ADDIS ABABAUNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF NURSING AND MIDWIFERY

DEPARTMENT OF NURSING

MAGNITUDE AND ASSOCIATED FACTORS OF INTRAVENTRICULAR HEMORRHAGE AMONG PRETERM NEONATES ADMITTED TO NEONATAL INTENSIVE CARE UNIT OF ADDIS ABABA, PUBLIC HOSPITALS, ETHIOPIA, 2023, A CROSS-SECTIONAL STUDY

PRINCIPAL INVESTIGATOR: MIHRET ALEMU (Bsc)

A RESEARCH THESIS TO BE SUBMITTED TO THE SCHOOL OF NURSING AND MIDWIFERY, COLLEGE OF HEALTH SCIENCE ADDISA BABA, UNIVERSITY FOR PARTIAL FULFILLMENT OF THE REQUIREMENTS OF A MASTER'S DEGREE IN NEONATAL NURSING

MAY, 2023

ADDIS ABABA, ETHIOPIA

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APPROVAL SHEET

I, the undersigned MSc. student, declare that I have submitted my original work on the title of Magnitude and associated factors of Intraventricular Hemorrhage among preterm neonates admitted to neonatal intensive care unit of Addis Ababa public hospitals in, Ethiopia, 2023 cross sectional study.

Submitted by **Signature Date**

Mihret Alemu (BSc.) _____ _____

This thesis work has been submitted for examination with my approval as an advisor.

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1. Name of Major Advisor: **Dr.Girum Sebsibie (PhD, Assistant Professor)**

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Name of Department Head **Signature** **Date**

Dr.Girum Sebsibie (PhD, Assistant Professor) _____ _____

DECLARATION SHEET

By my signature below, I declare and confirm that this thesis is my own work. I have followed all ethical and technical principles of scholarship in the preparation, data collection, data analysis and completion of this thesis. Any scholarly matter that is included in the thesis has been given recognition through citation.

This thesis is submitted in partial fulfillment of the requirement for a Masters Degree in Neonatal Nursing at the Addis Ababa University College of Health Sciences, School of Allied Health Sciences department of Nursing and Midwifery. It will be submitted to Addis Ababa University Digital Library and is made available to readers under the rules of the library. I declare that this thesis has not been submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

Name: _____ Signature: _____ Date: _____

RESEARCH ADVISORS:

_____	_____	_____	_____
NAME	RANK	SIGNITURE	DATE

_____	_____	_____	_____
NAME	RANK	SIGNITURE	DATE

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ABBREVIATIONS AND ACRONYMS

AAU	Addis Ababa University
APGAR	Appearance Pulse Grimace Activity Respiration
BSC	Bachelor Of Science
CP	Cerebral Palsy
CI	Confidence Interval
CPAP	Continuous Positive Active Pressure
ELBW	Extremely Low Birth Weight
EONS	Early Onset Neonatal Sepsis
GA	Gestational Age
IVF	In-vitro Fertilization
IVH	Intra Ventricular Hemorrhage
MSC	Masters of Science
NICU	Neonatal Intensive Care Unit
OR	Odd Ratio
PNA	Perinatal Asphyxia
PROM	Prolonged Rupture of Membrane
RDS	Respiratory Distress Syndrome
SGD	Sustainable Developmental Goal
SPSS	Statistical Package of Social Science
VLBW	Very Low Birth Weight

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ABSTRACT

Background: Intraventricular hemorrhage is one of the most severe brain injuries in preterm neonates, especially in VLBW and ELBW, and is associated with some perinatal risk factors, such as antepartum hemorrhage, urogenital tract infections, chorioamnionitis, and some neonatal risks, such as mechanical ventilation, continuous positive airway pressure, intubation, asphyxia, respiratory distress, sepsis, and thrombosis. **Objective:** To assess the magnitude of Intraventricular hemorrhage and associated factors among preterm neonates admitted to the neonatal intensive care unit of public hospitals in Addis Ababa in 2023.**Method:** An institution-based cross-sectional study was carried out. The final sample size was 381 preterm neonates admitted to selected public hospitals in Addis Ababa from February 27 to March 27, 2023. The study was conducted in five randomly selected public hospitals in Addis Ababa. Data was collected using a pretested data extraction tool (Kobo) chart reviewed by the data collector. The collected data was exported to SPSS version 26 for analysis. Descriptive statistics to describe the variables were conducted for bi-variable logistic regression and multi-variable logistic regression analysis. Variables with a P-value < 0.05 in the multivariate analysis (final model) were considered significantly associated. The tables, figures, and graphs were used to present the findings. **Result:** The magnitude of Intraventricular hemorrhage was reported in 93 (25%), with 37.6% of patients having grade II, which was the most frequent, followed by severe grade III (24.7%), grade IV (20.4%), and grade I (17.2%), which was the least prevalent. Our study found that very low birth weight (AOR: 7.45; 95% CI: 2.12, 26.21), hypothermia (AOR: 2.53, 95% CI: 1.36, 4.47), Thrombocytopenia (4.03, 95% CI: 1.73, 9.40), and blood transfusion (AOR: 2.85; 95% CI: 1.18, 6.90) were independent factors for Intraventricular hemorrhage. **Conclusion and recommendation:** The magnitudes of Intraventricular hemorrhage were low compared to reports of other studies in Africa and globally, while the severity of Intraventricular hemorrhage was relatively high. Therefore, a further large-scale study with the same title is required to understand factors associated with Intraventricular hemorrhage among preterm neonates.

Key words: preterm, Intraventricular hemorrhage, risk factors, retrospective, public hospitals, analysis.

1. INTRODUCTION

1.1. Background

Intraventricular hemorrhage (IVH) is the clinical term for bleeding into the ventricles, the main fluid-filled compartments of the brain. Typically, it arises in an extensively vascularized population of neuroglial progenitor cells in the developing brain called the embryonic matrix (1).

Term newborns are less likely to experience intraventricular hemorrhage (IVH) with maternal risk factors like pre-eclampsia, prolonged rupture of membrane, urogenital tract infections, and chorioamnionitis, but it is one of the most serious brain injuries in preterm infants, especially VLBW and ELBW, and is associated with prematurity, asphyxia, trauma, continuous active positive pressure, vitamin K deficiency, thrombocytopenia, and sinus venous thrombosis events (2).

This classification is based on the severity of intraventricular hemorrhage Grade I–IV according to Pa-Pile's classification method, which assigns the site of the bleeding four grades. Grade I subependymal area and/or germinal matrix; Grade II subependymal hemorrhage with extension into the lateral ventricles, filling without or with modest ventricular enlargement (10–50% ventricular filling); Grade III subependymal hemorrhage accompanied by lateral ventricle extension and considerable ventricular enlargement (greater than 50% ventricular filling); and Grade IV intraparenchymal hemorrhage (3).

When a newborn is physically examined, symptoms such as apnea, bradycardia, cyanosis, high-pitched wailing, swollen fontanels, low blood pressure, lethargy, pain between the baby's skull bones, and seizures may be found. When bleeding starts, persistent, unexplained hyperbilirubinemia is the first symptom of intraventricular bleeding. In the first 7 days and 14 days after birth, a transfontanel ultrasound was done on every newborn born before 32 weeks of pregnancy to check for intraventricular hemorrhage (4).

All preterm infants born before 32 weeks of gestation should have transfontanel ultrasound screening, as should all newborns at risk who have clinically unstable neurological abnormalities (5). Almost all affected neonates are discharged without difficulties, but 10% of them need surgery, and some of them pass away (6).

Preterm newborns with intraventricular hemorrhage perished at least 1/5th to 1/3 of the time they were in the hospital, with nearly 86% to 100% of them passing away within the first seven days of life (7). Survivors of severe stage IVH often experience long-term sequelae, of which approximately 15% suffer from cerebral palsy, seizures, cognitive, or learning disabilities, and a further 27% have moderate symptoms by age 18–24 months. suffer from severe neuropathy (7–9).

On the other hand, blood transfusions are used in cases of massive or significant intraventricular hemorrhage associated with treatment to reduce hematocrit or hemoglobin levels, optimal oxygenation and ventilation, hydration and nutrition, stroke control, and treatment complications. Recommended (10).

The best way to prevent intraventricular hemorrhage is to give the mother prenatal corticosteroids to prevent premature birth, create optimal birth conditions, and protect neurons. Perinatal measures such as delaying cord clamping, preventing hypothermia in the delivery room, and minimizing manipulation and stimulation Postpartum measures such as early resuscitation, keeping body temperature between 36.5°C and 37.5°C, minimizing pain and stress through developmental care, and maintaining rest by elevating the head (11).

1.2. Statement of the problem

Under Sustainable Development Goal (SDG) 3, countries should agree on the goal of no more than 12 newborns per 1,000 live births by 2030 to further reduce complications from premature birth and ensure no more babies are left behind (12).

Globally, premature birth appears to be the leading cause of death for children under the age of five, accounting for more than half of all neonatal deaths. 909,000 newborns and more than 100,000 postnatal deaths, many of them after lengthy hospital stays. In addition to the direct effects of preterm birth, preterm infants are at increased risk of dying from a variety of causes, including infections such as respiratory and nutritional or feeding complications (12–14).

The leading causes of neonatal death are premature birth (37%), infections (28%), and perinatal asphyxia (24%), accounting for about half of all deaths in Africa. More than half of children born before 32 weeks of gestation die from PNA and premature birth(15). In these disorders, early detection and treatment of associated brain damage are associated with mortality and long-term cognitive, behavioral, sensory, linguistic, and motor effects in survivors (16).

As a result, very low birth weight (VLBW) infants, preterm infants, and infants with a gestational age (GA) of less than 32 weeks are at increased risk of intraventricular hemorrhage, particularly intraventricular hemorrhage (IVH). susceptible to less than or more than 1500 g per week (17). Globally, the reported incidence of intraventricular hemorrhage in preterm infants with VLBW and ELBW ranges from 14.7% to 44.7% and remains a serious public health concern (18).

Ninety percent of intraventricular hemorrhages affect newborns during the first three days of life, and 20–40% of these worsen and persist into the first week of life. In most cases, bleeding (grade 1 and grade 2) has no clinical sequelae, usually resolves on its own, and does not cause long-term problems. Preterm infants with IVH grades III and IV are approximately 60% more likely to develop cognitive deficits such as cerebral palsy and intellectual disability (19).

In Korea, the incidence of intraventricular hemorrhage in very low birth weight infants increased significantly among infants with grade 3–4 IVH, with mortality rates of 52.7% and 86.7%, respectively (20). Israel found that early neonatal sepsis and fertility treatment were associated

with an increased risk of high-grade IVH and that any dose of prenatal steroid therapy was associated with low-grade intraventricular hemorrhage (21).

Population-based studies conducted in North America and Asia have reported that the incidence of grade 2 IVH ranges from 5% to 11%. The burden of preterm birth, neonatal morbidity, and infant mortality is low to moderate. In low-income countries, health problems such as intraventricular hemorrhage are exacerbating already weak health care systems. Studies in low- and middle-income countries have shown that improved perinatal care has reduced IVH prevalence in VLBW infants over the past 30 years (from 50% to 34%). Neonatal mortality in sub-Saharan Africa is estimated at 27 per 1,000 live births (7,22–24).

Intraventricular hemorrhage is associated with increased mortality and neuro-developmental delays such as post-hemorrhagic hydrocephalus, cerebral palsy, epilepsy, and severe cognitive, visual, and hearing impairments (8).

Various prenatal, perinatal, and postnatal factors are considered independent risk factors for intraventricular hemorrhage in preterm infants. These include in vitro fertilization, lack of maternal antenatal care and use of steroids, chorioamnionitis, multiple pregnancies, HIV exposure, fetal distress, vaginal delivery, birth status, gestational age, and delivery. Male sex (including birth weight loss, resuscitation and intubation, delivery room, anemia (low hematocrit), blood transfusion) (23).

Furthermore, mortality associated with intraventricular hemorrhage remains unacceptably high, with at least one-fifth to one-third of preterm infants with intraventricular hemorrhage dying in hospital, even in the NICU. 86% to nearly 100% of deaths occur within the first week of life (6).

Those who survive have complications such as prolonged hospitalization, increased financial burden on families and the health care system, cognitive and/or motor delays, visual impairment, hearing impairment, seizures, and cerebral palsy (CP). Studies have shown that the prevalence of CP in survivors of intraventricular hemorrhage ranges from 45% to 80% (25). The goal of initial IVH treatment is to prevent further damage to the neonatal brain, which is primarily achieved by maintaining adequate cerebral perfusion. The best way to prevent IVH is to prevent premature birth. The first step is to transfer the baby in utero to a center with an existing neonatal intensive

care unit to prevent prenatal inflammation and provide optimal birth conditions if preterm birth is unavoidable (11,25,26).

Many drugs are being studied and believed to have the potential to prevent IVH. To date, the only pharmacological agents proven to be effective are prenatal steroids, and one study found that prenatal steroids reduced the incidence of intraventricular hemorrhage of any degree (5).

In the Ethiopian context, improving the daily care of premature babies and newborns suffering from complications of prematurity likes intraventricular hemorrhage while addressing the broader policy agenda of reducing neonatal morbidity and mortality are the major challenge for the health system. The results of a study published in Ethiopia are rare Therefore; the objective of this study is to assess the magnitude and associated factors of intraventricular hemorrhage in preterm infants admitted to the neonatal intensive care unit of a public hospital in Addis Ababa.

1.3. Significance of the study

Sustainable Development Goal 3 aims to reduce neonatal mortality (mortality) per 1,000 live births in all countries by 2030, ensure that no newborn is left behind, and reduce the morbidity associated with intraventricular hemorrhage, especially among preterm infants and aim to reduce mortality (12).

The purpose of this study was to assess the magnitude of intraventricular hemorrhage and associated factors in preterm infants. The results of this study will be useful for newborns. Identifying risk factors is crucial for effective and specific treatment to prevent further complications leading to neurological damage in neonates. The results of this study will also improve the knowledge of medical professionals working in the NICU about how intraventricular hemorrhage occurs and what factors are associated with it. These services are intended for professionals working in maternity hospitals, maternity wards, and maternity wards to plan the prevention of premature birth. For principal researchers, this serves as a groundwork exercise for further research paper writing.

As science and technology grow rapidly, up-to-date data are essential for evidence-based interventions. The research will help the Ethiopian government plan various intervention programs and revise various protocols and policies.

In general, this study is of interest to health care professionals, the community, baseline information policy makers and researchers, and governmental and non-governmental organizations and technicians working to reduce complications associated with preterm birth, such as intraventricular hemorrhage, and it will bring multiple benefits.

2. LITERATURE REVIEW

2.1. Overview of literature review

Different studies around the world have come to different conclusions about intraventricular hemorrhage. As a result, very low birth weight (VLBW) infants and neonates born before gestational age 32 (GA) are at increased risk of intracranial hemorrhage, especially intraventricular hemorrhage (IVH). susceptible to less than or more than 1500 g per week (27). This intraventricular hemorrhage is classified according to Papile's classification criteria. Grade I subependymal hemorrhage Grade II: Intraventricular hemorrhage without dilation; Grade III: Intraventricular hemorrhage with ventricular dilatation; and Grade IV: Intraventricular hemorrhage with parenchymal hemorrhage (28).

Worldwide, the incidence of intraventricular hemorrhage in preterm VLBW and ELBW infants has been reported to range from 14.7% to 44.7% and remains a serious public health problem (29). In Korea, the incidence of intraventricular hemorrhage in very low birth weight infants increased significantly among infants with grade 3–4 IVH, with mortality rates of 52.7% and 86.7%, respectively (20).

Studies conducted in developing countries indicate a decreasing prevalence of IVH in VLBW infants (from 50% to 34%) over the past 30 years owing to improved perinatal care. Neonatal mortality in Sub-Saharan Africa is estimated to be 27 per 1000 live births (23).

2.2. Magnitude of Intraventricular hemorrhage

Jiangsu University, China, identified perinatal risk factors that may be associated with IVH (intraventricular hemorrhage) in 292 preterm neonates born before 34 weeks of gestation. The incidence of PROM (premature rupture of membranes) was 24.1%, and maternal chorioamnionitis was 43.8% (30).

According to another multicenter study conducted in late-term infants in China, the overall incidence of intraventricular hemorrhage and the severity of intraventricular hemorrhage were 19.7%, and the factors associated with the development of intraventricular hemorrhage were vaginal delivery and mechanical ventilation (31).

In univariate analysis, gestational age, birth weight, resuscitation asphyxia, maternal chorioamnionitis, fetal asphyxia, amniotic fluid index, and latency from rupture of membranes to delivery were significantly affected by preterm infants born within 34 weeks of gestation. Intraventricular bleeding was associated with IVH (32).

A retrospective study of 421 very low birth weight premature infants conducted in the neonatal intensive care unit of Tianjin Central Hospital, China, showed that the incidence of early intraventricular hemorrhage in children born with SVD was higher in early gestational age. and significantly higher for low-birth-weight infants, APGAR score less than seven at 5 minutes, ventilator on, and baby had EONS (33).

According to a study conducted at the Iranian Medical University, a total of 115 preterm infants with intraventricular hemorrhage and 120 preterm infants without intraventricular hemorrhage were recruited, screened, and examined by their mother's obstetrician. and general health records were checked for all kinds of illnesses (34).

In a study of 95 very low-birth-weight infants (including 37 preoperative neonates and 58 postoperative neonates) conducted at the National Taiwan University Hospital, it was found that if prophylactic intervention was initiated at delivery, low-birth-weight premature infants were observed. The occurrence of hypothermia was greatly reduced (45.9% - 8.5%), while recording (59.5% to 15.5%). The short-term efficacy in very preterm newborns was significantly improved, especially the incidence of new intraventricular hemorrhage cases (21.6% to 5.2%, P = 0.015). This is clearly associated with a higher incidence (35).

Among all maternal conditions, laparoscopic sterilization and long-term cessation of in vitro fertilization significantly increased the risk of neonatal IVH (intraventricular hemorrhage), even after adjusting for variables. Results showed that PROM (premature rupture of membrane) and in vitro fertilization (IVF) are maternal conditions that increase the risk of intraventricular hemorrhage and that IVF is strongly associated with IVH (34).

2.3. Factors associated with IVH among preterm neonates

A study conducted in California found that the prevalence of severe IVH decreased significantly from 9.7% in 2005 to 5.9% in 2015, with 7.7% of patients having severe IVH. When grouped by gestational age, prenatal steroid exposure was associated with a reduced risk of severe IVH.

Whereas delivery room intubation increased the associated risk of severe intraventricular hemorrhage. Mediated analysis factors accounted for 45.6% (95% CI 38.7% to 71.8%) of serious IVH reductions. Increased antenatal steroid use and decreased delivery room intubation were associated with significant rates of severe IVH (19.4% (95% CI 13.9%–27.5%) and 27.3% (95% CI 20 (36).

Less therapy was linked to grade III intraventricular hemorrhage, according to a retrospective study of 267 hospitalized preterm infants (24–32 weeks' gestation) at the Department of Neonatology, Poznan Medical University, Poland, between 2011 and 2013, and the prevalence of IVH was minimal. AST has greater benefit among infants born at tertiary care facilities, infants who were born in asphyxia and were given NaHCO3 to correct acidosis, and infants who were given treatment for hypotension on their first day of life. Pregnant mothers who did not take AST supplements or who did insufficiently had a higher risk of severe intraventricular hemorrhage (18). In Nigeria, a prospective cross-sectional study found that 16.2 percent of patients had Intraventricular hemorrhage (37). It was noted in 12 neonates (33.3%) Extremely preterm (28 - 31 GA), and 4 (6.3%) Late preterm (32 and 36 weeks). Intraventricular hemorrhage (IVH) was found in five instances (31.3%) within 24 hours of delivery, nine cases (56.2%), four cases (12.5%), and two cases (12.5%) after forty eight to seventy two hours of neonatal birth. observed and identified between the first and seventh days following birth (37).

Low APGAR scores (less than three at the first and fifth minutes, respectively), neonatal birth status, low social class, the need for respiratory support, and blood transfusions were factors linked to IVH (intraventricular hemorrhage) in univariable analysis. Low gestational age and respiratory support, such as continuous positive airway pressure, were nonetheless retained by multivariate logistic regression models as important predictors of IVH (intraventricular hemorrhage) (7,39).

According to a study conducted in the Netherlands in 2011, the prevalence of thrombocytopenia was 27%, with a risk of greater than or equal to grade two intraventricular hemorrhage of 33% in the neonates compared to 5% in the neonates without thrombocytopenia ($P = 0.01$). This is related to factors like preterm deliveries, low birth weight, early-onset infections, perinatal asphyxia, and exchange transfusions (40).

According to a 2019 study that was published in the Journal of South Africa, the prevalence of intraventricular hemorrhage (IVH) was 44.3% and 67.0% in infants with VLBW. His IVH risk variables included vaginal delivery, extreme preterm birth, VLBW, respiratory distress syndrome, perinatal asphyxia or hypoxia, HIV exposure, thrombocytopenia, stillbirth, and blood transfusion, according to multivariate logistic regression. from mild to severe Infants with extremely low birth weights and preterm birth rates frequently experienced intraventricular hemorrhage, and severe intraventricular hemorrhage was strongly correlated with mortality (23). 18.8% of the participants had developmental problems at follow-up, and 6.3% had epilepsy diagnoses. At discharge, the all-cause death rate was 15.7%. To increase the outcome, convince the mother to attend the maternity unit and have a Caesarean delivery (23).

Another cross-sectional study of 298 preterm neonates with birth weights of 1500 grams or less in Zambia in 2012 found that intraventricular hemorrhage was prevalent during the first seven days of life at 34.2%, with CTUS being performed on postnatal days 3 and 7 to detect the most prevalent intraventricular hemorrhage grade and its associated risk factors. His IVH (intraventricular hemorrhage) grade 1 (moderate) was the most prevalent (54.9%), followed by severe IVH (grades 3 and 4) at 27.5%. At 3 days old, grade 4 mortality was 85.7%, while grade 2 mortality, at 17.7%, was extremely uncommon. Birth weight and gestational age were significant risk factors for IVH (intraventricular hemorrhage) (7).

Another prospective cohort study was done in Uganda, and it found that 34.2% of low birth weight infants had IVH, with 15% of them having severe cases (papyrus grades 3–4) and 19.2% having lesser cases (papillary grades 1-2). In patients with a known result, nearly all of this IVH (90.2%) occurred on the seventh day, with 88.9% of her IVH progressing. At day 28, 70.4% of patients (81/115) were still alive, and IVH was not a factor in their survival. Vaginal delivery, a gestational age (GA) of 32 weeks, and NICU resuscitation increase the risk of IVH (41).

In Kenya, prospective descriptive research found a prevalence of preterm newborns at 33.8%, with 51.4% of those children being in grade I according to the Papile grading system for IVH. 16.2% of newborns in grades II, III, and IV had IVH, with 67.6% having mild cases and 32.4% having severe cases (39).

While extremely preterm births and extremely low birth weights significantly increased the risk of intraventricular hemorrhage (IVH) by a factor of 2 and 3, respectively, prenatal steroids significantly decreased the risk of IVH. However, ventilated newborns and those with thrombocytopenia were significantly more likely to be diagnosed with IVH. Infants with IVH had a higher mortality rate from thrombocytopenia than from platelet levels that were normal. Preterm newborns with intraventricular hemorrhage are affected by all of the aforementioned factors both directly and indirectly (39).

2.4. Conceptual framework for Intraventricular hemorrhage

After analyzing a variety of literature, the conceptual framework for this study was adjusted to fit our setting. Based on this framework, the interactions between various socio-demographic, maternal conceptions of pregnancy, neonatal, therapeutic, and health-related factors were theorized in this study to explain intraventricular hemorrhage in preterm newborns.

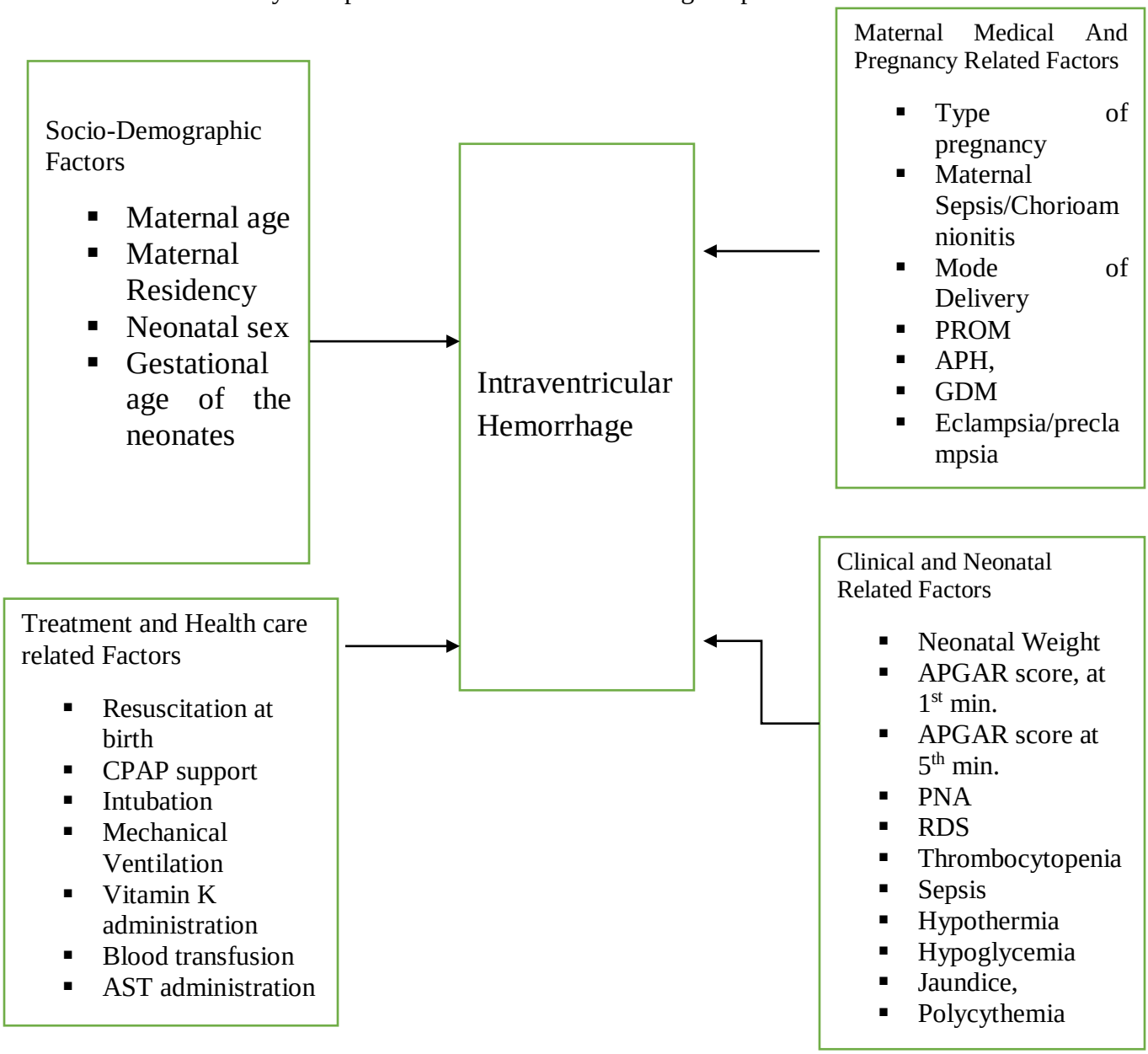

Figure 1: We have constructed a conceptual framework by reviewing different literature's which was expected to explain how those factors affect the preterm neonates directly or indirectly (7,11,39,42–44).

3. OBJECTIVES

3.1. General Objective

- To assess the magnitude and associated factors of intraventricular hemorrhage among preterm neonates admitted to the neonatal intensive care unit of Addis Ababa public hospitals, Ethiopia, 2023.

3.2. Specific Objectives

- To determine the magnitude of intraventricular hemorrhage among preterm neonates admitted to the neonatal intensive care unit of Addis Ababa public hospitals, Ethiopia, in 2023
- To identify factors associated with this Intraventricular Hemorrhage among preterm neonates admitted to neonatal intensive care unit of Addis Ababa public hospitals, Ethiopia, 2023.

4. METHODS ANDMATERIALS

4.1. Study Area and period

In Addis Ababa, the capital and largest city of Ethiopia, which also serves as the headquarters of the African Union and the United Nations World Economic Commission for Africa, the study was carried out. I have 11 sub-cities and a 527-square-kilometer territory. The city has an estimated 4.8 million residents (45). With the exception of Emmanuel Hospital, the city is home to twelve public hospitals, eleven of which offer neonatal critical care units. The following are listed in order of importance: Tikur Anbessa, Zewditu Memorial, Minilik II, Gandhi Memorial, Alert, Ras Desta, St. Paul's, Eka Kotebe, Yekatit 12, Tkrunesh Beijing, and St. Peter. The study has been carried out in five of these hospitals. These medical facilities were chosen at random. Tikur Anbessa Specialized Hospital, Gandhi Memorial Hospital, Saint Paul Millennium Medical College Hospital, and Saint Peter Specialized Hospital were the study's locations (46–50).

One of the public hospitals managed by the Addis Abeba City administration's health bureau is the Gandhi Memorial Hospital. Preterm neonates are admitted in varying numbers; the average admission rate after three years is 1,560. The Minilik II Memorial, which is also part of the Addis Abeba Health Bureau, has 1,620 premature neonates admitted to its NICU on average every three years. The average number of three-years preterm neonates admitted to the neonatal intensive care unit at the following hospitals under the administration of the federal ministry of health is 2,994 at St. Paul's Millennium Medical College, 861 at St. Peter Specialized Hospital, and 2,088 at Tikur Anbessa Specialized Hospital.

The study period was conducted from February 27, 2023, to March 27, 2023, on the medical charts of preterm neonates admitted to selected public hospitals from November 3, 2019–November 3, 2022.

4.2. Study Design

- A cross sectional study design was carried out in selected Addis Ababa public hospitals.

4.3. Population

4.3.1. Source of Population

- All preterm neonates' medical charts were admitted to the NICU in the selected public hospitals of Addis Ababa, Ethiopia, from November 3, 2019–November 3, 2022.

4.3.2. Study Population

- The medical records of every premature neonate admitted to a randomly chosen public hospital's NICU between November 3, 2019, and November 3, 2022.

4.4. Inclusion and Exclusion Criteria

4.4.1. Inclusion Criteria

- All medical records of premature neonates admitted to the NICU from November 3, 2019, to November 3, 2022, in the selected public hospitals in Addis Ababa that are eligible for such records.

4.4.2. Exclusion Criteria

- Preterm infants' medical records with missing or incomplete information about outcome variables were eliminated.

4.5. Sample Size Determination and Sampling Procedure

4.5.1. Sample size calculation

As a starting point, the proportion value of 34.2% from a study conducted in Zambia was used. Intraventricular hemorrhage (IVH) is common in premature babies (7).

A single population proportion with a 5% significance level, a 95% confidence level, a margin of error of 5% = 0.05, and a 10% non-respondents rate(with drawl).

The initial sample size was taken using the formula for the magnitude of IVH among preterm infants;

Where: n= the provided sample size

Z= the standard score corresponding to 95% CI, and was equal to 1.96

P= the proportion of prevalence of IVH among preterm neonates to be 34.2%

d= margin of error which was taken 5%

$$n = \frac{z2\ p(1-p)}{d^2} n = \frac{(1.96)2\ 0.342(1-0.342)}{0.05^2} = 345.8 \approx 346$$

By adding a ten percent non-respondent rate, it finally= 381

4.5.2. Sampling technique and Sampling Procedure

There are twelve government hospitals in Addis Ababa. Five hospitals about 42% of them were chosen using a basic random sampling by lottery technique while eleven of them deliver NICU services. The HMIS from each chosen hospital was used to extract the typical baseline preterm admission data. A total of 9123 preterm newborns were admitted on average every three years at selected public hospitals, which were taken from their HMIS books. The whole sample was drawn proportionately from a few public hospitals based on the statistics. At the start of the data collection period, a random selection was made from the first participants' medical charts. Then, using a systematic sampling technique, each study participant (medical records of preterm infants) was chosen after every Kth (24), until the necessary sample size was attained.

The proportional allocation is shown the schematic presentation below and

Distributed to each hospital using the following formula:

$$\boldsymbol{nH = \frac{n.NH}{N}} =$$

Where; nH =required sample size from each hospital

n= the total sample size (381)

NH= numbers of participant in specific hospital

N= total numbers of preterm infants in five selected public hospitals

$$n\,SPHMMC = \frac{n.NH}{N} = \frac{2994.381}{9123} = 125$$

$$n\,TASH = \frac{n.NH}{N} = \frac{2088*381}{9123} = 87$$

$$n\,MII\,RH = \frac{n.NH}{N} = \frac{1620*381}{9123} = 67$$

$$n\,GMH = \frac{n.NH}{N} = \frac{1560*381}{9123} = 65$$

$$n\,St.PSH = \frac{n.NH}{N} = \frac{861*381}{9123} = 36$$

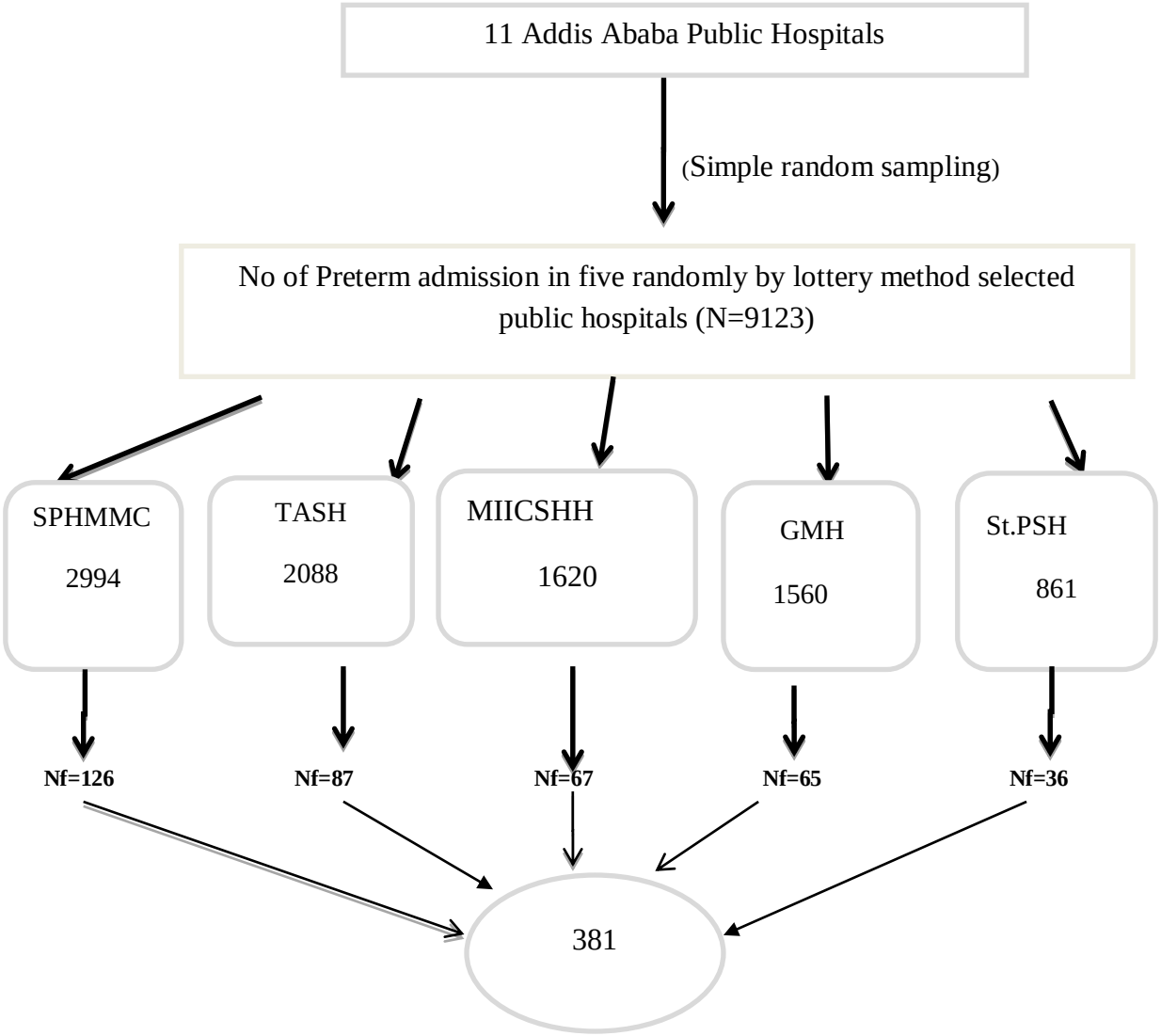

Figure 2 -Schematic presentation of sampling procedures.

4.2. Study Variables

4.2.1 Dependent Variable

Intraventricular hemorrhage

4.2.2 Independent Variables

- **Socio-demographic Variables of Mother and Neonates**

  - Maternal age

  -Gender of the neonates, weight of the preterm infants,

  -Residency

- **Maternal and neonatal medical, obstetrics related Variables**: - Parity, Type of pregnancy, Mode of delivery, Pregnancy related complications(PROM, APH, Eclampsia/Pre-eclampsia/, GDM,PPH)
- **Neonatal related Variables**: - APGAR score, at 1^{st} minute, APGAR score at 5^{th} minutes ,Birth, weight of the neonates
- **Health and Health related Variables:** Hypothermia, PNA, RDS, Thrombocytopenia, Sepsis, Hypoglycemia, Polycythemia, Jaundice
- **Treatment and health service variable:- AST administration,** Blood transfusion, CPAP, Intubation, Mechanical Ventilation, Resuscitation, Vitamin K administration.

4.3. Operational Definitions/ Definition of Terms

- **Chorioamnionitis:** It is an infection of the amniotic fluid and placenta, or the mother presented with a high-grade fever, foul-smelling vaginal discharge, and back pain.
- **Intraventricular Hemorrhage:** when the preterm neonate are diagnosed with intraventricular bleeding (confirmed by cranial ultrasound) (52).
- **Intubation:** A process of inserting an end tracheal tube by using laparoscopy into the mouth or nose, larynx, and trachea to keep the airway open by a health care provider.
- **Gestational Age (GA**): The age of pregnancy, starting from LMNP to the time of birth (53).
- **Mode of delivery:** The method of delivery is either assisted by instruments or spontaneous vaginal delivery.

- **Preterm**: Neonates who are born before 36weeks and 6 days of gestational age and are diagnosed with intraventricular bleeding (54).
- **Resuscitation**: The state of recovering the physiological process of newborns like Air way clearance, Respiratory, circulation via stimulation, cardiopulmonary assistance, and giving medicines.

4.4. Data Collection Tools and Procedures

4.7.1. Data Collection Tools

Data extraction tools was adapted by reviewing literature and modified according to our context (1,7,30,38,39,39,54,55). The medical records of premature babies hospitalized in the neonatal critical care units of a few public hospitals in Addis Ababa throughout a three-year period (November 3, 2019–November 3, 2022) four variables were mentioned in the question. Variables like Socio-demographic, maternal, obstetric, and neonatal health care as well as health and treatment.

4.7.2. Data Collection Tools and Procedures

From a proportionally dispersed sample size for each hospital, newborns that fulfilled the inclusion criteria were chosen by systematic random sampling, and pertinent data was acquired from registries and medical records and examined. Five registered nurses with a bachelor's in nursing and two senior supervisors with a bachelor's in nursing, all of whom worked in child care facilities and had expertise collecting data, were chosen and given training in data collection. One day of training on research relevance, consumer privacy, eligibility requirements, and data collection was given to data collector team and the supervisors.

4.5. Data Quality Control

The study's questionnaire was written in English. Before the actual data collection day, the data collectors received training in data collection techniques. To preserve the privacy of neonatal information, it is claimed that the complete procedure of data gathering and testing was reviewed and developed during the training process. Two weeks before the actual data collection, a pretest at Zewditu Memorial Hospital was conducted on 5% of the sample size (n = 19) to ensure the instruments' clarity, application, and availability.

4.6. Data Analysis and processing

The collected data were exported to the statistical program SPSS V.26 for cleaning, coding, and additional analysis. The descriptive statistics of percentile, frequency, mean, median, and standard deviation were used to summarize continuous data.

Multiple co-linearity tests were done to check value of correlation coefficient between independent variables, variance inflation (VIF) and tolerance. It was determined that the model fit was good using the Hosmer-Lemeshow quality test (statistically insignificant p-value > 0.05). The study's outcome variable, Intraventricular hemorrhage was coded as "1" and newborns without IVH were designated as "0."In order to assess associations between dependent and independent variables, bi-variable logistic regression was used. Following a bi-variable logistic regression analysis, variables that were eligible for a multi-variable logistic regression analysis were chosen using a p-value cutoff of 0.25 to determine the association between dependent and independent variables with 95% confidence intervals. A p-value < less than 0.05 was considered statistically significant. After that, the results were interpreted and summarized using statements, tables, figures, and diagrams.

4.10. Ethical Consideration

The Institutional Review Board of the University of Health Sciences and the AAU provided their ethical approval. Following clearance, all levels of security were established for the letter of cooperation issued to TASH, St. Paul Hospital, Millennium Medical College, Gandhi Memorial Hospital, Minilik II Hospital, and St. Peters Specialty Hospital. Numerous precautions are taken to protect the privacy of information on these newborns.

4.11. Dissemination of the results

The research findings of our study will be presented to the Addis Ababa University College of Health Science School of Nursing and Midwifery. The finding will be also presented at local or international seminars, workshops, conferences, and meetings, and thesis will be also shared with TASH, SPHMMC, Gandhi Memorial Hospital, Minilik II Hospital, and St.Peter Specialized Hospital. Publication in peer-reviewed national and international, reputable journals will be attempted.

5. RESULTS

5. 1. Socio-demographic characteristics of study participants (n=365)

During this study, there were a total of 381 preterm neonates. Of those 10 of charts of preterm infants were excluded due to incompleteness, and 6 were missed. 365 (96%) of the participants were successfully recruited. Most of the 269 (74%) index mothers and neonates were living in Addis Ababa. The median maternal age was 27 with an IQR of 24–30. The median gestational age of the neonates was 33.4 weeks, with an IQR of 32.25–35.1. Of whom 209 (57%) neonates were male. About 240 (66%), of the preterm neonates birth weight was between 1500-2499grams (See-table 1).

Table 1: Magnitude and associated factors of Intraventricular Hemorrhage among preterm neonates admitted to Neonatal intensive care unit of Addis Ababa public hospitals, Ethiopia, 2023.

Variables	Category	IVH		Percent (%)
		Yes (%)	No (%)	
Residency	Addis Ababa	64(24)	205(76)	74
	Out Of Addis Ababa	29(30)	67(70)	26
Maternal Age	14-21	17(38)	28(62)	12.3
	22-28	48(24)	153(76)	55
	29-35	24(24)	76(76)	27.3
	36-42	4(21)	15(79)	5
Gestational Age of the neonates	28-32	58(66)	30)34)	24
	32.1-34	31(28)	79(72)	30
	34.1-36.6	4(2)	163(98)	46
Birth Weight of the neonates	<1500grams	54(56)	43(44)	26.5
	1501-2499grams	35(15)	205(85)	66
	>2500grams	4(16)	21(84)	7.7
Gender of the neonates	Male	51(24)	158(76)	57
	Female	42(27)	114(73)	48

5.2. Maternal, Medical, Pregnancy and Obstetrics Related Characteristics (n=365)

In our study Almost 60% of the index mothers were primigravida. About 339(93%) of the pregnancy was singleton. About 220 (60%) of the index mothers had four or more antenatal visits. One third of the mothers 128(35%) had pregnancy-related complications. Almost 269 (74% of index mothers) gave birth via SVD (See table 2).

Table 2: Magnitude and associated factors of Intraventricular Hemorrhage among preterm neonates admitted to neonatal intensive care unit of Addis Ababa public hospitals, Ethiopia, 2023.

Variables	Category	IVH		Frequency(n=365)	Percent (100%)
		Yes (%)	No (%)		
Parity of the mother	Primigravida	49(26)	168(74)	217	59.4
	Multigravida	44(30)	104(70)	148	40.6
Type of Pregnancy	Singleton	86(25)	253(75)	339	93
	Multiple	7(27)	19(73)	26	7
No of ANC	Less than four times	45(31)	100(69)	145	40
	Greater than four times	48(22)	172(78)	220	60
Pregnancy Related Complications	Yes	47(37)	81(63)	128	35
	No	46(19)	191(81)	237	65
APH	Yes	8(50)	8(50)	16	14
	No	85(24)	264(76)	349	86
Eclampsia/Pre-eclampsia	Yes	9(37)	15(63)	24	7
	No	84(27)	257(73)	341	93
PROM	Yes	16(42)	22(58)	38	10
	No	77(23.5)	250(76.5)	327	90
Sepsis/Chorioamnionitis	Yes	9(43)	12(57)	21	6
	No	84(24)	260(76)	344	94

GDM	Yes	3(25)	9(75)	12	3
	No	90(26)	263(74)	353	97
Others*	Yes	2(12)	15(88)	17	5
	No	91(26)	257(74)	348	95
	SVD	67(25)	202(75)	269	74
Mode of Delivery	Instrumental	26(27)	70(73)	96	26

*PPH, Hyper emesis gravid-arum, Placenta previa, and Abruptio

5.3. Neonatal health and health related Characteristics

In this cross sectional study, the first and fifth minute Apgar scores were obtained 14 neonates in the first minute, and 2 neonates in the fifth minute remained with a very low Apgar score (0–3). About 266 (73%) of the neonates was admitted with diagnosis ofEONS, followed by jaundice (102) (28%) (See table 3).

Table 3: Magnitude and associated factors of Intraventricular Hemorrhage among preterm neonates admitted to neonatal intensive care unit of Addis Ababa public hospitals, Ethiopia, 2023.

Variables	**Categories**	**IVH**		**Frequency(n=365)**	**Percent (100%)**
		Yes (%)	No (%)		
First Minutes APGAR score	0-3	3(21)	11(89)	14	4
	4-6	27(25)	80(75)	107	29
	7-10	63(26)	137(74)	244	67
Fifth Minutes APGAR score	0-3		2(100)	2	.5
	4-6	11(27)	30(73)	41	11
	7-10	82(25)	240(75)	322	88.5
PNA at Birth	Yes	13(32.5)	27(67.5)	40	11
	No	80(25)	245(75)	325	89
RDS	Yes	42(44)	54(56)	96	26
	No	51(19)	218(81)	269	74
Sepsis during admission	Yes	71(27)	195(73)	266	73
	No	22(22)	77(78)	99	27
Hypothermia at admission	Yes	35(41)	47(59)	85	23
	No	58(20.5)	222(79.5)	280	77
Hypoglycemia during admission	Yes	34(40.5)	50(59.5)	84	23
	No	59(21)	222(79)	281	77
Jaundice	Yes	38(34)	64(66)	102	28
	No	57(22)	208(78)	263	72
Polycythemia	Yes	5(26)	14(74)	19	5
	No	88(34)	258(66)	346	95
Thrombocytopenia	Yes	34(50)	34(50)	68	19
	No	59(20)	238(80)	297	81

5.4. Treatment related factors of Intraventricular Hemorrhage (n=365)

Among those preterm babies, 338 (93%) had received a vitamin K injection at birth, and about 44 (12%) preterm neonates were resuscitated at birth. About 85 (23%) babies had received CPAP for respiratory support. In this study, about 75 (20.5%) neonates had a history of blood transfusion. About 309 (85%) of the preterm neonates were improved and discharged with a good outcome (See table-4).

Table 4: Magnitude and associated factors of Intraventricular Hemorrhage among preterm neonates admitted to neonatal intensive care unit of Addis Ababa public hospitals Ethiopia, 2023

Variables	**Categories**	**IVH**		**Frequency (n=365)**	**Percent (100%)**
		Yes (%)	No (%)		
Vitamin-K-administration	Yes	72(21)	266(79)	338	93
	No	21(78)	6(22)	27	7
AST	Yes	34(30)	80(70)	114	31
	No	59(23.5)	192(76.5)	251	69
Resuscitation at birth	Yes	27(61)	17(39)	44	12
	No	66(20.5)	225(79.5)	321	88
CPAP Respiratory support	Yes	38(450	47(55)	85	23
	No	55(20)	225(80)	280	77
Blood transfusion history	Yes	28(37)	47(63)	75	20.5
	No	65(22)	225(78)	290	77.5
Outcome of neonates with IVH and without IVH	Improved and discharged	82(26.5)	227(73.5)	309	85
	Died	11(20)	45(80)	56	15

5.5. The Magnitude of Intraventricularhemorrhage(IVH)

In this cross-sectional study among 365 preterm neonates preterm infants admitted to the NICU of Addis Ababa Public Hospital, we found the magnitude of Intraventricular hemorrhage at 93 (25%) (See figure -3).

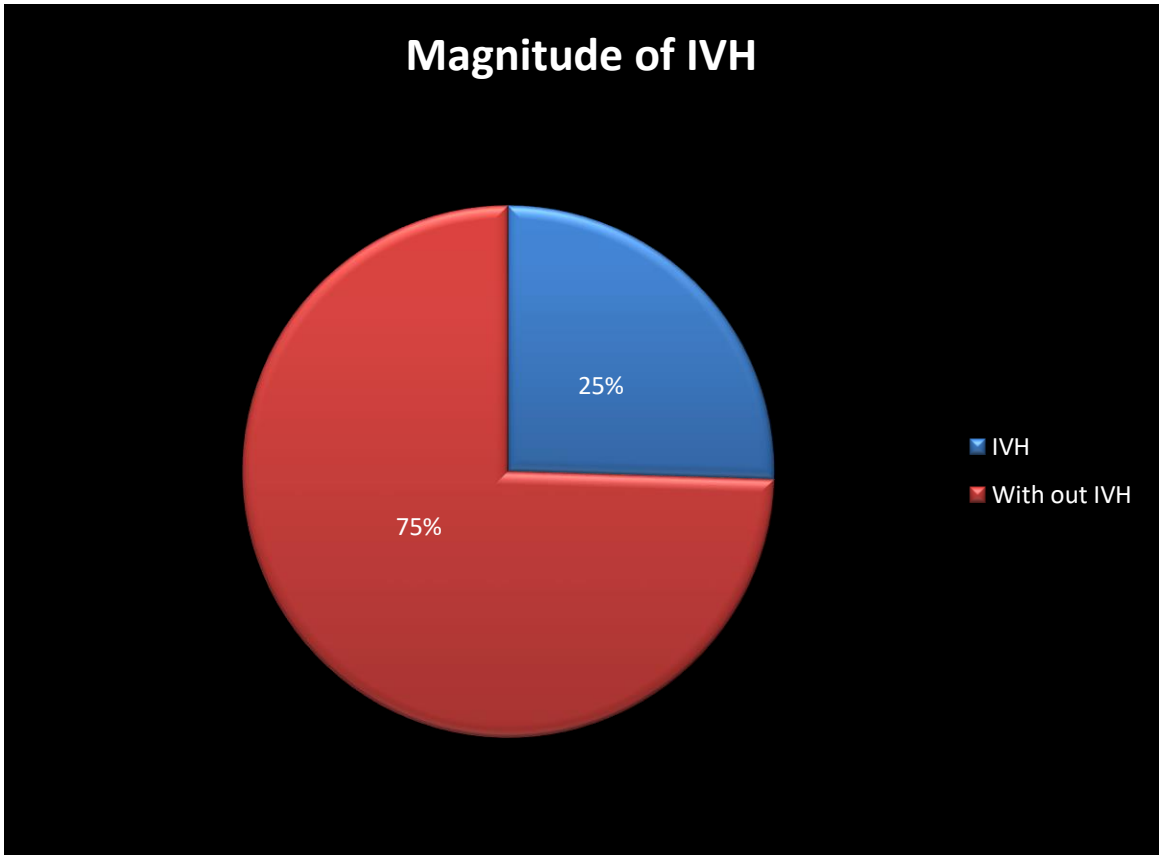

Figure 3*:* Magnitude and associated factors of Intraventricular hemorrhage among preterm neonates admitted to neonatal intensive care unit of in Addis Ababa public hospitals, Ethiopia, 2023.

5.6. Grade of Intraventricular hemorrhage among preterm neonates

Of these 365 preterm infants, 93 (25%) developed Intraventricular hemorrhage. Based on the papile's grading system grade I 16 (17.2%), grade II 35(37.7%) was the most frequent, followed by grade III in 23 (24.5%), and grade IV 19(20.4%) (56). (See figure-4).

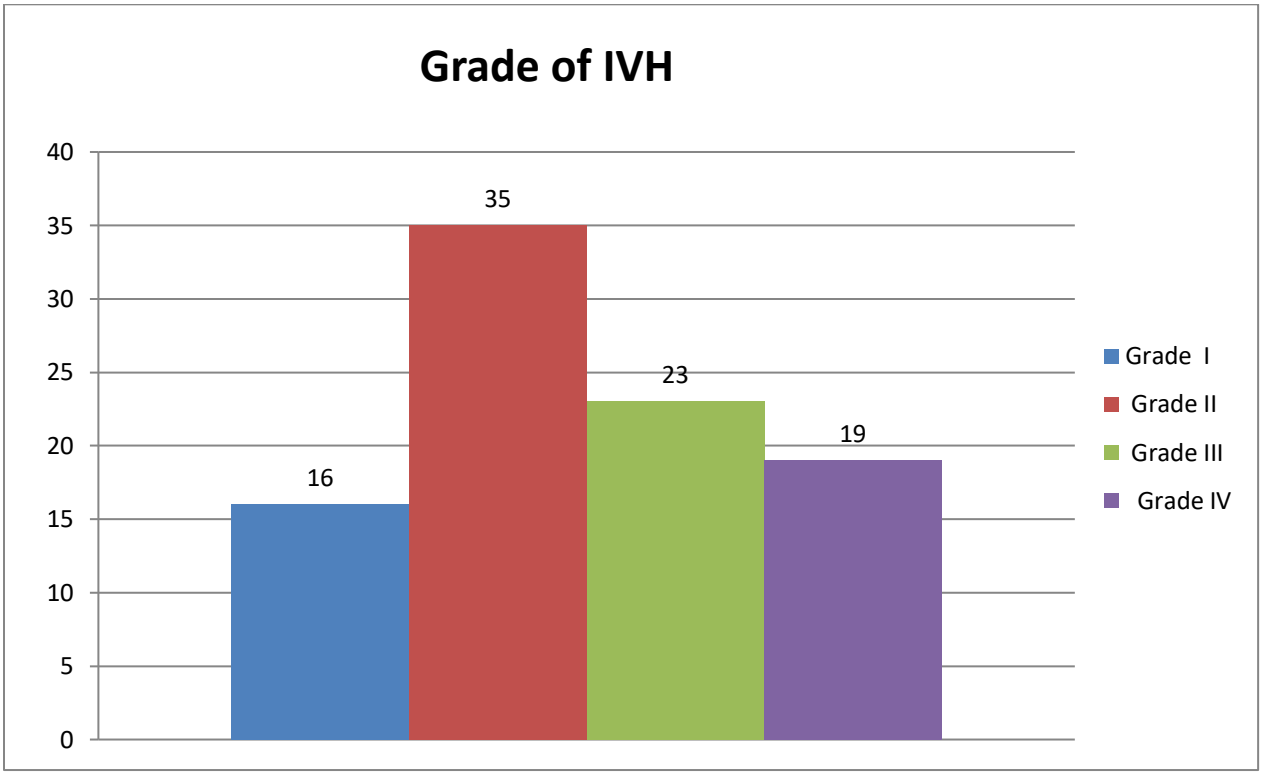

*Figure **4:*** Magnitude and associated factors of Intraventricular Hemorrhage among preterm neonates admitted neonatal intensive care unit of in Addis Ababa public hospitals, Ethiopia, 2023.According to papiles's grading system (56).

5.7. Factors associated with Intraventricular Hemorrhage

In this study, to determine associated factors with intraventricular hemorrhage, a logistic regression model was used between outcome and independent variables. In bi-variable logistic regression with COR and a p-value <0.05 associated with intraventricular hemorrhage, likes pregnancy-related complications, birth weight of neonates, RDS, hypothermia, hypoglycemia, jaundice, thrombocytopenia, CPAP respiratory support, and blood transfusion were exported to multi-variable analysis. Then multi-variable logistic regression was used to adjust confounders with AOR with 95% confidence intervals for the effects of outcome variables, and independent variables such as very low birth weight, hypothermia, thrombocytopenia, and blood transfusion were statistically significant with P-values of <0.05 (See table-5).

Preterm neonates with birth weight <1500grams were 7.45 times more likely to have Intraventricular hemorrhage (AOR = 7.45 (2.12, 26.21; 95% CI; P = 0.00). Preterm neonates diagnosed with hypothermia had a 2.5-times higher risk of intraventricular hemorrhage (AOR = 2.53 (1.36, 4.71; 95% CI; P = 0.004). Preterm neonates diagnosed with thrombocytopenia were four times more likely to have intraventricular hemorrhage than neonates without thrombocytopenia (AOR = 4.03 (1.73, 9.40; 95% CI; P = 0.001). Preterm neonates who had a history of blood transfusion were three times more likely to have a risk of intraventricular hemorrhage (AOR = 2.85 (1.18, 6.90; 95% CI; P = 0.002).

Table 5-Magnitude and associated factors of Intraventricular Hemorrhage among preterm neonates admitted to neonatal intensive care unit of Addis Ababa public hospitals, Ethiopia, 2023.

Variables	Category	IVH		COR(95%CI)	AOR(95%CI)	P-Value
		Yes (%)	No (%)			
Pregnancy Related complications	Yes	46(36)	81(64)	2.255 (1.50,3.90)	0.64(0.36,1.14)	0.13
	No	47(20)	191(80)	1	1	
Birth Weight of the neonate	<1500gm	54(56)	43(44)	7.37(2.43,23.37)	7.45(2.10,26.2)	**0.000***
	1501-2499gm	35(13)	205(87)	1.02 (0.36,3.13)	1	
	>/=2500gm	4(16)	24(84)	1	1	
RDS at Admission	Yes	42(44)	54(56)	3.32(2.00,5.21)	0.68(0.50,2.04)	0.26
	No	51(19)	218(81)	1	1	
Hypothermia at Admission	Yes	35(43)	47(57)	0.35(0.205,0.58)	2.53(1.36,4.71)	**0.004**
	No	58(26)	225(74)	1	1	
Hypoglycemia at admission	Yes	34(40)	50(60)	2.56(1.52,4.31)	1.007(0.45,2.04)	0.85
	No	59(2)	222(78)			
Jaundice	Yes	38(23.5)	64(76.5)	2.24(1.36,3.70)	0.60(0.25,1.40)	0.23
	No	55(18)	208(82)	1	1	
Blood transfusion History	Yes	28(37)	47(63)	0.50(0.3,0.83)	2.85 (1.18,6.90)	**0.02**
	No	65(22)	225(78)	1	1	
Thrombocytopenia	Yes	34(50)	34(50)	4.03(2.32,7.02)	4.03(1.73,9.40)	**0.001**
	No	59(20)	238(80)	1	1	
Supported with CPAP	Yes	38(45)	47(55)	3.30(0.18,0.51)	1.62(0.83,3.31)	0.16
	No	55(20)	225(80)	1	1	

Key

- 1=References
- *= statistically significant at AOR p-value <0.05

6. DISCUSSION

This cross-sectional study assessed the magnitude of intraventricular hemorrhage among premature babies admitted to the NICU of Addis Ababa public hospitals. Neonates, particularly preterm and LBW neonates being hospitalized in the NICU, frequently suffer from intraventricular hemorrhage. Regardless of our nation's newborn intensive care unit setup, intraventricular hemorrhage has been mostly ignored until recently, despite the considerable burden it places on neonates' health globally. In this study, hypothermia, thrombocytopenia, preterm neonates with very low birth weight, and a history of blood transfusions were significantly associated factors for the presence of intraventricular hemorrhage.

The study identified no association between various maternal and newborn health problems and treatment factors such as pregnancy-related complications, RDS, hypoglycemia, jaundice, and CPAP and the severity of intraventricular hemorrhage.

Our investigation shows that one-fourth, or 93 (25%) preterm newborns admitted to the neonatal intensive care unit at the Public Hospital of Addis Ababa, had intraventricular hemorrhage that was of significantly high magnitude.

This study adopted the Papile's grading system of IVH(28) mild (grade II) being the most frequent at (37.6%),followed by grade III (24.7%),grade IV 20.6% and grade I (17.7%) (56).

In this cross-sectional study, the finding of grade II intraventricular hemorrhage is in line with that reported in a study conducted in Poland (37.2%), followed by grade I (21.6%) (18). One study contrasting IVH grade proportion was a Kenyan prospective study where the most frequent IVH grade was reported by a writer (39)was grade I at 51.5%, followed by grades II, III, and IV at 16.2% for everyone. This difference could be attributed to methodological differences. Retrospective study design has been affected by incomplete data, and this could be the reason for it. The findings of this study are consistent with those studies conducted in Nigeria 24.1 (4). This similarity is likely due to the fact that both studies were conducted in similar settings (developing countries).

The findings of our study was higher than studies done in China 19.7% (31). A possible explanation for this discrepancy might be due to differences in the neonatal ICU. Unlike our

NICU facilities, developed countries have advanced medical tools such as ventilators and infusion pumps to help with prematurity and related complications.

Our results also show higher levels of Intraventricular hemorrhage, which is more than prospective studies in Nigeria 16.2% (28). A possible explanation for these differences might be due to the methodological differences.

However, our study finding is lower than the study reported in Zambia 34.2% (7), Uganda 34.2% (41) and Kenya 33.8% (39). The difference can be due to the following reasons: However, all preterm infants were screened by brain ultrasound during the first 60 hours to 7 days and throughout the study and methods.

A current study revealed that preterm neonates with <1500grams of birth weight at admission had significantly increased risk of IVH (AOR=7.45; 95% CI; 2.12, 26.21, P=0.000) a 7.4 times increased risk of IVH. The finding of this study is supported by A retrospective case control study conducted in China (30). This similarity might be due to prematurity, low birth weight, hypoglycemia, and hypoxia, which are all frequently seen in premature infants. This increases the risk of an Intraventricular hemorrhage by causing vasodilatation in the cerebral vessels.

In the current study, we reported that preterm neonates with hypothermia (AOR = 2.53; 95% CI 1.36–4.71; P = 0.001) have 2.6 times higher probabilities of developing intraventricular hemorrhage compared with preterm neonates without hypothermia.

This finding is supported by the studies conducted in Taiwan (35). A possible explanation for this similarity is that persistent hypothermia in preterm neonates has been associated with disturbed cardio-vascular or decreased coagulation mechanisms that have been shown to be offset by increased platelet aggregation. It might be precipitating the severity of intraventricular hemorrhage other than the cause.

We report that preterm neonates who were diagnosed with thrombocytopenia (AOR = 4.03; 95% CI 1.73, 9.40; P = 0.001) were four times more likely to increase the risk of intraventricular hemorrhage than those without thrombocytopenia, respectively (40). A possible explanation for this is that thrombocytopenia is the most common bleeding disorder of prematurity, as are very

low birth weight and sepsis. Bleeding may be due to preexisting weakness of wall structures and damage to immature blood vessels in the area.

In our study, we report that the preterm neonates who received blood transfusion (AOR = 2.85; 95% CI 1.18, 6.90; P = 0.02) had a two-times higher risk of developing intraventricular hemorrhage than those who didn't receive blood (23). This finding is supported by a studies conducted in Iran/Tehran (34). The reasons for such similarities might be that premature births are complicated by several factors, including the fact that the most likely reason for receiving blood products is a severely ill newborn. Rapid volume expansion of blood products can lead to increased blood overflow to the brain and damage to sensitive blood vessels in the embryonic matrix.

7. STRENGTH AND LIMITATION

7.1. Strengths

This is the first study to determine the magnitude of intraventricular hemorrhage in preterm neonates admitted to the NICU of a public hospital in Addis Ababa. Because this study was conducted on secondary data from hospitalized neonates, it was easier to get medical and other important predictors diagnosed and treated during hospitalization. The data were collected by health professionals working in the NICU, who played major role in the quality of the data.

7.2. Limitations

- Lacks of adequate literature on the same topic in Ethiopia.
- Being a retrospective study, there is variables not included in this study due to not available on the chart.
- In this study, data were limited to preterm infants admitted to public hospitals and therefore preterm babies admitted to private hospitals were not included, which may underestimate or overestimate the magnitude of Intraventricular hemorrhage there is.

8. CONCLUSION

Overall magnitude of intraventricular hemorrhage among preterm neonates who admitted to the neonatal intensive care unit of Addis Ababa public hospitals during the period of November 3, 2019 - November 3, 2022 was high (93%). Based on the papile's grading system, grade II (37.7%) was the most common, followed by grade II in 23 (24.5%), grade IV in 19 (20.4%), and grade IV I in 16 (17.2%). The factors significantly associated with intraventricular hemorrhage were VLBW, hypothermia, thrombocytopenia, and blood transfusion, which were significant and highly likely to cause intraventricular hemorrhage.

10. RECOMMENDATIONS

Based on the findings of this study, the following recommendations are forwarded.

For Federal Ministry of Health (FMOH)

The Federal Department of Health should focus on standardizing NICU facilities, including radiant warmers, incubators to prevent hypothermia, and infusion pumps to control blood transfusions.

To health care providers

All medical professionals should closely monitor for signs of intraventricular hemorrhage in preterm infants observed in the NICU. At the same time, strictly follow established procedures for the prevention of hypothermia, thrombocytopenia, and transfusion protocols. It is best for health professionals working in ANC and labor departments to give pregnant women special attention in the management and prevention of premature birth.

To Researchers

Therefore, a further large-scale study is required with the same title to understand factors associated with intraventricular hemorrhage among preterm neonates.

For each study facility

To prevent hypothermia, thrombocytopenia, and blood transfusions at all levels of the facility, hospitals should have their own guidelines, especially regarding the care of preterm neonates.

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APPENDIX: Data Collection/Extraction Tool

Principal investigator: **Mr. Mihret Alemu**

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DATA EXTRACTION TOOL

Data collector Name …… Signature…….

Supervisor Name ……Signature…….

Date of data collection……..

Hospital Name _____

Subject's Code No._____

Part I: - Maternal Socio demographic related Data

No.	Variable	Response	Skip to
101.	MRN		
102.	Maternal Age		
103.	Residency of mother	1. Urban 2. Rural	

Part II:-Medical, Pregnancy, labor and Obstetrics related Data of the Mother

No.	Variables	Responses	Skip to
201.	Chronic illness of the mother	1. Yes 2. No	If No skip to 203
202.	If the answer for number 201 is yes, Specify it	1. CHF 2. TB 3. HPN 4. HIV/AIDS 5. Other specify-----	
203.	Parity	1. primigravida 2.Multi-gravida	
204.	History of ANC	1.Yes 2.No	

205.	Q.205 yes, Number of ANC	1.<Three times 2. >Four times	
206.	Pregnancy related complication	1. Yes 2. No	If no skip to 208
207.	If the answer for number 204 is yes?	1. PROM 2. APH 3. Eclampsia/preeclampsia 4. Chorioamnionitis/sepsis 5. GDM 6. others	
208.	Types of pregnancy	1. Singleton 2. Multiple	
209.	Mode of delivery	1. Normal SVD 2. Instrumental assisted Delivery and C/S	
210.	Was there Steroid Administered	1. Yes 2. No	If No skip to 2010.
211.	If the answer for 210 is yes, dose of the steroid?	_____	
212	Was the vitamin k given at birth	1. Yes 2. No	

Part III:-Neonatal Related Data

No.	Variables	Responses	Skip to
301.	Gender of the Neonate	1. Male 2. Female	
302.	First Minute APGAR score	_____	
303.	Fifth Minutes APGAR score		
304.	GA of the neonates	_____	
305.	Birth weight of the Neonate in grams	_____	

Part IV:- Admission and Sequential developed Neonatal Problems

No.	Variables	Response	Skip to
401.	RDS during admission	1. Yes 2. No	
402.	Sepsis during admission	1. Yes 2. No	
403.	Hypothermia at admission	1. Yes 2. No	
404.	Perinatal asphyxia at admission	1. Yes 2. No	
405.	Other specify	_____	

406.	Does the neonate diagnosed with new diagnosis?		1. Yes 2. No	If no skip to 413
407.	If yes?	Neonatal Jaundice	1. Yes 2. No	
408.		Thrombocytopenia	1. Yes 2. No	
409.		Polycythemia	1. Yes 2. No	
410.		Hypoglycemia	1. Yes 2. No	
411.		Other specify	---------	
412.	Was the neonate diagnosed with IVH?		1. Yes 2. No	If No, skip to 415
413.	If the answer for Q. 413 is yes, classification of IVH		1. Grade I 2. Grade II 3. Grade II 4. Grade IV	
414.	Onset of IVH from Admission		_____	

Part V: - Treatment and Outcome Related Data

No.	Variable	Response	Skip to
501.	Was the baby resuscitated or respiratory support given	1. Yes 2. No	If yes .
502.	Was the neonate treated with CPAP	1.Yes 2.No	
503.	Was the supported with Mechanical ventilation	1. Yes 2. No	
504.	Was the neonate Intubated	1. Yes 2. No	
505.	Did the neonate had history Blood transfusion	1. Yes 2. No	
506.	Outcome of the neonate with IVH	1. Died 2. Discharged	
507.	Outcome of the neonate without IVH	1. Died 2.discharged	
508.	If the answer for number 505 is died, time to death from admission	_____	

End!