

## Maternal Factors Associated with Sepsis among Neonates Admitted in Kenyatta National Hospital Pediatric Wards

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### ABSTRACT

**Introduction:** Neonatal sepsis is a major cause of neonatal mortality. The proportion of under-five deaths in the newborn period was found to have increased from 41 per cent (in year 2000) to 46 percent [1]. Statistics indicate that 98% of the global one million deaths as a result of neonatal sepsis occur in Africa. Neonatal sepsis contributes to 28% of neonatal mortality in Kenya.

**Study objective:** The study sought to identify maternal characteristics of mothers to neonates admitted for management of neonatal sepsis in Kenyatta National Hospital (K.N.H) pediatric wards.

**Methodology:** This was a mixed-method study where both quantitative cross-sectional and qualitative approaches were used within K.N.H pediatric wards. A total of 107 study participants were enrolled in the study. The study subjects were selected by systematic random sampling method in which every alternate participant was selected. Data was obtained from consenting mothers and healthcare workers. The researcher gathered data on maternal factors associated with the development of neonatal sepsis. Three focused group discussions comprising nurses, doctors and clinical officers were conducted.

Data was collected by use of researcher administered semi-structured questionnaire. Qualitative data was audio-taped, transcribed and analyzed into themes. Data was cleaned, entered into computer and analyzed using Statistical Package for Social Sciences (SPSS) version 20. Level of significance was at  $\leq 0.05$ .

**Study results:** Among the sampled mothers, (44.9%) were aged between 20-25 years, (78.5%) were married while fifty-two (48.6%) had attained secondary school education. Fifty-two (47.7%) of the mothers were unemployed and most (42.1%) were earning between KShs of 10,000 – 20,000 per month. More than half 60(56.1%) of the mothers were primiparas.

### Conclusion

The study revealed maternal factors such as primary level of education, low economic class, being a first-time mother and unemployment were common among mothers to newborns admitted with sepsis.

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## Keywords

Neonatal sepsis, Patient, Prevalence.

## Background

Neonatal sepsis is a systemic infection occurring in infants during the first 28 days of life and is an important cause of morbidity and mortality of new-born [2]. The chances of survival are slim for newborns with a serious infection, whether hospitalized or in the community due to their weak immune status. Many more newborns who survive have brain insults resulting in severe disabilities such as convulsive disorders, cerebral palsy, cognitive impairments [3], thus adding to the burden to healthcare, social systems and home environment [4].

Neonatal sepsis is a major cause of neonatal mortality. It accounted for 34% of all deaths of under five year old children globally in year 2011 [5]. Over 98% of the estimated four million neonatal deaths occur in developing nations with highest rates in Africa [6]. More than one-third of the estimated four million neonatal deaths around the world each year are caused by severe infections, one million of which are due to neonatal sepsis alone [7]. Kenya is not spared either of the high incidences of neonatal mortality mainly due to neonatal sepsis.

Kenya was ranked sixth among the African countries with highest newborn mortality in a study on African newborns [8]. The study concluded that 28% (43,600 neonatal deaths) of the neonatal deaths in Kenya are due to neonatal sepsis [8]. This implies that a lot of Government resources are required in the management of neonatal sepsis.

Although there was a decline in under-five year old mortality rates globally, the neonatal mortality was noted to be on the rise accounting for 44% of the under-five year old deaths in year 2012 as compared to 37% in 1990 [9]. A longitudinal study done on the burden of neonatal admissions in a Rural District Hospital-Kilifi showed that close to 60% of under five-year-old children's death occurred during the neonatal period [4].

Despite previous studies on neonatal sepsis, the neonatal mortality from neonatal sepsis remains high. This necessitated the study with an emphasis on factors contributing to severity of neonatal sepsis. The study was aimed at identifying maternal factors among mothers whose neonates suffered sepsis. The information generated would be useful in development of strategies to reduce neonatal mortality from severe forms of neonatal sepsis.

## Methods

### Study design and setting

This was a mixed method whereby both quantitative and qualitative cross sectional descriptive study carried out within pediatric wards at Kenyatta National Hospital, Nairobi, Kenya. This is a National Referral Hospital with a bed capacity of 2000, located in Nairobi, the country's capital city. It offers both preventative and curative services for a variety of illnesses to patients from all over Kenya

with an average of 600,000 outpatient visits and 89,000 in patients annually. The pediatric department has eight inpatient wards where general medical patients, orthopedic, oncology and surgical pediatric patients are admitted. The medical pediatric bed capacity was 256 and bed occupancy of not less than 150%. Patients suffering neonatal sepsis were admitted in the four medical pediatric wards (mainly term newborns) through the pediatric emergency unit. Medical wards admit patients in a rooster whereby a ward admits every fourth day.

### Sample size

The study participants consisted of mothers to patients aged 0-28days. The sample size was calculated using the formula of Fishers et al. (1998):

$$n = Z^2_{\alpha/2} P (1 - P) / d^2 = (1.96)^2 (0.5)(0.5) / (0.05)^2 = 385.$$

Where  $Z$  = standard normal distribution curve value for 95 % CI which is 1.96.

$P$  = proportion of severe NNS during admission was taken as 50%.

$d$  = absolute precision (0.05).

However, sample size adjustment was made since the target population was <10,000 using the following formula:  $n_f = n / (1 + n/N) = 385 / (1 + 385/145) = 107$ .

Where:  $n_f$  = the desired sample size for population <10,000;  $N$  = Total population (number of neonates admitted to K.N.H pediatric wards per month suffering neonatal sepsis is about 145);  $n$  = the calculated sample size (107).

Therefore, the minimum sample size of the study was 107 respondents.

### Sampling technique

Systematic sampling method was used to select the study sample. The first study participant was selected by simple random among mothers with neonates suffering from neonatal sepsis. The mothers were allowed to pick a folded numbered paper from a basket. The mother who picked the paper numbered 001 was the first respondent. Thereafter every alternate consenting mother to neonate with sepsis was included in the study sample.

### Data collection and data quality control

A pretested semi structured questionnaire was used to collect information on the mothers' socio-economic, demographic as well as obstetric characteristics maternal characteristics. Mothers to neonates with sepsis were determined based on the presenting clinical manifestation on admission. Neonates' symptoms included; either refusal to feed, hotness of body or yellowness of body, systemic involvement and organ dysfunction symptoms including convulsion, lack of urine, skin eruptions/rashes, gangrene, bloody vomitus, abdominal distension, difficulty in breathing, bloody urine and dehydration.

The study instrument was pre-tested with 10% of the study's sample size in KNH. It was considered that being a referral hospital, pretesting in other hospital with similar patient would have same patients included in the study sample following referral to KNH. Participants involved in the sample were excluded from the study. One research assistant who was a registered BscN nurse was trained on data collection process. Moreover, the principal investigator was monitoring the data collection on daily basis.

### Data analysis

Data collected was entered into a Microsoft excel spread sheet and analyzed using Statistical Package for Social Sciences (SPSS) version 20.0 (IBM Corporation, Armonk, NY, USA). Pearson's chi-square test was used to establish the association between the dependent variable (development of NNS) and independent variables in order to determine which maternal factors had significant association. *Backward LR* method was specified with removal at  $P < 0.05$ .

### Ethical Considerations

Study approval was sought from the Kenyatta National Hospital/ university of Nairobi Ethics and Research committee (KNH/ UON-ERC). Written informed consent was sought from all study participants after they were given participant information, before they were interviewed. Participation was purely on voluntary bases. Privacy and confidentiality were maintained while handling participants' information.

## Results

### Distribution of mothers by socio-demographic characteristics

The study participants had various socio-demographic characteristics as displayed in table 1 below.

Socio-demographic characteristics	Frequency (n=107)	Percent (%)
<b>Age in years</b>		
Below 20	12	11.2
20-25	48	44.9
26-30	23	21.5
30-49	24	22.4
<b>Religion</b>		
Protestant	64	59.8
Catholic	34	31.8
Muslim	3	2.8
Others (SDA)	6	5.6
<b>Mother's marital status</b>		
Single	20	18.7
Married	84	78.5
Separated/widowed/Divorced	3	2.8
<b>Mother's level of education</b>		
Primary level	20	18.7
Secondary level	52	48.6
College/University level	35	32.7
<b>Mother's occupation</b>		
Self employed	29	27.1
Informal employment	27	25.2
Not employed	51	47.7

**Table 1:** Distribution of mothers by socio-demographic characteristics

### Gross income of the household per month

Forty five (42.1%) of the participants earned between KShs of 10,000 – 20,000 per month while 40(37.7%) earned below KShs 10,000 as gross income (Figure 1).

### Distribution of health practices of mothers during pregnancy

Majority of the mothers 105 (98.1%) attended antenatal care (ANC) during their pregnancy of the current baby as shown in Table 2. Majority, 84 (80.0%) attended the minimum 4 recommended antenatal care visits. When the mothers were asked about gestation at which first ANC visit was made, majority 73 (69.5%) indicated in the second trimester. Majority 76 (71.0%) indicated that they did not experience any medical illness during pregnancy while the remaining 31 (29.0%) reported otherwise. All the mothers underwent HIV test during pregnancy and almost all 105 (98.1%) tested negative. A large percentage 104 (97.2%) of mothers did not use any drug of abuse during pregnancy. About three quarter 83 (77.6%) of the mothers had been on medically prescribed drugs during pregnancy. The most commonly 69 (83.1%) prescribed drugs for the mothers was hematinic.

### Types of illness during pregnancy

Most of the mothers did not suffer illness during pregnancy. However for the 31 mothers who did, urinary tract infection emerged as the common illness for 16(51.6%), n=31) as demonstrated in Figure 2.

### Obstetric, pregnancy and labor characteristics

Majority 90 (84.1%) of the mothers indicated that they had less than three children (Table 3). About half 55 (51.4%) of the mothers were primiparas. Ninety-one (85.0%) had never experienced miscarriage while the remaining 16 (15.0%) reported history of miscarriage/abortion. During delivery of the current child, majority

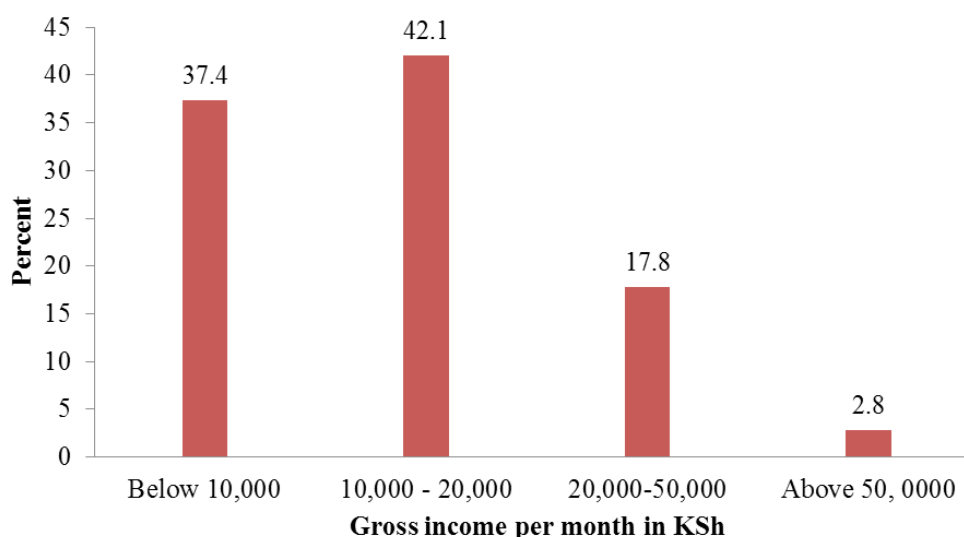


Figure 1: Gross income of the household per month.

Variables	Frequency (n=107)	Percent (%)
<b>ANC attendance during pregnancy</b>		
Yes	105	98.1
No	2	1.9
<b>Frequency of ANC attendance</b>		
4 times or more	86	80.0
1-3 times	21	20.0
<b>Gestation at which first ANC visit was made</b>		
Second 3months	73	69.5
Within the first 3months	27	25.7
Last 3months	7	4.8
<b>Any medical illness during pregnancy</b>		
Yes	31	29.0
No	76	71.0
<b>Ever been tested for HIV</b>		
Yes	107	100.0
<b>Mother's status of HIV</b>		
Negative	105	98.1
Positive	2	1.9
<b>Drug of abuse during pregnancy</b>		
Yes	3	2.8
No	104	97.2
<b>Type of drugs of abuse, If used during pregnancy</b>		
Alcohol	3	2.8
Not applicable	104	97.2
<b>Any prescribed drugs during pregnancy</b>		
Yes	83	77.6
No	24	22.4
<b>*If any prescribed drugs during pregnancy, Which ones</b>		
Haematinics	69	83.1
Pregnacare	4	4.8
Vaginal pessaries	2	2.4
Antifungal	2	2.4
Aldomet	2	2.4
Others	7	8.4

Table 2: Distribution of mothers' health practices during pregnancy.

of the deliveries took place in a public/government health facility 68 (63.6%). The highest percentage 39 (36.4%) of the mothers indicated that the duration of labor was less than six hours while 29 (27.1%) labored more than 10 hours. Majority 70 (68.6%) of the mothers reported that the labor took less than 4 hours from the time membranes ruptured to delivery. Similarly, most 80 (78.4%) indicated that color of the liquor was clear.

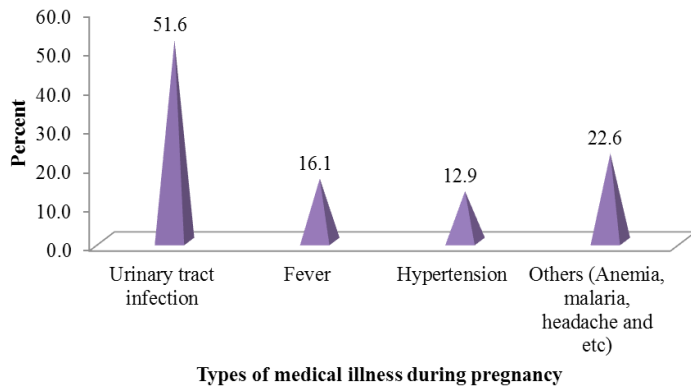


Figure 2: Types of illness during pregnancy.

Table 3: Obstetric, pregnancy and labor characteristics.

Variables	Frequency (n=107)	Percent (%)
<b>How many children do you have?</b>		
Less than three	90	84.1
Three to five	17	15.9
<b>Parity</b>		
Primipara	60	56.1
Multiparous	47	43.6
<b>Any history of miscarriage</b>		
Yes	16	15.0
No	91	85.0
<b>Place of delivery for the child</b>		
On my way to hospital	3	2.8
In a public/government health facility	68	63.6
In private health facility	36	33.6
<b>Duration of the labor</b>		
Less than six hours	39	36.4
6-10 hours	34	31.8
More than 10hours	29	27.1
Elective c/s( did not labor	5	4.7
<b>Time taken from the time membranes ruptured to delivery</b>		
Less than 4 hours	70	68.6
4-6hours	17	16.7
More than six hours	15	14.7
Not applicable	5	
<b>Color of the liquor</b>		
Clear	80	74.8
Greenish	22	20.6
Not applicable	5	4.6

## Discussion

### Socio-demographic characteristics of mothers

The dominance of the young adult age category in the study depicts the challenges the young mothers were faced by as regards

newborn care and this may have led to the development of neonatal sepsis. The study findings concur with Central Intelligence Agency report which concluded that the median age for getting first child was 20.3 years [10]. Strategies to educate the young mothers on newborn care are thus vital in addressing the knowledge gap among the mothers.

With respect to level of education, over 80% of the mothers had attained a level of education higher than primary school level. This tells that majority of the Kenyans have embraced formal education as a way of intellectual development. It also shows that education for the girl-child has been acknowledged by the majority.

The study revealed an alarming unemployment rate of (47.7%) among the mothers. This closely tends to agree with Kenya Bureau of Statistics findings which stated that unemployment rate in Kenya was 40 percent in year 2011 [11].

This implied that unemployed mothers were economically dependent on some economic network system. The ability to seek healthcare promptly and from established facilities was thus dependent on the strength of the support system. Lack of economic independence may also have contributed to delay in seeking healthcare upon realizing that the newborn was unwell. Delay in seeking healthcare could have contributed to more severe forms of neonatal sepsis on admission. Economic empowerment of the women is therefore a key pillar towards attainment of optimum health.

### Distribution of health practices of mothers during pregnancy

The study shows that most (80.0%) of the mothers attended at least the 4 times WHO recommended antenatal care visits during pregnancy [12]. When the mothers were asked about gestation at which they made their first ANC visit, majority (69.5%) indicated in the second trimester. This implies that pre-conception as well as first trimester interventions were missed among these mothers. Majority (71.0%) indicated that they did not experience any medical illness during pregnancy. The 100% HIV testing among the pregnant women indicates good progress towards sustainable development goal 3(good health and wellbeing) set out by UN in 2016 [13]. The finding on HIV status however contradicts previous research that concluded that 5.6% of pregnant women were HIV positive [14]. Lack of acceptance of positive HIV status as well as fear of stigma due to positive status might have led to the <2% HIV positive status response. This implies that further studies should not only focus on HIV prevalence among pregnant women, but also evaluate the challenges HIV positive pregnant women are faced with in order to offer relevant healthcare assistance.

### Types of medical illness during pregnancy

A total of 31 mothers reported to have suffered some form of medical illness during pregnancy. Urinary tract infections (U.T.Is) emerged as the common illness during pregnancy having affected (51.6%) of the women. The high rate of U.T.Is implores future studies to look into relationships between urinary tract infections



and occurrence of neonatal sepsis. Moreover, identification and screening of high risk mothers was noted to be deficient. Large percentages (93.5%) of the mothers were not tested for infection during pregnancy. Among those who were tested for infection, urinalysis was main test done (57.1%). Studies have shown that the leading cause (70%) of neonatal sepsis most frequently involved in early-onset neonatal sepsis of term and preterm infants together are normal gastrointestinal tract flora (which turn pathogenic in the reproductive tract) such as Group B-Streptococcus (GBS) and *Escherichia coli* [15]. The study however found that such screening was not done during the Kenya antenatal profile. The need for screening was further emphasized during the focused group discussion where a participant said, 'early detection of infection, sometimes you find the infection requires early detection and treatment, we should do some laboratory investigations and treat'.

About half (51.4%) of the mothers were primiparas. These further points to the challenge newborn care poses to the first time mothers. During delivery of the current child, majority of the deliveries took place in a health facility (93.2%). This could be attributed to the fact that the Kenyatta National Hospital patient population was mainly from the urban setting. However, while the study results showed that majority of medium income earners might have had embraced the free maternity care offered in Kenyan Government health facilities, study findings in a rural setting reported contrary statistics on deliveries that occurred in health facility. A study done in 2014 reported that 48% of births in Western Kenya occurred in a health facility [16]. It could be argued that there still are many deliveries in the rural setting which occur outside health facility. This would be in order for the mothers to avoid congestion in the hospitals. This is in particular with regard to the study finding that 25.2% of the mothers reported to have shared beds during the health facility stay for the delivery of newborn. It further implies the need to further improve quality of health facilities as well as expand the infrastructure in order to successfully implore citizens to deliver in health facilities. Most (78.4%) of the mothers indicated that they drained clear liquor during labor while 21.6% reported to have drained greenish (meconium stained) liquor. Twenty two (20.6%) of the babies were put on medication upon delivery mainly, T.E.O (68.2%) and Vitamin K (59.1%). This exposes a deficit in the health management of babies born through meconium-stained liquor and thus a need for healthcare practice reform since only 9.1% of the neonates were put on antibiotics. It also implies that the proposed administration of T.E.O and vitamin K to all newborns is yet to be realized (Pediatric protocols, 2016).

#### **Duration of stay in health facility after delivery**

Mothers reported various durations of stay before being discharged from health facility after delivery. Thirty seven (34.6%) mothers stayed for one day while 18.7% were discharged from the health facility hours after delivery. This duration limited the post-delivery exposure to health education as well as the initiation of lactation. With a 56.1% first time mothers, there was a high possibility that neonates would come back with neonatal sepsis due to early

discharge from health facility without initiation of lactation and newborn care information. This was further exposed during the focused group discussions where a participant said 'Owing to the fact that now today there are very few families who are able to have someone to assist them, you know in Nairobi somebody *ako na bwana yake tu na ukiona hao* (has the husband only and if you see them), are very young people. Sincerely these young mothers, some of them are married by these people still in college or they have just started working. So now that there is that challenge for the first time mothers, I think they should be given some priority. Could be they go home not after the 48 hours may be 72hours or even referred immediately to someone who can help teach them well...am telling you these young mothers can sleep and the baby sleeps!'

Lack adequate infrastructure was seen as a contributing factor to development of sepsis. The was further emphasized during the FGDs, during which one of the participants said, 'you know the mothers are given mattresses to sleep on the floor, and these mattresses, no-one cleans them. They use them today, tomorrow.....'.

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