ARSI UNIVERSITY

COLLEGE OF HEALTH SCIENCE DEPARTEMENT OF

PEDIATRICS AND CHILD HEALTH

Magnitude and Associated Factors of Meconium Aspiration Syndrome among Neonates Admitted to Asella Referral and Teaching Hospital, Southeast Ethiopia

By:Dr .Tsegaye Zebenu (Md, Pediatric and Child Health Resident)

Advisor:

Dr Mohammed Abubeker (Md, Assistant Prof. of Pediatrics And Child Health)

Mr:Abebe Ferede(Assistant Prof. of Public Health & Nutrition)

A Research Thesis to be Submitted to Arsi University College of Health Sciences, School of Medicine, Department of Pediatrics and Child Health, in Partial Fulfillment of the Requirements for Speciality Certificate in Pediatrics and Child Health.

January , 2026 G.C
Asella , Ethiopia

ARSI UNIVERSITY COLLEGE OF HEALTH SCIENCE

DEPARTEMENT OF PEDIATRICS AND CHILD HEALTH

Name of Investigator	Dr .Tsegaye Zebenu (Md, Pediatric and Child Health,Resident)
Name of Advisor	Dr:Mohammed Abubeker (Md, Assistant Prof. of Pediatrics And Child Health) Mr:Abebe Ferede(Assistant Prof. of Public Health & Nutrition)
Title of Research project	Magnitude and Associated Factors of Meconium Aspiration Syndrome among Neonates Admitted to Asella Referral and Teaching Hospital, Southeast Ethiopia
Study Area	Asella Referral and Teaching Hospital
Duration of The Project	September 1st 2024_ November,2025
Total cost of the project	32,450ETB
Contact Information:	
Investigator	Phone:0962939394 Gmail:tsegayezebenu@gmail.com
Advisors	Phone: 0920164082 Gmail: abebeferede95@yahoo.com Phone: 0911980646 Gmail: mabubeker36@gmail.com

January , 2026 G.C

Asella , Ethiopia

ACKNOWLEDGEMENTS

I am deeply grateful to Arsi University's College of Health Sciences and Department of Pediatrics and Child Health for providing me with the opportunity to carried out this research. that will serve as the cornerstone of my future career development and academic involvement in research. Furthermore, I would like to extend my sincere appreciation to my esteemed advisors, Mr. Abebe Ferede (Assistant prof. of Public Health & Nutrition) and Dr . Mohammed Abubeker (MD, Assistant Prof. of Pediatrics and Child Health), for their unwavering support, valuable insights, and constructive feedback during the preparation of my proposal and carry out this research.

ABBREVATIONANDACRONYMS

ANC-Ante Natal Care

APGAR-Appearance, Pulse ,Grimace, Activity, Respiration

CI-Confidence Interval

GA-Gestational Age

MAS-Meconium Aspiration Syndrome

MSAF-Meconium Stained Amniotic Fluid

NICU-Neonatal Intensive Care Unit

PPHN-Persistent Pulmonary Hypertension Of New Born

PIH-Pregnancy Induced Hypertension

PROM-Premature Rupture of Membrane

ENC-Essential New born care

CAF-Clear amniotic fluid

SPSS-Statistical Package for Social Science

AOR-Adjusted odds ratio

COR-Crude odds ratio

TABLE OF CONTENTS

LIST OF TABLE

LIST OF FIGURE

Abstract

Background: *Meconium Aspiration Syndrome (MAS) remains a major cause of neonatal morbidity and mortality, particularly in low- and middle-income countries such as Ethiopia. Despite global efforts to reduce perinatal complications, MAS continues to pose significant clinical challenges, especially in resource-constrained healthcare settings. Understanding its magnitude and associated risk factors is critical for developing effective prevention and management strategies. There is a notable lack of data regarding the burden and contributing factors of MAS among neonates admitted to Asella Referral and Teaching Hospital, a key referral center in Southeast Ethiopia. This study aims to address this knowledge gap by assessing the magnitude and associated factors of MAS in this setting.*

Objective: *To assess the magnitude and associated factors of meconium aspiration syndrome among neonates admitted to Asella Referral and Teaching Hospital, Southeast Ethiopia, from September 2024 to November 2025.*

Method: *A cross-sectional study was conducted among neonates admitted to the Neonatal Intensive Care Unit of Asella Referral and Teaching Hospital. A systematic random sampling technique was employed and a total of 295 neonates were included in the analysis. The diagnosis of meconium aspiration syndrome was made based on clinical criteria. Descriptive statistics were used to determine the magnitude of MAS. Bivariable and multivariable logistic regression analyses were performed to identify factors associated with MAS. Statistical significance was declared at a p-value < 0.05 with a 95% confidence interval.*

Result: *The magnitude of meconium aspiration syndrome among admitted neonates was 19% at 95% CI. Gestational age of ≥37 weeks was significantly associated with MAS (AOR = 2.46; 95% CI: 1.05–5.81; p = 0.039). Exposure to meconium-stained amniotic fluid (MSAF) showed a strong association with MAS (AOR = 33.36; 95% CI: 8.61–129.16; p < 0.001). In addition, the requirement for oxygen therapy immediately after birth was also associated with MAS (AOR = 29.41; 95% CI: 5.02–172.37; p < 0.001).*

Conclusion: *Overall, the magnitude of meconium aspiration syndrome was high among admitted neonates. Exposure to meconium-stained amniotic fluid, requirement for oxygen therapy at birth and gestational age were significantly associated with MAS. Understanding these associations is crucial for improving risk assessment, strengthening preventive strategies and optimizing the management of MAS in neonates.*

Keywords: *Neonates**,** Meconium Aspiration Syndrome, Asella Referral and Teaching Hospital,Ethiopia*

1. INTRODUCTION

1.1 Background

Meconium is a sterile, thick, odorless, dark greenish-black substance that constitutes the first intestinal discharge of newborns. It is typically presented in the fetal intestine between the 10th and 12th weeks of pregnancy. Under certain conditions, particularly fetal stress, the fetus may pass meconium in utero, resulting in Meconium-Stained Amniotic Fluid [1].

Meconium aspiration syndrome is a serious respiratory condition affecting newborns, characterized by respiratory distress due to the aspiration of meconium-stained amniotic fluid into the lungs during the antepartum or intrapartum period. This aspiration triggers airway obstruction, chemical pneumonitis, surfactant dysfunction, and pulmonary hypertension, leading to significant hypoxia . Newborn present by Tachypnea, retractions, grunting, nasal flaring, and cyanosis are common signs of respiratory distress in neonates with MAS shortly after birth[2].

Certain pathological conditions can cause its emission before delivery, thus staining the amniotic fluid green. MSAF is a common finding in obstetric and neonatal practice with occurrence varying from 5% to 24.6% of deliveries . Its incidence increases with gestational age, up to 30% at 40 weeks and 50% at 42 weeks. Although the exact cause of this MSAF is unclear, fetal distress, cord accidents and maternal hypertension have been identified as potential risk factors .Intrauterine emission of meconium has both fetal and neonatal consequences aswell as maternal risks[3].

The consequences of MSAF extend beyond immediate respiratory distress. MSAF was found to be linked to a wide range of negative perinatal outcomes, including stillbirth, low APGAR scores, hypoxic-ischemic encephalopathy, increased rates of Caesarean delivery, and admission to the neonatal intensive care unit [4].

Meconium aspiration syndrome is a leading cause of morbidity and mortality in term infants. Pneumothorax remains an important complication of MAS, occurring in 9.6% of MAS and the median number of days stayed in the hospital was 13 days in an international stud[3] .

The presence of MSAF is considered to be an indicator of fetal stress due to hypoxia and acidosis causing a vagal response that triggers an increase in peristalsis and anal sphincter release with a resulting meconium passage into the uterine cavity .Risk factors for MSAF include placental insufficiency, maternal hypertension, pre-eclampsia,oligohydramnios with umbilical cord compression during labor, infections and maternal substance abuse[5].

The identification of high-risk pregnancies and the effective management of MSAF during delivery are therefore critical for preventing MAS and its associated complications, underscoring the need for continued research and improved clinical protocols in this area[6] .

Meconium enters the amniotic fluid when the fetus is under stress. It leads to higher perinatal morbidity and death and is an indication of fetal impairment . A higher incidence of instrumental delivery, cesarean delivery, low birth weight, fetal distress, neonatal intensive care unit admission rate, and neonatal death is linked to meconium-stained amniotic fluid [7].

1.2 Statement of the problem

The intrauterine passage of meconium poses substantial risks to both the fetus and the neonate and may also be associated with maternal complications. Studies conducted in India and Thailand have demonstrated increased rates of cesarean section, abnormal fetal heart rate patterns, meconium aspiration syndrome (MAS), low fifth-minute Apgar scores (<7), neonatal sepsis, and neonatal mortality among deliveries complicated by meconium-stained amniotic fluid [8] .

Meconium staining of amniotic fluid occurs in 10 to 15% of deliveries. Approximately 3% to 4% of neonates born through MSAF develop MAS in western countries, but in developing countries, a higher incidence of around 11% to 28% is reported. In a recent multicentric study done in Nepal, MAS was found to be 2 per 1000 live births[9].

MAS is further associated with numerous severe complications, including hypoxic-ischemic encephalopathy in 46% of cases, hypotensive shock (22%), pneumothorax (11.4%), myocardial dysfunction (22%), and persistent pulmonary hypertension of the newborn (17%) [10].

The perinatal morbidity and mortality related to MSAF can be decreased if major risk factors are recognized early and closely monitoring of the labor and careful decisions are made about the timing and mode of delivery. Although the magnitude and associated factors of MSAF have been extensively studied in developed countries, there is limited locally generated evidence in Ethiopia. A study conducted at Felege Hiwot Comprehensive Specialized Referral Hospital highlighted the need for context-specific data to guide appropriate prevention strategies [11] .

The Ethiopian government has made efforts to improve maternal and neonatal health through initiatives like the Health Sector Development Program, which focuses on expanding access to antenatal care, skilled birth attendance, and emergency obstetric care. These efforts aim to reduce risk factors associated with MAS, such as post-term pregnancies and fetal distress. However, despite these efforts, significant gaps remain[12]. Despite the fact, the precise magnitude of MAS in Ethiopia, particularly at Asella Referral and Teaching Hospital, remains unknown. Therefore, this study aims to determine the magnitude of clinically diagnosed MAS among neonates admitted to the neonatal intensive care unit at Asella Referral and Teaching Hospital and to identify associated risk factors. The findings of this study will provide essential evidence to inform targeted interventions aimed at reducing the incidence of MAS and improving neonatal outcomes in the study area.

1.3 Significance of the study

This study on the magnitude and associated risk factors of clinically diagnosed Meconium Aspiration Syndrome among neonates admitted to the NICU at Asella Referral and Teaching Hospital is significant for improving neonatal health outcomes in the region. It provides crucial data on the local prevalence of MAS, helping healthcare providers and policymakers prioritize resources and develop targeted interventions. By identifying specific risk factors associated with MAS, the study enables the creation of effective prevention strategies, such as improving gestational age assessment, enhancing intrapartum monitoring, and ensuring timely delivery.

Furthermore, this research addresses the existing data gap in Asella Referral and Teaching Hospital and surrounding areas, contributing to a broader understanding of MAS epidemiology in Ethiopia and informing national policies aimed at reducing neonatal morbidity and mortality. Additionally, it offers baseline data for future studies to monitor MAS incidence trends, evaluate the effectiveness of interventions, and explore new prevention and treatment approaches. Ultimately, this study will support efforts to enhance the quality of neonatal care and reduce the burden of MAS in Ethiopia.

2. LITERATURE REVIEW

2.1Magnitude of meconium aspiration syndrome

A study conducted in an urban population in Pakistan found the prevalence of MAS among infants born through meconium-stained liquor to be 17.4%, a figure considerably higher than that observed in developed nations. Furthermore, the same study reported a neonatal mortality rate due to MAS as high as 14% [1].

Meconium aspiration syndrome (MAS) remains a major contributor to morbidity and mortality among term neonates. Meconium-stained amniotic fluid (MSAF) occurs in approximately 10% to 15% of all deliveries, predominantly in term and post-term pregnancies. A study conducted in Southwestern Nigeria reported that MAS accounted for 6.1% of neonatal cases [13].

Meconium aspiration syndrome's reported incidence and prevalence vary widely within African contexts. On the other hand, incidence rates expressed per 1,000 live births are frequently reported in South African facility-based research; these rates typically range from 2 to 11 per 1,000, suggesting population-level occurrence within larger birth cohorts. All things considered, these results show that meconium aspiration syndrome continues to be a major cause of newborn morbidity and mortality in sub-Saharan Africa, with reported variations mostly impacted by variances in study populations, healthcare settings, and methodological techniques[14].

In Ethiopia, the prevalence of MSAF has been reported to range from 12.1% to 24.7%, which exceeds global estimates. Additionally, cases involving MSAF are associated with higher rates of operative deliveries, birth asphyxia, neonatal sepsis, and admissions to neonatal intensive care units[15].

2.2 Associated Factors of Meconium Aspiration Syndrome

2.2.1 Socio-demographic characteristics

A study conducted at the Government General Hospital in Anantapuramu, Andhra Pradesh, reported that MAS accounted for 1.4% of all Neonatal Intensive Care Unit (NICU) admissions. During the study period, seventy-two newborns were analyzed, of whom 55.6% (n=40) were female. Similarly, a study on the prevalence of meconium-stained amniotic fluid and its associated factors among women who gave birth at term in Felege Hiwot Comprehensive Specialized Referral Hospital, Northwest Ethiopia, found that nearly two-thirds of mothers, 344 (69.5%), were over 30 years old, and 403 (81.4%) were from urban areas. Another study identified 72 newborns with MAS, of whom 11 (15.3%) were born asymptomatic but developed respiratory distress within their first hours of life [11,16].

2.2.2 Neonatal factor

A study conducted by Irfan Waheed et al. included seventy-two neonates diagnosed with MAS. The mean gestational age was 37 ± 0.56 weeks, and the mean birth weight was 2.87 ± 0.49 kg. The male-to-female ratio was 1.57:1, and the mean age at admission was 9.59 ± 5.27 hours. Chemical pneumonitis, persistent pulmonary hypertension (PHN), and a combination of chemical pneumonitis with PHN were observed in 23.6%, 20.8%, and 26.4% of neonates, respectively. The overall mortality rate was 19.44%, with the highest mortality seen in neonates having chemical pneumonitis with PHN , followed by the chemical pneumonitis group and the PHN group [10].

Meconium proteins and fatty acids deactivate surfactant, leading to atelectasis and lung complications. The resulting reduction in surfactant production exacerbates poor lung compliance, contributing to respiratory failure in MAS. Administration of exogenous surfactant is believed to improve lung function and oxygenation in neonates with severe MAS [16].

Meconium-stained amniotic fluid (MSAF) is infrequently observed before 34 weeks of gestation, occurring in only about 2% of neonates delivered before 37 weeks. However, its prevalence rises significantly in post-term pregnancies, affecting approximately 44% of neonates born after 42 weeks. In pregnancies extending beyond 42 weeks, the incidence of MSAF can range from 23% to 52%[17].

The Neonatal Resuscitation Program (NRP) is widely recognized and implemented across the globe as an effective strategy to enhance neonatal outcomes and mitigate complications associated with MAS. Infants who receive care aligned with NRP guidelines have demonstrated improved outcomes, including shorter hospital stays, higher Apgar scores, reduced need for mechanical ventilation, lower mortality rates, and decreased levels of meconium in the amniotic fluid when compared to those managed with conventional care approaches[18].

2.3 Maternal factor

Several maternal and fetal conditions are known to predispose the fetus to intrauterine passage of meconium, leading to Meconium-Stained Amniotic Fluid (MSAF). These include uteroplacental insufficiency, maternal hypertension, umbilical cord entanglement, oligohydramnios, diabetes mellitus, post-term pregnancy, intrauterine growth restriction (IUGR), antepartum hemorrhage, anemia, and tobacco use [19].

Concerning maternal health status, one study reported that 7.1% of participants had diabetes, 13% had urinary tract infections, and 4.76% tested positive for hepatitis B, while 90.65% were negative and 4.59% had an unknown status. Notably, women with normal hematocrit levels were 83% less likely to experience MSAF compared to anemic women . Furthermore, mothers who encountered prolonged labor were 7.5 times more likely to deliver with MSAF, and those with obstructed labor were 3.6 times more likely to have MSAF than those without such complications [20].

Additional contributing factors to MAS include post-term pregnancy, preeclampsia, placental insufficiency, maternal diabetes, black ethnicity, maternal smoking, and oligohydramnios [21]. The presence of meconium during labor often raises concerns about fetal distress, which frequently influences the mode of delivery. This concern has been linked to increased rates of cesarean sections, even in healthcare settings equipped with advanced intrapartum fetal monitoring techniques such as cardiotocography and fetal blood sampling [22].

Although many studies have investigated the risk factors for MAS, some inconsistencies remain. While certain studies have identified thick meconium, low Apgar scores at both 1 and 5 minutes, and non-reassuring fetal heart rate patterns as significant indicators, others have not. For instance, factors such as oligohydramnios and male sex were implicated in some studies but not validated in others. Nonetheless, with vigilant antenatal care, timely management of labor complications, and prompt neonatal resuscitation, MAS is considered largely preventable. Yet, despite these efforts, the condition still persists [23].

Moreover, other identified predisposing conditions are prolonged labor (lasting more than 12 hours), pregnancy-induced hypertension, placental insufficiency, preeclampsia, maternal age, IUGR, diabetes mellitus, antepartum hemorrhage, premature rupture of membranes, and obstructed labor [24].

A meta-analysis of 14 randomized controlled trials indicates that elective induction of labor for pregnancies at or beyond 41 weeks is associated with a significant reduction in the incidence of Meconium Aspiration Syndrome and a lower rate of perinatal deaths, compared to expectant management [25].

2.4 Conceptual Frame Work of the Study

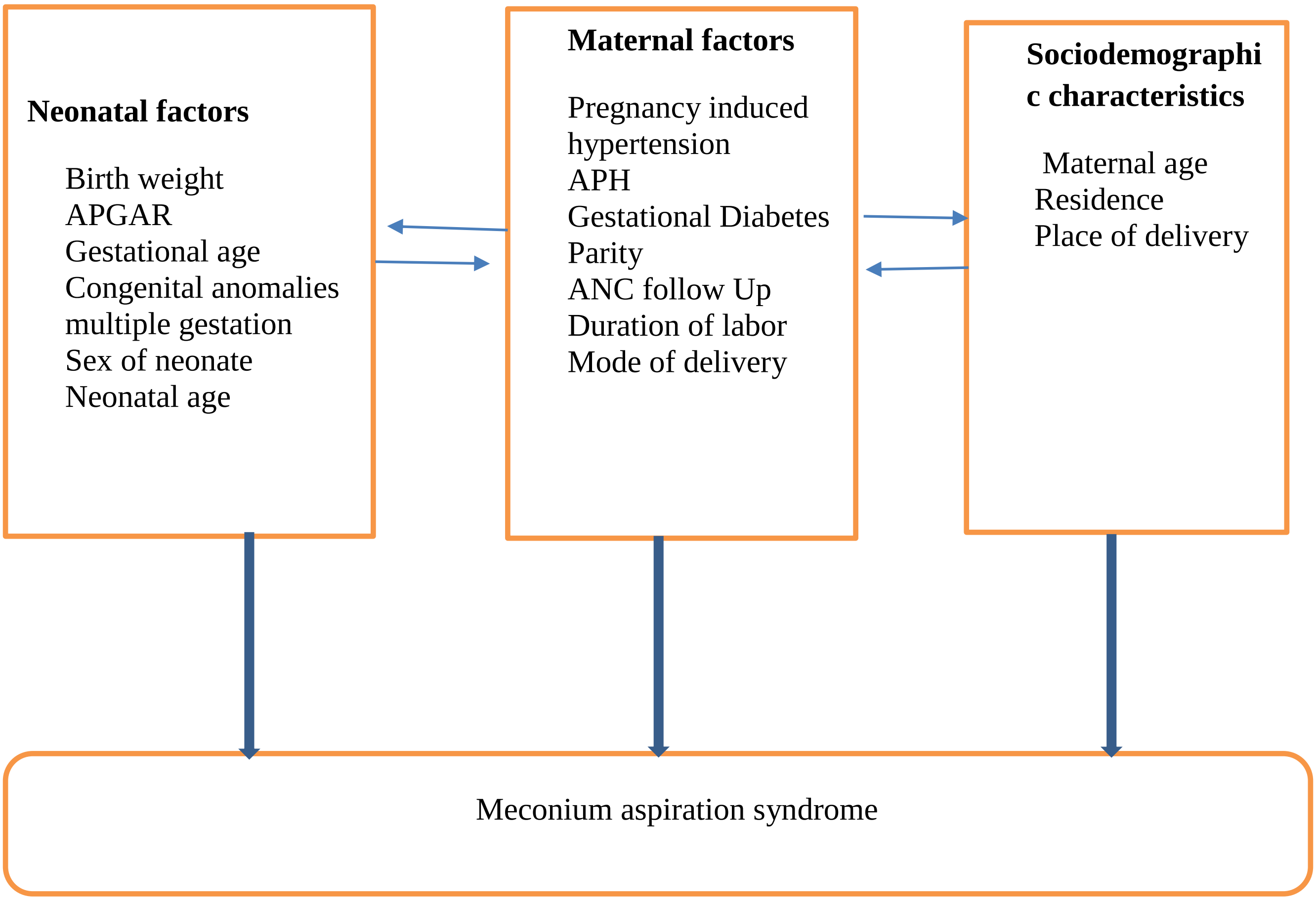

Figure 1:Schematic presentation of conceptual frame work of MAS and associated risk factors among neonate admitted to NICU at ARTH developed by reviewing related literatures

3. OBJECTIVES

3.1 General objectives

To assess the magnitude and associated factors of meconium aspiration syndrome among neonates admitted to Asella Referral and Teaching Hospital, Southeast Ethiopia, from September 2024 to November 2025.

3.2 specific objectives

To determine the magnitude of Meconium Aspiration Syndrome among neonates admitted to the NICU at Asella Referral and Teaching Hospital .

To identify factors associated with meconium aspiration syndrome among neonates admitted to the NICU at Asella Referral and Teaching Hospital .

4. METHODS

4.1 Study Area

The study was conducted at Arsi University, College of Health Sciences , Asella Referral and Teaching Hospital, located in the town of Asella. Asella is a town in central Ethiopia, situated in the Arsi Zone of the Oromia Region, about 175 kilometers from Addis Ababa, the capital city of the country. Arsi University is one of the young universities in Ethiopia, established in 2014. Since 1964, Asella Referral and Teaching Hospital has been serving the populations in Arsi and nearby zones, covering a current population of approximately 3.8 million. The hospital has 321 beds with more than six departments, including Internal Medicine, Surgery, Pediatrics, Gynecology and Obstetrics, Orthopedics, and Oncology. It is involved in training undergraduate and postgraduate students in various specialties across four major departments (Internal Medicine, Surgery, Pediatrics and Child Health, and Gynecology and Obstetrics). The hospital has been improving its health service delivery and currently provides modern diagnostic services such as digital X-rays, portable X-ray, different types of ultrasound, echocardiography, computerized tomography scan, and culture services. The Department of Pediatrics and Child Health has 50 ward beds and 40 NICU beds, which are functional 24 hours. The NICUstaff includes 12 pediatricians, 23 residents, and 21 nurses, 10 of whom are specialized neonatal nurses.

4.2 Study design and period

A cross-sectional study was conducted from September 2024 to November 2025 in the NICU of Asella Referral and Teaching Hospital, Ethiopia.

4.3 Source and Study population

4.3.1 Source population

All neonates admitted to the Neonatal Intensive Care Unit of Asella Referral and Teaching Hospital during the study period.

4.3.2 Study population

All selected neonates admitted to the Neonatal Intensive Care Unit of Asella Referral and Teaching Hospital during the study period ,who fulfill Inclusion criteria.

4.4 Eligibility criteria

4.4.1 Inclusion criteria

All neonates admitted to the NICU at Asella Referral and Teaching Hospital during the specified Study period were included .

4.4.2. Exclusion criteria

- ✓ Neonatal records with incomplete or missing key data or admitted outside the study period.

- ✓ Neonates with major congenital anomalies (e.g., congenital heart disease, diaphragmatic hernia, chromosomal abnormalities).
- ✓ Neonates with a confirmed diagnosis of early-onset sepsis or congenital pneumonia as the primary cause of respiratory distress.

4.5 Sample size estimation and Sampling Procedures

4.5.1 Sample size estimation

A single population proportion formula was used to calculate the sample with the following

Assumption: - p = proportion of neonates with meconium aspiration syndrome 23.43% from Previous research and by considering 95% confidence interval (CI) with level of precision Zα/2=1.96, p value 0.05, margin of error 0.05 and

$$\mathbf{n}=\frac{\boldsymbol{Z^2 x p(1-p)}}{\boldsymbol{d^2}}$$

$$n=\frac{(1.96)^2 x 0.2343 \ x \ (1-0.2343}{(0.05)^2}$$

Where n = required sample size

Z = Z-score for 95% confidence level = 1.96

p= estimated prevalence (from previous study = 23.43% or 0.2343)

d = margin of error (commonly 5% or 0.05

The calculated sample size is 276 neonates with Meconium Aspiration Syndrome. I can also add 10% for non-response or incomplete records, making the final sample size: 276+ (276×0.1) =304

For the second objective sample size was calculated using double population proportion formula usingEpi-info software version 7.2 (stat Cal) using two-sided confidence level ratio (unexposed to exposed) =1 with the following assumptions; confidence level of 95%, power = 80%, and adding 10% non-response rate.

Table 1:Sample size determination for factor associated MAS among children admitted to NICU

Variables	Exposed	unexposed	OR	Sample size
Thick meconium	65%	35%	30.902	122
1st min Low APGAR score	47.1%	22.4	3.084	136

This sample size is less than the sample size from the first objective which was 304. Therefore the final sample size used for this study was the sample size that was obtained from the first objective that is 304.

4.5.2 Sampling Procedures

The study population was derived from the charts of 1,674 neonates admitted to the NICU during the study period. A sample of 304 neonates was selected using a systematic random sampling technique. The sampling interval (k) was calculated using the formula: $k=N/n=1674/304\approx5.5\approx6$.A complete list of neonates, arranged by their Medical Registration Number (MRN), was used as the sampling frame. The first neonate was selected randomly from the first Six MRNs using a lottery method. Thereafter, every 6th neonate was included until the desired sample size of 304 was reached.

4.6. Study variables

4.6.1. Dependent variable:

Meconium Aspiration Syndrome .

4.6.2. Independent variable:

Sociodemographic characteristics: Maternal age, Residence and place of delivery

Maternal factors: Pregnancy induced hypertension , APH, Gestational Diabetes, Parity ,ANC follow Up,Duration of labor and Mode of delivery

Neonatal factors: Birth weight,APGAR, Gestational age, Congenital anomalies, multiple gestation ,age of neonates and Sex of neonate

4.7 Operational definition

Incomplete Medical Record: A neonatal record that lacks at least patient identification, maternal and neonatal birth history, medical diagnosis of the neonate, amniotic fluid status, APGAR score, birth weight (BW) and gestational age (GA) missing at least two of these key elements.

Meconium Aspiration Syndrome (MAS): A clinical diagnosis documented in the neonate's chart based on the presence of meconium-stained amniotic fluid and respiratory distress.

Low APGAR: A quick assessment of a newborn's overall health conducted at 1 and 5 minutes after birth, evaluating breathing effort, heart rate, muscle tone, reflexes, and skin color.

Perinatal Asphyxia: Failure to establish breathing at birth, accompanied by clinical and biochemical evidence of hypoxia.

Persistent Pulmonary Hypertension of the Newborn (PPHN): A failure of the normal circulatory transition at birth, where pulmonary vascular resistance remains abnormally elevated, causing right-to-left extrapulmonary shunting of blood and severe hypoxemia.

Prolonged Labor: Labor lasting more than 20 hours for primiparous (first-time) mothers and more than 14 hours for multiparous mother

4.8 Data Collection Procedures

An organized, data extraction checklist was developed based on previous relevant literature. Data was collected through a retrospective record review using the structured checklist. The tool will consist of three sections:

Section I: Socio-demographic characteristics of the mother and neonate

Section II: Neonatal-related factors

Section III: Maternal-related factors

Three health professionals with BSc degrees and one pediatric Resident R1, working in the pediatric ward, were recruited as data collectors. They received a one-day training session covering the study objectives, ethical considerations, and the data collection procedures. Patient charts were retrieved using registration numbers found in the neonatal logbook. The required data was extracted by reviewing the medical records of eligible neonates.

4.9. Data quality assurance

The adapted checklist was approved by the advisors, and data collectors received one days of training on the study's objectives and the eligibility criteria for the study population prior to data collection. Additionally, a pre-test was conducted with 15 neonates at Rehobot hospital to assess the clarity, completeness and applicability of the data collection tool. Based on the findings, necessary modifications were made. During data collection, the principal investigator conducted daily random checks on completed checklists to ensure data completeness and consistency. Any discrepancies identified was resolved by revisiting the original patient charts.

4.10. Data processing and analysis

All collected data were checked for completeness, and the data were coded and entered into EpiData version 4.7, and were exported into SPSS version 27 statistical software for analysis. To summarize a data descriptive statistics such as frequencies and percentages were performed, and results were presented in tables and charts. Logistic regression analysis was performed to identify the independent risk factors associated with MAS. An initial bivariate logistic regression analysis was performed to assess associations between the dependent variable and each independent variable. The independent variables with p values less than 0.25 in the initial bivariate logistic regression analysis were considered for further analysis. For categorical data, multicollinearity was checked by using standard error (SE), and For linear data, multicollinearity was checked using the variance inflation factor (VIF). Goodness of fitness was checked using the Hosmer-Lemeshow test.

The strength of associations between the MAS and independent predictor variables was assessed by using multivariable logistic regression at 5% significance level. Adjusted odds ratios (AORs) with 95% confidence intervals and a P value less than 0.05 were used to declare the statistical significance of the observed associations. All tests were done in two-sided, and variables with P-values <0.05 in the multivariable analysis were statistically significant.

4.11 Ethical clearance

Ethical clearance was obtained from the Institutional Research Ethical Review Board (IRB) of Arsi University, College of Health Sciences and accredited by CoHS/226/2025. Official written permission was also secured from the management of Asella Referral and Teaching Hospital. Anonymity was assured on the data retrieval form by omitting names, telephone numbers and chart numbers of patients, and confidentiality of the information from individual charts is maintained.

4.12 Dissemination plan

After research completion and finalizing report, this study will be presented to the department of pediatrics and child health and public health, as part of pediatrics and child health specialty thesis at Arsi University and submitted to post graduate programs coordinating office of college of health sciences of Arsi University and other stake holders for possible application and publication of the study.

5. RESULTS

5.1 Sociodemographic, Maternal and Birth Characteristics

A total of 304 participants were planned to be included in the study. Of these, 295 neonate data were collected, giving a response rate of 97%. Nine neonates were excluded due to a chart being lost. A total of 295 mothers were included and the majority of mothers were aged 20–34 years, 252 (85.4%) indicating that most deliveries occurred among women in the optimal reproductive age group. Mothers aged ≥35 years constituted 33 (11.2%) of the study population, whereas adolescent mothers aged ≤19 years accounted for 10 (3.4%) of the study . Overall, the distribution shows that maternal age was predominantly concentrated in the 20–34 year age group, with relatively fewer mothers at the extremes of reproductive age. 239 (81%) resided in rural areas, while 56(19%) resided in urban areas

Government hospitals were the most common place of delivery, accounting for nearly three-quarters of all births 220(74.6%). Health centers contributed 54 deliveries (18.3%). In contrast, deliveries in private hospitals 11 (3.7%) and home 10(3.4%) were relatively uncommon. Deliveries were primarily attended by skilled health professionals (96.6%), with a small proportion attended by untrained personnel (3.4%).

The majority of mothers were multiparous, 269 (91.18%) reporting more than one previous birth, while 26 (8.81%) were primiparous. Notably, all mothers (100%) had attended antenatal care (ANC) during the pregnancy and Most of them ,97% have more than 3 visit.

The majority of mothers delivered through spontaneous vaginal delivery, 264 (89.5%). Cesarean section was performed 31 (10.5%) mothers . Overall, these findings indicate that spontaneous vaginal delivery was the predominant mode of delivery.

The majority of mother had blood group O (41.7%), followed by AB (27.8%), A (25.4%), and B (5.1%). Almost all mothers were Rh positive (98.6%). Most mothers had no medical complications during pregnancy (95.3%), while a small number had diabetes (1.4%), cardiac disease (1.4%), chronic hypertension (1.4%), or were HIV positive (0.7%)

Table 2: Sociodemographic, Maternal and birth characteristics among mothers with neonates admitted at NICU to Asella Referral and Teaching Hospital.

Variable	Category	**Frequency (n)=295**	**Percentage (%)**
Maternal age (years)	≤19	10	3.4
	20–34	252	85.4
	≥35	33	11.2
Residence	Rural	239	81.0
	Urban	56	19.0
Place of delivery	Government hospital	220	74.6
	Health center	54	18.3
	Private hospital	11	3.7
	Home	10	3.4
Birth attendant	Skilled health professional	285	96.6
	Untrained personnel	10	3.4
Parity	Primiparous	26	8.8
	Multiparous	269	91.2
ANC follow-up	Yes	295	100.0
Number of ANC	>= 3	286	97
Mode of delivery	Spontaneous vaginal delivery	264	89.5
	Cesarean section	31	10.5
Maternal blood group	O	123	41.7
	AB	82	27.8
	A	75	25.4
	B	15	5.1
Rh factor	Rh positive	291	98.6
	Rh negative	4	1.4
Medical complications during pregnancy	No complications	281	95.3
	Diabetes mellitus	4	1.4
	Cardiac disease	2	0.7
	Chronic hypertension	6	2.1
	HIV positive	2	0.7

5.2 Maternal and Neonatal Complications

From obstetric-related complications, 67 mothers (22.7%) had at least one obstetric complication.From that , meconium-stained amniotic fluid (MSAF) was the most frequent complication, occurring in 28 (9.5%) followed by pregnancy-induced hypertension (PIH) in 19 (6.4%), placenta previa in 17 (5.8%) and abruption placenta in (1%). The majority of mothers had intrapartum rupture of membranes (86.4%) and the rupture occurred spontaneously in 97.3%, whereas only 2.7% had artificial rupture of membranes . Regarding labor , 86.8% of mothers had spontaneous labor, whereas 6.4% were induced and 6.8% required augmentation. Labor duration was ≤18 hours for 86.4% of mothers and exceeded 18 hours in 13.6% of cases. Intrapartum antibiotics were administered in 10.5% of mothers.

From all mother , 31 (10.5%) gave birth by cesarean section. The most common indication for cesarean delivery was non-reassuring fetal heart rate pattern, accounting for 18 (6.1%) then Cephalopelvic disproportion was 7 mothers (2.4%), followed by failed instrumental delivery in 4 mothers (1.4%) and Unspecified indications accounted for 2 cases (0.7%).

APGAR scores were documented for 285 neonates (96.6%). Among these, the majority 262 (88.8%) had a normal APGAR score at birth, while 23 neonates (7.8%) had a low APGAR score and 10 neonates (3.4%) were not documented. Only a small proportion of neonates, 21 (7.1%) required resuscitation at birth. In addition, congenital anomalies were documented in 7 neonates (2.4%) of the study.

Table 3:Maternal and neonatal complications among mothers with neonate admitted at NICU To Asella Referral andTeaching Hospital

Variable	**Category**	**Frequency (n)=295**	**Percentage (%)**
Any obstetric complication	Yes	67	22.7
	No	228	77.3
Typeofobstetric complication	MSAF	28	9.5
	Pregnancy-induced hypertension (PIH)	19	6.4
	Placenta previa	17	5.8
	Abruptio placentae	3	1.0
Ruptureofmembranes Intrapartam	Yes	255	86.4
	No	40	13.6
Type of ROM	Spontaneous ROM	288	97.3
	Artificial ROM	7	2.7
Onset of labor	Spontaneous	256	86.8
	Induced	19	6.4
	Augmented	20	6.8
Duration of labor	≤18 hours	255	86.4
	>18 hours	40	13.6
Intrapartum antibiotics	Yes	31	10.5
	No	264	89.5
Mode of delivery	Vaginal delivery	264	89.5
	Cesarean section	31	10.5
Indication for cesarean	Non-reassuring fetal heart rate	18	6.1
	Cephalopelvic disproportion	7	2.4
	Failed instrumental delivery	4	1.4
	Unspecified	2	0.7
APGAR score documented	Yes	285	96.6
	No	10	3.4
APGAR score at birth	Normal	262	88.8
	Low	23	7.8
	Unknown	10	3.4
Resuscitation at birth	Yes	21	7.1
	No	274	92.9
Congenital anomalies	Yes	7	2.4
	No	288	97.6

5.3 Newborn Characteristics

From 295 neonates , 181 (61.4%) were born at term while 114 (38.6%) were preterm. The majority of neonates, 285 (96.6%) were assessed within the first 24 hours of life, whereas only 10 (3.4%) were aged 24 hours or older at the time of admission.

Regarding sex distribution, 172 neonates (58.3%) were female and 123 (41.7%) were male.Neonates of 200 (67.8%) had a normal birth weight (2500–4000 g), 85 (28.8%) were low birth weight (<2500 g) and 10 neonates (3.4%) birth weight were unkown.

All neonates were delivered from singleton pregnancies and 174 (59.0%) were initiated on breastfeeding within the first hour of birth, while 121 (41.0%) did not receive breastfeeding within the first hour after delivery. From all neonates,245 (82.2%) received routine newborn care, 40 (13.4%) underwent oropharyngeal suctioning and 10 (3.4%) had unknown delivery room performance.

Among the 295 neonates , 34 (11.5%) received oxygen treatment at birth while the majority, 261 (88.5%) did not receive oxygen therapy.Out of 295 neonates , 220 (74.6%) were referred from other health facilities while 75 (25.4%) were admitted without referral. From all neonates, 56 (18.98.0%) were diagnosed with Meconium Aspiration Syndrome (MAS), while the majority, 239 (81.02%), were not

Table 4:Newborn Characteristics of Neonates admitted at NICU to Asella Referral and Teaching Hospital

Variable	**Category**	**Frequency (n)=295**	**Percentage (%)**
Gestational age	Term	181	61.4
	Preterm	114	38.6
Age at admission	< 24 hours	285	96.6
	≥ 24 hours	10	3.4
Sex of neonate	Female	172	58.3
	Male	123	41.7
Birth weight	Normal (2500–4000 g)	200	67.8
	Low birth weight (<2500 g)	85	28.8
	Unknown	10	3.4
Type of pregnancy	Singleton	295	100.0
Breastfeeding initiation	Within 1 hour	174	59.0
	After 1 hour	121	41.0
Delivery room performance	Routine newborn care	245	82.2
	Oropharyngeal suctioning	40	13.4
	Unknown	10	3.4
Oxygen therapy at birth	Yes	34	11.5
	No	261	88.5
Referral status	Referred	220	74.6
	Not referred	75	25.4
MeconiumAspiration Syndrome (MAS)	Yes	56	19
	No	239	81

5.4 Magnitude of Meconium Aspiration Syndrome

The magnitude of neonates diagnosed with meconium aspiration syndrome (MAS) was 19% at 95% confidence interval. It highlights the significant proportion of neonates affected by this condition.

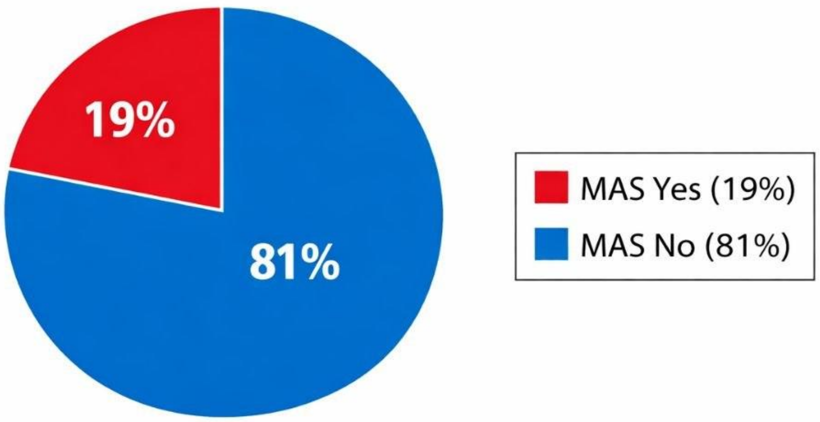

Figure 2: Magnitude of MAS among Neonates admitted to the NICU at Asella Referral and Teaching Hospital

5.5 Factors Associated with Meconium Aspiration Syndrome

Variables associated with meconium aspiration syndrome were identified using bivariate and multivariable logistic regression analysis of data collected from mothers and their neonates during pregnancy and delivery. Bivariate analysis showed that as maternal age increased, the likelihood of a neonate developing MAS decreased. Neonates born to mothers older than 35 years had 72% lower odds of developing MAS compared to those born to mothers younger than 35 years (COR = 0.28, 95% CI: 0.09–0.86, $p = 0.026$). Neonates delivered at term (≥37 weeks) were more likely to develop MAS compared to preterm neonates (<37 weeks) (COR = 2.46, 95% CI: 1.05–5.81, $p = 0.039$).

Although male neonates had 1.4 times the odds of developing MAS compared to female neonates (COR = 1.42, 95% CI: 0.61–3.32, $p = 0.219$). Similarly, neonates who required resuscitation at birth were 2.5 times more likely to develop MAS than those not resuscitated (COR = 2.52, 95% CI: 0.75–8.51, $p = 0.137$). Neonates who were breastfed within one hour of delivery had 71% less risk of developing MAS compared to those who started breastfeeding after the first hour (COR = 0.29, 95% CI: 0.06–1.33, $p = 0.111$).

Neonates who came with referral had 71% lower odds of MAS compared to non-referred neonates (COR = 0.29, 95% CI: 0.07–1.28, $p = 0.103$). Neonates born to mothers residing in urban areas had 67% lower odds of developing MAS compared to those from rural areas (COR = 0.33, 95% CI: 0.11–1.01, $p = 0.051$). Conversely, neonates with other medical complications had significantly lower odds of MAS (COR = 0.25, 95% CI: 0.03–0.92, $p = 0.078$).

After adjusing for confounders in a Multivariable logistic regression analysis indicated that several factors were independently associated with MAS. Maternal age demonstrated a statistically significant inverse relationship, with each one-year increase reducing the odds of MAS by 72% (AOR = 0.28, 95% CI: 0.09–0.86, $p = 0.026$). Term gestational age (≥37 weeks) was associated with higher odds of MAS (AOR = 2.46, 95% CI: 1.05–5.81, $p = 0.039$). Exposure to meconium-stained amniotic fluid (MSAF) was strongly associated with MAS, with affected neonates being 33 times more likely to develop the condition compared to those without exposure (AOR = 33.36, 95% CI: 8.61–129.16, $p < 0.001$). Neonates who required oxygen therapy immediately after birth had substantially higher odds of developing MAS (AOR = 29.41, 95% CI: 5.02–172.37, $p < 0.001$).

Table 5:Factor associated with MAS among Neonate admitted at NICU To Asella Referral and Teaching Hospital

Variable	**Category**	**MAS**		**COR (95% CI)**	**P-value**	**AOR (95% CI)**	**P-value**
		No	**Yes**				
Maternalage (years)	≤19	7	3	0.28 (0.09–0.86)	0.026*	0.28 (0.09–0.86)	0.026*
	20–34	202	50	1		1	
	≥35	30	3	1		1	1
Residence	Rural	190	49	0.37 (0.11–1.22)	0.102	2.20 (0.88–5.51)	0.093
	Urban	49	7	1		1	1
MSAF	No	229	38	33.36 (8.61–129.16)	<0.001*	33.36 (8.61–129.16)	<0.001*
	Yes	10	18	1		1	
Resuscitation at birth	No	225	49	2.52 (0.75–8.51)	0.137	0.54 (0.19–1.51)	0.237
	Yes	14	7	1		1	
Sex of neonate	Male	155	22	1.42 (0.61–3.32)	0.219	2.10 (1.01–4.38)	0.48
	Female	84	34	1		1	
Gestational age	Term	178	37	2.46 (1.05–5.81)	0.039*	2.46 (1.05–5.81)	0.039*
	Preterm	61	19	1		1	
Other medical complication	No complication	203	55	0.25 (0.003–0.92)	0.18*	0.04 (0.003–0.92)	0.078
	Oliguria	25	1	1		1	
	Unspecified	11	0	1		1	
Oxygen treatment at birth	No	227	34	29.41 (5.02–172.37)	<0.001*	29.41 (5.02–172.37)	<0.001*
	Yes	12	22	1		1	
Early initiation of breastfeeding	≤1 hour vs >1 hour	—	—	0.29 (0.06–1.33)	0.111	0.70 (0.32–1.50)	0.355
Referral status	Yes	177	43	0.29 (0.07–1.28)	0.103	0.99 (0.42–2.31)	0.977
	No	62	13	1		1	

*Significant with P <0.05 and ** Significant with P<0.001, CI= Confidence Interval, COR= Crude Odds Ratio, AOR= Adjusted Odds ratio

6.DISCUSSION

The present study found that the magnitude of neonates diagnosed with MAS in this study was 19%, indicating a significant proportion of neonates affected by this condition,this shows that lower than study done at Neonatal Intensive Care Unit of Wachemo University Nigist Eleni, Comprehensive Specialized Hospital, Southern Ethiopia,30.6% [21] and This study's prevalence is also in line with the study done at Jimma university specialized teaching hospiatal , where the prevalence of MAS was 19.9% [26]. The similarities might be due to comparable obstetric care and neonatal management protocols in these healthcare settings. But there is a study conducted at Wolkite university where the prevalence is higher than this study, 28.7 %. The higher prevalence is due to the population used for the study, where all the participants were those who passed through MSAF [27]. However, our study was higher than a study conducted in Nigeria (10.8%) by Okonkwo et al. (2019) , Tanzania (12.5%) [28].The discrepancy in prevalence rates may be attributed to differences in neonatal care quality, obstetric practices, and facility-level capabilities in managing intrapartum complications Higher prevalence rates in our study compared to some studies in Africa could be due to delayed recognition of fetal distress and inadequate access to timely cesarean delivery.

This study investigated risk factors associated with Meconium Aspiration Syndrome in neonates. The findings revealed significant associations between MAS and MSAF, Oxygen therapy, and Gestational age. The presence of meconium-stained amniotic fluid showed a strong and statistically significant association with MAS. Neonates exposed to MSAF were 33.36 times more likely to develop MAS compared with neonates without MSAF exposure (AOR = 33.36; 95% CI: 8.61–129.16; $p < 0.001$).

This is consistent with other studies done in our country showing similar health service settings, and it is likely due to insufficient intrapartum monitoring and follow-up in rural clinics, which allowed moderate meconium to persist and become thick [29]. This showed the sharing of many conditions, like having similar health service systems, including delayed referrals and home births, and challenges like limited access to cesarean sections and inadequate labor follow-up and monitoring. Similar findings were also documented in studies all over the world But, there are studies done in India and Europe that showed a reduction in the prevalence of meconium staining of amniotic fluid and MAS. This is due to the consistent use of protocol in monitoring labor, fetal and neonatal status, and timely interventions, like immediate action on neonatal resuscitation. It is the advanced fetal and labor monitoring in the developed countries that enabled early detection of distress, preventing progression to thick meconium [29].

Gestational age was significantly associated with MAS. Neonates born at ≥37 weeks of gestation had 2.46 times higher odds of developing MAS compared with those born before 37 weeks (AOR = 2.46; 95% CI: 1.05–5.81; $p = 0.039$) in my study. This association is consistent with existing knowledge. Accordingly, a study done on neonates admitted to the neonatal intensive care unit at Northwest Ethiopia comprehensive specialized hospitals, North west Ethiopia shows that the odds of having MAS among neonates with ≥41 weeks of gestation were 4.7 times more likely to have MAS than neonates with less than 37 weeks [30]. The study done at the University of California, San Francisco, also shows that the risk of MAS increased progressively, from 1.3% at 38 weeks to 4.8% at 42 weeks. For each additional week of gestational age, the risk of MAS increased by 30%. Other colleagues have also noted a progressive increase in MAS in prolonged pregnancies beyond 40 weeks [31].

A study on clinical profile states that,Higher birth weight (>2.5 kg) was significantly associated withworse outcomes/mortality in MAS cases. Term and post-term neonates with higher birth weights represent a group at particular risk for severe [32].

The study done at the Burgundy perinatal network also shows that the incidence of MSAF linearly increased with GA. The rate of MSAF was 3.52% at 37-38 WG versus 9.07% at 39–41 WG (OR = 2.74 [2.56 to 2.92, P < 0.0001]) and 14.37% at 42-43 WG (OR = 4.60 [4.03 to 5.26; P < 0.001]) [33].

According to Manivannan V., Jegan Murugan R., Devandiran RS ,MAS was more common in term and post-term neonates, particularly those with gestational age around 38–40 weeks, and with birth weight > 2.5 kg, indicating that maturity and larger birth weight are associated with higher MAS incidence[34].

my study, neonates who required oxygen therapy immediately after birth had substantially higher odds of developing MAS. These neonates were approximately 29 times more likely to develop MAS than those who did not receive oxygen therapy (AOR = 29.41; 95% CI: 5.02–172.37; $p < 0.001$). The study done at the Neonatal Intensive Care Unit, Pediatrics Hospital, Centro Hospitalar at Portugal also shows consistent with my study.Newborns with severe MAS required more days of oxygen therapy (p < .001) and higher maximum fraction of inspired oxygen (FiO2) (p ¼ .004) [35]. Oxygen administration is the primary treatment for MAS in many mild cases, it may be the only therapy needed. Oxygen saturations should be targeted within the range of 90–95%.[36].

The study done at three tertiary care neonatal intensive care units (NICUs) in Hyderabad, Telangana, India, show that There was an increased duration of oxygen therapy (median 45.5 [28.0-78.3] vs 26 [20.0-48.0] hours; P = .001) 5-10 L/min hood oxygen supplied and Bubble NCPAP in comparison with with MAS reduces the need for mechanical ventilation in the first 7 days of life [36].

An observational study conducted in India found that continuous positive airway pressure (CPAP) was successful in treating the majority of neonates with MAS. Its effectiveness was linked to less respiratory decline and a lower incidence of complications.

CPAP is considered a highly effective therapy for moderate-to-severe MAS, providing benefits compared to mechanical ventilation by reducing the risk of associated complications.Moreover, early use of CPAP enhances respiratory outcomes and minimizes the need for invasive ventilatio.[37]

7. STRENGTHS AND LIMITATION

7.1 Strength

It applied multivariable logistic regression to adjust for potential confounders, improving result validity. In addition, the study setting, a tertiary referral hospital, ensures a well-documented dataset with standardized neonatal care protocols.

7.2 Limitation

This study has some limitations that should be acknowledged. The relatively small sample size can influence the precision of our estimates. The study design and the setting of the study have its own influence which we believe should be considered. Furthermore, the study relied on medical records, which may have potential misclassification bias in some variables.

*8. **CONCLUSION AND RECOMMENDATIONS***

8.1 Conclusion

Overall, the Magnitude of meconium aspiration syndrome was high. MSAF, Oxygen therapy and Gestational age factors associated with MAS. Future research with larger sample sizes and robust study designs is needed to confirm these findings and explore the underlying mechanisms linking these factors to MAS, particularly on the oxygen therapy and MAS since there is limited data. Understanding these associations can help improve risk assessment, prevention strategies, and management of MAS in neonates.

8.2 *Recommendations*

To ARTH

- ✓ Strengthen intrapartum fetal monitoring to allow early detection of non-reassuring fetal heart rate patterns and meconium-stained amniotic fluid.
- ✓ Ensure continuous availability of oxygen and essential neonatal resuscitation equipment in delivery rooms and NICUs.
- ✓ Provide regular standardized neonatal resuscitation training for healthcare professionals working in delivery and neonatal care units.

Zonal Level

- ✓ Strengthen supervision and support to ensure adherence to intrapartum and neonatal care guidelines.
- ✓ Coordinate refresher training and capacity-building programs on neonatal resuscitation across health facilities.

Regional Level

- ✓ Strengthen regional programs aimed at improving intrapartum and neonatal care services to prevent MAS.
- ✓ Promote multicenter longitudinal studies to establish causal relationships between identified risk factors and MAS.

For Future Researchers

- ✓ To use the findings of this study as baseline evidence to design prospective and longitudinal studies that further investigate risk factors, outcomes and preventive strategies for meconium aspiration syndrome.

.

9.Reference

[1] K. S. Rao, S. Pathapati, C. Vansipriya, and P. G. Student, “A. Moeed, H. Lohana, S. Urooj, S. Ahmed, K. Ahmed, en K. Humayun, ‘Frequency and Outcome of Meconium Aspiration Syndrome in Babies Born with Meconium-Stained Liquor at Secondary Care Hospital in Pakistan: A Case Series Study’, Open J. Pediatr., vol 10, no,” *Indian Journal of Obstetrics and Gynecology Research*, vol. 4, no. 1, pp. 1–5, 2017, doi: 10.18231/2394-2754.2017.0001.

[2] “Meconium Aspiration Syndrome Among Neonates Admitted In Governmental Hospitals In Addis Ababa Ethiopia 2021,” *Pharmacogn. Mag.*, vol. 75, no. 17, pp. 399–405, 2021.

[3] J. S. Dohbit *et al.*, “Maternal and Fetal Outcomes Following Labour at Term in Singleton Pregnancies with Meconium-Stained Amniotic Fluid: A Prospective Cohort Study,” *Open J. Obstet. Gynecol.*, vol. 08, no. 09, pp. 790–802, 2018, doi: 10.4236/ojog.2018.89082.

[4] T. F. Yeh, “Meconium Aspiration Syndrome: The Core Concept of Pathophysiology during Resuscitation,” *Neonatal Medicine*, vol. 24, no. 2, p. 53, 2017, doi: 10.5385/nm.2017.24.2.53.

[5] C. Monfredini, F. Cavallin, P. E. Villani, G. Paterlini, B. Allais, and D. Trevisanuto, “Meconium aspiration syndrome: A narrative review,” Mar. 01, 2021, *MDPI*. doi: 10.3390/children8030230.

[6] V. Sathenahalli, D. Dwivedi, N. Bajaj, and H. Singh, “Predictors of poor outcome in neonates with respiratory distress,” *Int. J. Contemp. Pediatrics*, pp. 76–79, 2016, doi: 10.18203/2349-3291.ijcp20160092.

[7] N. S. Karpe, M. B. Tagad, R. R. Holkar, and V. S. More, “Evaluation and Association of Meconium-Stained Amniotic Fluid With Fetal Distress,” *Cureus*, May 2025, doi: 10.7759/cureus.83295.

[8] M. Mohan and D. A. V., “Maternal risk factors and perinatal outcome in meconium stained amniotic fluid: a cross sectional study,” *Int. J. Reprod. Contracept. Obstet. Gynecol.*, vol. 7, no. 10, p. 4103, Sep. 2018, doi: 10.18203/2320-1770.ijrcog20184136.

[9] Amrita G, Sheekham R, Ramchard. Incidence, risk factors, and clinical outcome: prospective study . May 2022

[10] M. Shaikh *et al.*, “Detrimental Complications Of Meconium Aspiration Syndrome And Their Impact On Outcome,” 2016. [Online]. Available: Http://Www.Jamc.Ayubmed.Edu.Pk506

[11] D. Addisu, A. Asres, G. Gedefaw, and S. Asmer, “Prevalence of meconium stained amniotic fluid and its associated factors among women who gave birth at term in Felege Hiwot comprehensive specialized referral hospital, North West Ethiopia: A facility based cross-sectional study,” *BMC Pregnancy Childbirth*, vol. 18, no. 1, Oct. 2018, doi: 10.1186/s12884-018-2056-y.

[12] “Health Sector Medium-Term Development and Investment Plan (HSDIP) Health Sector Medium-Term Development and Investment Plan (HSDIP) Health Sector Medium-Term Development and Investment Plan (HSDIP) III Contents,” 2016.

[13] E. Abate, K. Alamirew, E. Admassu, and A. Derbie, “The highest child mortality rates are still seen in Sub-Saharan Africa with a mortality rate (NMR) of 27 deaths per 1,000 live births and MAS is a contributing factor . Research conducted in Southwestern Nigeria revealed that MAS was responsible for 6.1% ,” *Obstet. Gynecol. Int.*, vol. 2021, 2021, doi: 10.1155/2021/5520117.

[14] R. Singh, M. Adhikari, P. Tinarwo, and P. M. Jeena, “Epidemiology and risk factors for acquiring and predicting disease severity in meconium aspiration syndrome,” *SAJCH South African Journal of Child Health*, vol. 16, no. 4, pp. 239–244, Dec. 2022, doi: 10.7196/SAJCH.2022.v16i4.1856.

[15] M. Tefera, D. Birhanu, A. Mihretie, E. Belete, A. Demis, and L. Alemaw, “Magnitude of meconium stained amniotic fluid and associated factors among women who gave birth in North Shoa Zone hospitals, Amhara Region, Ethiopia 2022,” *PLoS One*, vol. 19, no. 2 February, Feb. 2024, doi: 10.1371/journal.pone.0297654.

[16] M. Ahmed, A. Mohammed, and O. Al-Soukhni, “CLINICAL AND ECONOMIC EVALUATION OF SURFACTANT USE IN THE MANAGEMENT OF MECONIUM ASPIRATION SYNDROME IN THE INTENSIVE CARE SETTING IN QATAR Title: Clinical and Economic Evaluation of Surfactant Use in the Management of Meconium Aspiration Syndrome in the Intensive Care Setting in Qatar,” 2020.

[17] L. Luo *et al.*, “Clinical characteristics of meconium aspiration syndrome in neonates with different gestational ages and the risk factors for neurological injury and death: A 9-year cohort study,” *Front. Pediatr.*, vol. 11, Mar. 2023, doi: 10.3389/fped.2023.1110891.

[18] P. Myers and A. G. Gupta, “Impact of the revised NRP meconium aspiration guidelines on term infant outcomes,” *Hosp. Pediatr.*, vol. 10, no. 3, pp. 295–299, 2020, doi: 10.1542/hpeds.2019-0155.

[19] J. S. D, G. Jayasakthi, R. Rai, and R. Banu, “Perinatal outcome of meconium stained amniotic fluid in pregnancy beyond 37 weeks,” vol. 10, no. 2, pp. 624–626, 2021.

[20] L. ; T. Panton H., “Outcome of Neonates with Meconium Aspiration Syndrome at the University Hospital of the West Indies, Jamaica: A Resource-Limited Setting,” *Am J Perinatol*, vol. 34, no. 12, pp. 1250–1254, 2017, doi: 10.1055/s-0037-1603330.

[21] M. Adugna, K. Asmare, and A. Wondim, “Meconium aspiration syndrome and associated factors among neonates admitted at neonatal intensive care unit at Northwest Ethiopia comprehensive specialized hospitals Northwest Ethiopia 2023,” *BMC Pediatr.*, vol. 25, no. 1, Dec. 2025, doi: 10.1186/s12887-024-05181-4.

[22] R. Singh, M. Adhikari, P. Tinarwo, and P. M. Jeena, “Epidemiology and risk factors for acquiring and predicting disease severity in meconium aspiration syndrome,” *SAJCH South African Journal of Child Health*, vol. 16, no. 4, pp. 239–244, Dec. 2022, doi: 10.7196/SAJCH.2022.v16i4.1856.

[23] T. Tantu, D. Zewdu, F. Degemu, and T. Yehualeshet, “after emergency cesarean section : study in a specialized hospital ,” no. March, pp. 1–8, 2023, doi: 10.3389/fped.2023.1149398.

[24] S. Khatua, P. R. Serrao, and E. L. Milano, “Advances in management of meconium aspiration syndrome,” *Indian J. Pediatr.*, vol. 67, no. 11, pp. 837–841, 2020, doi: 10.1007/BF02726230.

[25] S. Awgchew Mamo, T. Mezgebu, T. Eneyew, E. Ezo, and Z. Demisse, “Prevalence and risk factors Associated with Meconium Aspiration Syndrome among neonates admitted to Neonatal Intensive Care Unit in Southern Ethiopia,” *Journal of Pediatrics and Neonatology*, vol. 4, p. 1032, 2023.

[26] M. Adugna, K. Asmare, and A. Wondim, “Meconium aspiration syndrome and associated factors among neonates admitted at neonatal intensive care unit at Northwest Ethiopia comprehensive specialized hospitals Northwest Ethiopia 2023,” *BMC Pediatr.*, vol. 25, no. 1, Dec. 2025, doi: 10.1186/s12887-024-05181-4.

[27] N. Ee, O. Ip, M. Oo, and E. Iu, “Acta Scientific PAEDIATRICS (ISSN: 2581-883X) Meconium Aspiration in a Tertiary Hospital in Southern Nigeria: Incidence, Treatment and Outcome,” 2021.

[28] Mwachaka PM, M.J., Wanyoro AK. X, *Burden and predictors of meconium aspiration syndrome in Kenyan neonates: A tertiary hospital-baseaminuabatd study*. East Afr Med J. , 2021. **98(1)**.

[29] A. Biadgo *et al.*, “Quality of maternal and newborn health care in Ethiopia: a cross-sectional study,” *BMC Health Serv. Res.*, vol. 21, no. 1, Dec. 2021, doi: 10.1186/s12913-021-06680-1.

[30] C. Ward and A. B. Caughey, “The risk of meconium aspiration syndrome (MAS) increases with gestational age at term,” *Journal of Maternal-Fetal and Neonatal Medicine*, vol. 35, no. 1, pp. 155–160, 2022, doi: 10.1080/14767058.2020.1713744.

[31] C. Fischer, C. Rybakowski, C. Ferdynus, P. Sagot, and J. B. Gouyon, “A Population-Based Study of Meconium Aspiration Syndrome in Neonates Born between 37 and 43 Weeks of Gestation,” *Int. J. Pediatr.*, vol. 2019, pp. 1–7, 2019, doi: 10.1155/2012/321545.

[32] R. Fikre, S. Ejeta, T. Gari, and A. Alemayhu, “Determinants of stillbirths among women who gave birth at Hawassa university comprehensive specialized hospital, Hawassa, Sidama, Ethiopia 2019: a case-control study,” *Matern. Health Neonatol. Perinatol.*, vol. 7, no. 1, pp. 1–9, 2021, doi: 10.1186/s40748-021-00128-4.

[33] K. Yokoi, O. Iwata, S. Kobayashi, K. Muramatsu, and H. Goto, “Influence of foetal inflammation on the development of meconium aspiration syndrome in term neonates with meconium-stained amniotic fluid,” *PeerJ*, vol. 2019, no. 5, 2019, doi: 10.7717/peerj.7049.

[34] M. V., J. M. R., and D. R. S., “A study on clinical profile of meconium aspiration syndrome in relation to gestational age and birth weight and their immediate outcome,” *Int. J. Contemp. Pediatrics*, vol. 6, no. 6, p. 2346, Oct. 2019, doi: 10.18203/2349-3291.ijcp20194185.

[35] G. Dini, S. Ceccarelli, F. Celi, C. M. Semeraro, P. Gorello, and A. Verrotti, “Meconium aspiration syndrome: from pathophysiology to treatment,” *Annals of Medicine & Surgery*, vol. 86, no. 4, pp. 2023–2031, Apr. 2024, doi: 10.1097/ms9.0000000000001835.

[36] A. Pandita *et al.*, “Effect of nasal continuous positive airway pressure on infants with meconium aspiration syndrome a randomized clinical trial,” *JAMA Pediatr.*, vol. 172, no. 2, pp. 161–165, Feb. 2018, doi: 10.1001/jamapediatrics.2017.3873.

[37] K. Dangriwal, V. Arora, P. Narnolia, and A. Dhawal, “Continuous positive airway pressure in the treatment of meconium aspiration syndrome,” *Int. J. Contemp. Pediatrics*, vol. 12, no. 3, pp. 467–470, Feb. 2025, doi: 10.18203/2349-3291.ijcp20250412.

Annex;1 Data collection checklist

1. Section 1 Socio-demographic Factors of Neonate and Mother

No	Variable	
1	Maternal age in years	……
2	Residence	1. Urban 2. rural
3.	The neonate comes with a referral.	1. yes 2.no
4	Age of the neonate	…hr.
5	Place of Delivery	1. Health center 2. Governmental hospital 3. Private hospital 4. Home
6	Sex of neonate	1. Male 2. Female
7	Birth attendant	1. Skilled health professional 2. Health extension worker 3. Untrained birth attendant

2 . Neonatal Factors

1	Gestational age	1. preterm 2. term
2	Birth weight	--------grams
3	Was APGAR scored one	1. Yes 2. No
4	Ifyesforquestionno3whatwas1stminute and 5thminuteAPGARscore	1 minute……….. 5thminute…………
5	Was the current pregnancy multiple (twin?)	1. Yes 2. No
6	Did the newborn have a birth defect or any Congenital anomalies?	1. Yes 2. No
7	Was the neonate diagnosed with MAS	1. Yes 2. No
8	Was there any other medical complication that was the medical diagnosis?	1. No complication 2. Pneumothorax 3. unspecified 4. Oliguria
9	Was the newborn resuscitated	1. YES 2.NO
10	Health professionals, Delivery room performance for newborns	1. Routine born care 2.Oropharyngeal aspiration
11	Was the neonate treated with oxygen treatment at birth	1. Yes 2. No
12	Wastheneonateinitiatedbreastfeedwithin1hr.?	1. yes 2.no

3 Maternal Factor

1	No of Parity	… in number
2	Does the mother have ANC follow-up?	1. Yes 2. No
3	If yes for Q-4, how many times?	
4	Which medical problem had the mother been diagnosed with during pregnancy?	1. Yes 2. No
5	If yes for question no 6, which medical problem does the mother have?	1. Diabetes 2. HIV/AIDS 3. Cardiac diseases 4. Other specify…….
6	What was mother's blood group?	1. A 2. B 3.AB 4. O 5. unknown
7	What was mothers RH?	1. positive 2. negative

8	Had mother been diagnosed with preexisting medical pregnancy complications?	1. Yes 2. No
9	If yes, for Q-10Which among the following did the mother have diagnosed?	1. Abruptio placenta 2. Pregnancy-induced hypertension 3. Chronic hypertension 4. Placenta previa 5. MSAF 6. Other….
10	What was the Time of ROM?	1. PPROM 2. PROM 3. INTRAPARTAL
11	How did ROM occur?	1. Spontaneously 2. ARM
12	Was the mother induced?	1. Yes 2. No
13	Was the mother augmented?	1. Yes 2. No
14	Duration of labor	No -------------hours
15	Use of intrapartum antibiotics	1. Yes 2. No
16	What was her mode of delivery for this pregnancy?	1. Spontanousvaginaldelivery 2. Cesarean section 3. Instrumental

17	If the answer for Q 18 is 2, what was the indication?	1. CPD 2. NRFHRP 3. Failed instrumental delivery 4. Elective C/S 5. Other not specified

Annex 2;Frequences table

Variable	Category	Frequency (n)	Percentage (%)
Maternal age	≤19	10	3.4
	20–34	252	85.4
	≥35	33	11.2
Residence	Rural	239	81.0
	Urban	56	19.0
Neonate referral	Yes	220	74.6
	No	75	25.4
Age of neonate (hours)	<24hr	285	96.6
	>=24 hr	10	3.4
Place of delivery	Government hospital	220	74.6
	Health center	54	18.3
	Private hospital	11	3.7
	Home	10	3.4
Sex of neonate	Female	172	58.3
	Male	123	41.7
Birth attendant	Skilled	285	96.6
	Untrained	10	3.4
Gestational age	Term	181	61.4
	Preterm	114	38.6
Birth weight	Normal (2500–4000 g)	200	67.8
	Low (<2500 g)	85	28.8
	Unknown	10	3.4
APGAR scored	Yes	285	96.6
	No	10	3.4
APGAR 1st & 5th minute	Normal	262	88.8
	low	23	7.8
	unkown	10	3.4
Multiple pregnancy	Yes	0	0
	No	295	100
Congenital anomalies	Yes	7	2.4
	No	288	97.6
MAS diagnosis	Yes	56	18.9
	No	239	81.1
Neonatal resuscitation	Yes	21	7.1
	No	274	92.9
other medical complications of ne onates	No complication	258	87.5
	oliguria	26	8.81
	unspecified	11	3.7
Health professional intervention	Routine care	245	82.2
	Oropharyngeal aspiration	40	13.4

	Unknown	10	3.4
Oxygen therapy at birth	Yes	34	11.5
	No	261	88.5
Early breastfeeding initiation	Yes	174	59.0
	No	121	41.0
Parity	Primiparous	26	8.81
	Multiparous	269	91.18
ANC follow-up	Yes	295	100
	No	0	0
Number of ANC visits	>3	286	97
Maternal medical problems	Diabetes	4	1.4
	Cardiac disease	4	1.4
	Chronic hypertension	4	1.4
	HIV positive	2	0.7
	None	281	95.3
Mother’s blood group	O	123	41.7
	AB	82	27.8
	A	75	25.4
	B	15	5.1
RH factor	Positive	291	98.6
	Negative	4	1.4
Obstetric-related complications	Any	67	22.7
	MSAF	28	9.5
	PIH	19	6.4
	Placenta previa	17	5.8
	Abruption placenta	3	1.0
Time of ROM	PROM	40	13.6
	Intrapartum	255	86.4
How ROM occurred	Spontaneous	248	97.3
	ARM	7	2.7
Mother induced	Yes	19	6.4
	No	276	93.6
Mother augmented	Yes	20	6.8
	No	275	93.2
Duration of labor (hours)	≤18 hr	255	86.4
	>18 hr	40	13.6
Intrapartum antibiotics	Yes	31	10.5
	No	264	89.5
Mode of delivery	Spontaneous vaginal	264	89.5
	Cesarean section	31	10.5
	Instrumental	0	0
Cesarean indications	CPD	7	2.4
	NRFHRP	18	6.1
	Failed instrumental	4	1.4
	Elective C/S		
	Other not specified	2	0.7

Annex 3 Declarations

2.1 Declaration of Investigator

I, the undersigned student of specialization in Pediatric and Child Health, declare that this Research is my original work in partial fulfillment of the requirement for specialization in Pediatric and child Health, to my best knowledge.

Name of investigator: Dr.Tsegaye Zebenu

Signature: ______________ Date_________________

2.2 Declaration of Advisors

We, the undersigned Advisors, declare that this research is our original work in partial fulfillment of the requirement specialization in Pediatric and Child Health for the stated student

above to our best knowledge. We confirmed that this research is ready for defense with our

approval as the university advisor(s).

Date of Submission: ____________________________

Name of Primary Advisors:	Signatures	Date
1. Dr. Mohammed Abubeker	____________	__________
Name of Secondary Advisors:	**Signatures**	**Date**
2. Mr. Abebe Ferede	_____________	___________