1			
Yes	15 (36.59)	26 (63.41)	2.28 (1.18 to 4.42)	0.014	1.21 (0.56 to 2.62)	0.61
Prolonged labour						
No <12	127 (17.91)	582 (82.09)	1			
Yes ≥12	40 (46.51)	46 (53.49)	3.98 (2.50 to 6.34)	0.000	(1.03 to 3.88)	0.04
Prolonged rupture of membrane						
No <12	130 (18.13)	587 (81.87)	1			
Yes ≥12	37 (47.44)	41 (52.56)	4.07 (2.51 to 6.60)	0.000	1.87 (1.01 to 3.54)	0.04
Per vaginal examination						
<5	108 (17.76)	500 (82.24)	1			
≥5	59 (31.55)	128 (68.45)	2.13 (1.47 to 3.09)		1.52 (0.93 to 2.48)	0.09
Hand washing with soap before handling baby						
No	142 (23.79)	455 (76.21)	1			
Yes	25 (12.63)	173 (87.37)	0.46 (0.29 to 0.73)	0.001	0.63 (0.37-1/07)	0.09

UTI/STI, Urinary tract infection/sexually transmitted infection.

CONCLUSION

The prevalence of sepsis was high with several maternal and neonatal variables identified as risk factors associated with neonatal sepsis in Mali. A specific emphasis should be placed on enhancing care provided to mothers during the prenatal and perinatal periods, with the objective of

reducing the risk of EOS. It will also be crucial to enhance the monitoring and care of newborns who presented with risk factors or were born to mothers with risk factors. For prompt medical intervention, it may be important to improve caregivers' practices on the neonatal sepsis. This will help to reduce sepsis-related mortality.

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