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# Pattern of disease & associated factors among neonates admitted to neonatal intensive care unit at jimma university medical center, jimma, Southwest Ethiopia

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**Abstract**
Neonatal period is a susceptible time in which the newborn has to adapt to a totally new environment and is vulnerable to many problems, which may even be life threatening. Analyzing the neonatal disease pattern helps health care givers and policy makers to design better strategies.
This study aimed to assess the pattern of diseases and associated factors among neonates admitted to neonatal intensive care unit at Jimma university medical center, Jimma, Southwest Ethiopi
Retrospective cross-sectional study design was conducted from March 15 to 30, 2018 among neonates admitted over a period of two years (January 1, 2016 to December 31, 2017) on 341 samples. Systematic random sampling technique was employed to get required samples from database. Data was entered to Epi-data 3.1 and exported to SPSS Version 23 for analysis. Bivariate and multivariate logistic regression was used to analyze the association between dependent and independent variables and P-value <0.05 at 95% CI was declared statistically significant association.
The main disease patterns identified were neonatal sepsis (19.9%), prematurity (14.0%) and hyaline membrane disease (11.9%). More than half (55.56%) of neonates were admitted in the first 24 hours. Neonatal sepsis, prematurity, and hyaline membrane disease were the most frequently occurring diseases.

**Keywords:** Pattern of disease, neonate, neonatal intensive care unit

## Introduction
Neonatal period is defined as the period from birth up to first 28 days of life and further divided into very early (birth to < 24 hour (hr)), early (24hr to <7 days), and late neonatal period (7 days to < 28 days) [1]. The period is characterized by the transition to extra uterine life and rapid growth and development. Newborn health is the key to child health and survival and is the most hazardous period compared to any other time during the child's first year of life [2].
The pattern of diseases in neonatal period is a sensitive indicator of availability, utilization and effectiveness of mother and child health services in the community [3, 4]. Neonatal morbidity and mortality continue to be a large component of the burden of disease in Sub-Sahara Africa and its rates reflect a nation's socio-economic status, the efficiency and effectiveness of health care services [5]. Management of common neonatal problems requires clinical expertise, training, access to suitable equipment, and well organized referral pathways [6] to ensure health care is of sufficient quality, which is important to monitor outcomes of care provided [7]. Neonatal morbidity and mortality is concerning health problem among low and middle income countries [8]. Preterm birth (PTB) and very preterm birth (VPTB) are leading causes of morbidity in infants worldwide [9, 10]. In Sub-Saharan Africa (SSA), neonates confronted with a diversity of harmful clinical conditions, especially infectious diseases, which requires urgent interventions [11]. One of challenge in developing country is caring for the critically ill neonate, where health needs often surpass available resources like infrastructures, which are typically limited in low income countries [12]. Timely access to simple interventions such as treating maternal infections during pregnancy, ensuring a clean safe birth and care of the umbilical cord can also decrease neonatal morbidity and mortality [13, 14].

## Methods and Materials
### Study Area and period
The study was conducted in Jimma university medical center which is located in Jimma town, 352 km south-west of Addis Ababa. It is also the only hospital having NICU unit in Jimma Zone.
Jimma university medical center is one of the biggest and oldest university specialized hospital in the country established in 1922 and providing service for more than 15 million people in the catchment area. Currently, it is the only teaching and referral hospital in south western part of the country.
Jimma university medical center has major clinical departments like internal medicine, surgery, pediatrics, and gynecology/obstetrics and also has other clinical departments like, dentistry, ophthalmology, psychiatry, anesthesia, and dermatology.
The study was conducted from March 15-30, 2018 G.

### Data processing and analysis
The data was checked for completeness, compiled, coded, cleaned and entered into Epi-data version 3.1 and exported to SPSS version 23 for analysis. Data analysis involved descriptive statistics, including frequency, percentage, mean and standard deviations. Crude and adjusted odds ratio (AOR) was analyzed with a 95% confidence interval (CI).

P-value <0.05 was declared a statistically significant association.

**Ethical consideration**

Ethical clearance and approval to conduct this research was obtained from Research and Ethical Review Committee of School of Nursing and Midwifery, College of Health Sciences, Addis Ababa University. Permission to conduct the study was also requested from JUMC Administrative office. To keep the confidentiality all collected data was coded and locked in a separate place and it was used only for the research purpose. The ethical consideration was taken in to account throughout the study

## Result

**Socio-demographic Characteristics of neonates admitted to NICU**

Out of 370 samples, 29 of the samples were excluded from the study. Three hundred forty one (341) were eligible for the study, out of which 211 (61.9%) were male neonates making the male to female ratio 1.6:1. Vast majority of them, 233 (68.3) were admitted in less than 24 hours of their birth. Concerning their place of residence about two third, 228 (66.9%) of them lives outside of Jimma town. Regarding their birth place more than half, 205 (60.1%) of the neonates were inborn (Table 1).

**Maternal factors/delivery factors and neonatal factors**

Regarding parity, 184 (54%) were multiparous mothers. Among 123 (36.07%) of mothers having maternal disease, 38 (30.9%) had infections followed by hypertensive disorder of pregnancy which accounted 32 (26.1%). Concerning their gestational age, more than two third (69.5%) of the neonates were term. Regarding their weight, more than half 207 (60.7%) of the neonates had weight 2500- 4000gm and with respect to anthropometry almost all, 317 (93%) of them were appropriate for their gestational age. Regarding to mode of delivery, about half (51.6 %) of neonates were delivered spontaneously (Table 2).

**Pattern of Disease**

The major morbidity profile among all neonates was sepsis which accounted 145 (19.9%) followed by prematurity102 (14.0%) and hyaline membrane disease 87 (11.9%) (Figure1).

**Factors associated with pattern of diseases**

In multivariate analysis maternal infection, PROM, age of neonate greater than 7days, C/S and instrumental delivery were significantly associated to neonatal sepsis.

Those neonates born from mothers who had infection [P = 0.001,AOR=3.84 95% CI: (1.78,8.31)] and PROM (P = 0.050,AOR = 2.31, 95%CI (0.99,5.40) acquired sepsis 4 times and 2 times respectively compared to those who have no any maternal diseases. Those neonates greater than 7days of age [P= 0.003, AOR= 4.78, 95%CI= (1.68, 13.57)] were 5 times more likely developed sepsis compared to those <24hr. Neonates delivered by C/S [P=0.017, AOR=1.93, 95%CI: (1.12, 3.33)] and instrumental delivery [P=0.026, AOR=2.16, 95%CI: (1.09, 4.26)] increased the risk of acquiring sepsis by two times compared to SVD..

Maternal infection and gestational was significantly associated to meningitis. Those neonates who were born from mothers who had infection [P= 0.002, AOR=3.29, 95%CI: (1.57, 6.92)] were 3 times more likely acquired meningitis compared to those who were born from mothers who had no any maternal disease.

Preterm birth and weight of neonates (< 2500gm and > 4000gm) were significantly associated to HMD. Preterm neonates [(P= 0.000, AOR = 5.66(2.86, 11.18)] were 6 times more likely acquired HMD compared to term neonates. Similarly weight <2500gm [P =0.000, AOR= 6.54, 95%CI: (3.18, 13.41)], and weight >4000gm [P= 0.032, AOR= 7.17, 95%CI (1.18, 43.43)] acquired HMD 7 times compared to normal birth weight neonates.

Only age was significantly associated to hypothermia. Neonates whose their age was 24hr to 7days [P= 0.004, AOR= 0.33, 95% CI: (0.15, 0.71)] were 67% less likely acquired hypothermia compared to those less than 24hr life of their age.

Primipara, instrumental deliveries and LGA were significantly associated to PNA. Neonates who born from primipara mothers [P= 0.039, AOR= 1.96, 95 %CI: (1.03, 3.73)] were 2 times more likely acquired PNA compared to neonates who born from multiparous mothers. Neonates delivered with assistance of instruments [P = 0.002, AOR = 3.61, 95%CI (1.62, 8.048] were 4 times more likely acquired PNA compared to those neonates delivered by SVD. Large for gestational ages [P= 0.016, AOR= 8.03, (1.47, 43.64)] were 8 times more likely developed PNA compared to AGA neonates.

Instrumental deliveries were significantly associated to MAS. Neonates delivered with assistance of instruments [P=0.002, AOR=3.42, 95%CI:(1.59,7.37)] were 3 times more likely acquired MAS compared to those who were born by SVD.

Hypertensive disorder of pregnancy, APH and multiple births were significantly associated to prematurity. Neonates born from of mothers who had hypertensive disorder of pregnancy [P = 0.000, AOR = 4.95, 95%CI: (2.01,12.17)] and APH [P= 0.001,AOR = 8.34,95%CI: (2.31,30.11)] were 5 times and 8 times respectively more likely acquired prematurity compared to those neonates born from mothers who had no any disease. Similarly neonates who were multiple births [P= 0.000, AOR= 6.45, 95%CI: (3.00, 13.84) were 6 times more likely acquired prematurity compared to singletons (Table 3).

## Discussion

This study revealed sepsis was the frequently occurring disease among neonates admitted in NICU. This finding was similar with study conducted at Tamale, Nepal and BPKIHS [15, 17].

The similarity in finding might be due to overcrowding, high patient to few staff ratio, inadequate availability of disposable materials and poor compliance to infection control measures, but study conducted in Punjab, Multan, Tamil and South Africa showed that the frequently occurring disease was asphyxia [18, 21]. This difference might be explained due to the maternal and obstetric related problems.

In this study, maternal diseases like infection and PROM, age of the neonates > 7days, mode of deliveries like C/S, and instrumental deliveries, were observed as significant predictors of sepsis. This finding is almost consistent with studies conducted in other countries like Thailand, Pakistan and Rwanda [22, 24]. This might be explained due to unclean deliveries, lack of health education on danger signs of pregnancy, inadequate antenatal services and late referral of

complicated labor. This implies that as we have to give attention to maternal infection to save the life newborn. Age of neonates > 7 days is also one predictor of neonatal sepsis which might be due to environmental sources or horizontal transmission from direct contacts of parents.

In this study, maternal infection was detected as significant predictors of meningitis. This finding is consistent with study conducted in Iran [25] in which prenatal risk factors associated with meningitis were, maternal vaginitis, asymptomatic bacteriuria, and prematurity. This similarity might be due to the chance of ascending microorganisms from the birth canal into uterus.

This study also revealed being preterm, weight of the neonates < 2500gm and >were detected as significant predictors of HMD. This finding is almost similar with study conducted in Cameroon and Turkey [26, 27] which showed preterm and macrosomia were independent predictors of HMD.

This might be due to structural and functional immaturity of the lungs (a deficiency in pulmonary surfactant) of preterm. The role of macrosomia as a predictor of HMD might be to the increased incidence of intra-partum fetal distress, shoulder dystocia, instrumental vaginal deliveries with birth injuries, and neonatal hypoglycemia that is frequently associated with big baby.

In this study age of the neonates 24 hr to 7days was significantly associated to hypothermia. Study conducted in Nigeria revealed the hypothermia was highly prevalent among babies aged -6 h [28]. This justifies neonates > 24hr less likely acquire hypothermia compared to those < 24hr ages of their life. This might be due to neonatal adaptations to the environment and decreased loss of heat from a combination of different factors like evaporation of fluid from the skin, convective loss to relatively cold environment and conductive heat loss through contact with cold surfaces.

In this study, LGA, primipara and instrumental deliveries were significant predictors of PNA. Neonates who were LGA might acquire PNA due to with feto-pelvic disproportion, which results in prolonged or obstructed labor as compared with AGA. Prim parity was also identified as a significant risk factor of perinatal asphyxia which is in line with study conducted in different places (Ahmedabad, Nigeria and Karachi) [29, 31]. This might be explained that, primi-parous women are often ignorant of the demands of pregnancy there by neglecting early booking and regular attendance to antenatal care. This may result in complications of prolonged labor, which may subsequently end up with delivery of asphyxiated babies.

Instrumental delivery was found to be associated with asphyxia in this study, which is consistent to study conducted in Dire Dhowa and Gusau [32, 33]. This may be explained by the fact that the hospital is a referral center where cases that could not be managed by other hospitals are referred to and also where women with pregnancy/labor complications attend without referral. It might be also due to the pelvic disproportions and prolonged labour which make deliveries more difficult. These could lead to fetal complications which resultant in fetal distress and ultimately perinatal asphyxia. This study identified that those neonates delivered by instrument were 3 time more likely acquired MAS. In contrast to this, study conducted in in a tertiary care center in Kerala showed that MAS was more common among neonates delivered by normal vaginal delivery (34). However study conducted in Narayana medical college hospital showed MAS occurred more commonly in babies born through caesarean section [35]. This variation might be due to difference sample size, management protocols of the centers and preferences of mothers.

According to this study maternal hypertensive disorder was significant predictors of prematurity. In line to this finding, in USA preeclampsia was one subsequent cause of prematurity [36]. The risk of prematurity is increased in women with preexisting, chronic hypertension, pregnancy-induced hypertensive disorders; was also identified in America [37].

This might be due to the fact that hypertensive disorders prevents the placenta from receiving enough blood and makes the placenta pulls away from the wall of the uterus, causing maternal premature delivery.

Similarly this study also identified those neonates born from mothers who had APH were 8 times more likely to be premature. Inline to this finding, study conducted in UK and kenyatta national hospital also revealed that prematurity was high among neonates born from mothers having APH [38, 39]. This might be due to uteroplacental ischemia that results in preterm delivery even though this may not be causal in nature.

Multiple births were also significantly associated with prematurity in this study. This is consistent with study conducted at Kenya and Beijing [39, 40]. This might be due to uterine over distension which results in spontaneous preterm

## Conclusion

This study indicated that neonatal sepsis (19.9%), prematurity (14%) and hyaline membrane disease (11.9%) were the frequently occurring neonatal diseases. Maternal disease such as infection, hypertensive disorder of pregnancy, antepartum hemorrhage and premature rapture of membrane, age of neonate >24 hour, mode of delivery such as cesarean section and instrumental delivery, presence of multiple births, gestational age less than 37 weeks (preterm), weight of the neonate < 2500gm and > 4000gm, place of delivery (out born), parity (primipara) and birth size like large for gestational age were found to independent predictors of pattern of diseases.

## Conflicts of interests

There is no competing interest

## Acknowledgements

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**Table 1:** Socio-demographic Characteristics of neonates admitted in NICU of JUMC, Jimma town, Oromia, Southwest Ethiopia, 2018 (n=341)

| Characteristics | | Frequency | Percent |
|---|---|---|---|
| Sex | Male | 211 | 61.9 |
| | Female | 130 | 38.1 |
| Age | Less than 24 hr | 233 | 68.3 |
| | 24hr-7 days | 88 | 25.8 |
| | Greater than7 days and <28 days | 20 | 5.9 |
| Place of residence | Jimma Town | 113 | 33.1 |
| | Outside of Jimma Town | 228 | 66.9 |
| Place of delivery | In born | 205 | 60.1 |
| | Out born | 136 | 39.9 |

**Table 2:** Maternal/delivery and neonatal factors admitted in NICU of JUMC, Jimma town, Oromia, Southwest Ethiopia, 2018 (n=341)

| Characteristics | | Frequency | Percent |
|---|---|---|---|
| Parity | Primipara | 157 | 46.0 |
| | Multipara | 184 | 54.0 |
| Mode of delivery | SVD | 176 | 51.6 |
| | C/S | 113 | 33.1 |
| | Instrumental | 52 | 15.2 |
| Maternal diseases (n = 123) | Gestational diabetes | 2 | 1.6 |
| | Hypertensive disorder of pregnancy | 32 | 26.0 |
| | Infections | 38 | 30.9 |
| | HIV/AIDS | 7 | 5.7 |
| | Antepartum hemorrhage | 13 | 10.6 |
| | PROM | 27 | 21.9 |
| | Others | 4 | 3.3 |
| Gestational age | Preterm (3< 37 weeks) | 102 | 29.9 |
| | Term (37-42 weeks) | 237 | 69.5 |
| | Post-term (> 42 weeks) | 2 | 0.6 |
| Birth weight | Low birth weight(<2500gm) | 207 | 60.7 |
| | Normal birth weight(2500-4000gm) | 128 | 37.5 |
| | Macrosomia(>4000gm) | 6 | 1.8 |
| Birth Size | Appropriate for Gestational Age (AGA) | 317 | 93.0 |
| | Small for Gestational Age (SGA) | 18 | 5.3 |
| | Large for Gestational Age (LGA) | 6 | 1.8 |

NB: SVD = Spontaneous Vaginal Delivery, C/S = Cesarean Section, PROM = Premature Rapture of Membrane

**Table 3:** Multivariate analysis of factors associated with distributions diseases of neonates admitted in NICU of JUMC, Jimma town, Oromia, Southwest Ethiopia, 2018(n=341)

| Characteristics | Disease Patterns | COR(95% C.I) | AOR (95% C.I) | P-Value |
|---|---|---|---|---|
| | Sepsis | | | |
| Maternal disease | Infection | 3.84 (1.81,8.14) | 3.84(1.78,8.31) | 0.001* |
| | PROM | 2.66 (1.16,6.08) | 2.31(0.99,5.40) | 00.05* |
| | No Disease | | 1 | |
| Age of neonate | < 24hr | | 1 | |
| | > 7days | 3.70 (1.37,9.99) | 4.78(1.68,13.57) | 0.003* |
| Mode of delivery | C/S | 1.50 (0.93,2.43) | 1.93(1.12,3.33) | 0.017* |
| | Instrumental | 1.84 (0.98,3.44) | 2.16(1.09,4.26) | 0.026* |
| | SVD | | 1 | |
| | Meningitis | | | |
| Maternal disease | Infection | 3.29 (1.57,6.92) | 3.29(1.57,6.92) | 0.002* |
| | No Disease | | 1 | |
| | HMD | | | |
| Gestational age | Term | | 1 | |
| | Preterm | 13.14 (7.40,23.34) | 5.66 (2.86,11.18) | 0.000* |
| Wight of the neonate | 2500-4000gm | | 1 | |
| | < 2500gm | 15.44 (8.22,29.01) | 6.54 (3.18,13.41) | 0.000* |
| | > 4000gm | 6.40 (1.08,37.83) | 7.17(1.18,43.43) | 0.032* |
| | Hypothermia | | | |
| Age | < 24hr | | 1 | |
| | 24hr-7days | 0.33 (0.15,0.71) | 0.33 (0.15,0.71) | 0.004* |
| | PNA | | | |
| Parity | Primipara | 1.93 (1.05,3.57) | 1.96 (1.03,3.73) | 0.039* |

| | | | | |
|---|---|---|---|---|
| | Multipara | | 1 | |
| Mode of delivery | SVD | | 1 | |
| | Instrumental | 3.79 (1.73,8.28) | 3.92(1.69,9.10) | 0.001* |
| Birth size | AGA | | 1 | |
| | LGA | 5.89 (1.15,30.08) | 8.03(1.47,43.64) | 0.016* |
| | MAS | | | |
| Mode of delivery | SVD | | 1 | |
| | Instrumental | 4.75 (2.27,9.95) | 3.42 (1.59,7.37) | 0.002* |
| | Prematurity | | | |
| Maternal disease | Hypertensive disorder | 2.49 (1.16,5.31) | 4.95(2.01,12.17) | 0.000* |
| | APH | 4.51 (1.42,14.38) | 8.34(2.31,30.11) | 0.001* |
| | No maternal disease | | 1 | |
| Multiple birth | Yes | 5.37 (2.7,10.6) | 6.45(3.00,13.84) | 0.000* |
| | No | | 1 | |

*significant association, 1 = reference categories

**NB:** APH=Antepartum Hemorrhage, PROM= Premature Rapture of Membrane, C/S= cesarean Section, SVD= Spontaneous Vaginal Delivery, HMD= Hyaline Membrane Disease, PNA= Perinatal Asphyxia, LGA=Large for Gestational Age

**Distribution of diseases in neonatal intensive care unit of Jimma university medical center**

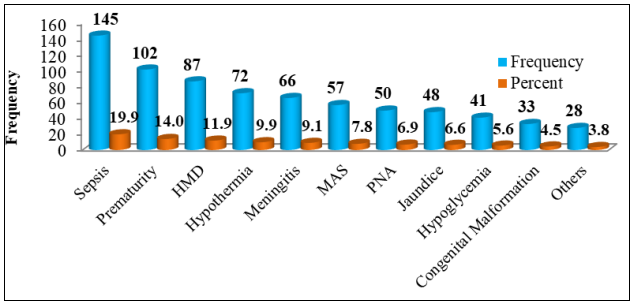


**Fig 1:** Distributions of diseases of neonates admitted in NICU of JUMC, Jimma town, Oromia, Southwest Ethiopia, 2018(n=341). The Blue color indicates frequency and the red color shows its percentage.

- More than two response is possible

NB: HMD = Hyaline Membrane Disease, MAS = Meconiu*m Aspiration Syndrome,* PNA = Perinatal Asphyxia

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