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Research Article

Prevalence of Preterm Neonatal Sepsis and Associated Factors Among Preterm Neonates Admitted in Neonatal Intensive Care Unit of Public Hospitals, Southwest Shewa Zone, Ethiopia, 2022

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Abstract

Back-ground: -Neonatal sepsis is one of the major causes of neonatal mortality and sickness worldwide. In Ethiopia, it is also the main cause of neonatal deaths. As a result, there have been many advances in the prevention, evaluation and management of neonatal sepsis in past few decades. However, neonatal sepsis rates in Ethiopia are continuously rising. This study aims to assess the prevalence of preterm neonatal sepsis and associated factors among preterm neonates admitted in neonatal intensive care units of public hospitals, Southwest Shewa, Oromia, Ethiopia, 2022. Objective: - To assess prevalence of preterm neonatal sepsis and associated factors among preterm neonates admitted in neonatal intensive care unit of public hospitals, Southwest Shewa Zone, Ethiopia, 2022 Methods: Institutional based cross-sectional study was conducted from April 4 to June 30, 2022, in public hospitals of Southwest Shewa, Oromia, Ethiopia 2022. A total of 422 mother-neonates' pairs were selected by systematic random sampling technique. Pretest and structured questionnaires were used to collect data. Multivariate logistic regression analysis was fitted to identify factors associated with neonatal sepsis. Adjusted odd ratio (AOR) with the corresponding 95% confidence interval was used to show the strength of association and variables with p-values of < 0.05 were considered statistically significant. Results: The overall, prevalence of preterm neonatal sepsis was 63% and among all preterm neonates who had sepsis 65.1% had early onset of neonatal sepsis. Among maternal factors urinary tract infection (UTI) (AOR=5, 95%CI= (2.79, 8.24) and duration of labor greater than twelve hours (AOR=3.2, 95%CI= (1.47, 5.85) and among neonatal factors preterm/Gestational age >37wks (AOR=2.5, 95%CI= (1.45, 4.15), Low admission birth weight (AOR=3.7, 95% CI=(2.09, 6.36) and Breast initiation within the first one hours (AOR=0.38, 95%CI=(0.22, 0.68). Conclusion and Recommendation: overall, prevalence of preterm neonatal sepsis was high. Preterm neonatal sepsis was positively associated with low birth weight, premature birth and urinary tract infection. To decrease the severity of neonatal sepsis, it was recommended to prevent maternal urinary tract infection (UTI) during pregnancy and improve intrapartum and postpartum care

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Keywords

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1. Introduction

Sepsis is a deregulated host response to infection leading to life-threatening organ dysfunction and, organ dysfunctions can be represented by an increase in sequential or sepsis-related organ failure assessment score of two points or more [1].

Neonatal sepsis, a frequent serious condition in the neonatal intensive care unit, has been defined as a clinical condition marked by a syndrome of infections with the presence of clinically suspected or culture-confirmed infection within the first 28 days following birth [2]. Numerous neonatal systemic diseases, including septicemia, meningitis, pneumonia, and urinary tract infection, are included [3].

The manifestations of neonatal sepsis are non-specific and vary among neonate [4]. World health organization (WHO) has recognized seven clinical indicators (convulsion, lethargy, respiratory rate of >=60 breaths per minute, chest in-drawing and axillary temperature of >=37.5℃ or <35.5℃ [5, 6]. Escherichia coli, Klebsiella, and staphylococcus Aures are the most prevalent bacteria that cause bacterial newborn sepsis in underdeveloped nations [7].

Newborn sepsis continued to be a significant global public health concern since it significantly increased the burden of neonatal morbidity and mortality around the world [8]. Even though finding the pathogen in a blood culture is the gold standard for diagnosing sepsis, the results take one to two days to come in and are challenging to interpret due to the limited sensitivity of the test [9].

About 6.9 million newborns are predicted to experience a dangerous bacterial illness each year due to neonatal sepsis globally [10] and 8.7 million disability adjusted life years were lost due to neonatal sepsis. Additionally, its financial burden ranges from $10 billion to $469 billion [11]. Globally, an estimated annual neonatal death due to sepsis were 400,000 to 700,000, out of this about 6700 newborns died every day [12]. Neonatal mortality in Ethiopia was 30/1000 live births, which showed an increase rate, and 28% of neonatal deaths were related to sepsis [13, 14]. By reducing the burden of newborn sepsis, the target of sustainable development goals for child survival can be reached [15].

Previous studies discovered that low birth weight, antenatal care, urinary tract infection, premature rapture of the membranes, intrapartum fever, and educational level were risk factors for neonatal sepsis. World health organization (WHO) was launched global neonatal sepsis initiative for effective prevention, identification and management of neonatal sepsis to reducing new born death by strengthening health care system and improving the quality of health service [16, 17].

Neonatal sepsis has been studied in Ethiopia, although it continues to be the leading cause of neonatal death, impeding the country's efforts to achieve the Sustainable Development Goal of reducing neonatal mortality to below 12/1000 live births by 2030 [18]. In order to meet these goals updated studies involving several factors (variables) need to be conducted. Even though the impact of neonatal sepsis remains a public health problem in resource-limited settings like Ethiopia and as far as literature searching showed, there is no study conduct on my study area. Therefore, the aim of this study was to assess the prevalence of preterm neonatal sepsis and associated factors among preterm neonates admitted to neonatal intensive care unit of public hospitals of Southwest Shewa, Ethiopia.

2. Methods and Materials

2.1. Study Area/Setting, Study Period and Study Design

The study was conducted in Southwest Shewa Zone, Oromia region, Ethiopia at five public hospitals. Southwest Shewa Zone located to the south of Addis Ababa. It has three primary hospitals and two general hospitals, Named as Ameya primary hospital, Bantu primary hospital, Leman primary hospital, Tullu Bollo general hospital and Waliso general hospital. It has also 270 health posts and 64 health centers. Based on the 2007 census conducted by central statistical agency of Ethiopia, this zone has a total population of 1.7 million, of whom 49.9% female and 50.1% were male. It is 114 km far from the capital city of the country Addis [19]. The study was conducted from April 4 to June 30, 2022.

Institutional based cross-sectional study design was carried out among preterm neonates admitted in Neonatal intensive care unit of public hospitals, Southwest Shewa Zone/Oromia/Ethiopia, 2022.

2.2. Population

Source of population: -All preterm neonates who were admitted to neonatal intensive care unit of public hospitals, Southwest Shewa /Oromia/Ethiopia 2022. Study population: -All randomly selected neonates <=28 days of life and who were fulfill the inclusion criteria.

2.3. Inclusion Criteria and Exclusion Criteria

All preterm neonates who were admitted in NICU of public hospitals, Southwest Showa, Ethiopia and during data collection period, 2022. Mothers participating in face-to-face interviews during the data collection period who are seriously ill and unable to communicate and preterm neonates admitted without their mothers or care givers were excluded.

2.4. Sample Size Determination and Sampling Technique

The sample size was calculated by using single population proportion formula using the assumption of 95% confidence interval (CI) with marginal error of 5%, The proportion of neonatal sepsis (52.6%) was taken from the previous study conducted in Jimma (20).

$$n = \frac{(Z\alpha/2)^2 P(1-p)}{d^2}$$

n = required sample size,

Z = is standardized normal distribution value for the 95% confidence interval (CI) = 1.96

P = proportion = 52.6% prevalence of neonatal sepsis

D = margin of error that can be tolerated 5% (0.05) and

(1-p) = proportion of population that do not possess the character of interest.

Therefore, $(1.96)^2$ (0.526) (0.474) / $(0.05)^2$ = 384.

Finally, by considering nonresponse rate as 10%, the total sample size was 422.

To calculates sample size for specific objective different variables taken from different literatures by considering independent variable which has significant association with dependent variables. Women with premature rupture of membrane (PROM) and urinary tract infection (UTI) variables were taken from literature [20, 21]. By using Epi-info version 7.2, By considering 95% level of confidence, with power of 80%, proportion of variables, adjusted odd ratio (AOR), one to one risk ratio (1:1) and by adding 10% non-response rate the total sample size for second objective were calculated. Since the sample size obtained (422) is larger than the sample size for the specific objectives, then (422) sample size was taken for this study.

Sampling Technique: -The number of study participants from each hospital was determined by proportional allocation to population size by reviewing the report of last years of neonatal intensive care unit service. The calculated sample size was distributed proportionally to the hospitals based on the number of neonatal care service given in the last year by each of the hospitals. Finally, systematic random sampling technique was used to select mothers-pairs neonate. In the study participant's selection technique, two months of last year NICU service reports of all hospitals divided by final sample size, then every two-interval mother-pair neonate was selected for interview. The first participants (sampling interval) were determined for all hospitals by using lottery methods. Then, by using a systematic random sampling method the data collectors were interviewed the mothers-pairs neonates every two- interval on a daily basis at the time of admission until the required sample size allocated was maintained.

2.5. Study Variables

Dependent variable: -Preterm neonatal sepsis.

Independent Variable: -Socio-Demographic Factor, Age of the mother, educational level of mother, residence and marital status, Maternal factor: Urinary tract infection, duration of labor, mode of delivery, duration of rupture of membrane, Antenatal cares, perinatal/intranatal maternal fever and place of delivery, Neonatal factors: -Mode of feeding, age of neonates, prematurity and admission birth weight of neonate.

2.6. Operation Definition

Neonatal sepsis: Neonates with presence of at least two clinical features: fever/hypothermia, convulsion, lethargy, fast breathing, unable to feed, severe chest in drawing, nasal flaring, grunting, umbilical readiness and not able to suck at all were suggestive clinical features for neonatal sepsis [7].

Neonate: A neonate whose age is less than or equal to 28 days [22].

Early onset of neonatal sepsis: Occurs birth to seven days, usually less than 72 hours [7].

Late on set of neonatal sepsis: On set of occurring after the first 7 days of birth [7].

2.7. Data Collection Instrument and Technique

2.7.1. Data Collection Instrument

Structured questionnaires and check lists were modified after review of different literature for the data collection. Most questions are adapted from questionnaires used in other studies [23, 24]. The questionnaires were translated into local language and again retranslated back to English before data processing by language translator expert to check for any inconsistencies or distortions in the meaning of words and concepts.

2.7.2. Data Collection Technique

The data were collected through a face-to-face interview of the index mothers using a pretested structured questionnaire. Data were collected by trained four BSC nurses who are fluent with local language and supervised by two BSc supervisors. The interviews of the mothers were interviewed in a separated area with protected privacy and the data were collected after direct communication with the clients and reached an agreement. Collection of data was lasted three months, and the collected data was checked on the daily basis for its completeness by supervisors.

2.8. Data Quality (Control) Assurance

To assure the validity of tools, it adapted from related research, pre-tested on fifty of mother- pairs neonate who admitted in neonatal intensive care unit of chancho primary hospital and was entered to crobacch alpha analysis by SPSS version 25 prior to the actual data collection started to assess the reliability of the questionaries. Then necessery comments and feedbacks was incorporated in the final tool to improve its quality. Mult co-linearity was checked by using variance inflation factors and tolerance. To insure the consistency of the questionnaire, the english version was translated into local language and again retranslated back to english by language translator expert. Data collectors and supervisors were recruited from out of the employee of the study hospitals to minimize bias. Orentation was given for those data collectors and supervisors, regarding to data collection procedure, on matter of the questionnaire, ethical consideration of participant and danger of clarity of the data if they would not follow what was wanted. At the end of each day, the questionnaire was reviewed and cross checked for completeness and inconsistency by the investigator and supervisor and correction was made.

The collected data was checked for completeness, by the investigator and supervisors before data entry into the application and each questionaries approval to enter into the application for analysis was correctly coded. Data was entered into Epi data version 4.6 to minimize errors, to check double data entered, design skipping pattern, then validation to check the consistency, accuracy and clarity for data entered was done and compared to the original data. Model goodness of fit was checked by Hosmer-Lermeshows. Appropriate corrective measure was taken after all data screening and data cleaning measure would taken accordingly before exporting data to SPSS version 25 for analysis.

2.9. Data Processing and Analysis

After data collection, each questionnaire was checked for completeness and consistency of the information obtained from the study participant. After this validation, collected data was coded and entered into EPI data version 4.6 in order to minimize logical errors and skipping patterns. Then data were exported to SPSS version 25 for cleaning, editing and analysis. Descriptive analysis was done by computing proportions (like frequencies, percentages, means, and standard deviation) and inferential analysis was done. Then the information was presented by using simple frequency, summary measures, tables and figure. The bivariate and multivariate logistic regression analysis was performed. Variables with a p-values < 0.25 were transferred to multiple logistic regression models in order to control all possible confounders. AOR with their 95% confidence interval was computed, and p-value < 0.05 was considered as the statistically significant in the multivariate model and it was considered to declare a result as statistically significant association.

2.10. Ethical Consideration

Ethical clearance was obtained from Salale University, Health Sciences College Institutional review board (IRB) by *Ref no. HSC/878/* on date *29/03/2022*. Supportive letter also taken from Salale University, Health Sciences College by Ref no. HSC// on date *30/03/2022*. Permissions for collection of data were obtained from chief executive officer of each hospital. Informed consent was taken from study participant prior to interview. The study participants were informed about the purpose of the study and the importance of their participation in the study by contributing information that may help in assessing prevalence and determinant factors of neonatal sepsis. Also, the study participants were informed as they can skip question or questions that they do not want to answer fully or partially and also to stop at any time if they want to do so. Confidentiality of the information is secured throughout the interview process.

3. Result

A total of 422 women with index neonates were participated in this study, with the response rate of 100%.

3.1. Socio-Demographic Characteristics of Mothers with Their Index Neonates

The mean age of the study participants was 30.70 and SD ± 7.93 years. Majority of the respondents were live in rural 310 (73.5%) and Orthodox in religion 217 (51.4%). Most of the respondents were housewife 200 (47.4%) followed by civil servants 88 (20.9%). Regarding educational status of the respondents 150 (35.5%) was informal education. The age of neonates from 0-7 days was 250 (59.4%) (Table 1).

Table 1. *Socio-demographic characteristics of mothers with their index neonates for the study of prevalence of preterm neonatal sepsis and associated factors among preterm neonates admitted to NICU of public hospitals of Southwest Shewa, Ethiopia, 2022.*

Variable		Frequency (N)	Percent (%)
Residence	Rural	310	73.5
	Urban	112	26.5

Variable		Frequency (N)	Percent (%)
Maternal Age	15-19	49	8.8
	20-24	157	20.4
	25-34	122	39.1
	>=35	94	31.8
Marital Status	Single	21	5.0
	Married	377	89.3
	Divorced	24	5.7
Religion	Orthodox	217	51.4
	Muslim	139	32.9
	Others	66	15.6
Educational status	Informal education	150	35.5
	Primary	167	39.6
	Secondary	73	17.3
	More than secondary	32	7.6
Maternal Occupation	Housewife	200	47.4
	civil servant	88	20.9
	private organization	54	12.8
	daily laborer	20	4.7
	Student	60	14.2
Neonatal Sex	Male	224	53.1
	Female	198	46.9

3.2. Descriptive Statistics of Maternal Health Related Factors for Neonatal Sepsis

Of the total respondents, 254 (60.2%) were multiparous, primiparous 116 (27.5%) followed grand multiparous 52 (12.3). Two hundred twenty-six (53.6%) of the respondent women had ANC follow up whereas one hundred ninety-six (46.4%) had not got ANC follow up for this pregnancy. Two hundred thirty-seven (56.2%) of respondents had history of urinary tract infection during their pregnancy. Majority 268 (63.5%) of the respondent women were delivered in hospital and 93 (22.0%) delivered in Health center. Among the respondent's majority 309 (73.2%) of them delivered after 12 hours of their onset of labor and 113 (26.8%) were delivered within 12 hours of their onset of labor (Table 2).

Table 2. *Description of maternal health Related Factors for the study of prevalence preterm neonatal sepsis and associated factors among preterm neonates admitted to NICU of public hospitals in Southwest Shewa, Ethiopia, 2022.*

Variable		Frequency	Percent (%)
Gestational Age	<37 weeks	205	48.6
	>=37 weeks	217	51.4
Place of Delivery	Home	61	14.5
	Health Center	93	22.0
	Hospital	268	63.5

Variable		Frequency	Percent (%)
HIV Test result	Positive	22	5.2
	Negative	381	90.3
	Unknown	19	4.5
VDRL Test result	Reactive	21	5.0
	Nonreactive	383	90.8
	Unknown	18	4.3
Intrapartum fever	Yes	206	48.8
	No	216	51.2
Mode of Delivery	Spontaneous vaginal delivery	274	64.9
	Instrumental vagina delivery	148	27
	Caesarean section	34	8.1
Duration of Rupture of Membrane	>12	310	73.5
	<=12 hours	112	26.5

3.3. Descriptive Statistics of Neonatal Health-Related Characteristics

More than half of the neonate 222 (52.6%) weight is >=2500 g and 200 (47.4%) were <2500 g. Majority of neonate 368 (87.2%) were practice exclusive breast feeding and 301 (71.3%) of neonates cries immediately after delivery. Majority 314 (74.4%) of neonate has no umbilical infection (Table 3).

Table 3. *Description of neonatal characteristics for the study of prevalence of preterm neonatal sepsis and associated factors among preterm neonates admitted to NICU of public hospitals, Southwest Shewa, Ethiopia, 2022.*

Variable		Frequency (N)	Percent (%)
Time of breast initiation at birth	Within the first one hour	236	55.9
	After one hour	186	44.1
Mode of feeding	Exclusive breast feeding	368	87.2
	Bottle feeding	54	12.8
Neonates cries after birth	Yes	301	71.3
	No	121	28.7
Neonatal convulsion	Yes	45	10.7
	No	377	89.3
Neonatal grunting	Ye	132	31.2
	No	290	68.7
Severe chest in drawing	Yes	163	38.6
	No	259	61.4
Fast breathing (RR>=60 bpm)	Yes	125	29.6
	No	297	70.4
Fever/hypothermia (>=37.5 ℃/<35 ℃)	Yes	144	34.1

Variable		Frequency (N)	Percent (%)
Lethargy/abnormal body movement	No	278	65.9
	Yes	154	36.5
Unable to feed breast	No	268	63.5
	Yes	171	40.5
Unable to suck breast at all	No	251	59.5
	Yes	78	18.5
	No	344	81.5

3.4. Prevalence of Preterm Neonatal Sepsis

The overall prevalence of preterm neonatal sepsis in this study was 265 (62.8%). From this, 163 (65.2%) and 110 (59.3%) of neonates were early-onset and late-onset neonatal sepsis, respectively (Figure 1).

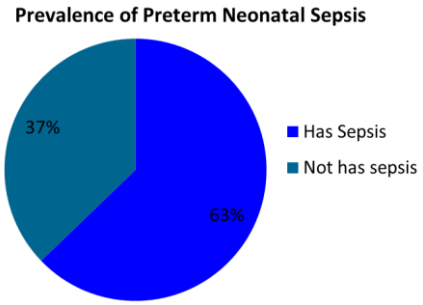

Figure 1. *Pie Chart presentation of prevalence of preterm neonatal sepsis among preterm neonates admitted in NICU of public hospitals in Southwest Shewa, Ethiopia, 2022.*

3.5. Bivariable and Multivariable Logistic Regression Analysis Result of the Study

In the bivariate logistic regression analysis, Gestational age, place of delivery, history of UTI during this pregnancy, duration of labor, duration of rupture of membrane, Time of breast initiation, mode of feeding and Admission birth weight were candidate variable for multivariate analysis at (p-value <0.25). Multivariate logistic regression was conducted to identify the factors associated with neonatal sepsis. Most of variables that showed significant association in bivariate analysis were included in multivariate for controlling of confounder.

Among all variables entered into multiple logistic regression analysis, Gestational age was found to be significantly associated with preterm neonatal sepsis. Those neonates who born with gestational age of <37 weeks were 2.4 times more likely to develop neonatal sepsis than their gestational age was>=37 weeks (AOR=2.4, 95%CI: 1.46-4.06).

Time of breast initiation was significantly associated with preterm neonatal sepsis. Neonates instantiated breast feeding within the first one hours after birth was 61% less likely to develop neonatal sepsis compared to that instantiated breast feeding after one hours (AOR=0.39, 95%CI: 0.22-0.68). Maternal urinary tract infection during pregnancy and not treated was significantly associated with preterm neonatal sepsis. The odds of neonatal sepsis born from mother who had history of urinary tract infection during pregnancy and not treated were around 5 times more likely to develop neonatal sepsis with compared to their counterpart (AOR=4.8, 95%CI: 2.79-8.21).

Duration of labor was found to be significantly associated with preterm neonatal sepsis. Those neonates born after 12 hours of onset of labor were 3.2 times more likely to develop neonatal sepsis than their counterpart (AOR=3.2, 95%CI: 1.73-5.82). Additionally, admission birth weight of neonate significantly associated with neonatal sepsis. Neonate those admission birth weights were <2500 gm were 3.7 times more likely to develop preterm neonatal sepsis than those their admission birth weights were >=2500 gm (AOR=95%CI: 2.09-6.36) (Table 4).

Table 4. *Bivariable and multivariable logistic regression result prevalence of preterm neonatal sepsis and associated factors among preterm neonates admitted to neonatal intensive care unit of public hospitals Southwest Shewa, Ethiopia, 2022 (n=422).*

Variable		Neonatal sepsis		COR (95%CI)	AOR (95%CI)	P-value
		Yes N (%)	No N (%)			
Gestational Age	<37wks	160 (78)	45 (22)	3.8 (2.5, 5.8)	2.4 (1.46, 4.06)	0.001*

Variable		Neonatal sepsis		COR (95%CI)	AOR (95%CI)	P-value
		Yes N (%)	No N (%)			
ANC Visit	>=37wks	105 (48.4)	112 (51.6)	1	1	
	Yes	132 (58.4)	94 (41.6)	0.7 (0.45, 0.99)	0.69 (0.43, 1.14)	0. 15
	No	133 (67.9)	63 (32.1)	1	1	
Place of Delivery	Home	48 (78.7)	13 (21.3)	2.6 (1.2, 5.3)	1.89 (0.76, 4.69)	0.16
	Health center	55 (59.1)	38 (41.9)	1.1 (0.65, 1.7)	1.36 (0.74, 2.52)	0.32
	Hospital	162 (60.4)	106 (3.6)	1	1	
UTI during this pregnancy	Has UTI and not treated	177 (74.7)	60 (25.3)	3.3 (2.2, 4.9)	4.8 (2.79, 8.21)	0.001*
	Has UTI and treated	88 (47.6)	97 (52.4)	1	1	
Time of breast initiation at birth	Within the first one hours	121 (51.3)	115 (48.7)	0.3 (0.2, 0.5)	0.39 (0.22, 0.68)	0.001*
	After one hours	144 (77.4)	42 (22.6)	1	1	
Duration of labor	>12 hours	216 (69.9)	93 (30.1)	3.03 (1.95, 4.3)	3.2 (1.73, 5.82)	0.001*
	<=12 hours	49 (43.4)	64 (56.6)	1	1	
Duration of rupture of member	>12 hours	208 (67.1)	102 (32.9)	1.97 (1.27, 3.5)	1.44 (0.76, 2.73)	0.253
	<=12 hours	57 (50.9)	55 (49.1)	1	1	
Mode of breast feeding	Exclusive breast feeding	223 (60.6)	145 (39.4)	0.44 (0.22, 0.6)	0.44 (0.18, 1.04)	0.06
	Bottle feeding	42 (77.8)	12 (22.2)	1	1	
Admission birth weight	<2500 g	150 (75.0)	50 (25.0)	2.8 (1.8, 4.2)	3.7 (2.09, 6.36)	0.000*
	>=2500 g	115 (51.8)	107 (48.2)	1	1	

Keys: * = Statistically significant at p <0.05; 1 = Reference; COR = Crude Odds Ratio; AOR = Adjusted Odds Ratio and 95% CI = 95% Confidence Interval.

4. Discussion

According to this study, the overall prevalence of preterm neonatal sepsis was 62.8% (95%CI: 58%-67%). According to this study, there are several factors that are significantly linked to preterm neonatal sepsis, including gestational age, neonatal admission weight, UTI through pregnancy, labor lasting more than 12 hours and immediate breast feeding within the first hour. The prevalence of preterm neonatal sepsis in this study 62.8% was in line with study conducted in public hospitals of jimma 52.6% [20], Central Gonder zone 64.8% [25]. Sidama zone 53.3% [26]. The similarity of the result might be due to sample size, methods, operational definition and study area.

The findings of this study were lower than those of previous studies done in Bangladesh 69.35% [27]., Tanzania 69% [28], Tigray region 79% [29], Bishoftu referral hospital 72.2% [30], and shashamene referral hospital 77.9% [31]. This disparity might be due to study sites that frequently treat severe pregnant mother as well as neonatal complications, which might be enhance preterm neonatal sepsis. Also, the discrepancy might be due to the result of the socio-economic difference between countries and the sample size difference.

Current study revealed that higher prevalence of preterm neonatal sepsis than study conduct in Nigeria 37.6% [32], Uganda 12.8% [33], Tanzania 49.8% [34], and Kenya 28.8% [35]. This difference might be contributed by methodological difference and the difference in diagnostic modality to confirm neonatal sepsis. Furthermore, the difference might be due to socio-cultural difference and sample size.

Current study found that the proportion of preterm neonatal sepsis (65.2%) higher than the study conduct in Nigeria 34% [32], and Jimma 39.8% [20]. The discrepancy might be due to study area, lack of advance infrastructures, sample size and socio-economic difference between the countries. Furthermore, the difference might be due to delays early identification of risk factors and take appropriate interventions, like maternal prenatal care continues to be important for prevention of early-onset neonatal sepsis caused by gram-positive bacilli staphylococcus bacterial sepsis, with identification of maternal carriage of GBS through universal screening for all pregnant women.

This study found that maternal urinary tract infection (UTI) during pregnancy and not treated was significantly associated with neonatal sepsis; specifically, neonates born from mothers with urinary tract infection during their pregnancy and not treated were around five times more likely to suffer from sepsis compared to those neonates born from mothers those with urinary tract infection and treated. This finding was similar with findings of study conduct in Kenya [35], Ghana [36]., Congo [37], Tigray [29], and jimma [20] were also reported that those mothers with urinary tract infection were positively associated with neonatal sepsis.

This could be explained by the fact that, if mothers with urinary tract infection were not treated during the third trimester of pregnancy, maternal genitourinary tract infections can be associated with NS following colonization of the birth canal by infectious agents and the most microorganism that cause neonatal sepsis are found across the birth canal, possibly increase the risk while the new born was born and pass through the vaginal wall [29, 30]. This study revealed that time of breast initiation after birth significantly associated with neonatal sepsis. Specifically, those neonates who practice breast feeding immediately after delivery within the first one hour were around 61% more protective from sepsis as compared to those who practiced breast initiation beyond one hour after delivery. Despite no more other study reported that the association of neonatal sepsis and time of breast initiation. It is fact, that breast milk contains significant concentration of IGA and oligosaccharides that used for the neonates as ant-infectious properties.

The exclusive use breast milk result more diverse intestinal micro biota, which leads to a lower probability of infections. Additionally, the reason why early initiation of breast feeding significantly associated as protector for neonatal sepsis might be due to early initiation of breast feeding stimulates the gastrointestinal tract, stimulating intestinal maturity, preventing villous atrophy, decreasing bacterial translocation and invasion through the intestinal mucosa.

This study revealed that duration of labor is positively associated with preterm neonatal sepsis. This finding was agreed with previous studies conducted in different regions of the world [20, 37, 38]. This finding could be explained by the fact that the number of hours of labor was a significant independent risk factor for vaginal colonization in women with prolonged labor [39].

In the present study, the odds of developing neonatal sepsis among the preterm neonates with < 2.5 kg weight at admission was 3.7 times more likely to had neonatal sepsis than neonates with admission weight of >= 2.5 kg. This finding is consistent with study done in Bangladesh [27], and in Tanzania [37]. This might be due to at birth, a newborn's immune system remains immature, and some protection is provided by maternal antibodies crossing the placenta. This process is less complete in low birth weight, especially if it is premature. In addition, newborn with low birth weight were more likely to require invasive procedures (umbilical catheterization and intubation) and have a long stay. Poor practices and failure to follow guidelines by healthcare professionals during procedure can predispose the newborn to a higher risk of developing sepsis.

5. Strength of the Study and Limitation of the Study

Strength of study: It was conducted in relatively larger area/multicenter and data was collected through face-to-face interview which could be able to reduce information bias.

Limitation of the study: Using clinical diagnosis of preterm neonatal sepsis might be overestimates the proportion of neonatal sepsis. Neonates having sign and symptoms of sepsis who didn't come to hospitals for medical care might be missed resulting in reduced external validity.

6. Conclusion

Overall, the prevalence of preterm neonatal sepsis was high, and it was more prevalent among neonates aged >7 days. Among neonatal factors, being preterm, low admission birth weight and initiation of breast feeding within the first one hour were found significantly associated with neonatal sepsis. Among maternal factors, absence of maternal urinary tract infection and duration of labor >12 hours were found significantly decreased the odds of neonatal sepsis. Professionals who are working in NICUS should adhere to aseptic techniques while carrying out neonatal invasive procedures, especially for those neonates who need invasive procedure (preterm and low birth weight neonate) and attention should be given for neonates delivered from women with urinary tract infection. Pregnant women should be screened for urinary tract infection (UTI) and those diagnosed with urinary tract infection should be treated with full course of antibiotics for the prevention of neonatal sepsis. Enhancing the dissemination of health information on rapid and exclusive breastfeeding, and prioritizing and managing laboring mothers to shorten labor times and taking into account antibiotic prophylaxis for neonates born to mothers who had extended labors.

Abbreviations

AOR	Adjusted Odds Ratio
COR	Crude Odds Ratio
CI	Confidence Interval
EBF	Exclusive Breastfeeding
EDHS	Ethiopia Demographic and Health Survey
EONS	Early Onset of Neonatal Sepsis
LONS	Late Onset of Neonatal Sepsis
NICU	Neonatal Intensive Unit
PROM	Premature Rupture of Membrane
SVD	Spontaneous Vaginal Delivery

UNICEF	United Nation International Children's Emergency Fund
UTI	Urinary Tract Infection

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Author Contributions

Bacha Merga Chuko: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing

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Data Availability Statement

The corresponding author is willing to provide the dataset that was used in this study based upon reasonable request.

Consent

Informed consent was taken from every study participant before the actual data collection started.

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Conflicts of Interest

The authors declare no conflicts of interest.

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