



ARSI UNIVERSITY

COLLEGE OF HEALTH SCIENCES

DEPARTMENT OF MIDWIFERY

Prevalence of Adverse Birth Outcomes and Associated Factors among Pregnant Women with Hypertensive Disorders at Hospitals in Arsi and East Shewa Zones, Oromia, Ethiopia, 2024GC.

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LIST OF ACRONYMS/ABBREVIATIONS

ANC	Antenatal Care
ABO	Adverse birth outcomes
DBP	Diastolic Blood Pressure
DIC	Disseminated Intravascular Coagulation
DM	Diabetic Mellitus
EC	Eclampsia
EDHS	Ethiopian Demographic and Health Survey
EONC	Emergency Obstetric and Newborn Care
FMOH	Federal Ministry of Health
HDP	Hypertensive Disorders of Pregnancy
HTN	Hypertension
IUFD	Intrauterine Fetal Death
IUGR	Intrauterine Growth Restriction
ISSHP	International Society for the Study of Hypertension in Pregnancy
LBW	Low Birth Weight
NICU	Neonatal Intensive Care Unit
PE	Preeclampsia
PIH	Pregnancy-Induced Hypertension
SBP	Systolic Blood Pressure
SPSS	Statistical Package for Social Sciences
WHO	World Health Organization

Abstract

Background: Hypertensive disorders of pregnancy pose a significant risk to maternal and neonatal health, contributing to adverse birth outcomes such as low birth weight, preterm delivery, and stillbirth. In Ethiopia, the burden of Hypertensive disorder of pregnancy (HDP) related complications remains high, underscoring the need for detailed studies to inform effective interventions.

Objectives: This study aimed to assess adverse birth outcomes and identify associated factors among pregnant women with Hypertensive disorders of pregnancy at hospitals in Arsi and East Shewa Zones, Oromia, Ethiopia.

Methods: This multicenter, institutional-based cross-sectional study analyzed data from 465 women diagnosed with hypertensive disorders of pregnancy, systematically sampled from Asella Teaching and Referral Hospital, Adama Comprehensive and Specialized Hospital, and Bekoji Primary Hospital. The study was conducted between August and November 2024. Data were collected using structured questionnaires and medical records and analyzed with SPSS version 20. The prevalence of adverse birth outcomes was calculated as proportions, along with 95% confidence intervals (CIs) to estimate the range within which the true prevalence likely falls. Bivariate and multivariable logistic regression analyses were conducted to identify factors associated with adverse outcomes. Results were reported as adjusted odds ratios (AORs) with corresponding 95% CIs, and a p-value of <0.05 was considered statistically significant.

Result: The study revealed a high prevalence of adverse birth outcomes 47.2% (95% CI: 42.7%–51.7%) with common outcomes including low birth weight (29.8%), preterm birth (25.7%), and stillbirth (12.5%). Significant predictors of adverse outcomes included lack of antenatal care (ANC) visits (AOR = 3.70, 95% CI: 2.00-6.90), severe preeclampsia (AOR = 4.60, 95% CI: 2.30-9.10), rural residence (AOR = 2.31, 95% CI: 1.42-3.75), and maternal age below 25 years (AOR = 2.10, 95% CI: 1.32-3.34).

Conclusions: The study underscores the significant burden of adverse birth outcomes among women with Hypertensive disorders of pregnancy at hospitals in Arsi and East Shewa Zones,

Oromia, Ethiopia, highlighting the urgent need for targeted interventions to improve maternal and neonatal health outcomes.

Key Words: *Adverse Birth Outcome, Perinatal Outcome, Neonatal Outcome, Hypertensive Disorders.*

1. INTRODUCTION

1.1 Background

Hypertensive disorder of pregnancy is defined as chronic hypertension, exceeding 140/90 mm Hg before pregnancy or before 20 weeks gestation, or preeclampsia, gestational hypertension is the new onset of elevated blood pressure after 20 weeks gestation, on two occasions at least 6 hours apart, but not more than 7 days, or a single blood pressure recording of 160/110 mm Hg with preeclampsia consideration (1).

The American College of Obstetricians and Gynecologists classified Hypertensive Disorders of Pregnancy (HDP) as: Gestational hypertension, chronic hypertension, preeclampsia/ eclampsia, and Preeclampsia superimposed on chronic hypertension (2).

Gestational hypertension refers to hypertension without proteinuria developing after the 20th week of pregnancy in a previously normotensive pregnant woman. Chronic hypertension is defined as hypertension that antedates pregnancy; is present before the 20th week of pregnancy; or persists after 12 weeks postpartum. Preeclampsia refers to the new onset of hypertension and proteinuria after 20 weeks of gestation in a previously normotensive woman. Eclampsia is defined as the occurrence of convulsions or coma that is not attributable to other causes in a woman with preeclampsia. Superimposed preeclampsia is diagnosed when a woman with chronic hypertension develops severe features of Preeclampsia after 20 weeks of gestation (2).

Preeclampsia has an immense adverse impact on maternal and perinatal health, especially in the developing world. It is a major cause of almost a million maternal deaths in low and middle-income settings and also accounts for substantial proportions of more than six million perinatal deaths. Approximately eight million preterm births and almost 20 million low birth-weight infants in developing nations (3).

Adverse perinatal outcomes associated with the hypertensive disorders of pregnancy include stillbirth, neonatal death, Oligohydramnios, Bronchopulmonary dysplasia, and fetal growth restriction. Of perinatal deaths (i.e., stillbirth or neonatal death), an estimated 9–20% are reported to be directly related to the hypertensive disorders of pregnancy in several large multicounty cohort studies (4).

Hypertensive disorders in pregnancy (i.e. Pre-eclampsia) are a major underlying cause of late fetal and early neonatal death, accounting for between 1 in 10 and 1 in 4 perinatal deaths (5).

Hypertensive disorders of pregnancies continue to be one of the prime etiological factors for maternal and perinatal morbidity and mortality. In Ethiopia, the burden of adverse birth outcomes is alarming, with maternal and neonatal mortality rates remaining among the highest globally. Factors contributing to this burden include limited access to quality prenatal care, inadequate health infrastructure, and a high prevalence of hypertensive disorders among pregnant women (8).

Addressing this challenge requires evidence-based interventions focused on antenatal care coverage, early detection, and effective management of HDP. This study provides critical insights into these aspects, offering a foundation for targeted improvements in maternal and neonatal health outcomes at hospitals in Arsi and East Shewa Zones, Oromia Region.

Although numerous studies have been conducted on adverse birth outcomes among women with HDP in Oromia, this study provides additional value by examining the issue through a hospital based approach and incorporating updated data from diverse hospital settings. This ensures a comprehensive understanding of the prevalence, associated factors, and regional variation in outcomes, thereby offering localized evidence to strengthen interventions for maternal and neonatal health.

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1.2 Statement of the Problem

Hypertensive disorders of pregnancy, which cause adverse birth outcomes, are a major public health concern, especially in low- and middle-income countries like Ethiopia.

Globally, HDP complicates 5–10% of pregnancies and remains one of the major causes of maternal and neonatal health complications in developing countries this includes stillbirths, preterm deliveries, and small-for-gestational-age newborns and More than 99% of these adverse outcomes occur in LMICs, due to the limited healthcare resources available to them (2).

The burden of HDP in Ethiopia is high, attributable to multiple, interrelated factors Access to good quality ANC is limited: ANC is grossly inadequate for women in rural and underserved areas, thus delaying the diagnosis and treatment of HDPs (4). Additionally, many health facilities are not equipped with equipment and skilled human resources to manage complicated pregnancies (5).

Socioeconomic Challenges such as Low income, low levels of education, and cultural beliefs further hinder women's ability to seek timely and appropriate healthcare services (8).

Studies in Ethiopia have shown that 25% of women who develop HDP have perinatal loss, and complications like HELLP syndrome, placental abruption, and preterm birth are common (10).

Furthermore, 30.5% of babies born to women with HDP are underweight, indicating the need for better maternal health care (11).

Despite the Ethiopian Federal Ministry of Health has implemented several initiatives, including maternal health programs, health care provider training, and HDP management guidelines, large gaps remains (9). Institutional delivery rates low and poor availability of basic drugs and services for the treatment of HDP. For example, high maternal and perinatal mortality from eclampsia at Kara Mara Regional Hospital was associated with late presentation and poor quality of care (11).

While global literature on HDP's magnitude and risk factors, knowledge about its regional impact on birth outcomes is not limited As such, However a few studies have been conducted in Oromia, including the Arsi and East Shewa Zones, with the drawback of lack of data that could specifically pinpoint targeted interventions.

Therefore, this study aimed to bridge this gap in knowledge by finding out the magnitude of adverse birth outcomes among women with HDP and its associated factors in selected hospitals of the Arsi and East Shewa Zones, Oromia Region.

1.3 Significance of the study

This study is significant in informing and improving healthcare practices for pregnant women with hypertensive disorders. It highlights the burden of HDP in Adama, Bokoji, Asela, town and the Arsi Zone, providing evidence-based recommendations. By shedding light on the challenges women face, particularly in rural areas, this study underscores the need for improved health infrastructure. Additionally, it contributes to the broader call for further research and serves as a foundation for more in-depth studies on maternal and neonatal health in the area. Ultimately, the insights gained will help reduce maternal and neonatal morbidity and mortality, improving overall health outcomes in Oromia.

2. LITERATURE REVIEW

2.1 Magnitude of adverse birth outcomes among hypertensive pregnant women

Adverse birth outcomes (ABO) related to hypertensive disorders of pregnancy (HDP) have been widely documented. A cross-sectional study at Korle Bu Teaching Hospital in Ghana reported that perinatal outcomes among women with HDP included intrauterine growth restriction (IUGR) (6.3%), intrauterine fetal death (6.8%), preterm delivery (21.7%), low birth weight (24.7%), and birth asphyxia or neonatal respiratory distress (15.2%) (15).

Similarly, a study conducted in Amhara Region referral hospitals in Ethiopia found an overall prevalence of unfavorable perinatal outcomes of 46.5% among mothers with severe preeclampsia/eclampsia (17).

In a retrospective study at Mettu Karl Referral Hospital, Ethiopia, neonatal outcomes indicated a perinatal mortality rate of 120.37 per 1,000 deliveries, a stillbirth rate of 10.2%, low birth weight of 30.5%, and preterm delivery of 31.4% associated with HDP (18).

A study in Brazilian tertiary referral hospitals showed that fetal and neonatal mortality, as well as newborn respiratory distress, were very high in all HDP cases, with the highest mortality rate close to 27% in eclampsia cases (19).

2.2. Factors Associated with Adverse Birth Outcome

2.2.1 Maternal Age

Adverse birth outcomes such as unfavorable fetal and neonatal outcomes, LBW, preterm delivery, and birth asphyxia have been associated consistently with mothers aged 20-25 years (20, 22, 23).

The incidence of severe preeclampsia/eclampsia and related complications is also higher in women aged ≥ 35 years as compared to the younger age groups. This group also suffers a 1.6-fold increased risk of preeclampsia and adverse fetal outcomes (24, 25, 27).

The maternal and neonatal outcomes, including prematurity and respiratory complications, are more common in mothers aged ≥ 35 years (15, 33).

2.2.2 Source of Referral

Referrals from rural or under-resourced settings have been associated with delay in diagnosis and management, contributing to higher rates of adverse outcomes including maternal and perinatal mortality (28, 29).

Hospital-based studies also point out that poor health systems in referral networks heighten the risk for hypertensive disorders of pregnancy and their outcomes.

2.2.3 Residence

Women from rural areas face a significantly increased risk of adverse maternal and neonatal outcomes due to lack of access to facilities and delay at various levels of healthcare (28, 29).

Some studies done in Ethiopia and Berhampur found that most cases of HDP belong to a rural background, with 72.9% prevalence in some series of studies (29).

2.3. Types of hypertensive disorders

In Ghana, the proportion of perinatal deaths was highest in preeclampsia cases compared to other HDP categories, with stillbirths and early neonatal deaths being more frequent in severe preeclampsia and eclampsia (15).

The type of hypertensive disorder significantly affects birth outcomes. A study in Ethiopian teaching hospitals revealed that the distribution of perinatal mortality by type of HDP was highest in preeclampsia (49.4%), followed by eclampsia (44.4%), and other types of HDP (6.2%) (30).

Retrospective cohort studies in Brazil and Tanzania have shown that severe preeclampsia and eclampsia are associated with significantly higher risks of low birth weight, preterm birth, and neonatal mortality (4, 30).

Another retrospective medical record study conducted at rural hospital in Western Tanzania revealed that Perinatal deaths occurred in 30 % of women with eclampsia and 27 % of women with severe pre-eclampsia and were associated with low birth weight and prolonged time between admission and birth(31).

A prospective cohort study conducted in Ghana showed that Pre-eclamptic or eclamptic women had a higher risk of a low birth weight infant and a higher risk of neonatal death. Pre-eclamptic

or eclamptic women also had persistent low Apgar scores after 5 min and a higher risk of preterm birth. (32).

An analytical cross-sectional study conducted in Ghana showed that 87% of women with HDPs had adverse maternal or perinatal outcomes. Women with pre-eclampsia/eclampsia were at increased risks of caesarean section, and preterm delivery, compared to women with chronic/gestational hypertension. The risks of prolonged maternal hospital stay (43.9% vs. 27.1%), NICU admission (30.7% vs. 19.8%) and perinatal mortality (23.5% vs. 11.2%) were significantly higher among women with pre-eclampsia/eclampsia compared with other HD(32).

A hospital-based cross-sectional study conducted at hospitals in Wolaita zone, Southern Ethiopia, showed that type of HDP was strongly associated with unfavorable fetal and neonatal outcome ($P < 0.05$). The odds of having unfavorable outcome in preeclampsia was 5.126 (0.033-16.94), and the odds of having unfavorable outcome in eclampsia was 6.129 (0.024-22.147)(27).

A prospective cohort study conducted to assess Effect of pregnancy induced hypertension on adverse perinatal outcomes in Tigray Regional State, Ethiopia showed that the overall incidence of adverse perinatal outcome was higher among women with pregnancy-induced hypertension than normotensive women (66.4% vs. 22.2%). women with pregnancy-induced hypertension were born babies with a higher risk of low birth weight, birth asphyxia, small for gestational age, preterm delivery, stillbirth, admission to neonatal intensive care unit, and perinatal death compared to normotensive pregnant women(29).

Women with chronic hypertension in US studies have an approximately threefold increased risk of delivery before 37 weeks' gestation, birth weight < 2500 g, and neonatal intensive care admission and fourfold increased risk of perinatal death compared with the US general pregnancy population (33).

A retrospective cohort study conducted to determine maternal and fetal outcomes among women with HDP at Brazilian tertiary referral hospital showed that chronic hypertension, is a very important risk factor for fetal death and new born respiratory complications. All groups of women with HDP had high proportion of stillbirth (close to 10%), and new-born respiratory complications (anoxia and/or respiratory distress) were also high in all groups of HDP (14–23%)(19).

A similar prospective cohort study conducted in Ghana showed that Women with chronic hypertension were at significantly higher risk to deliver a premature child born before 37 weeks an infant with a low Apgar score after 1 min (32). A hospital-based cross-sectional study conducted at hospitals in Wolaita zone, Southern Ethiopia, showed that high blood pressure was strongly associated with unfavorable fetal and neonatal outcome ($P < 0.05$)(15).

A retrospective cohort study conducted at three university teaching hospitals in the Southern Regional State of Ethiopia showed that there was a statistically significant association of perinatal mortality with the highest BP of $\geq 160/110$ mmHg (30).

A Cross-sectional descriptive study conducted at Kenyatta National Hospital showed that there was a statistically significant relationship between the diastolic BP and development of complications ($p = .001$). The commonest complications were pulmonary edema (17.7%), acute renal failure (22.6%), sepsis (14.5%), postpartum hemorrhage, (11.3%) and abruption placenta (11.3%)(34).

A retrospective cohort study conducted to determine maternal and fetal outcomes among women with HDP at Brazilian tertiary referral hospital showed chronic hypertension, is a very important risk factor for fetal death and new born respiratory complications. All groups of women with HDP had high proportion of stillbirth (close to 10%), and new-born respiratory complications (anoxia and/or respiratory distress) were also high in all groups (14–23%)(19).

2.4. Reproductive and Obstetric factors

An analytical cross-sectional study conducted in Ghana showed that Women who had less than 4 ANC visits were at increased risk of adverse maternal and perinatal outcomes compared with women who had more than 4 ANC visits(12). A prospective observational study conducted at Hospitals, in Berhampur, showed that women with HDP who had not received prenatal care have a greater chance to develop maternal complications and have a poor neonatal outcome (29).

A Cross-sectional descriptive study conducted at Kenyatta National Hospital showed that the majority of the patients who had not attended ANC (61.9%) developed complications. The relationship between the attendance of ANC and non-attendance and the occurrence of complications was statistically significant (34).

A hospital-based cross-sectional study conducted at hospitals in Wolaita zone, Southern Ethiopia, showed that parity was strongly associated with unfavorable fetal and neonatal

outcome ($P < 0.05$). Nulliparous women were about 5 times more likely to develop unfavorable outcome in comparison with multiparous women.(15).

Institution-based retrospective cross sectional study conducted at Referral Hospital in Debre Berhan, Ethiopia showed that hypertensive disorders of pregnancy shows increasing trend from the previous years and preeclampsia and eclampsia were the prevalent types of HDP. Prim gravida ladies were affected more than multi-gravid ones (35).

A Prospective cohort study conducted in Iran showed that Pregnancy-induced hypertension was associated with multiple complications in the mother and baby, particularly preterm delivery. HDP was found to be more common in Prim-gravida compared to multigravida mothers(22).

A retrospective Cohort study conducted at Saudi Arabia showed that multigravida women and women with chronic hypertension were at increased risk of prematurity compared to other pregnant women(36).

2.4.1. Gestational Age

The gestational age at diagnosis less than 34 weeks is strongly associated with adverse perinatal outcomes including low birth weight, neonatal mortality, and prolonged hospital stays. Indeed, studies show that very preterm babies have up to sevenfold higher risks for perinatal mortality compared to term births (11, 30).

Chronic hypertension increases the risk of delivery before 37 completed weeks, adding further risks to mothers and newborn (33).

2.5 Pre-existing medical conditions

2.5.1 Maternal Cardiac Conditions

Cardiac complications in preeclampsia/eclampsia include elevated blood pressure $\geq 160/110$ mmHg, which increases the risks of maternal and perinatal mortality among women significantly (30, 34). Cardiac-related complications such as pulmonary edema and acute renal failure commonly arise in the cases of HDP patients, where diastolic blood pressure strongly relates to a poor outcome (34).

2.5.2. Diabetes Mellitus (DM)

Diabetes mellitus increases risks of maternal complications such as cesarean delivery and neonatal outcomes like low birth weight and respiratory distress when coexisting with HDP

(19, 32).Chronic conditions like DM, when unmanaged, significantly compound risks for adverse outcomes, highlighting the importance of integrated care (19).

2.3. Conceptual Framework

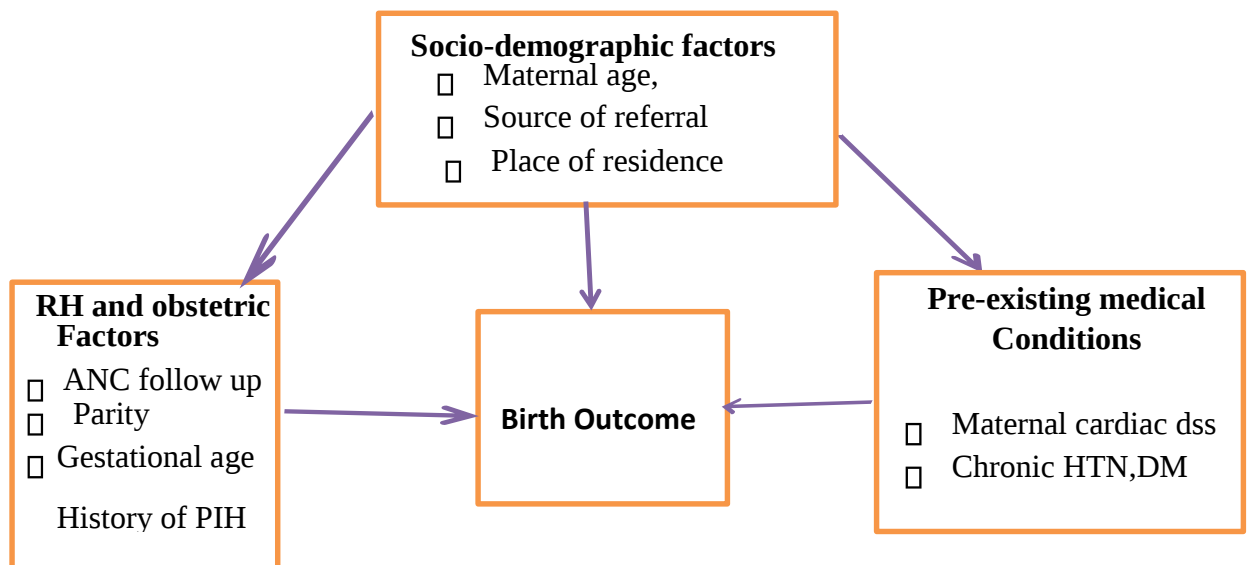


Figure 1: Conceptual frame for Assessment of Adverse Birth Outcomes and Associated Factors among Pregnant Women with Hypertensive Disorders at Selected Hospitals in Oromia, Ethiopia (11, 15, 16, 37).

3. STUDY OBJECTIVE

3.1 General objective

To assess Adverse Birth Outcomes and Associated Factors among Pregnant Women with Hypertensive Disorders at hospitals in Arsi and East Shewa Zones, Oromia, Ethiopia.2024.

3.2 Specific objectives

To quantify the prevalence of adverse birth outcomes among women with hypertensive disorders at selected hospitals in Oromia, Ethiopia, by November 30, 2024.

To identify factors associated with Adverse Birth Outcomes and Associated Factors Among Pregnant Women with Hypertensive Disorders at Selected Hospitals in Oromia, Ethiopia By November 30.2024.

4. METHOD AND MATERIALS

4.1 Study Area and Period:

The study was conducted at three hospitals, including Asella Teaching and Referral Hospital, Adama Comprehensive and Specialized Hospital Medical College, and Bekoji Primary Hospital located in Arsi and East Shewa Zones, Oromia Region, Ethiopia, from August to November 2024. These hospitals were purposively selected based on delivery volume and availability of registered data on HDP. The findings are therefore specific to these hospitals and should not be generalized to the entire Oromia Region.

Adama Comprehensive and Specialized Hospital Medical College was located in Adama town, 99 km southeast of Addis Ababa, Ethiopia. The national census of 2007 reported the total residents of the town as 388,925, of which 196,407 were males. The town had 8 public health facilities (one hospital, the rest health centers), 9 private hospitals, 6 non-governmental health centers, and 104 private clinics. The hospital served an estimated five million catchment and surrounding population, and also served as a teaching center for specialty programs (Pediatrics, Internal Medicine, General Surgery, and Gynecology and Obstetrics), and other general medical fields.

Asella Referral and Teaching Hospital (ARTH) was situated in Asella town, Arsi Zone, Oromia region, Ethiopia. Asella was located approximately 167 km southeast of Addis Ababa, the capital city of Ethiopia. Established in 1964, ARTH encompassed various departments and 10 wards, including the outpatient department (OPD), medical ward, gynecology and obstetrics ward, pediatrics ward, pediatrics surgery ward, surgical ward, orthopedics ward, oncologic ward, and intensive care unit (ICU). The hospital boasted a total of 265 beds and offered a wide array of healthcare services and clinics, such as emergency services, dental clinic, mother-child health (MCH), psychiatry clinic, laboratory, radiology, pharmacy, and chronic disease and cancer follow-up. The hospital staff comprised a total of 605 members, including 200 doctors, 208 nurses, and 197 other healthcare providers.

Bekoji was a town in central Ethiopia. Located in the Arsi Zone of the Oromia Region, it had a latitude and longitude of 7°35'N 39°10'E with an elevation of 2810 m. This town was located on the all-weather road to Goba built during the Italian occupation, 56 km south of Asella, and

50 km east of Lake Langano. As of 2022, the town accommodated a total of 34,315 residents. Among them, females constituted 17,226 individuals.

Bekoji town offered two public healthcare facilities—a health center and a district hospital to meet the healthcare needs of its population. Additionally, the town hosted 11 drug stores and 19 private medium-sized clinics, expanding access to healthcare services.

Bekoji Hospital offered a range of services, including outpatient and inpatient care, maternal and child health services, delivery services, major and minor surgeries, NICU facilities, intensive care units, radiological services, and laboratory services, to address diverse healthcare needs for the local residents. On average, the hospital handled 190 deliveries and 40 neonatal intensive care unit (NICU) admissions each month, showcasing the community's substantial utilization of medical services.

4.2. Study Design

A multi-centered institutional-based cross-sectional study design was employed to assess adverse birth outcomes and associated factors among pregnant women with hypertensive disorders.

4.3. Source Population

All women with hypertensive disorders of pregnancy who gave birth at selected hospitals in Oromia, Ethiopia during the study period.

4.4. Study Population

The study population included a systematically selected sample of women with hypertensive disorders of pregnancy who gave birth during the study period.

4.5. Inclusion and Exclusion Criteria

4.5.1. Inclusion Criteria

All women diagnosed with hypertensive disorders of pregnancy who gave birth after 28 weeks of gestation at selected hospitals.

4.5.2. Exclusion Criteria

Women with twin gestations and congenital birth defects were excluded to avoid their potential confounding effect on birth outcomes associated with HDP. Those who were mentally ill during data collection were also excluded from the study.

4.6. Sample Size Determination

The sample size was calculated using a single population proportion formula.

$$\text{Formula: } n = (Z_{\alpha/2})^2 * p * (1-p) / d^2$$

Where, n_0 = the initial sample size

$Z_{\alpha/2}$ = confidence interval at 95 %, which is =1.96 p = the proportion of adverse perinatal outcome of women with PIH (66.4%) (29).

d =the margin of error, taken as 4.5 %.

Substituting the above values in single population proportion formula:

$$n = (Z_{\alpha/2})^2 * p * (1-p) / d^2$$

$$n = (1.96)^2 * 0.664 * (1-0.664) / (0.045)^2$$

$$n = 424.64$$

By taking non-response rate of 10% the final sample size become:-

$$\text{Adjusting for Non-Response Rate: } N_f = n + (10/100 * n)$$

$$N_f = 424.64 + (10\% \text{ of } 424.64)$$

$$N_f = 424.64 + 42.464$$

$$N_f = 467.104$$

Final Sample Size: ≈ 467

By adding 10% non-response rate the final sample size was 467 mothers

The sample size determination for the second objective calculated by EPI Info will be 410 HDP mothers which calculated from three independent variables of previous study done in wolaita (15). Therefore, by comparing the sample size for the first and second objectives, the final sample size for this study was 465 mothers.

Table:1 Sample size Calculation for study conducted on adverse birth outcomes and its associated factors among hypertensive disorder of pregnancy

S.no	Factors associated with adverse birth outcomes	Assumptions					Sample Size	10 % nonresponse rate	Final Sample size
		CI	Power	Ratio	Prevalence of exposed group	Prevalence of unexposed group			
1.	Age	95%	80%	1	59.1%	31.7%	114	11.4	126
2.	Rural residence	95%	80%	1	71.1%	32.6%	62	6.2	69
3.	Lack of ANC follow up	95%	80%	1	60%	42.4%	274	27.4	302

4.7. Sampling Techniques and Procedures

4.7.1. Sampling Techniques and Sampling Procedure

A systematic random sampling technique was used to select a total of 467 hypertensive women who gave birth within the study period. Asela Referral and Teaching Hospital, Bokoji Hospital, and Adama Comprehensive and Specialized Hospital Medical College, which offered maternal and newborn care services, were selected purposively based on delivery load and the presence of better-registered data. The total sample size of the study was allocated proportionally for the selected hospitals based on their respective number of cases of hypertensive women in the past twelve months to avoid selection bias.

The proportional sample size of hypertensive mothers was calculated by multiplying the total sample size (467) by the number of hypertensive mothers in each hospital and then divided by the total HDP (6310).

The first mother selected from each hospital was chosen by the lottery method, and then the next study participants was selected by calculating the sampling interval (kth) = N/n every 13 participant for each hospital.

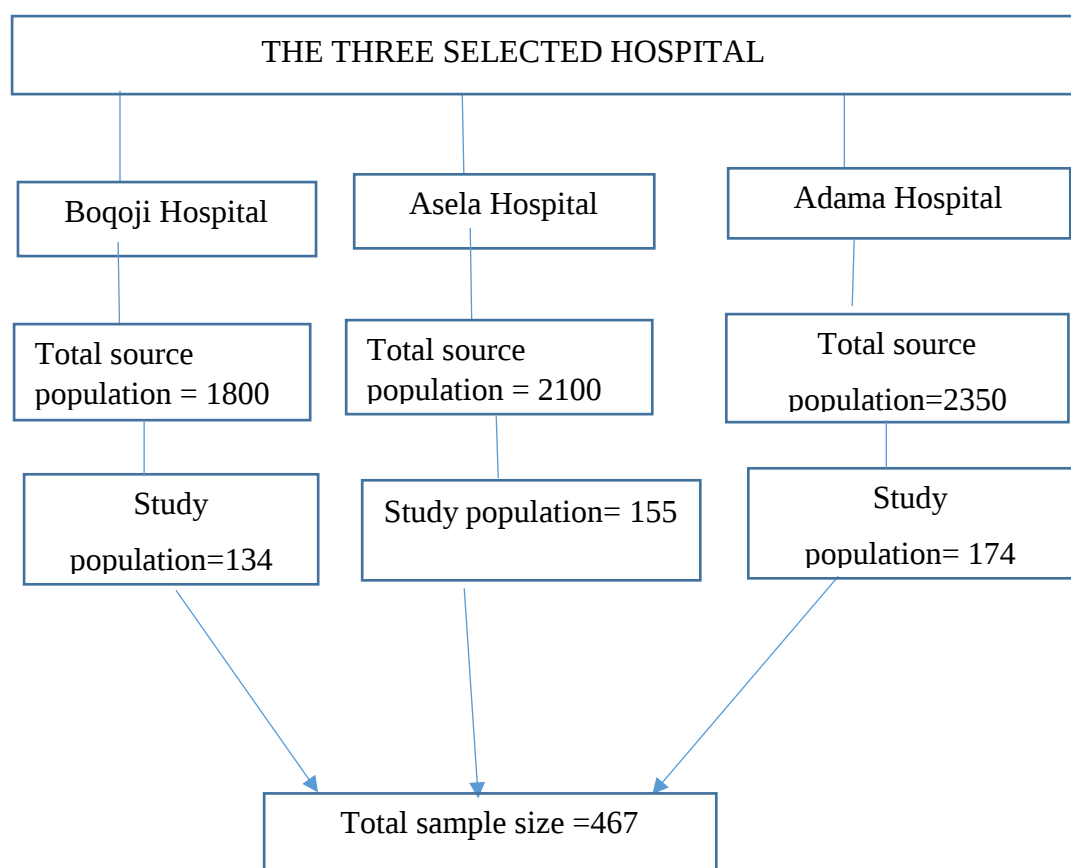


Figure 2: Schematic presentation among Pregnant of sampling procedure for Assessment of Adverse Birth Outcomes and Associated Factors among Women with Hypertensive Disorders at hospitals in Arsi and East Shewa Zones, Oromia Region, Ethiopia, 2024.

4.8.1. Data Collection Tools and Procedure

Pre-tested questionnaires, adapted from similar studies, were used to collect data from both medical records and participants. The structured questionnaires, initially prepared in English, were translated into **Afan Oromo** by bilingual experts and then back-translated into English to ensure consistency and accuracy. Any discrepancies were reviewed and resolved by an expert panel to maintain conceptual integrity. Before data collection, the data collectors (ten trained midwives) received comprehensive training on the study's objectives, relevance, confidentiality protocols, and participants' rights. To ensure **reliability** and **validity**, a pretest was conducted outside the study area among 5% of the total sample size (approximately 23 women with hypertensive disorders of pregnancy). The pretest evaluated the

questionnaire's **clarity, comprehensibility, and response consistency**, leading to minor adjustments to enhance its effectiveness. The final questionnaire included **6 socio-demographic questions, 15 questions on laboratory and clinical findings, 2 questions on the type and onset of HDP, and 11 questions on reproductive health and obstetric characteristics**. The tool was available in **English, Amharic, and Afan Oromo** to accommodate participants' language preferences

4.8.2. Data Collection Procedure

Data were collected using a pretested, interviewer-administered questionnaire and a structured checklist by ten trained midwives at Asella, Adama, and Bekoji hospitals. Eligible women diagnosed with hypertensive disorders of pregnancy (HDP) who gave birth after 28 weeks of gestation were systematically selected using a predetermined sampling interval (kk). After obtaining written informed consent, midwives conducted face-to-face interviews to collect socio-demographic data (e.g., age, residence, referral source) and obstetric history (e.g., parity, ANC visits). This was immediately followed by a review of medical records to extract clinical and laboratory data, including blood pressure, platelet counts, liver and renal function tests, gestational age at diagnosis, type and onset of HDP, APGAR scores, NICU admissions, and birth outcomes (e.g., stillbirth, low birth weight, preterm birth). For women with severe conditions like eclampsia, data were obtained from medical records and, if necessary, from family members. Data collection took place in postnatal wards or recovery rooms, with daily supervision by the principal investigator and supervisors to ensure accuracy and completeness.

4.9. Study Variables

4.9.1. Dependent Variable

Adverse birth outcomes.

4.9.2. Independent Variables

- **Socio-demographic factors:** Maternal age, place of residence, and source of referral
- **Reproductive health and obstetric factors:** ANC follow-up, parity, gestational age
- **Pre-existing medical conditions:** Chronic hypertension (HTN), diabetes mellitus (DM), cardiac disease
- **Pregnancy-induced hypertension:** Pre-eclampsia (PE), eclampsia (EC), chronic HTN, and superimposed PE

4.10. Operational Definitions

Adverse birth outcomes were defined as negative health conditions affecting the newborn, including low birth weight, stillbirth, preterm delivery, intrauterine growth restriction, intrauterine fetal death, low Apgar score at birth, neonatal asphyxia, perinatal death, admission to neonatal intensive care unit (NICU), or the presence of one or more.

- **Low birth weight:** A newborn with birth weight below 2500g.
- **Stillbirth:** A newborn with no signs of life at or after 28 completed weeks of pregnancy.
- **Preterm delivery:** The delivery of the baby occurs after 28 completed weeks but before 37 completed weeks of gestational age.

No Adverse Outcome: A newborn without any of the a for mentioned negative conditions, including normal birth weight (≥ 2500 g), delivery at term (≥ 37 weeks), no signs of intrauterine or neonatal complications, an Apgar score ≥ 7 , and no requirement for NICU admission.

4.11. Data Quality Control

To assure the quality of data, before starting data collection, a feasibility check was conducted through a pilot survey on 5% of the sample size outside of the study area to identify any potential issues with the data collection process. Data collectors received a one-day training session on how to accurately collect data from patients' charts. This training covered proper techniques, the importance of data accuracy, and common pitfalls to avoid. The questionnaire was translated into the local language to ensure clarity and accurate participant responses. Supervisors and the Principal Investigator (PI) oversaw data collectors to ensure that data was being gathered correctly. Daily checks for data completeness and consistency were conducted, and any missing or incomplete data was promptly rectified. After verifying data completeness, data was entered using Epi-data software, which has built-in controls and error detection systems. Double data entry was performed to ensure the consistency and accuracy of the collected data.

4.12. Data Processing and Analysis

First, data was checked manually for its completeness and consistency. Then, data was coded and entered into Epi Data version 3.1 statistical software and exported to SPSS version 20 statistical software for analysis. Descriptive statistics were computed to describe the data, and the results were presented using frequency, summary measures, graphs, and tables. Each birth

outcome (stillbirth, low birth weight, birth asphyxia, preterm birth, and NICU admission) was dichotomized into present (1) or absent (0). The prevalence of each adverse birth outcome was calculated among women with hypertensive disorders of pregnancy.

The goodness of fit for the final logistic model was assessed using the Hosmer and Lemeshow test, with statistical significance set at $P > 0.05$. Variables were initially screened through bivariable analysis, and those with $p < 0.025$ were included in the multivariable analysis. Binary and multivariable logistic regression analyses were performed to identify factors associated with adverse birth outcomes. The prevalence of adverse outcomes was calculated with 95% confidence intervals. Results are presented as adjusted odds ratios (AORs) with corresponding 95% CIs.

4.13. Ethical Considerations

The study was conducted after getting ethical clearance from Arsi University, Institutional Review Board (IRB). Support letter was obtained from Oromia Regional Health Bureau and concerned Arsi Zonal health departments. Written informed consent was secured from study participants after explaining about the objective and purpose of the study to each study participants. The participants are also assured about the confidentiality of the data.

5. RESULT

5.1. Socio-Demographic Characteristics

465 pregnant women with HDP were enrolled from Adama, Bokoji, and Assela hospitals, with two participants excluded due to incomplete records, achieving a 99.6% response rate. The mean age was 29.5 years ($SD \pm 6.1$), with most participants (58.7%) aged between 25 and 35 years. Urban residents accounted for 73.4% of the participants, while 65.2% had attained secondary education or higher (Table 1).

Table 1: Socio-demographic characteristics of pregnant women with hypertensive disorders at hospitals in Arsi and East Shewa Zones, Oromia Region, Ethiopia (N=465, 2024).

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	<20	45	9.6
	20–24	102	21.8
	25–34	190	40.7
	≥ 35	130	27.8
Place of Residence	Urban	343	73.4
	Rural	124	26.6
Educational Status	No formal education	87	18.6
	Primary education	110	23.5
	Secondary education	145	31.0
	College/University	125	26.8
Marital Status	Single	62	13.3
	Married	367	78.6

	Divorced/Widowed	38	8.1
Socioeconomic Status	Middle	195	41.7
	High	92	19.7
	Low	180	38.5

5.2.2. Reproductive and Obstetric Characteristics

Most of the participants were multigravida (62%) while 38% were primigravida. About 78.9% of women attended at least one ANC visit, and 45.5% completed four or more visits. Just under half (47.3%) were diagnosed with HDP after 34 weeks of gestation. among the participants, 25.1% have a history of pregnancies complicated by HDP, while 10.3% reported a history of stillbirth (table 2).

Table 2: Reproductive and Obstetric Characteristics of Pregnant Women with Hypertensive Disorders at hospitals in Arsi and East Shewa Zones, Oromia Region, Ethiopia (N=465, 2024).

Variable	Category	Frequency (n)	Percentage (%)
Gravidity	Primigravida	178	38.0
	Multigravida	287	62.0
Antenatal Care (ANC) Visits	No ANC visits	80	17.1
	1–3 visits	174	37.3
	4 or more visits	213	45.6
Gestational Age at Diagnosis	Before 34 weeks	221	47.3
	After 34 weeks	246	52.7
History of Previous HDP	Yes	117	25.1
	No	348	74.9
History of Stillbirth	Yes	48	10.3
	No	419	89.7

5.2.3. Clinical and Laboratory Findings

At admission, the mean systolic blood pressure (SBP) was 161.2 mmHg (SD ± 15.4), and 31.6% of participants recorded an SBP of ≥180 mm Hg Platelet counts were below the normal range in 18.4% of cases, and 22.7% of participants had abnormal liver function (AST >40 IU/L).

5.3. Prevalence of Adverse Birth Outcomes

Adverse birth outcomes were recorded in 47.2% of the respondents. The most prevalent outcome was low birth weight (<2500 g), which occurred in 29.8% of newborns. Babies born preterm (<37 weeks) accounted for 25.7%, and 12.5% of deliveries were stillbirths. Neonatal asphyxia, defined as a low APGAR score at the 1st minute (<7), occurred in 8.9% of live births (Figure 3).

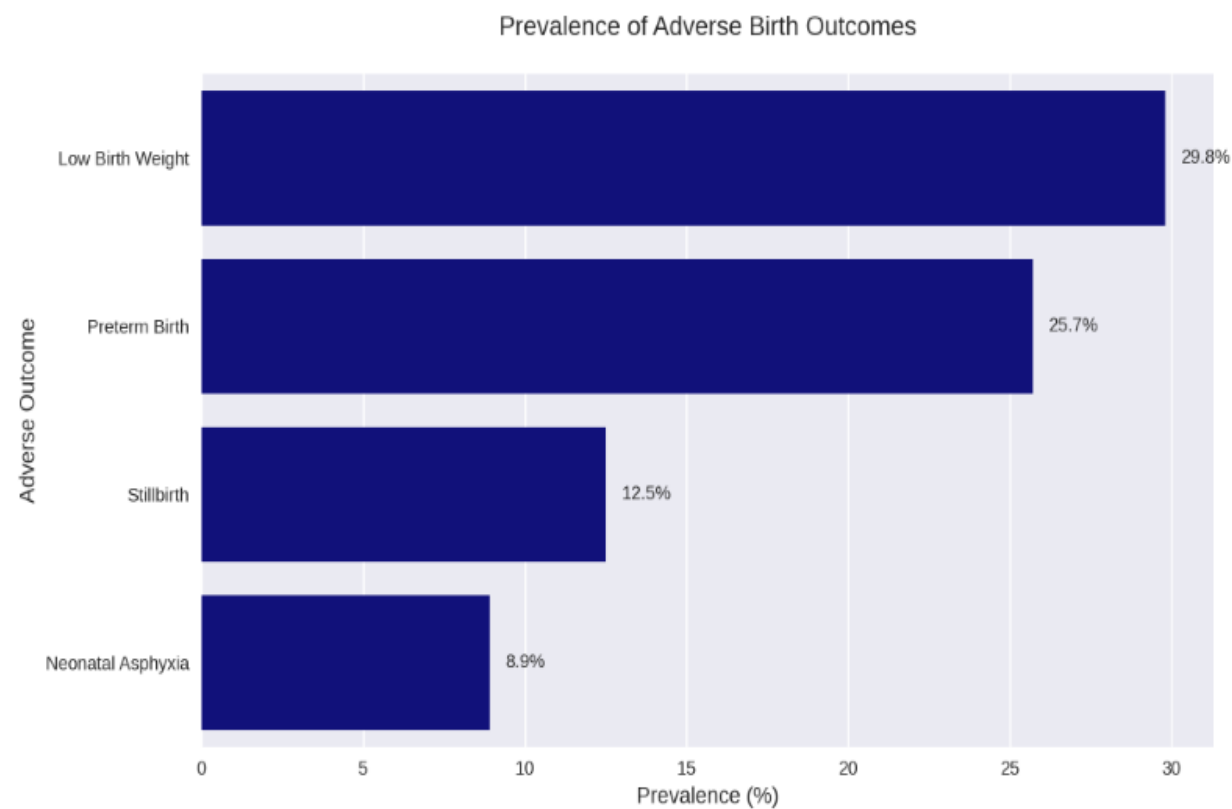


Figure 3: Prevalence of specific adverse birth outcomes among women with hypertensive disorders at hospitals in Arsi and East Shewa Zones, Oromia Region, Ethiopia N=465, 2024).

5.3.1. Stratified Analyses by Type of Hypertensive Disorder

The effect of HDP classifications (severe preeclampsia, eclampsia, gestational hypertension, and chronic hypertension) on adverse birth outcomes was analyzed: This stratification underscores the

disproportionate impact of severe preeclampsia and eclampsia on adverse birth outcomes, compared to gestational and chronic hypertension (Figure 4).

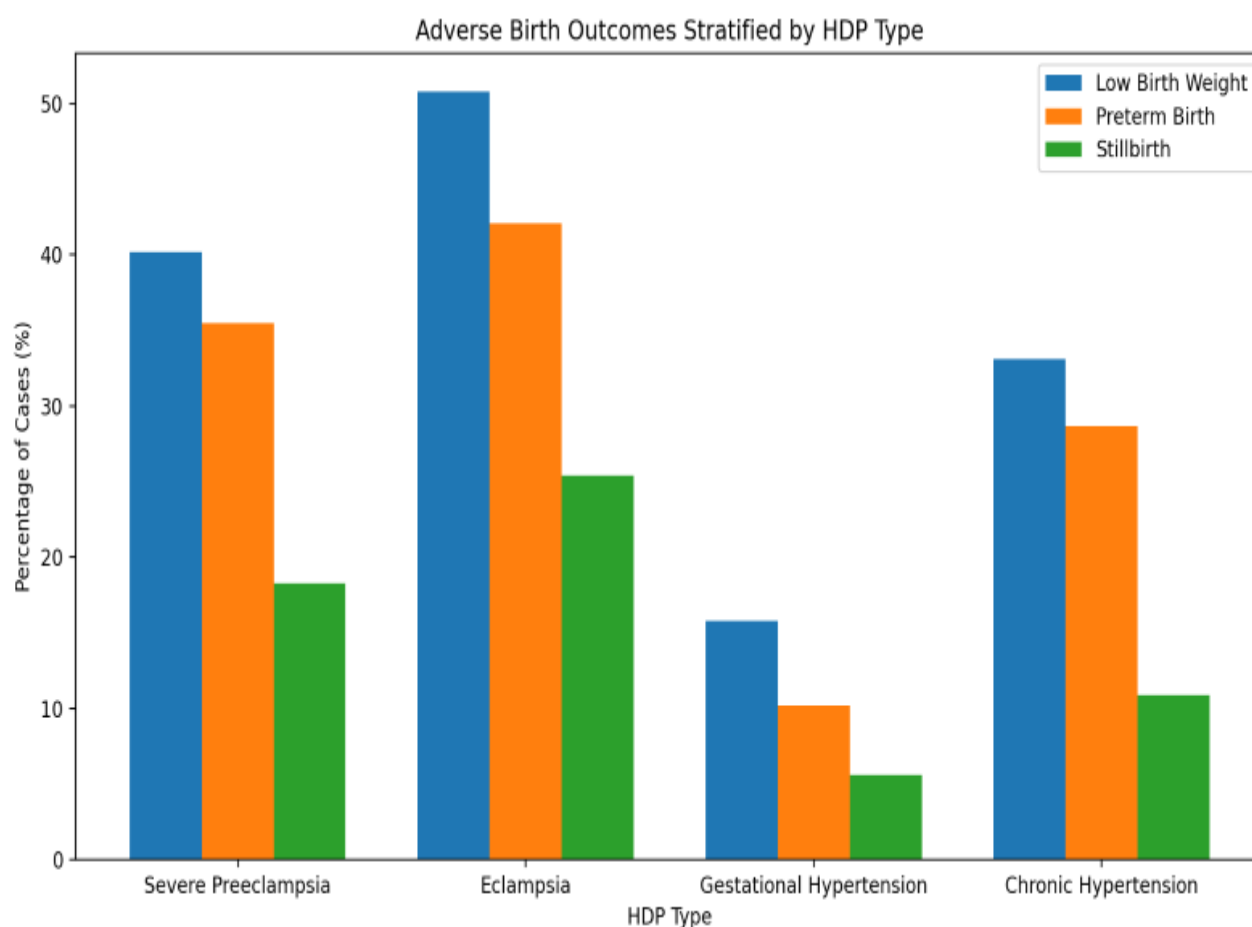


Figure 4: Adverse birth outcomes stratified by type of hypertensive disorder among women at hospitals in Arsi and East Shewa Zones, Oromia Region, Ethiopia (2024)

5.4. Factors Associated with Perinatal Outcomes among women with HDP disorder of pregnancy

Among women with hypertensive disorders of pregnancy (HDP), several factors were independently associated with adverse birth outcomes. Gestational age at diagnosis before 34 weeks was the strongest predictor, with these women having significantly higher odds of adverse outcomes (AOR = 7.92, 95% CI: 4.87–12.87, $p < 0.001$) compared to those diagnosed after 34 weeks.

The absence of antenatal care (ANC) visits was another critical risk factor. Women who did not attend ANC visits had markedly increased odds of adverse outcomes (AOR = 3.70, 95% CI: 2.00–6.90, $p < 0.001$) compared to those with at least one visit. Similarly, rural residence increased the

likelihood of adverse outcomes (AOR = 2.31, 95% CI: 1.42–3.75, $p < 0.05$) compared to urban residence. Maternal age below 25 years also significantly raised the odds of adverse outcomes (AOR = 2.10, 95% CI: 1.32–3.34, $p = 0.002$) compared to women aged ≥ 25 years.

Bivariate analysis highlighted additional significant associations. Women under 25 years showed higher rates of adverse outcomes compared to older women, with a crude odds ratio (OR) of 2.30. Rural residents also experienced higher rates of adverse outcomes, with a crude OR of 1.80. The absence of ANC visits demonstrated the strongest bivariate association, with a crude OR of 6.92. Prim-gravida women and those diagnosed with HDP before 34 weeks gestation also had significantly higher crude odds of adverse outcomes.

After adjusting for potential confounders, the multivariate model confirmed the independent associations of maternal age, rural residence, lack of ANC visits, and early diagnosis of HDP with adverse birth outcomes. The model demonstrated good explanatory power, accounting for 68% of the variance in adverse outcomes, and showed a good fit (Hosmer-Lemeshow test, $p > 0.05$) (Table 2).

low maternal age, residing in a rural setting, not engaging in ANC consultations, being a beginner mother and detecting HDP at an early stage are critical risk factors that lead to poor pregnancy outcomes. This means that there is a potential for substantial maternal and neonatal benefits in the future if there is heightened improvement of healthcare services availability in rural settings, increased ANC participation and HDP is diagnosed at an early stage.

Table 3: Bivariate and multivariate analysis of factors associated with adverse birth outcomes among women with hypertensive disorders at hospitals in Arsi and East Shewa Zones, Oromia Region, (N=467, Oromia, Ethiopia, 2024.

Variable	Category	Adverse Outcom e (n=220)	No Adverse Outcom e (n=247)	p-value	Crude OR (95% CI)	Adjusted OR (95% CI)	Adjusted p-value
Maternal Age (years)	<25	90 (40.9%)	57 (23.1%)	0.002	2.30 (1.45–3.64)	2.10 (1.32–3.34)	0.002
	≥ 25	130	190	Reference	Reference	Reference	Reference

		(59.1%)	(76.9%)				
Place of Residence	Rural	80 (36.4%)	44 (17.8%)	0.03	1.80 (1.20–2.70)	2.31 (1.42–3.75)	<0.05
	Urban	140 (63.6%)	203 (82.2%)	Reference	Reference	Reference	Reference
ANC Visits	None	80 (36.4%)	20 (8.1%)	<0.001	6.92 (3.97–12.08)	3.70 (2.00–6.90)	<0.001
	≥1	140 (63.6%)	227 (91.9%)	Reference	Reference	Reference	Reference
Parity	Primigravida	120 (54.5%)	58 (23.5%)	<0.001	3.91 (2.55–6.00)	3.50 (2.20–5.56)	<0.001
	Multigravida	100 (45.5%)	189 (76.5%)	Reference	Reference	Reference	Reference
Type of HDP	Severe Preeclampsia	100 (45.5%)	50 (20.2%)	<0.001	3.40 (2.18–5.28)	4.60 (2.30–9.10)	<0.001
	Other Types	120 (54.5%)	197 (79.8%)	Reference	Reference	Reference	Reference
Gestational Age at Diagnosis	<34 weeks	110 (50.0%)	30 (12.1%)	<0.001	7.92 (4.87–12.87)	6.90 (4.00–11.90)	<0.001
	≥34 weeks	110 (50.0%)	217 (87.9%)	Reference	Reference	Reference	Referenc

6. DISCUSSION

This study attempted to identify adverse birth outcomes and associated factors in pregnant women with HDP at hospitals in Arsi and East Shewa Zones, Oromia Region, Ethiopia. The finding shows a significantly high prevalence of adverse birth outcomes whereby nearly 47.2% had at least one adverse birth outcome. The most predominant adverse outcomes are low birth weight (29.8%), preterm birth (25.7%), and stillbirth (12.5%). These results show that HDP is a major determinant of neonatal health and point to the compelling need for effective interventions that can improve outcomes for mothers and neonates. Some of the main determinants of adverse birth outcomes were found to be maternal age, place of residence, ANC visits, parity, type of HDP, and gestational age at diagnosis. Younger maternal age (<25 years) and rural residence were associated with increased risks of adverse outcomes, possibly related to access to quality health care. No ANC visit proved to be a strong predictor of an adverse outcome, reinforcing the need for regular prenatal care in the management of HDP to reduce risk. Severe preeclampsia and eclampsia were the types of HDP most strongly associated with adverse outcomes, again underlining the importance of early diagnosis and effective management of the latter conditions.

These results are nearly similar to those from previous studies conducted in Ethiopia and other low-resource settings. For example, a high prevalence of adverse birth outcomes was reported by studies conducted in Amhara Region and Mettu Karl Referral Hospital, evidenced by similar rates in perinatal mortality, preterm birth, and low birth weight among the women with HDP studied (18).

This association is supported by other literature. A study from Wolaita Zone, Southern Ethiopia, and other parts of the country showed that non-follow-up of ANC during pregnancy was a strong predictor for poor fetal and neonatal outcomes (20).

The findings on the effect of socio-demographic factors, such as maternal age and rural residence on adverse outcomes, are consistent with studies conducted in Ghana, Tanzania, and Brazil that have pointed out similar trends (11, 16 37).

However, this study provides new insights specific to hospitals in Arsi and East Shewa Zones, Oromia Region by offering a wide-based analysis of the factors associated with adverse birth outcomes in this particular setting. The finding that severe preeclampsia and eclampsia are the types

of HDP most strongly associated with adverse outcomes points to the need for focused interventions targeting these conditions.

7. STRENGTHS AND LIMITATION

7.1 LIMITATION

The study was conducted in three purposively selected hospitals, two of which are in the Arsi zone..the study's cross-sectional nature precludes causal inferences. The reliance on medical records introduces potential biases due to missing or incomplete data. Additionally, the exclusion of twin pregnancies and cases with congenital anomalies, while intended to reduce confounding, may result in an underestimation of the overall burden of adverse outcomes in this population

8. CONCLUSIONS AND RECOMMENDATION

8.1. Conclusions

This study attempted to evaluate adverse birth outcomes and related factors among pregnant women with hypertensive disorders of pregnancy at hospitals in Arsi and East Shewa Zones, Oromia Region, Ethiopia. The major findings from this study have shed light on the huge burden of adverse birth outcomes associated with HDP.

High Prevalence of Adverse Outcomes: In this study, 47.2% of participants had at least one adverse birth outcome, the most common of which included low birth weight, preterm birth, and stillbirth with rates of 29.8%, 25.7%, and 12.5%, respectively. Important Risk Factors: Younger maternal age <25 years, rural residence, no ANC visits, prim-gravida status, severe preeclampsia, and early gestational age at diagnosis <34 weeks were the important risk factors related to increased risks of adverse outcomes.

Severe preeclampsia and eclampsia were the types of HDPs most strongly associated with adverse outcomes, which need targeted interventions.

The findings have shown the critical need for focused interventions to improve maternal and neonatal health outcomes among women with HDP at hospitals in Arsi and East Shewa Zones, Oromia Region Ethiopia.

8.2. Recommendations

While the findings provide valuable insights, they are specific to the selected hospitals. Broader studies that include hospitals from additional zones in Oromia Region are recommended to inform region-wide interventions. The following actionable suggestions emanate from the findings of this study for healthcare providers, policy makers, and researchers:

8.2.1. For Healthcare Providers:

Strengthen ANC Services: Increase ANC coverage and ensure quality prenatal care, especially in rural settings. Regular monitoring of blood pressure and laboratory markers may help in early diagnosis and management of HDP.

Improvement of Training and Awareness: Training of healthcare providers in the management of HDP and its complications, training for raising awareness among pregnant women and their families regarding the importance of ANC visits and early detection of hypertensive symptoms.

Improving Referral Systems: Ensuring well-thought-out referral systems are in place for high-risk pregnancies and accessing timely specialist care.

8.2.2. To the Policy Makers:

Invest in Healthcare Infrastructure: Provide access to emergency obstetric care and neonatal intensive care units in rural and underserved areas. Ensure that health facilities are equipped to handle high-risk pregnancies.

Formulate policies to support comprehensive maternal health programs, including ANC services, early diagnosis, and effective management of HDP. Avail financial and logistical support for the implementation of such programs.

Community Health Program Promotion: These programs on maternal and neonatal health should include education on the risks regarding HDP, and the essence of frequent health checkups.

8.2.3. To Researchers:

Further studies should aim at longitudinal evaluation to monitor maternal and neonatal outcomes for changes and the impact of HDP in the long run.

Provide translation and assessment of the effectiveness of specific interventions, such as enhanced ANC services and specialized treatment for severe preeclampsia and eclampsia, to inform evidence-based health recommendations.

Go beyond the limited range of socio-economic and cultural variables relevant to maternal/neonatal health in order to more accurately understand the nature of the challenges faced and possible solution paths.

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Annex I: English Version Questionnaires

Section One: Socio-Demographic Characteristics

No.	Question	Response	Skip
001	Place of residence	1. Urban 2. Rural	
002	Age	_____ (in years)	
003	Source of referral	1. Yes 2. No	
004	Educational Status	1. No formal education 2. Primary education 3. Secondary education 4. College/University	
005	Marital Status	1. Single 2. Married 3. Divorced 4. Widowed	
006	Monthly Income (in ETB): _____		

Section Two: Reproductive Health and Obstetric Characteristics

No.	Question	Response	Skip
007	ANC use	1. Yes 2. No	If you answered 'Yes' to Question 7, please proceed directly to Question 8. If 'No', proceed to Question 9.
008	Number of ANC follow-up	1. None 2. 1-3 contacts 3. 4-7 contacts 4. 8 or more	
009	Gravidity	1. Primi-gravida 2. Multigravida	
010	Parity	_____ (in number)	

No.	Question	Response	Skip
011	Gestational age at diagnosis	_____ (in weeks)	
012	Type of pregnancy	1. Singleton 2. Multiple gestation	
No.	Question	Response	Skip
013	Have you had any previous pregnancies with hypertensive disorders?	1. Yes 2. No	If you answered 'Yes' to Question 13, please proceed directly to Questions 14-17. If 'No', proceed to Question 18.
014	Did any previous pregnancies result in:	1. Perinatal death 2. Stillbirth 3. Early neonatal death	
015	Did you experience any of these complications in previous pregnancies?	1. HELLP syndrome 2. Placental abruption 3. Low birth weight 4. Preterm delivery	
016	Did you receive antihypertensive treatment in previous pregnancies?	1. Yes 2. No	
017	Were you admitted to hospital for HDP in previous pregnancies?	1. Yes 2. No	

Section Three: Current Pregnancy Types and Onset of HDP

No.	Question	Response	Skip
018	Type of HDP	1. Preeclampsia/Eclampsia 2. Superimposed PE on Chronic HTN 3. Chronic HTN 4. Gestational HTN	

No.	Question	Response	Skip
019	Onset of HDP	1. Antepartum 2. Intrapartum 3. Postpartum	

Section Four: Laboratory and Clinical Finding Characteristics

No.	Question	Response	Skip
020	Highest BP on admission	_____ Normal: 90-120 mmHg systolic, 60-80 mmHg diastolic	
021	Maternal Health Assessment	1. Height (cm): _____ 2. Weight (kg): _____ 3. BMI: _____ kg/m ²	
022	Urine protein level	1. Negative 2. Trace 3. +1 4. +2 5. +3	
023	Platelet count	_____ Normal: 150,000 to 450,000 cells/mcL	
024	Liver function test	1. AST: _____ Normal 10-40 IU/L 2. ALT: _____ Normal 7-56 IU/L 3. Other: _____	
025	Renal Function Test (RFT)	1. Creatinine: _____ Normal 0.6-1.2 mg/dL 2. BUN: _____ Normal 7-20 mg/dL 3. Other: _____	
026	Pre-existing Medical Conditions	1. Diabetes Mellitus 2. Cardiac Disease 3. Others _____	
027	Family history of hypertensive disorders?	1. Yes 2. No	
028	Onset of labour	1. Induced 2. Spontaneous	

No.	Question	Response	Skip
029	Current smoking	1. Yes 2. No	
030	Alcohol consumption	1. Yes 2. No	
No.	Question	Response	Skip
031	Mode of delivery	1. SVD 2. CS 3. Vacuum extraction 4. Forceps delivery 5. Others _____	
032	Was anti-hypertensive drug treatment given?	1. Yes 2. No	If you answered 'Yes' to Question 32, please proceed directly to Question 33. If 'No', proceed to Question 34.
033	What type of anti-hypertensive drug was given?	1. Anti-consultants (specify) _____ 2. Anti-hypertensive (specify) _____	
034	If No, please specify the reason:	1. Not prescribed by healthcare provider 2. Prescribed but not taken 3. Not available 4. Other (please specify) _____	

Section Five: Birth Outcomes

No.	Question	Response	Skip
035	Birth outcome	1. Stillbirth 2. Live birth	
036	Birth weight (grams)	1. <2500 g (Low birth weight) 2. ≥2500 g	
037	Gestational age at delivery (weeks)	1. <28 weeks (Extremely preterm) 2. 28-32 weeks (Very preterm) 3. 32-37 weeks (Moderate to late preterm) 4. ≥37 weeks (Term)	

No.	Question	Response	Skip
038	APGAR score at 1st minute	1. 0-3 2. 4-6 3. 7-10	
040	NICU admission	1. Yes 2. No	

Annex II: Supplementary Tables

Table S1: Sensitivity Analysis of Complete vs. Incomplete Data

Variable	Complete Data (n=455)	Incomplete Data (n=12)	p-value
Low Birth Weight (%)	29.6	33.3	0.742
Preterm Birth (%)	25.5	28.6	0.812
Stillbirth (%)	12.3	16.7	0.601
Neonatal Asphyxia (%)	8.8	9.1	0.967

Table S2: Distribution of HDP Types by Hospital

Hospital	Severe Preeclampsia (%)	Eclampsia (%)	Gestational Hypertension (%)	Chronic Hypertension (%)
Asella	45.2	20.3	25.0	9.5
Adama	50.1	18.7	21.5	9.7
Bekoji	38.7	22.1	28.4	10.8

Declaration of Investigator

I, the undersigned student of General Master of maternity and reproductive health declare that this THESIS is my original work in partial fulfillment of the requirement for the degree of General Master of maternity and reproductive health to my best knowledge.

Name of investigator: _____

Signature: _____ Date _____ Declaration of Advisors

We, the undersigned Advisors, declare that this THESIS is our original work in partial fulfillment of the requirement for the degree of General Master of maternity and reproductive health for the stated student above to our best knowledge. We confirmed that this THESIS is ready for defense with our approval as the university advisor(s).

Date of Submission: _____

Name of primary Advisors:	Signatures	Date
_____	_____	_____
Name of secondary Advisors:	Signatures	Date
_____	_____	_____