

**TREND ANALYSIS AND DETERMINANTS OF MATERNAL OUTCOMES OF SEVER PREECLAMPSIA AND ECLAMPSIA AT DEBRE MARKOS REFERRAL HOSPITAL, NORTHWEST ETHIOPIA 2018: RETROSPECTIVE STUDY DESIGN**<sup>1,\*</sup>Yibelu Bazezaw, <sup>1</sup>Keralem Anteneh, <sup>1</sup>Temesgen Getaneh, <sup>2</sup>Alemtsehay Getahun and Tewodros Eshete<sup>1</sup>Department of Midwifery, College of Health sciences, Debre Markos University, Debre Markos, Ethiopia<sup>2</sup>Department of Nursing, College of Health sciences, Debre Markos University, Debre Markos, Ethiopia<sup>3</sup>Department of Public health, College of Health sciences, Debre Markos University, Debre Markos, Ethiopia**Received** 20<sup>th</sup> March 2020; **Accepted** 25<sup>th</sup> April 2020; **Published online** 31<sup>st</sup> May 2020

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**Abstract**

**Introduction:** Preeclampsia/eclampsia has remained a significant public health threat in both developed and developing countries contributing to maternal morbidity and mortality globally. **Aim:** This study aimed to assess trend analysis and determinants of maternal outcomes of preeclampsia and Eclampsia. **Methods:** Institutional based retrospective cross-sectional study on 289 women who diagnosed as preeclampsia/eclampsia in Debre Markos Referral Hospital. **Results:** Trends of the occurrences of preeclampsia/eclampsia increased from 2013 to 2017 by 12.75 times. Of the 289 mothers with preeclampsia/eclampsia, 63.3% had experienced at least one maternal complication over the five-year period. The number of women with at least one type of maternal complication increased from 2013 to 2017 by 20.67 times. The main complications were HELLP syndrome (45.4%) and maternal death (25.2%). Mothers who took Hydralazine and diazepam were less likely to develop complications than who didn't take the drug. **Conclusion:** An increasing trend of preeclampsia/eclampsia and maternal complications were observed over a five years' period in the study area. Therefore, efforts would be strengthening to end the increased trend of preeclampsia/eclampsia and maternal complications both in the community and the health institutions.

**Keywords:** Preeclampsia/eclampsia, Maternal complications, Trend analysis.

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**INTRODUCTION**

Every day, approximately 830 women die from preventable causes related to pregnancy and childbirth and 99% of this maternal death occur in developing countries (WHO, 2016). Preeclampsia is a pregnancy-related hypertensive disorder occurring usually after 20 weeks of gestation. If left untreated, it progresses to Eclampsia. Preeclampsia and Eclampsia are not distinct disorders but the manifestation of the spectrum of clinical symptoms of the same condition (Wagnew *et al.*, 2016). Hypertensive disorders during pregnancy represent a significant public health problem throughout the world, contributing to maternal morbidity and mortality globally (Shah *et al.*, 2009; McClure *et al.*, 2009) and preeclampsia is the most common of these disorders. Of these, about half are due to or associated with severe preeclampsia which is more prevalent contributor to maternal morbidity and mortality (Ngwenya *et al.*, 2017). However, the impact of the disease is felt more severely in developing countries (Organization, 2016), where, unlike other more prevalent causes of MM (such as hemorrhage and sepsis), medical interventions may be ineffective due to late presentation of cases (Ngwenya, 2017) as well as the problem is confounded by the continued mystery of the etiology and the unpredictable nature of the disease (Dufera, 2015). The prevalence of preeclampsia in developing countries ranges from 1.8% to 16.1% and many challenges exist in the prevention and management of consequences of severe preeclampsia and Eclampsia (Organization, 2016). Additionally, hypertensive disorders of pregnancy are the third leading cause of maternal deaths in sub Saharan Africa (Ota *et al.*, 2014).

In Ethiopia, the major direct obstetric complications including pre-eclampsia/eclampsia account for 85% of the maternal deaths. Unlike deaths due to other direct causes, pre-eclampsia and eclampsia related deaths appear to be increasing and linked to multiple factors, making prevention of the disease a continuous challenge (Grum *et al.*, 2017). Hypertensive disorders represent the most common medical complications of pregnancy with a reported incidence between 5 and 10% (Wolde *et al.*, 2011). A systemic review conducted in 2018 reported that the overall pooled prevalence of hypertensive disorders of pregnancy in Ethiopia was 6.07% (95% CI: 4.83%, 7.31%) (Berhe *et al.*, 2018). Another study done at Addis Ababa University in 2015 addressed that hypertensive disorders occurring in 12-22% of all pregnancies (Dufera, 2015). However, the factors associated with these adverse outcomes are poorly understood in low resource settings. As Ethiopia is one of these low resource areas, the rates of maternal morbidity and mortality are among the highest in the world. The magnitude and determinant factors for the occurrence of preeclampsia/eclampsia were not known in the study area. Reduction of maternal mortality is the major issue throughout the world and each country of the globe currently works to end preventable cause of maternal mortality including preeclampsia/eclampsia in order to meet the sustainable developmental goal 3 target 3.1 which states to convey reduction of maternal mortality less than 70/100,000 live births in the year 2030 (12, 13). Therefore, the aim of this research was to determine the trends of preeclampsia/eclampsia and maternal outcomes and determinants of the outcome among women delivered from 2013 to 2017 in Debre-Markos Referral hospital, East Gojjam Zone, Ethiopia.

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## METHODS

### Study area and period

This study was conducted in East Gojjam Zone, Debre Markos town, Debre Markos referral Hospital. Debre Markos is one of the four town administrations and the capital city of east Gojjam. According to the 2015 Ethiopian population and housing census, the population was 29,921 men and 32,576 women with a total of 262,497 people. The majority of the inhabitants practiced Ethiopian Orthodox Christianity. The hospital provides both teaching to Debre Markos University and health services for the community. In the hospital there is actively functioning hypertensive disorder of pregnancy case follow up clinic providing services in daily bases and had 241 health professionals. The study was conducted from October to December 2018.

### Study design and population

Retrospective institutional based cross-sectional study was conducted using the data source consisting from September 01/ 2013 to August 30/ 2017. All women who gave birth at Debre Markos referral hospital were taken as a source population and all women who gave birth at Debre Markos referral hospital for the last five years with the diagnosis of pregnancy induced hypertension were the study populations. All women who gave birth and had complete records were included; women who were diagnosed with chronic hypertension before their pregnancy were excluded from the study. The purpose of the study was to determine the trends of preeclampsia/ eclampsia and maternal outcomes and to identify determinants of maternal outcome among women who gave birth from September 01/ 2013 to August 30/ 2017 with the diagnosis of preeclampsia/ eclampsia in Debre Markos referral hospital.

### Sampling and study variables

Debre Markos referral hospital selected purposely. Total women who delivered in the hospital from September 01/ 2013 to August 30/ 2017 were identified from registration book and all cases of severe preeclampsia and eclampsia found in the study hospital were recruited during the data collection. Then all women (289) who were diagnosed as preeclampsia/ eclampsia, who were taken from registration book were taken as our sample size. Socio-demographic, clinical, laboratory, and management data as well as maternal complications were collected from the registered data on all women with preeclampsia/ eclampsia who delivered for the last five years in the study area. Data like maternal age, marital status, parity, gestational age, antenatal care, blood pressure, mode of delivery, laboratory investigation, medical history, diagnosis, clinical features including complications and commencement of anti-hypertension or anti-convulsion drugs were collected.

### Operational definitions

**Severe Preeclampsia:** Diastolic blood pressure is equal or greater than 110mmHg after 20 weeks of gestation. There may be severity sign and symptom like severe headache, blurred vision, Epigastric pain, hyper reflexes, oligo-uria (urinary output equal or less than 400mls/24hours).

**Eclampsia:** Mother with signs and symptoms of severe preeclampsia and convulsions or coma.

### Data collection

A structured data extracting (checklist) tool was developed and pre-test was conducted on 5% of sample size at Finoteselam Hospital to ensure whether the structured tool can measure our objective or not and to check its consistency and completeness. Three-degree midwife professionals involved to collect the data using the tool prepared for this study after giving one-day training regarding the aim of study, data collection tool and procedures. The same code was given to the registration card and to the questionnaire during data collection so that any identified problems was solved using the codes. Data related to maternal age, marital status, parity, gestational age, antenatal care, blood pressure, mode of delivery, laboratory investigation, medical history, diagnosis, clinical features including complications and commencement of anti-hypertension or anti-convulsion drugs were extracted by reviewing medical records and delivery registry books.

### Statistical methods

The extracted data was cleaned, checked for accuracy, consistency, entered using Epi data version 3.1 software and analyzed using SPSS version 25. Both descriptive and analytical statistical procedures were employed. The analysis presented in the epidemiological trends followed the following steps: proportions were computed by dividing those severe preeclampsia/ eclampsia values with the respective total delivery/ denominator for each specific year; proportions were computed for maternal outcomes among severe preeclampsia/ eclampsia cases for each year; trends of maternal outcomes among severe preeclampsia/ eclampsia cases for each year were analyzed. Logistic regression was done to identify those factors associated with maternal outcome and the crude and adjusted odds ratios together with their corresponding standard errors were computed. A p-value less than or equal to 0.05 was considered statistically significant.

## RESULTS

A total of 289 cards of women who gave birth and diagnosed as preeclampsia/ eclampsia were included in this study. Thirty-two percent of the patients belonged to the age group of 25-29 years with the mean age of the women 27.3 ( $\pm 5.862$ SD) years. Regarding to their residence 54.7% was rural and nearly all women were married and orthodox followers (96.2% & 96.5% respectively). Almost half of the women were illiterate and farmer (48.8% & 49.1% respectively).

### Condition of the mother at the time of admission and during delivery

Among 289 women three-fourth of them had ANC follow up at least once. Nearly half of the women admit at gestational age of 35-39 weeks as well as the majority pregnancy status was singleton (90.3%). Based on the data recorded 3.5% mothers had history of DM, 4.5% had family history of preeclampsia, 5.5% were HIV positive and more than half of them were multipara (56.1%). More than half of the mothers started labor by induction mostly with indication of severe

preeclampsia, eclampsia, HELLP syndrome and abruption placenta.

**Table 1. Characteristics of mothers with HDP at admission and during labor delivery in Debre Markos referral hospital from 2013-2017, Debre Markos, East Gojjam Zone, Ethiopia**

Variables	Response	Frequency (N)	Percentage (%)
ANC follow up	Yes	222	76.8
	No	67	23.2
Gestational age at admission (wks)	<20	8	2.8
	20-24	20	6.9
	25-29	22	7.6
	30-34	51	17.6
Type of pregnancy	35-39	147	50.9
	40-44	41	14.2
	Single	261	90.3
History of DM	Multiple	28	9.7
	Yes	10	3.5
HIV status	No	279	96.5
	Positive	16	5.5
Family history of chronic HTN	Negative	273	94.5
	Yes	60	20.8
Family history preeclampsia	No	229	79.2
	Yes	13	4.5
Onset of labor	No	276	95.5
	Spontaneous	76	26.3
Mode of delivery	Induction	167	57.8
	Elective c/s	46	15.9
	Spontaneous SVD	130	45
Type of anesthesia	Instrumental	59	20.4
	C/s	100	34.6
Parity	General	80	80
	Regional	20	20
Parity	Primi-para	127	43.9
	Multi-para	162	56.1

### Disease manifestation and laboratory investigation

According to the report 5 (1.7%) women were diagnosed as gestational HTN, 6 (2.1%) as super imposed preeclampsia, 32 (11.1%) as mild preeclampsia, 181 (62.6%) as severe preeclampsia and the rest 65 (22.5%) were diagnosed as eclampsia.

Among mothers who had HDP present at admission, many complained of one or more of the following signs and symptoms: 86.5% complained of headache, 65.4% had blurred vision, 63.7% had Epigastric pain, and 56.4% had edema. From 289 cards with preeclampsia/eclampsia recorded from 2013 to 2017, for more than half of the women (63.7%) laboratory investigation was done at least one investigation. Among those women 68.4% had Creatinine value of >0.99 mg/dl, 41.5% of them +1&+2 protein urea, 81.8% of them uric acid of <250 mg/24hrs and 40.9% & 37.9% of them had ALT & AST <35 $\mu$ /cell respectively.

### HDP management related finding

Among 289 women with preeclampsia/eclampsia, nearly all of them received antihypertensive (96.5%) and anti convulsant (90.7%) drugs at least one. From those drugs 84.6% of mothers took Hydralazine, 80.6% took methyldopa, 94.8% took magnesium sulfate and only 29.4% of mothers took diazepam for prevention and treatment preeclampsia/eclampsia. In addition to these, three-fourth of the women kept in the hospital from 1-6 days for treatment and follow up.

**Table 2. Disease manifestations and laboratory investigation of mothers who had HDP at Debre Markos referral hospital from 2013-2017, Debre Markos, East Gojjam Zone, Ethiopia**

Variables	Response	Frequency (N)	Percentage (%)
Eclampsia time of occurrence	<20 wks	6	6
	>=20 wks	36	36
	During labor	6	6
	During post-partum	23	23
Total number of convulsion	Not recorded	29	29
	<=2	18	18
	Three and above	20	20
Dizziness	Not recorded	62	62
	Yes	146	50.5
Headache	No	143	49.5
	Yes	250	86.5
Epigastric pain	No	39	13.5
	Yes	184	63.7
Blurred vision	No	105	36.3
	Yes	189	65.4
Systolic BP	No	100	34.6
	90-140	83	28.8
	141-160	121	41.9
	>160	85	29.4
Diastolic BP	60-100	155	53.6
	101-120	119	41.2
	>120	15	5.2
Edema	Yes	163	56.4
	No	126	43.6
Proteinuria	Negative	60	20.8
	+1 & +2	120	41.5
	+3	109	37.7
AST	<35	104	37.9
	35	72	26.3
	>35	98	35.8
ALT	<35	112	40.9
	35	78	28.7
	>35	84	30.4
Creatinine	<=0.99	89	31.6
	>0.99	193	68.4
	<250 mg/24hr	18	81.8
Uric acid	250-650 mg/24hr	3	13.6
	>650 mg/24hr	1	4.6

**Table 3. Management related findings of mothers who had HDP at Debre Markos referral hospital from 2013-2017, Debre Markos, East Gojjam Zone, Ethiopia**

Variables	Response	Frequency (N)	Percentage (%)
Ant-hypertensive	Yes	279	96.5
	No	10	3.5
Methyldopa	Yes	233	80.6
	No	56	19.4
Nifedipine	Yes	45	15.6
	No	244	84.4
Hydralazine	Yes	245	84.8
	No	44	15.2
Ant-convulsion	Yes	262	90.7
	No	27	9.3
Magnesium sulfate	Yes	274	94.8
	No	15	5.2
Diazepam	Yes	85	29.4
	No	204	70.6
Other drug	Yes	252	87.2
	No	37	12.8
Type of other drug	Antibiotics	168	66.7
	Dexamethasone	59	23.4
	Both	25	9.9
Type of management	Conservative	51	17.6
	Active	238	82.4
Days of hospitalization (days)	1-6	211	73
	7-13	62	21.5
	>=14	16	5.5
Maternal complication	Yes	183	63.3
	No	106	36.7

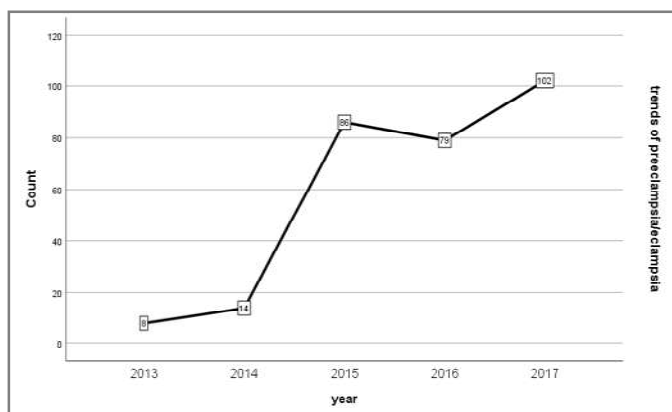
**Table 4. Bivariate and multiple logistic regression analyses for determinants of maternal complication of HDP in Debre- Markos Referral Hospital Ethiopia 2013-2017 (N=289)**

Variables	Response	Maternal complication		COR (CI at 95%)	AOR (CI at 95%)	P value
		Yes	No			
Hydralazine	Yes	169	76	0.21(0.10-0.41)	0.38(0.16-0.88)	0.024*
	No	14	30	1	1	
Diazepam	Yes	71	14	0.24(0.13-0.45)	0.30(0.14-0.61)	0.001*
	No	112	92	1	1	
Headache	Yes	164	86	1	1	0.63
	No	19	20	0.3(0.21-0.96)	0.51(0.05-5.98)	
Epigastric pain	Yes	130	54	1	1	0.20
	No	53	52	0.36(1.43-3.88)	0.47(0.8-2.67)	
Convulsion	Yes	47	13	1	1	0.84
	No	136	93	0.47(0.27-0.92)	0.39(0.73-5.56)	
Type of management	Conservative	42	9	1	1	0.99
	Aggressive	141	97	0.21(0.50-0.90)	0.06(0.86-5.58)	
Days of hospitalization	1-6	117	94	5.62(0.27-25.35)	0.82(0.76-19.12)	0.61
	7-13	51	10	0.77(0.27-7.00)	0.14(0.20-6.26)	0.87
	>=14	14	2	1	1	
Creatinine	<=0.99	43	46	0.68(0.60-0.99)	0.46(0.78-2.70)	0.52
	>0.99	138	55	1	1	

\*Significantly associated

### Trends of preeclampsia/eclampsia over five year

As shown in Figure 1, the incidence of preeclampsia/eclampsia increased yearly from 2013 to 2017 (from 8 (2.77%) to 102 (35.29%) respectively) except from 2015 to 2016 (from 86 (29.76%) to 79 (27.34%)) from the total delivery of each year. From the figure we have understood that the number of cases in 2017 is about 12.75 times more than that of the 2013 one. According to the five year data review, severe preeclampsia dominated in all five years and had greater changes throughout the five-year period and eclampsia was the second, while gestational hypertension and superimposed preeclampsia had the lowest incidence in the five-year study, and the change was minimal.

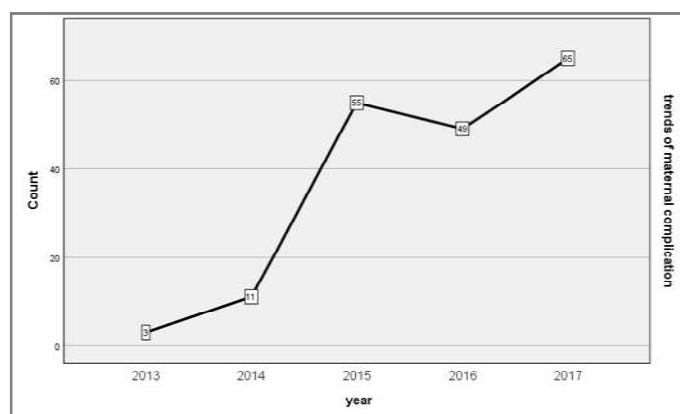


**Figure 1. Trend of HDP among mothers who delivered at Debre Markos referral hospital from 2013-2017, Ethiopia**

### Trend of maternal complication of preeclampsia/eclampsia from 2013-2017

Based on the five-year data of mothers who had preeclampsia/eclampsia, 63.3% of women develop at least one complication. Those complications were HELLP syndrome (45.4%), maternal death (25.2%), abruption placenta (8%), DIC (6.1%) and other like postpartum hemorrhage, shock, renal failure and pulmonary edema (15.3%). The number of women with at least one type of maternal complication increased from 2013 (3(37.5%)) to 2017 (65(63.7%)).

Although this increase in number of complications may be related to an increase in the number of preeclampsia/eclampsia; however, the proportion of maternal complications was lowest in 2013 and 2014, but it shows 80% increase from 2014 to 2015 with 10.9% decrease from 2015 to 2016 and 26.6% increase from 2016 to 2017. Irrespective of such small decrease from 2015 to 2016, the percentage change in maternal complications over time as shown in this trend of the graphs has a global significance of linearity. The overall trend change through the five years has showed a 95.4% increase. The maternal complication rate in 2015 was 5 times the rate in 2014 and that of 2017 was 1.33 times in 2016.



**Figure 2. Trend of maternal complication among mothers who delivered and diagnosed as HDP from 2013-2017 at Debre Markos referral hospital, East Gojjam Zone, Ethiopia**

As shown in Table-4, hydralazine and diazepam was significantly associated with maternal complication. Mothers who took hydralazine and diazepam were less likely to develop maternal complication when we compared with mothers who didn't take the drugs.

### DISCUSSION

Hypertensive disorders during pregnancy represent a significant public health problem throughout the world, contributing to maternal morbidity and mortality globally and it represent the most common medical complications of

pregnancy (Shah *et al.*, 2009; McClure *et al.*, 20019). However, the impact of the disease is felt more severely in developing countries (Organization, 2016) including Ethiopia. In this study, the overall trend of preeclampsia/eclampsia in the last five years was increased. The magnitude of preeclampsia/eclampsia was 1.8% among 24,627 deliveries in Debre Markos referral hospital which is less than study done in Addis Ababa selected hospitals and Tikur Anbessa hospital which was 4.2% and 5% respectively (Grum *et al.*, 2017). This might be due to number of hospitals included in the study and number population difference.

The trend of preeclampsia/eclampsia was increased as evidenced by the cases in 2017 was 12.75 times than cases in 2013 which much higher than study conducted in Addis Ababa selected hospitals (Grum *et al.*, 2017). This difference may be related to high ANC follow up as three-fourth had ANC follow up at least once which leads to early detection of the cases and also might be due to increase prevalence of preeclampsia/eclampsia all over the country as evidenced by different literatures (Grum *et al.*, 2017; Wolde *et al.*, 2011). According to this paper, the highest percentage of HDP was taken by severe preeclampsia which was 63.3%. Eclampsia 20.8%, mild preeclampsia 12.1%, superimposed preeclampsia 2.1% and gestational hypertension 1.7% hold the step next to severe preeclampsia in their order. This finding was consistent with study done in Jima University specialized hospital which reported that severe preeclampsia took the first rank with prevalence of 53.9% then eclampsia (23.4%), mild preeclampsia (7.6%), superimposed preeclampsia (5.1%) and gestational hypertension (2%) hold the next rank(10). Severe preeclampsia was the most prevalent HDP which is similar with study conducted in India (55.5%) and Ethiopia at Gandhi hospital (82.5%) (Thomas *et al.*, 2014; Gaym, 2017). This may be due to the studies conducted at referral hospitals in which severe cases managed. But this finding was less than study conducted in Addis Ababa Tikur Anbessa Hospital (78%) which may be number study population difference (24,627 vs 1,941). The five-year data of mothers who had preeclampsia/eclampsia indicate that, 63.3% of women develop at least one complication. This result was much higher than study conducted in Nigeria and Addis Ababa on similar study group (Grum *et al.*, 2017; Mohammedseid *et al.*, 2017). This might be due to severe and complicated cases found in referral hospital than primary and specialized hospitals as well as early detection also common. The number of women with at least one type of maternal complication in 2017 was 21.6 times higher than 2013. This increase in number of complications may be related to actual increase of prevalence HDP and severe preeclampsia. The overall trend change through the five years has showed a 95.4% increase. The maternal complication rate in 2015 was 5 times the rate in 2014 and that of 2017 was 1.33 times in 2016.

The most prevalent complication was HELLP syndrome (45.4%). This finding was in line with study done in Jima university specialized hospital, Addis Ababa selected hospitals and Addis Ababa Gandhi hospital (Grum *et al.*, 2017; Wolde2011; Thomas *et al.*, 2014). The reason for this was in all papers including this, prevalence of severe preeclampsia and eclampsia was high and HELLP syndrome is one of their manifestations. From mothers who had HELLP syndrome 73% and 15% was as a result of severe preeclampsia and eclampsia respectively. Maternal death (25.2%) was the second most

common complication of HDP followed by abruption placenta (8%), DIC (6.1%) and other like postpartum hemorrhage, shock, renal failure and pulmonary edema (15.3%). From all mothers who develop complications, 59.6% was caused by severe preeclampsia and around 30% by eclampsia. This is due to the fact that severe and prevalent diseases followed with more complication than those mild and less prevalent. Mild preeclampsia, superimposed and gestational hypertension causes the remaining complication in their respective. Bivariate logistic regression showed that hydralazine, diazepam, short duration of hospitalization, presence of convulsion, epigastric pain, headache, management type and creatinine value >0.99mg/dl were significantly associated with maternal complication HDP. But in multiple logistic regression only hydralazine and diazepam were significantly associated with the development of maternal complication among mothers who diagnosed as HDP. Mothers who took hydralazine were 0.38 times less likely develop complication than who didn't take hydralazine with (AOR=0.38; 95% CI 0.16, 0.88). This is due to the fact that as we have known hydralazine is the most common and effective short acting antihypertensive drug given for preeclampsia/eclampsia especially for severe preeclampsia with higher blood pressure as a treatment. So this effective treatment will tackle the disease progression as we have mentioned early that severe preeclampsia was the most prevalent cause of maternal complications. Diazepam is the second significantly associated factors with maternal outcomes. Mothers who took diazepam were 0.3 times less likely to develop complications than who didn't take it with (AOR=0.30; 95% CI 0.14, 0.61). The result is in line with the above fact as diazepam is one of the ant-convulsant drugs given for prevention and treatment of eclampsia which was one of the prevalent causes of maternal complication in this paper.

## Conclusion and Recommendation

Sever preeclampsia and Eclampsia were found important causes for the occurrence of maternal complications. An increasing trend of Pregnancy induced Hypertension mainly severe preeclampsia/eclampsia and maternal complications were observed over a five years' period in the study area in this study. Therefore, efforts would be strengthening to end the increased trend of preeclampsia/eclampsia and maternal complications both in the community and the health institutions and further, longitudinal studies should be conducted, in this area to identify the determinant factors.

## Abbreviations

**ANC:** Antenatal Care,  
**GA:** Gestational age,  
**HDP:** Hypertensive Disorders of Pregnancy,  
**MM:** Maternal Mortality.

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