ORIGINAL RESEARCH ARTICLE

Socio-demographic predictors of perinatal outcomes among women with hypertensive disorders in pregnancy at selected health facilities in Kenya

Jacqueline Kituku[1,2], Kenneth Ngure[1], Lister Onsongo[2]

[1]School of Public Health, Jomo Kenyatta University of Agriculture and Technology, Kenya
[2]Department of Community Health and Reproductive Health Nursing, Kenyatta University, Kenya

Corresponding author email: kituku.jacqueline@ku.ac.ke

Abstract

Pregnancy outcomes are dependent on many factors. The leading adverse perinatal outcomes in low and middle-income countries are preterm births, stillbirths and low birth weight. There is a dearth of locally published data on hypertensive disorders and associated perinatal outcomes. The study aimed to identify the influence of socio-demographic factors on perinatal outcomes of women with hypertensive disorders in pregnancy. We recruited one hundred twenty-six pregnant women with hypertensive disorders into this longitudinal panel study. Data was collected at baseline, antenatal follow-up(s), labour and postnatal using structured questionnaires from October 2021 to January 2023. We followed up with the study participants every 4-6 weeks, depending on clinic appointments and up to six weeks after birth. Descriptive statistics and multiple logistic regression were used to analyze the data. Majority (32%) were aged 35-39 years and 60% resided in rural areas. At the first follow-up, 6% did not show an increase in fundal height. At labour and delivery, 70% had preterm gestation, 9% had an absent fetal heart and 13.0% had stillbirths. Residing in the rural area was associated with higher likelihood (OR=0.2) of having IUGR. Households with a monthly income of <Ksh 20,000.00 displayed higher odds of delayed initiation of breastfeeding (OR=14.5). There was higher likelihood for infants born to women aged 35-49 years (OR=4.9) and having education level of primary and below (OR=0.2) to experience complications during the 4th postnatal visits, respectively. Age (35-49 years), residing in the rural area, primary level of education and below, household income <Ksh 20,000.00 and increasing household size were associated with adverse perinatal outcomes. This study recommends scaling up efforts on the importance of early initiation and adherence to all ANC appointments through community outreaches.

Keywords: Pregnancy, Perinatal outcomes, Women, Hypertensive Disorders in Pregnancy, Socio-Demographic Factors

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10

1.0 Introduction

Globally, approximately one million neonatal deaths occurred in 2020 from complications of prematurity (World Health Organization 2023; Momanyi et al. 2025). The neonatal mortality ratio in Kenya of 22 deaths per 1,000 live births is higher than the sustainable development goals target of less than 12 per 1,000 live births by 2030 (KNBS 2022; United Nations 2015). Among the neonates born globally in 2015, 20.5 million of them had low birth weight (LBW), and about half of them were from south Asia (World Health Organization 2022; UNICEF & World Health Organization 2019). Perinatal outcomes are determined by multiple factors including socio-demographic characteristics. Hypertensive disorders in pregnancy (HDP) complicate an estimated 4-10% of all pregnancies and are a leading cause of maternal and neonatal morbidity and mortality globally (Dolatian et al. 2020; Assefaid & Demissie 2019; Dassah et al. 2019; Gupta et al. 2019). Preeclampsia is associated with prematurity, intra-uterine fetal death (IUFD), low Apgar score, stillbirth, neonatal admissions and neonatal deaths (Magee et al. 2020; Logan et al. 2020; Asseffaid & Demissie 2019).

Studies have demonstrated that socio-demographic characteristics influence perinatal outcomes. Women aged between 20 and 34 years had a lower risk of adverse birth outcomes as compared to those younger than 20 years (Kaforau et al. 2022; Mnabwiru et al. 2024). Lower literacy levels of Primary education and below are associated with poor pregnancy outcomes such as prematurity and still births (Woday et al. 2019; Sinha et al. 2022). There is an inverse proportional association between increasing maternal education and decreased prevalence of low birth weight neonates. The woman's occupation may be associated with adverse outcomes, where women who were not employed were more likely to have LBW infants (Iaconoa et al. (2024); Alemu et al. (2019) . Those residing in rural areas had higher odds of having stillbirths (Sinha et al. 2022; Kassahun et al. 2019). There is a paucity of locally published studies on HDP and perinatal outcomes. It is against this backdrop that our study aimed to establish the association between socio-demographic factors and perinatal outcomes among women with HDP in northwestern Kenya.

2.0 Materials and methods

2.1 Study setting

This was a longitudinal panel study design. Data was collected from Matunda, Kwanza and Cherang'any sub-county hospitals and Kitale County referral hospital, in Trans Nzoia. Matunda. Kwanza and Cherang'any were selected because they offered prenatal, intrapartum, postpartum and newborn care services, as well as Basic Emergency Obstretric and Newborn Care (BEmONC). Kitale County referral hospital was selected because apart from offering all the services offered in the lower level facilites, it also offered comprehensive Emergency Obstetric and Newborn Care (CEmONC).

2.1.1 Sampling

Multi-stage sampling was employed. Simple random sampling was used to select three sub-counties. Sub-county hospitals in each sub-county were listed down and simple random sampling was used to

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10

select one. Stratified random sampling was then employed where pregnant women attending ANC were divided into three strata: no complications, HDP and other complications. Women with HDP were selected. Probability proportionate to size was used to allocate the sample to each facility and lastly, systematic sampling was used to select the women with HDP (kth=1).

2.2 Study population

This study included pregnant women with hypertensive disorders at 24 to 28 weeks gestation, residing within the catchment area of the selected health facilities and seeking antenatal care services there. The study excluded women who were too sick, those with very severe hypertension above 160/110 mmHg or underlying conditions at the time of recruitment.

The study sample size was calculated using the sample size formula for estimating a proportion (Alemie et al. 2021) as:

$$n = Z1-\alpha^2 \frac{p(1-p)}{d^2} = 1.96^2 \frac{0.664(0.336)}{0.05^2} =$$
$$3.8416 \frac{0.223104}{0.0025} = 3.8416 * 89.2416 = 343$$

Where: Z1-α: statistical constant α=0.05=1.96
p: Proportion of population that develop an outcome (66.4%) (Berhe et al. 2020)
q: (1-p)= 1-0.664=0.336
d: Sampling error (0.05)

Being a finite population (<10,000) (Alemie et al. 2021), Cochran correction formula was used:

$$n = \frac{no}{1+(n0-1)/N} = \frac{343}{1+(343-1)/166} = \frac{343}{1+(342)/166} = 112$$
$$\frac{343}{1+2.06} = \frac{343}{3.06} = 112 = 112*12\% = n=126$$

Where:
n0: sample size n=343
N: population with HDP (approx. 2739 women attended first ANC visit in selected health facilities within 6-month period. Consolidated prevalence of HDP in Ethiopia (6.07 %) (Berhe et al. 2018) used to estimate number of women with HDP (2739*6.07%=166. To cater for non-response n was increased by 12%.

2.3 Data collection

Data was collected using structured questionnaires at baseline (24-28 weeks of pregnancy), follow-up (clinic-appointed dates) and outcome (labour and delivery, within 24 hours, 48-72 hours and six

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10

weeks after birth), from October 2021 to January 2023. Recruitment and follow-up of the women were done on a rolling basis. Follow-up data was collected every 4-6 weeks.

2.4 Reliability and validity

The research tools were pretested on 20% of the sample size and the Cronbach alpha of 0.75 was determined statistically. Ambiguous or confusing question was modified accordingly. Tools were shared with midwives, doctors, obstetricians and supervisors to test for content validity and unclear questions were revised accordingly.

2.5 Data analysis

Data was analyzed using STATA version 16 and was presented as frequencies and percentages. Multiple logistic regression was performed to test the correlation between independent and outcome variables. Results were considered statistically significant for $p<0.05$ and 95% confidence intervals.

3.0 Results

Figure 1 describes the sample size during the course of the study period.

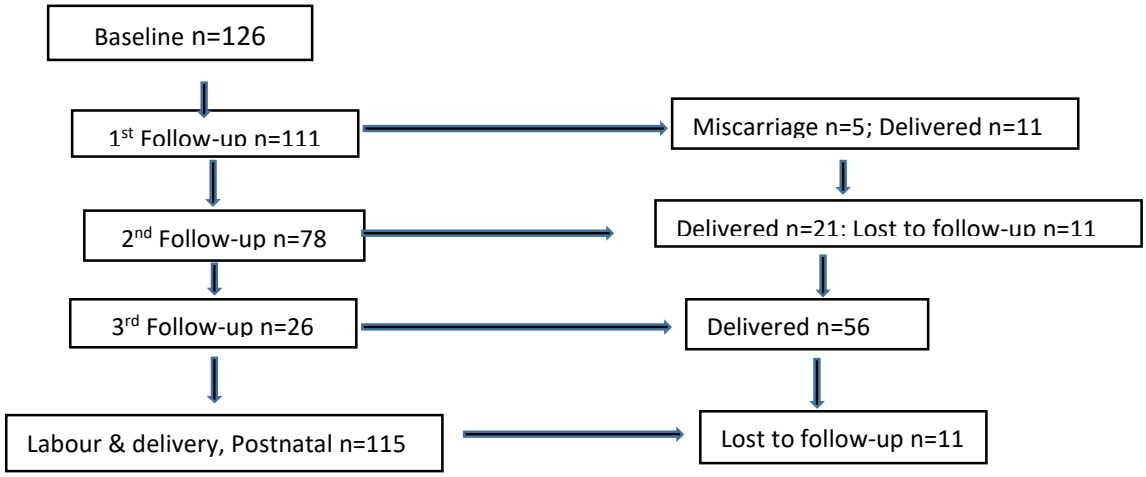

Figure 1: Flow Chart Describing the Sample (n) at Different Points in Time

3.1 Socio-economic and demographic characteristics

Majority, 32% (*n=41*) were aged 35-39 years and 84% (*n=106*) were married. About 42% (*n=53*) had secondary education and 72% (*n=91*) were employed/self-employed. About two-thirds (60% *n=76*) of respondents resided in rural areas and more than half (64% *n=81*), had monthly household incomes of less than Ksh 20,000. See Table 1.

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10

Table 1: Socio-Demographic Characteristics

Variables		N (%)
Age	15-19	3 (2%)
	20-24	9 (7%)
	25-29	35 (28%)
	30-34	31 (25%)
	35-39	41 (32%)
	40-44	7 (6%)
Marital Status	Single/Separated	20 (16%)
	Married	106 (84%)
Education level	≤Primary	44 (35%)
	Secondary	53 (42%)
	≥Tertiary	29 (23%)
Employment Status	Employed/Self-employed	91 (72%)
	Unemployed	35 (28%)
Residence	Urban	50 (40%)
	Rural	76 (60%)
Monthly Household Income (Ksh)	<Ksh 10,000	81 (64%)
	Ksh 10,000-20,000	26 (21%)
	Ksh 20,001-30,000	11 (9%)
	>Ksh 40,000	8 (6%)
Religion	Christians	124 (98%)
	Others	2 (2%)

3.1.1 Perinatal outcomes during pregnancy, labour and postnatal period

Minority, 6% (*n=7*) of the women experienced no increase in fundal height (intrauterine growth restriction [IUGR]), at the first follow-up visit. The fetal heart (intrauterine fetal death [IUFD]) could not be detected in very few respondents (8% n=2) at the third follow-up. (Table 2)

Table 2: Perinatal Outcomes during Pregnancy and Labour

Variables		N (%)
First antenatal follow-up		
Change in Fundal Height	Increase	104 (94%)
	No Change/decrease	7 (6%)
Status of Foetal Heart	Present	107 (96%)
	Palpable Mass/Absent/Not Heard/Not recorded	4 (4%)
Second antenatal follow-up		
Change in Fundal Height	Increase	68 (87%)
	No Change/decrease	10 (13%)
Status of Foetal Heart	Present	76 (97%)
	Palpable Mass/Absent/Not Heard	2 (3%)
Third antenatal follow-up		
Change in Fundal Height	Increase	24 (92%)
	No Change/decrease	2 (8%)
Status of Foetal Heart	Present	24 (92%)

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10

	Palpable Mass/Absent/Not Heard	2 (8%)

The mean gestation at admission was 36.8 weeks and majority (70% *n=80*) had preterm gestation. Few, 9% (*n=11*) had IUFD. Slightly less than a fifth (18% *n=21*) of infants were admitted to the newborn unit (NBU) immediately following birth (Table 3)

Table 2: Perinatal Outcomes during Pregnancy and Labour

Variables		N (%)
First antenatal follow-up		
Change in Fundal Height	Increase	104 (94%)
	No Change/decrease	7 (6%)
Status of Foetal Heart	Present	107 (96%)
	Palpable Mass/Absent/Not Heard/Not recorded	4 (4%)
Second antenatal follow-up		
Change in Fundal Height	Increase	68 (87%)
	No Change/decrease	10 (13%)
Status of Foetal Heart	Present	76 (97%)
	Palpable Mass/Absent/Not Heard	2 (3%)
Third antenatal follow-up		
Change in Fundal Height	Increase	24 (92%)
	No Change/decrease	2 (8%)
Status of Foetal Heart	Present	24 (92%)
	Palpable Mass/Absent/Not Heard	2 (8%)
Gestation at labour	Miscarriage (<28 weeks)	5 (4%)
	Premature (28-<38 weeks)	80 (70%)
	Term (>38-42 weeks)	30 (26%)
Status of Foetal Heart	Present	94 (82%)
	Absent	11 (9%)
	2nd Stage	2 (2%)
	Not Documented/Not applicable	8 (7%)
Condition of Newborn	Alive	93 (81%)
	Dead	17 (13%)
	Not Applicable	5 (6%)
Type of stillbirth	Fresh	10 (9%)
	Macerated	11 (9%)
	Not applicable/Not documented	94 (82%)
NBU Admission	Yes	21 (18%)
	No	72 (63%)
	Not Applicable	22 (19%)
Apgar score 1 Min	Normal	82 (71%)
	Birth Asphyxia	9 (8%)
	Not Applicable/Not documented	24 (21%)
Apgar Score 5 Min	Normal	89 (77%)
	Birth Asphyxia	2 (2%)
	Not Applicable/Not documented	24 (21%)
Apgar Score 10 Min	Normal	89 (77%)

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10

	Birth Asphyxia	2 (2%)
	Not Applicable/Not documented	24 (21%)
Time Taken to Initiate Breast Feeding	<30 minutes	74 (64%)
	30-60 minutes	15 (13%)
	>60 minutes	4 (4%)
	Not Applicable	22 (19%)
Birth weight	Normal	58 (50%)
	LBW	32 (29%)
	Very LBW	4 (3%)
	Extremely LBW	1 (1%)
	Macrosomia	4 (3%)
	Not weighed/Not applicable	16 (14%)

Table 3: Perinatal Outcomes during Labour and birth

Variables		N (%)
Gestation at labour	Miscarriage (<28 weeks)	5 (4%)
	Premature (28-<38 weeks)	80 (70%)
	Term (>38-42 weeks)	30 (26%)
Status of Foetal Heart	Present	94 (82%)
	Absent	11 (9%)
	2nd Stage	2 (2%)
	Not Documented/Not applicable	8 (7%)
Condition of Newborn	Alive	93 (81%)
	Dead	17 (13%)
	Not Applicable	5 (6%)
Type of stillbirth	Fresh	10 (9%)
	Macerated	11 (9%)
	Not applicable/Not documented	94 (82%)
NBU Admission	Yes	21 (18%)
	No	72 (63%)
	Not Applicable	22 (19%)
Apgar score 1 Min	Normal	82 (71%)
	Birth Asphyxia	9 (8%)
	Not Applicable/Not documented	24 (21%)
Apgar Score 5 Min	Normal	89 (77%)
	Birth Asphyxia	2 (2%)
	Not Applicable/Not documented	24 (21%)
Apgar Score 10 Min	Normal	89 (77%)
	Birth Asphyxia	2 (2%)
	Not Applicable/Not documented	24 (21%)
Time Taken to Initiate Breast Feeding	<30 minutes	74 (64%)
	30-60 minutes	15 (13%)
	>60 minutes	4 (4%)
	Not Applicable	22 (19%)
Birth weight	Normal	58 (50%)

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10

LBW	32 (29%)
Very LBW	4 (3%)
Extremely LBW	1 (1%)
Macrosomia	4 (3%)
Not weighed/Not applicable	16 (14%)

During the first postnatal (PN) visit, 81% (*n=93*) of babies were alive and 16% (*n=18*) were not exclusively breastfed. At the second PN visit, 10% (n=12) of babies had complications and were admitted to NBU. By the fourth PN visit, two babies were dead. (See Table 4)

Table 4: Postnatal neonatal outcomes

Variables	1st PN visit N (%)	2nd PN visit N (%)	3rd PN visit N (%)	4th PN visit N (%)
Condition of newborn				
Alive	93 (81%)	92 (80%)	92 (80%)	90 (78%)
Dead	0 (0%)	1 (1%)	0 (0%)	2 (2%)
Not Applicable	22 (19%)	22 (19%)	23 (20%)	23 (20%)
Complications of Newborn				
Yes	13 (11%)	12 (10%)	10 (9%)	13 (11%)
No	80 (70%)	80 (70%)	82 (71%)	77 (66%)
Not Applicable	22 (19%)	23 (20%)	23 (20%)	25 (22%)
Breastfeeding				
Yes	75 (65%)	78 (67%)	80 (70%)	88 (76%)
No	18 (16%)	14 (12%)	12 (10%)	2 (2%)
Not Applicable	22 (19%)	23 (20%)	23 (20%)	25 (22%)
NBU admission				
Yes	13 (11%)	12 (10%)	10 (9%)	1 (1%)
No	80 (70%)	80 (70%)	82 (71%)	89 (77%)
Not Applicable	22 (19%)	23 (20%)	23 (20%)	25 (22%)

3.1.2 Socio-demographic predictors of perinatal outcomes

In Table 5 below, women residing in rural areas were less likely (OR 0.2) to experience IUGR during pregnancy. Other socio-demographic variables were not significantly associated with adverse perinatal outcomes.

Table 5: Logistic regression of perinatal outcomes during pregnancy and labour

VARIABLES	FH OR (95% CI) [P]	FHR Preg OR (95% CI) [P]	Apgar1 OR (95% CI) [P]	FHR labour OR (95% CI) [P]	Stillbirth OR (95% CI) [P]	NBU0 OR (95% CI) [P]
Age						
35-49 years	2.2 (0.7- 7.2) [0.19] (1.3)	2.4 (0.3- 21.0) [0.425] (2.7)	1.8 (0.3- 10.3) [0.526] (1.6)	4.4 (1.0- 20.0) [0.057] (3.4)	2.3 (0.7- 7.3) [0.144] (1.4)	1.8 (0.6- 5.8) [0.292] (1.1)
15-34 years	1	1	1	1	1	1
Marital status						
Married		0.3 (0.03- 3.8)			1.5 (0.2- 11.2)	0.6 (0.1- 3.7)

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10

		[0.371]			[0.698]	[0.624]
		(0.4)			(1.5)	(0.6)
Single/ separated		1			1	1
Education Level						
≥Secondary	0.6 (0.2- 2.1)	1.0 (0.2- 5.2)	1.4 (0.2- 12.0)	0.6 (0.1- 3.7)	0.6 (0.1- 2.3)	0.6 (0.2- 2.5)
education	[0.4]	[0.996]	[0.773]	[0.613]	[0.44]	[0.524]
	(0.4)	(0.8)	(1.5)	(0.6)	(0.4)	(0.4)
≤Primary	1	1	1	1	1	1
education						
Employment Status						
Self-/ Employed	0.6 (0.2- 2.1)	0.9 (0.1- 14.9)	0.6 (0.1- 5.0)	1.1 (0.2- 8.4)	2.1 (0.3- 13.0)	0.7 (0.2- 2.5)
	[0.431]	[0.928]	[0.632]	[0.907]	[0.43]	[0.583]
	(0.4)	(1.3)	(0.6)	(1.2)	(1.9)	(0.5)
Unemployed	1	1	1	1	1	1
Location						
Rural	0.2 (0.1- 0.8)	0.8 (0.1- 4.6)	2.0 (0.3- 13.8)	0.8 (0.2- 3.2)	0.7 (0.2- 2.8)	1.3 (0.3- 5.4)
	[0.023]**	[0.759]	[0.469]	[0.726]	[0.667]	[0.724]
	(0.1)	0.7)	(2.0)	(0.6)	(0.5)	(0.9)
Urban	1	1	1	1	1	1
Income Level						
≥Ksh 20,000.00	2.0 (0.4- 9.4)	1.6 (0.1- 29.3)	4.9 (0.6- 41.4)	3.1 (0.6- 15.2)	3.6 (0.8- 15.6)	2.3 (0.4- 12.4)
	[0.389]	[0.747]	[0.149]	[0.159]	[0.086]	[0.325]
	(1.6)	(2.4)	(5.3)	(2.5)	(2.7)	(2.0)
<Ksh 20,000.00	1	1	1	1	1	1
Household Size						
Unit increase	1.1 (0.7- 1.5)	1.1 (0.6- 1.7)	0.8 (0.6- 1.1)	0.9 (0.6- 1.4)	0.9 (0.6- 1.2)	0.9 (0.6- 1.3)
	[0.769]	[0.826]	[0.167]	[0.568]	[0.392]	[0.521]
	(0.2)	(0.3)	(0.1)	(0.2)	(0.2)	(0.2)
Constant	0.8 (0.1- 8.4)	0.1 (0.0- 7.6)	0.2 (0.01- 7.9)	0.3 (0.02- 4.0)	0.2 (0.0- 4.7)	1.3 (0.1- 31.3)
	[0.887]	[0.294]	[0.402]	[0.335]	[0.322]	[0.873]
	(0.99)	(0.2)	(0.4)	(0.4)	(0.3)	(2.1)
Observations	106	117	78	87	105	86
Pseudo R squared	0.0982	0.0445	0.0918	0.0999	0.0809	0.0611
Chi squared	9.441	9.335	8.419	6.909	8.33	6.9

Explanatory variables showed no statistical significance except the level of income. Newborn babies from households where the monthly income was more than Ksh 20,000 had higher odds (OR 14.5) of being exclusively breastfed during the first PN visit compared to those with higher income. See Table 6.

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10

Table 6: Logistic regression of perinatal outcomes during labour and postnatal

VARIABLES	BF 0[1] OR (95% CI) [P]	PTB[2] OR (95% CI) [P]	LBW[3] OR (95% CI) [P]	NNM[7] OR (95% CI) [P]	CM NB1 OR (95% CI) [P]	CM NB2 OR (95% CI) [P]	CM NB3 OR (95% CI) [P]
Age							
35-49 years	0.7 (0.1- 4.4) [0.731] (0.7)	2.4 (0.9- 6.5) [0.083] (1.2)	1.2 (0.4- 3.2) [0.749] (0.6)	1.2 (0.3- 4.4) [0.751] (0.8)			8.7 (0.7- 107.6) [0.091] (11.2)
15-34 years	1	1	1	1			1
Marital status							
Married	0.3 (0.03- 3.6) [0.349] (0.4)	1.2 (0.2- 6.3) [0.821) (1.02)	0.8 (0.2- 3.6) [0.799] (0.6)	1.0 (0.1- 10.3) [0.99] (1.2)		0.4 (0.0- 43.6) [0.73] (1.04)	0.3 (0.0- 4.2) [0.342] (0.4)
Single/ separated	1	1	1	1		1	1
Education Level							
≥Secondary education	0.4 (0.1- 1.6) [0.185] (0.3)	0.4 (0.1- 1.3) [0.145] (0.2)	0.8 (0.3- 2.3) [0.63] (0.4)	0.3 (0.1- 1.8) [0.2] (0.3)	3.1 (0.4- 26.0) [0.29] (3.4)	6.03 (0.1- 272.4) [0.356] (11.7)	0.1 (0.0- 1.9) [0.135] (0.2)
≤Primary education	1	1	1	1	1	1	1
Employment Status							
Self-/ Employed	0.5 (0.1- 2.0) [0.296] (0.3)	0.5 (0.1- 1.7) [0.281] (0.3)	0.4 (0.1- 1.3) [0.133] (0.2)	1.6 (0.3- 9.6) [0.63] (1.5)	0.6 (0.1- 6.3) [0.691] (0.7)	0.3 (0.0- 5.1) [0.437] (0.5)	0.8 (0.1- 8.1) [0.869] (1.0)
Unemployed	1	1	1	1	1	1	1
Location							
Rural	2.1 (0.3- 12.3) [0.431] (1.9)	0.5 (0.2- 1.5) [0.213] (0.3)	0.4 (0.1- 1.5) [0.2] (0.3)	3.0 (0.6- 13.3) [0.158] (2.3)	1.4 (0.2- 9.5) [0.743] (1.4)		1.6 (0.1- 19.5) [0.73] (2.0)
Urban	1	1	1	1	1		1
Income Level							
≥Ksh 20,000.00	14.5 (1.9- 110.2) [0.01]*** (15.0)	3.4 (0.8- 15.0) [0.112] (2.6)	1.3 (0.3- 5.0) [0.687] (0.9)	4.2 (0.8- 22.6) [0.091] (3.6)	13.4 (0.6- 277.1) [0.093] (20.7)		
<Ksh 20,000.00	1	1	1	1	1		
Household Size							
Unit increase	0.8 (0.5- 1.4) [0.509] (0.2)	0.9 (0.6- 1.4) [0.763] (0.2)	1.0 (0.7- 1.4) [0.941] (0.2)	1.1 (0.8- 1.5) [0.687] (0.2)	1.3 (0.7- 2.3) [0.46] (0.4)	2.2 (0.6- 8.0) [0.245] (1.4)	0.9 (0.4- 1.8) [0.725] (0.3)
Constant	3.9 (0.1- 268.4) [0.525] (8.5)	18.2 (0.7- 495.8) [0.085] (30.7)	4.6 (0.3- 61.4) [0.253] (6.0)	0.01 (0.0- 0.7) [0.03]** (0.03)	0.03 (0.0- 7.6) [0.216] (0.1)	0.0 (1.14E-07- 830.8) [0.424] (0.1)	0.5 (0.0- 29.3) [0.732] (1.0)
Observations	85	103	89	117	50	17	73
Pseudo R squared	0.2196	0.0957	0.0532	0.106	0.144	0.196	0.238
Chi squared	20.1	11.1	4.583	5.716	5.14	5.44	10.96

[1] BF0 is delayed initiation of breastfeeding
[2] PTB is prematurity
[3] LBW is low birth weight

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10

Infants born to women aged 35-49 years were more likely to experience complications by the fourth postnatal visit (OR 4.9). Literacy played in birth outcomes with infants of women with more than secondary education having 0.2 lower odds of developing complications by the third postnatal visit. Infants from households with a monthly income of more than Ksh 20,000 were more likely (OR 14.5) to be exclusively breastfed during the first postnatal visit. See Table 7.

Table 7: Logistic regression of perinatal outcomes during post-natal

	CM NB4	BF1[4]	BF2	BF3	NBU1	NBU2	NBU3
VARIABLES	OR (95% CI) [P]	OR (95% CI) [P]	OR (95% CI) [P]	OR (95% CI) [P]	OR (95% CI) [P]	OR (95% CI) [P]	OR (95% CI) [P]
Age							
35-49 years	4.9 (1.4- 16.7) [0.012]** (3.1)	0.7 (0.1- 4.4) [0.731] (0.7)	1.3 (0.2- 6.8) [0.757] (1.1)	3.8 (0.7- 19.4) [0.11] (3.2)	1.1 (0.2- 5.8) [0.902] (0.9)	1.1 (0.2- 6.9) [0.93] (1.0)	3.0 (0.6- 16.0) [0.191] (2.6)
15-34 years	1	1	1	1	1	1	1
Marital Status							
Married	0.7 (0.1- 6.7) [0.758] (0.8)	0.3 (0.0- 3.6) [0.349] (0.4)	0.3 (0.0- 2.1) [0.225] (0.3)	0.3 (0.1- 1.7) [0.176] (0.3)	0.8 (0.0- 14.2) [0.861] (1.1)	0.8 (0.1- 9.0) [0.855] (1.0)	0.2 (0.0- 1.5) [0.129] (0.2)
Single/ separated	1	1	1	1	1	1	1
Education Level							
≥Secondary education	0.2 (0.0- 0.8) [0.03]** (0.1)	0.4 (0.1- 1.6) [0.185] (0.3)	0.3 (0.1- 1.4) [0.121] (0.2)	0.3 (0.0- 2.7) [0.281] (0.3)	0.7 (0.2- 3.1) [0.63] (0.5)	0.2 (0.0- 1.3) [0.099]* (0.2)	0.6 (0.1- 5.3) [0.618] (0.6)
≤Primary education	1	1	1	1	1	1	1
Employment Status							
Self-/ Employed	0.6 (0.1- 2.0) [0.369] (0.4)	0.5 (0.1- 2.0) [0.296] (0.3)	0.6 (0.1- 2.30 [0.425] (0.4)	1.7 (0.2- 12.9) [0.586] (1.8)	0.5 (0.1- 1.9) [0.29] (0.3)	0.5 (0.1- 2.2) [0.398] (0.4)	0.9 (0.1- 5.5) [0.897] (0.8)
Unemployed	1	1	1	1	1	1	1
Location							
Rural	2.3 (0.4- 12.3) [0.339] (2.0)	2.1 (0.3- 12.3) [0.431] (1.9)	1.7 (0.3- 9.2) [0.561] (1.5)	2.1 (0.4- 11.9) [0.393] (1.9)	3.0 (0.4- 21.0) [0.279] (3.0)	0.9 (0.2- 5.0) [0.902] (0.8)	0.9 (0.2- 5.4) [0.953] (0.8)
Urban	1	1	1	1	1	1	1
Income Level							
≥Ksh 20,000.00	0.8 (0.1- 10.7) [0.864] (1.1)	14.5 (1.9- 110.2) [0.01]*** (15.0)	5.1 (0.6- 42.2) [0.128] (5.5)		4.5 (0.5- 36.8) [0.164] (4.8)	1.7 (0.2- 15.8) [0.621] (2.0)	
<Ksh 20,000.00	1	1	1		1	1	
Household Size							
Unit increase	0.8 (0.5- 1.3) [0.398] (0.2)	0.8 (0.5- 1.4) [0.509] (0.3)	0.8 (0.5- 1.4) [0.464] (0.2)	0.7 (0.4- 1.3) [0.257] (0.2)	1.0 (0.5- 1.7) [0.886] (0.3)	0.7 (0.4- 1.4) [0.354] (0.2)	1.0 (0.6- 1.6) [0.948] (0.3)
Constant	0.5 (0.0- 21.9) [0.701] (0.9)	3.9 (0.1- 268.4) [0.525] (8.5)	3.3 (0.1- 144.8) [0.54] (6.3)	1.2 (0.0- 52.0) [0.924] 2.3	0.3 (0.0- 68.0) [0.662] (0.8)	3.1 (0.0- 233.9) [0.603] (6.9)	0.8 (0.0- 56.8) [0.916] (1.7)

[7] NNM is Neonatal Mortality
[8] BF symbolizes not exclusively breastfed

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10

Observations	85	85	86	74	86	86	74
Pseudo R square	0.168	0.220	0.153	0.140	0.110	0.146	0.124
Wald Chi-square	12.11	20.10	10.79	10.18	8.239	10.28	9.908

4.0 Discussion

We found an association between maternal age and infant complications at the fourth post-natal visit, with newborns of mothers ages 35-49 more likely to have complications during the third and fourth post-natal visits. While our study reported no association between maternal age and admission to the NICU or neonatal death, maternal age was associated with the infants' complications during the fourth postnatal visit as depicted by Asseffaid et al. (2019), and other similar findings. For instance, adverse pregnancy outcomes such as LBW was associated with women aged ≥40, <30 and 35-49 years (Iaconoa et al. 2024). These differences could stem from the categorization of maternal age in our study as; 35-49 and 15-34 years. A non-significant association existed between women aged ≥34 years and APO (Kassahun et al. 2019). Divergence in findings may be related to the nature of the APO tested; multiple in our study as compared to three among the authors.
In comparison to our data, other studies found that women aged >40 years were more at risk of IUFD, NBU admission and SGA (Montori et al. 2021). The difference may have arisen because we collected data at different points in time while the other studies collected data only once. There was an association between APO (LBW, stillbirth and prematurity), and maternal age of more than 34 years (Kassahun et al. 2019). Obsa et al. (2019) found an association between maternal age and IUFD, where women aged 20-34 and 30-34 years had higher risk of IUFD. The variation may result from our age classification and adjustments due to the limited data for mothers under 20 leading to grouping ages as 15-34 and 35-49 years.

Our findings revealed that education level was not associated with IUGR, IUFD, stillbirths, immediate admission of newborn to NBU after birth and initiation of breastfeeding. Nevertheless, having secondary education and above was associated with low odds of newborn complications during the fourth postnatal visit. Contrary studies found an association between some APO and education where illiterate women or those with low education level had higher odds of prematurity, LBW and stillbirths (Woday et al. 2019; Sinha et al. 2022; Iaconoa et al. 2024). Differences in the two studies may be attributed to the nature of classifying education as either primary and below, and secondary and above in our study. Other differing results findings indicated no statistical significance between exclusive breastfeeding (EBF) and maternal education (Nangolo et al. 2023).

We noted that women from rural settings were less likely to experience IUGR during pregnancy. This finding departs from a comparable study which found no association between socio-demographic factors and SGA (Kofarau et al. 2022). The difference lies in the type of risk factors assessed, with other authors focusing on stress, teenage pregnancy, malaria and poverty. Other contrary findings reported that women residing in rural areas had a higher likelihood of preterm labour and birth and

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10

stillbirths (Woday et al. 2019; Sinha et al. 2022). Nangolo et al. (2023), found no association between residence and EBF.

Our study found no association between employment status and APO. Differing findings reported increased likelihood of LBW infants among unemployed women (Iaconoa et al. 2024; Alemu et al. 2019). Moreover, those with lowest/intermediate level of occupation had greater odds for stillbirths, VLBW, LBW, prematurity and perinatal mortality (Thomson et al. 2021). Our study categorized women as either unemployed or employed/self-employed which may have contributed to differing results.

Higher household income was not associated with APO. Our findings are consistent with Milton et al. (2022) where women with ≥average household income had increased all-cause mortality rates compared to those with lower than average. Furthermore, there was an association between stillbirths and low socio-economic status/low wealth index (Sinha et al. 2022).

In our study women with higher household incomes were more likely to initiate breastfeeding within 60 minutes of birth and exclusively breastfeed their infants. Similar findings by Mundagowa et al. (2019), established a significant association between EBF and being independent. Contrary findings reported a significant association between low income and exclusive breastfeeding (Awoke & Mulatu 2021). Moreover, a differing finding by Nangolo et al. (2023), indicated no statistical significance between EBF and average household income. With higher household incomes, women are more likely to be educated, understand the importance of breastfeeding, have support systems and thus concentrate only on newborn care.

4.1 Limitations/strengths of the study

There were a few observations of some explanatory variables to enable meaningful analysis. This lead to classifying variables into two broad categories to allow analysis. Some independent variables displayed collinearity therefore affecting independent prediction of dependent variables.

5.0 Conclusion

Age, residence, education, income and household size were associated with adverse maternal outcomes. Residing in the rural area was associated with low odds of having IUGR infants (OR=0.2). Babies born to women aged 35-49 years were more likely to experience complications by the fourth postnatal visit (OR=4.9). Although these factors are largely unmodifiable, the role of ANC cannot be ignored. Early initiation and strict adherence to ANC appointments may improve maternal outcomes.

6.0 Recommendations

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10

This study recommends sensitization through community outreaches on the importance of early initiation and adherence to all ANC appointments. Adoption of and training on new ANC guidelines with a focus on the eight contacts and specific activities is vital.

7.0 Acknowledgements

I acknowledge all the women who sacrificed their precious time to participate in this study. Secondly, I wish to recognize the efforts of my worthy research assistants, for walking this long journey with me. Lastly, I wish to acknowledge all healthcare providers in the study sites for the enabling environment facilitating the study to progress seamlessly.

7.1 Conflict of interest statement

None 7.2 Ethical considerations

Ethical approval was sought from the Kenyatta University Ethics Review Committee [PKU/2152/E1296]. Research permit was obtained from NACOSTI [NACOSTI/P/20/7771]. Permission to carry out the study was sought from Trans Nzoia County. Informed consent was obtained from all study participants.

7.3 Funding

None.

7.4 Data availability statement

The data is available upon request.

11.0 References

Alemie, T., Abebe, A., Adal, O., Azazh, A., and Endeshaw, D. (2023). Clinical features and outcomes of patients with preeclampsia and eclampsia at Gondar University hospital, Amhara, Ethiopia 2021. *European Journal of Obstetrics & Gynecology and Reproductive Biology: X,* 20, 100254:1-6. https://doi.org/10.1016/j.eurox.2023.100254.

Alemu, A., Abageda, M., Assefa, B. and Melaku, G. (2019). Low birth weight: prevalence and associated factors among newborns at hospitals in Kambata-Tembaro zone, southern Ethiopia 2018. *Pan Afr Med J [Internet]*, [cited 2023 Nov 1]; 34. Available from: http://www.panafrican-med-journal.com/content/article/34/68/full/

Asseffaid, N.A. and Demissie, B.W. (2019). Perinatal outcomes of hypertensive disorders in pregnancy at a referral hospital, Southern Ethiopia. *PLoS ONE*, 14(2). Available from: https://doi.org/10.1371/journal.pone.0213240

Awoke, S. and Mulatu, B. (2021). Determinants of exclusive breastfeeding practice among mothers in Sheka Zone, Southwest Ethiopia: A cross-sectional study. *Public Health in Practice*, 2. https://doi.org/10.1016/j.puhip.2021.100108

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10

Berhe, A.K., Ilesanmi, A.O., Aimakhu, C.O. and Mulugeta, A. (2020). Effect of Pregnancy Induced Hypertension on Adverse Perinatal Outcomes in Tigray Regional State, Ethiopia: a prospective cohort study. *BMC Pregnancy and Childbirth*, 20(7):1-11. https://doi.org/10.1186/s12884-019-2708-6

Berhe, A.K., Kassa, G.M., Fekadu, G.A. and Muche, A.A. (2018). Prevalence of hypertensive disorders of pregnancy in Ethiopia: a systemic review and meta-analysis. *BMC Pregnancy and childbirth,* 18(34):1-11.DOI 10.1186/s12884-018-1667-7

Dassah, E.T., Kusi-Mensah, E., Morhe, E.S.K. and Odoi, A.T. (2019). Maternal and perinatal outcomes among women with hypertensive disorders in pregnancy in Kumasi, Ghana. *PLoS ONE*, 14(10). Available from: https://doi.org/10.1371/journal.pone.0223478.

Dolatian, M., Sharifi, N., Mahmoodi, Z., Fathnezhad-kazemi, A., Bahrami-vazir, E., Rashidian, T. (2020). Weight gain during pregnancy and its associated factors: A Path analysis. *Nurs Open*, 7(5):1568–77. DOI: 10.1002/nop2.539

Gupta, B.K., Shrivastava, A.K. and Shrestha, L. (2019). Hypertensive disorder of pregnancy and its immediate outcome on neonates in a tertiary care hospital of Western Nepal. *International Journal of Basic & Clinical Pharmacology*, 8(6):1343.

Iaconoa, C.D., Requenab, M. and Staneka M. (2024). Social inequalities, advanced maternal age, and birth weight. Evidence from a population-based study in Spain. *Gaceta Sanitaria*, 38: 102386; 1-7. https://doi.org/10.1016/j.gaceta.2024.102386

Kaforau, L.S.K., Tessema, G.A., Jancey, J., Dhamrait, G., Bugoro, H. and Pereira, G. (2022). Prevalence and risk factors of adverse birth outcomes in the Pacific Island region: A scoping review. *The Lancet Regional Health - Western Pacific*, 21:100402. Accessed form: https://doi.org/10.1016/j.lanwpc.2022.100402

Kassahun, .EA. Mitku, H.D. and Getu, M.A. (2019). Adverse birth outcomes and its associated factors among women who delivered in North Wollo zone, northeast Ethiopia: a facility based cross-sectional study. *BMC Res Notes*, 2(1):357. https://doi.org/10.1186/s13104-019-4387-9

Kenya National Bureau of Statistics. (2023). Kenya Demographic and Health Survey 2022 Key Indicators Report [Internet]. Available from: www.DHSprogram.com.

Logan, G.G., Njoroge, P.K., Nyabola, L.O. and Mweu, M.M. (2020). Determinants of preeclampsia and eclampsia among women delivering in county hospitals in Nairobi, Kenya. *F1000Research*, 9. Accessed from: https://doi.org/10.12688/f1000research.21684.1

Magee, .LA., Singer, J., Lee, T., McManus, R.J., Lay-Flurrie, S., Rey E, Chappell, L. C., Myers, J., Logan, A. G., and von Dadelszen, P. (2020). Are blood pressure levels and variability related to pregnancy outcomes? Analysis of control of hypertension in pregnancy study data. *Pregnancy Hypertension,* 19:87–93. https://doi.org/10.1016/j.preghy.2019.12.002

Milton, R., Gillespie, D., Dyer, C., Taiyari, K., Carvalho, M.J., Thomson, K., Sands, K., Porta,l E.A.R., Hood, K., Ferreira, A., Hender, T., Kirby, N., Mathias, J., Nieto, M., Watkins, W.J., Bekele, D., Abayneh, M., Solomon, S., Basu, S., Nandy, R.K., ….Chan, G.J. (2022). Neonatal sepsis and

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10

mortality in low-income and middle-income countries from a facility-based birth cohort: an international multisite prospective observational study. *Lancet Glob Health,* 10; e661–672

Mnabwiru, L.R., Cho, Y.S., Mahande, M.J., Mazugun, N., Mchome, B.L., and Park, E.Y. (2024). Impact of advanced maternal age on perinatal outcomes in Tanzania: Insights from Kilimanjaro Christian Medical Center Birth Registry. *Heliyon*, 10; e24608: 1-8. https://doi.org/10.1016/j.heliyon.2024.e24608

Momanyi, S., Makalliwa, G., Mambo, S and Gachohi, J. (2025). Neonatal health factors affecting optimal weight gain among preterm neonates in Murang'a county, Kenya. JAGST 24 (2) 2025, 49 – 61. 10.4314/jagst.v24i2.4

Montori, M.G., Martínez, A., Alvarez, C.L., Cuchí, N.A., Alcal, P.M. and Martínez, S.R. (2021). Advanced maternal age and adverse pregnancy outcomes: A cohort Study. *Taiwanese Journal of Obstetrics & Gynecology*, 60;119e124:119-124. https://doi.org/10.1016/j.tjog.2020.11.018.

Mundagowa, P.T., Chadambuka, E.M., Chimberengwa, P.T. and Mukora-Mutseyekwa, F. (2019). Determinants of exclusive breastfeeding among mothers of infants aged 6 to 12 months in Gwanda District, Zimbabwe. *International Breastfeeding Journal,* 14(1):30. https://doi.org/10.1186/s13006-019-0225-x

Nangolo, R.M., Robertson, A. and Crowley, T. (2023). Factors promoting exclusive breastfeeding at a public health facility in Windhoek Namibia: A descriptive comparative study. *International Journal of Africa Nursing Sciences*, 18. 100544. 1-6. https://doi.org/10.1016/j.ijans.2023.100544

Obsa, M.S., Woticha, E.W., Weji, B.G., Dessu, B.K., Wolde, G.D., Girmay, B.G., Bakru, E. T., Belay, L., Gediye, M. H., Kute, N. G. and Menchamo, M. W. (2019). Neonatal and Fetal Outcomes of Pregnant Mothers with Hypertensive Disorder of Pregnancy at Hospitals in Wolaita Zone, Southern Ethiopia. *Journal of Midwifery and Reproductive Health*, 1; 7(2):1636–40. DOI: 10.22038/jmrh.2018.29240.1315

Sinha, S., Mondal, P.R. and Gupta, V. (2022). Assessing the Role of Socioeconomic Factors and Place of Residence on the Burden of Stillbirth in India: A Comprehensive Review. *The Open Public Health Journal,* Volume 15 (2022); 1-13. DOI: 10.2174/18749445-v15-e2203150, 2022, *15*, e187494452203150

Thomson, K., Moffa, M., Arisa, O., Jesurasa, A., Richmond, C., Odeniyi, A. , Bambra, C, Rankin, J., Brown, H., Bishop, J., Wing, S., McNaughton, A. and Heslehurs,t N. (2021). Socioeconomic inequalities and adverse pregnancy outcomes in the UK and Republic of Ireland: a systematic review and meta-analysis. *BMJ Open,* 11:e042753: 1-21. doi:10.1136/ bmjopen-2020-042753

UNICEF and World Health Organization. (2019). UNICEF-WHO Low birthweight estimates: Levels and trends 2000–2015 | UNICEF [Internet]. [cited 2024 Apr 3]. Available from: https://www.unicef.org/reports/UNICEF-WHO-low-birthweight-estimates-2019

United Nations. (2015). Transforming our World: The 2030 Agenda for Sustainable Development Department of Economic and Social Affairs [Internet]. [cited 2024 Apr 3]. Available from:

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10

https://sdgs.un.org/publications/transforming-our-world-2030-agenda-sustainable-development-17981

Woday, A., Muluneh, M.D. and Sherif, S. (2019). Determinants of Preterm birth among mothers who gave birth at public hospitals in Amhara region, Ethiopia: A case-control study. *PLoS ONE*, 14(11): 1-12. e0225060. https://doi.org/10.1371/journal.pone.0225060

World Health Organization. (2023). W. Born too soon: Decade of action on preterm birth [Internet]. [cited 2024 Apr 2]. Available from: https://www.who.int/publications-detail-redirect/9789240073890

World Health Organization. (2022). WHO recommendations for care of the preterm and low-birth-weight infant [Internet]. [Cited 2024 April 3]. https://www.who.int/publications/i/item/9789240058262

ISSN 1561-7645 (online)
doi: 10.4314/jagst.v24i5.10