

# Audit of Clinical Care for Women with Preeclampsia or Eclampsia and Perinatal Outcome in Ethiopia: Second National EmONC Survey

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**Background:** Preeclampsia and eclampsia contribute to maternal and perinatal morbidity and mortality, especially in developing countries. However, the evidence on clinical practice in the management of preeclampsia/eclampsia and perinatal outcomes is limited. Therefore, the aim of this study was to assess clinical care and perinatal outcomes for women with preeclampsia/eclampsia admitted to health facilities in Ethiopia.

**Methods:** This study used the 2016 Emergency Obstetric and Newborn Care survey, which included 3804 health facilities. The last two cases of women with preeclampsia/eclampsia who were admitted for birth in each participating health facility were selected and their medical records were reviewed. Descriptive analyses by health facility type, location and management authority were conducted. A chi-squared test was used to test for differences.

**Results:** Out of the 3804 health-care facilities across the country, we could review a total of 959 medical records of women with preeclampsia or eclampsia. Of all cases, 90% (863) were hospitalised in public health facilities, 542 (56.6%) were admitted at health centre/clinics and 638 (66.3%) were in urban health facilities. A substantial proportion of maternal and newborn information was missing from their medical records. Of the 553 records that recorded perinatal outcomes, the proportion of perinatal mortality prior to discharge was 16.3% (95% CI: 13.4%, 19.6%). A significant perinatal death was recorded among mothers admitted to hospitals ( $P < 0.01$ ), maternal age 15–24 ( $P < 0.04$ ), facilities in urban areas ( $P < 0.01$ ), referred cases ( $P < 0.007$ ), high systolic and diastolic blood pressure ( $P < 0.001$ ), unconscious and experience seizure ( $P < 0.001$ ), newborn with morbidity ( $P < 0.001$ ), and women who spent more hours before giving birth ( $P < 0.002$ ).

**Conclusions and Recommendations:** High perinatal mortality in health facilities was reported and care toward mothers with preeclampsia/eclampsia was limited. Strengthening the health facility readiness to respond for management with data registration and reporting system needs to be improved for evidence-based decision-making on perinatal and maternal health.

**Keywords:** preeclampsia, eclampsia, perinatal mortality, Ethiopia, EmONC

## Introduction

Globally, in 2017, over 295,000 women died during or following pregnancy and childbirth.<sup>1</sup> Disproportionately, 94% of preventable pregnancy- and childbirth-related maternal deaths happened in low- and middle-income countries (LMICs), including sub-Saharan African countries.<sup>1,2</sup> Preeclampsia and eclampsia are among the leading causes of maternal and neonatal morbidity and mortality worldwide, with the highest burden in developing countries.<sup>3</sup> An analysis of the World Health Organization (WHO) multi-country survey has shown that there was between a 3- and 5-fold increased risk of perinatal death in women with preeclampsia and eclampsia, respectively, compared to women who did not experience these conditions.<sup>4</sup>

Ethiopia has achieved many of the Millennium Development Goals (MDGs); however, compared to other developing countries, the country still lags behind on most indicators that address maternal and neonatal health services.<sup>5</sup> According

to United Nations (UN) estimates, Ethiopia has reduced maternal mortality by 72% since 1990, with a 5% annual rate of reduction.<sup>3</sup> However, the rates of maternal and neonatal mortality are still unacceptably high compared to other countries, with 412 deaths per 100,000 live births and 29 per 1000 live births, respectively.<sup>6</sup> Furthermore, risk of perinatal mortality (both stillbirth and early neonatal death) is particularly related to maternal conditions during pregnancy and intrapartum conditions and the rate reflects the quality of delivery care. The rate of perinatal mortality in Ethiopia is among the highest in the world, with a rate of 33 deaths per 1000 births. Based on previous studies, preeclampsia or eclampsia might contribute to as much as 25% of all stillbirths and neonatal deaths.<sup>7</sup> In a five year retrospective review of perinatal outcomes at three teaching hospitals in southern Ethiopia, it was reported that preeclampsia contributed to a perinatal mortality rate of 290 per 1000 births.<sup>8</sup>

To date, the underlying causes of preeclampsia and eclampsia are largely unknown and there are no well-established measures for primary prevention. Birth of the newborn remains the ultimate treatment.<sup>9</sup> Access to prenatal care, early detection of the disorder, careful monitoring and appropriate management are crucial elements in the prevention of preeclampsia- and eclampsia-related morbidity and deaths. Proper management and close follow-up are important in women with preeclampsia/eclampsia to prevent end organ damage and serious health outcome to the mother as well as fetus.<sup>10–12</sup> Based on WHO recommendations, women with preeclampsia and eclampsia need very close monitoring when admitted to health-care facilities due to the progressive nature of the disease and the worsening of the woman's condition if not appropriately treated.<sup>13</sup> Although preeclampsia- and eclampsia-related morbidity and mortality has considerably fallen in developed countries, this decline has not yet been observed in developing countries.<sup>14,15</sup> Low implementation of early detection procedures and limited access to adequate treatment might contribute to high morbidity, stillbirths and deaths among neonates born to women with preeclampsia or eclampsia.<sup>16</sup> Hence, identifying challenges related to clinical practice in the monitoring of women with preeclampsia or eclampsia and their perinatal outcomes could provide vital evidence to help policy designers develop systems to help achieve the Sustainable Developmental Goals (SDGs) by 2030. In Ethiopia, the government initiative in expanding health facilities and access to health-care services has a vital role in improvement to maternal and neonatal care services in last decade.<sup>17</sup> As preeclampsia/eclampsia remain the main cause of maternal mortality and morbidity in Ethiopia, there has been little research focused on the capacity of health facilities in providing quality health-care services to women with preeclampsia/eclampsia. Therefore, the aim of this study is to assess the health facilities clinical care practice in preeclampsia/eclampsia management process and identify gaps in women admitted to health facilities.

## Method

### Study Area and Design

The 2016 Emergency Obstetric and Newborn Care (EmONC) assessment was a national, cross-sectional census of the public and private health facilities that provided maternal and newborn health services in Ethiopia. The 2016 EmONC was the second assessment conducted, the first being in 2008. The EmONC survey collects various data on maternal and neonatal health indicators from health facility logbooks, registers and client medical records. These data have been used for policymaking and strategy development.<sup>18</sup>

### Data Source and Study Period

The 2016 EmONC assessment included data from 3804 health facilities across the country. All eligible public hospitals, health centres, and eligible private (for-profit and not-for-profit) facilities (hospitals, Maternal and Child Health (MCH) Specialty Centres, MCH Specialty Clinics, and Higher Clinics) were included in the study. During the year of data collection, 4587 health facilities were to be surveyed. However, during the actual data collection, different events such as a lack of delivery services at some sites, downgrading of services, and non-functional health facilities, not all health facilities were included in the survey. The data collection period was from May to October 2016. The Ethiopia Public Health Institute (EPHI), in collaboration with the Averting Maternal Death and Disability program (AMDD), conducted the EmONC data collection.

## Inclusion Criteria

Eligibility of health facilities was determined by three characteristics: they were classified as higher clinic or above; they reported providing birthing services in the last 12 months; and they were considered functional at the time of data collection. According to the Food, Medicine and Health Care Administration and Control Authority of Ethiopia (FMHACA), all health facilities (both public and private) above health centres are eligible to provide services to birthing mothers, to attend deliveries and to treat women with preeclampsia or eclampsia.<sup>19</sup>

## Data Collection Instrument

The 2016 EmONC assessment tool used 14 facility-based modules and additional modules for woreda, zone, regional, and national levels of the health system. The assessment modules were adapted from the 2008 modules, and a set of tools revised by the AMDD program of Columbia University in 2014. The data collection instruments were revised and adapted to the local context and pretested in three rounds at different health facilities prior to data collection. A more detailed description of the methods can be found in the final report.<sup>20</sup>

## Study Participants

Information related to women with preeclampsia and eclampsia was collected using Module 9A under case review. Per facility, the last two cases of women diagnosed with preeclampsia or eclampsia that were admitted to the health facility in the 12 months prior to the time of data collection were selected for further review. The 12-month time period covered the 2015 calendar (January to December). Medical records and health facility registers were assessed to gather information about the women with preeclampsia and eclampsia. During the data collection, preeclampsia and eclampsia were not separately collected or reported. Therefore, throughout this study, cases are reported as “preeclampsia/eclampsia”.

## Data Analysis

Descriptive statistics were used for analysis. Cross tabulation and summarization of the findings of variables by type of health facility (health centre/hospitals), their location (urban or rural) and management authority (public/government, private for profit and private for non-profit) was conducted. All statistical analyses were conducted using Stata version 16. A chi-squared test was used to test for differences in treatment received and monitoring of women with preeclampsia/eclampsia admitted to health facility by perinatal outcome. These categories were based on the FMHACA designation of health facility and those facilities with similar management mechanisms and service packages are grouped together.

## Ethical Clearance

The 2016 EmONC assessment was granted ethical approval by the EPHI’s scientific and ethical review board. Ethical approval was granted (approval number SERO-67-6- 2016; Version 001). A protocol was developed to conduct this analysis of the 2016 EmONC assessment dataset and received ethical approval from the EPHI scientific and ethical review board after completing the necessary procedures (Protocol number: EPHI-IRB-193-2019). In addition, ethical approval for this analysis was obtained from the University of Newcastle’s Human Research Ethics Committee (approval number: H-2019-0229).

## Results

### Background Characteristics of Women with Preeclampsia/Eclampsia

In the 2016 EmONC survey, 959 preeclampsia/eclampsia cases were identified during the data collection period with further information collected from patient medical records. As shown in Table 1, most of the women with preeclampsia/eclampsia received care at health centres (55.8%) followed by primary hospitals (19.4%). Whereas, two-thirds of women received treatment in urban health facilities (66.5%). The vast majority of women visited a public/government health facility (90%) compared to private for-profit (6.3%) or private non-profit (3.8%) facilities. The majority of the cases were reported from the three biggest regions: Oromia (32.3%), Amhara (26.2%) and Tigray (13.6%). The mean maternal age was 25.3 years with Standard Deviation (SD)  $\pm$  5.86 with nearly half of women aged between 15 and 24 years, and

**Table 1** Characteristics of Women with Preeclampsia or Eclampsia in Ethiopia, National EmONC Survey, 2016

Variable (N=959)	n (%)
<b>Facility address</b>	
Urban	638 (66.5)
Rural	321 (33.5)
<b>Type of facility</b>	
Hospital/MCH speciality centre	417 (43.5)
Health centres/clinics	542 (56.5)
<b>Facility managing authority</b>	
Public/government	863 (90.0)
Private for profit	60 (6.2)
Private not for profit	36 (3.8)
<b>Region of health facility</b>	
Addis Ababa	77 (8.0)
Afar	14 (1.4)
Amhara	251 (26.6)
Benshangul Gumz	6 (0.6)
Dire Dawa	35 (3.6)
Gambella	5 (0.5)
Harari	12 (1.2)
Oramia	309 (32.2)
SNNPR	81 (8.4)
Somalia	39 (4.0)
Tigray	130 (13.6)
<b>Age (years)</b>	
15–24	435 (45.3)
25–34	410 (42.7)
≥35	90 (9.3)
No information	24 (2.7)
<b>Age, mean (SD)</b>	<b>25.3 years (± 5.86)</b>
<b>Parity</b>	
Nulliparous	431 (44.8)
Primiparous	133 (13.9)
Multiparous	249 (26)
No information	145 (15.2)
<b>Previous maternal complications</b>	
No information	622 (64.9)
History of previous pregnancy related complications <sup>a</sup>	88 (9.2)
First pregnancy	249 (26.0)

**Note:** <sup>a</sup>Previous complication related with pregnancy included: abortion, preeclampsia/eclampsia, stillbirth/early neonatal death, diabetes mellitus.

women aged less than or equal to 18 years accounted for 10.1% of cases. Nulliparous, primiparous and multiparous mothers accounted for 44.8%, 13.9% and 26.0% of cases, respectively. Previous maternal complications were documented among 9.2% of women and included: stillbirth or early neonatal death (2.6%), any preeclampsia/eclampsia history (2.2%), and abortion (2.5%). However, nearly two-thirds (64.8%) of cases had incomplete or missing maternal complication histories in their medical records (see Table 1).

## Assessment of Clinical Condition of Women with Preeclampsia/Eclampsia During Admission

Table 2 presents the findings describing the clinical assessments conducted with women with preeclampsia/eclampsia during admission to a health facility. Overall, women referral history only registered in 19% cases. Among the cases that

were referred, 40% of cases were admitted to hospitals and MCH speciality centres, and a higher proportion (23.3%) were admitted to private for-profit managed health facilities. More than 85% of women with preeclampsia/eclampsia had their both systolic and diastolic blood pressure measurement recorded during their admission. Whereas, compared to blood pressure, a low proportion of women had respiratory and pulse rate measurements recorded. Among the registered consciousness status upon arrival to health facilities, fifteen percent of women were unconscious during admission and the majority of them had a birth and were treated in public health facilities. Likewise, 18.1% of women experienced a seizure. Most of the information about the condition of women after admission to health facilities was not documented in the medical chart, leading to a high level of missing information. A higher proportion of missing information occurred in health centres/clinics, rural and public/government managed health facilities compared to that of hospitals, urban and private for profit or non-profit health facilities.

## Treatment Received at Health Facilities Among Women with Preeclampsia/Eclampsia

Among the women who were admitted, a proteinuria test was registered for 43.5%. Of these, more than 50% of proteinuria tests were registered in hospitals, urban and private for-profit health facilities. Analysis of MgSO<sub>4</sub> administration revealed that only about one-third of women had registered information about received loading and maintenance dose of MgSO<sub>4</sub> with more than 67.7% of reviewed cases missing out on the routine MgSO<sub>4</sub> administration. Among the women who were admitted to health facilities, type of delivery was recorded for 62.8%. Of these, 51% had a vaginal birth, while 12% had a caesarean section delivery. The majority of women who were admitted to private for profit (67%) and private non-profit (44%) health facilities had birth through caesarean section compared to 7% in public/government managed health facilities. Less than 20% of women had information in their medical record about tendon reflex and urine output monitoring during admission to health facilities. Across all variables, better clinical monitoring documentation was observed in hospitals, and urban and private for-profit health facilities (Table 3).

Table 4 describes the monitoring of women with preeclampsia/eclampsia in terms of length of stay, blood pressure check frequency and number of hours spent before giving birth. Based on the registered hours from admission to birth, the mean number of hours spent between admission and birth was 35% higher in private for-profit health facilities (22 hours) while the national average was 14 hours. Women admitted to health centres and rural health facilities gave birth in a shorter time than the national average. In addition, the frequency of blood pressure measurement was much lower for women admitted to health centres and rural health facilities. The average length of stay was broadly similar across all types of health facilities except that women spent more days in private-for-profit and private-non-profit facilities (Table 4).

## Characteristics of Birth Outcome Among Women with Preeclampsia/Eclampsia

Among newborns born to women with preeclampsia or eclampsia (N = 959), nearly half (42.3%) of the survival outcomes of newborns at discharge were not documented. Among registered newborn outcomes, 1 in 10 newborns died (either in stillbirth or early neonatal death) and about half of newborns (48.3%) were known to be discharged from health facilities alive. In addition, about 15% of newborn from women with preeclampsia/eclampsia admitted to hospital for delivery died. The proportion of perinatal death was double in urban health facilities compared to rural facilities.

Only 13.7% of the newborns had neonatal morbidity details recorded in their medical records, however out of those with complete data, 38.9% of neonates with morbidities recorded died before discharge from health facilities. On the other hand, only 18.7% of neonates with morbidities were discharged alive from health facilities. Approximately two-thirds of newborn deaths occurred at hospital/MCH speciality centres. Of the registered newborn morbidities, low birth weight was the highest reported morbidity (9.3%). The proportion of perinatal outcomes was calculated based on 553 cases whose birth outcome was registered. Based on this, perinatal mortality (stillbirth or early neonatal death) was 16.3% (95% Confidence Interval (CI): 13.4%, 19.6%). Overall, 83.7% (95% CI: 80.4%, 86.6%) of newborns were known to be discharged from the health facility alive (see Table 5).

**Table 2** Percentage of Clinical Status of Women with Preeclampsia or Eclampsia During Admission to Health Facilities in Ethiopia, National EmONC Survey, 2016

Variables (%)	National	Facility Type		Location		Managing Authority		
		Hospital/MCH Speciality Centre	Health Centre/ Clinics	Urban	Rural	Public/ Government	Private- for- Profit	Private- Not Profit
	n=959	n=417	n=542	n=638	n=321	n=863	n=60	n=36
<b>Referral status</b>								
Yes	19	40	3.3	26.3	5	19	23.3	16.7
No/no information	81	60	96.7	73.7	95	81	76.7	83.3
<b>Diastolic blood pressure</b>								
Yes	86.4	98.6	77.1	90.6	78.2	85.4	96.7	94.4
No information	13.6	1.4	22.9	9.4	21.8	14.6	3.3	5.6
<b>Systolic blood pressure</b>								
Yes	87.0	98.5	77.6	90.9	78.4	85.7	96.6	94.4
No information	13.0	1.4	22.3	9.0	21.6	14.2	3.4	5.6
<b>Pulse rate</b>								
Yes	60.2	86.3	40.0	66.5	47.7	58.9	80.0	58.3
No information	39.8	13.7	60.0	33.5	52.3	41.1	20.0	41.7
<b>Respiratory rate</b>								
Yes	45.4	74.1	23.2	53.6	29	45.9	43.3	36.1
No information	54.6	25.9	76.8	46.6	71	54.1	56.7	63.9
<b>Consciousness status</b>								
Yes	14.7	13.4	15.7	13.3	17.4	15.6	5.0	8.3
No information	85.3	86.6	84.3	86.7	82.6	84.4	95.0	91.7
<b>Seizure experience</b>								
Yes	18.1	23.5	14.0	17.2	20.0	19	11.3	8.3
No/No information	81.9	76.5	86.0	82.8	80.0	89.0	88.3	91.7

## Characteristics of Women with Preeclampsia or Eclampsia with Perinatal Mortality and Alive at Discharge

The monitoring and treatment characteristics of women with preeclampsia/eclampsia based on their birth outcome is summarised in Table 6. Of the registered 90 perinatal deaths among women with preeclampsia/eclampsia who were admitted to health facilities for birth, the majority of them were admitted to hospitals and urban health facilities. Almost half of perinatal deaths occurred in women age 15 to 24 (48.8%) and first-time pregnant women (47.6%). Perinatal deaths occurred in 9% of women who had documented previous maternal complications. Despite more than 60% of referral histories not being recorded, one-third of perinatal deaths occurred in women who were referred to a health facility for birth ( $P < 0.007^*$ ). One quarter of women with a live birth were referred from another health facility for birth. The majority of women experienced severe diastolic and systolic blood pressure had higher proportion of perinatal death compared to women with alive birth ( $P < 0.001^*$ ). Of the 90 women with preeclampsia/eclampsia who were identified as experiencing perinatal death, 41 (45.5%) received the loading dose MgSO<sub>4</sub> while the remaining 54.5% women had no information about loading dose of MgSO<sub>4</sub>. Similarly, 39 (43.4%) women received a maintenance dose of MgSO<sub>4</sub>. Women who experienced a perinatal death had double number of hours spent before birth of the newborn (mean=23 hours) compared to those women who were discharged with a live birth (mean=11.6 hours). A significant high proportion of newborn with registered neonatal morbidity end up to death. As a result, four out of ten newborns with morbidities such as low birth weight and birth asphyxia were not discharged from the health facility alive (Table 6).



**Table 3** Treatment Received During Admission to Health Facility Among Women with Preeclampsia/Eclampsia in Ethiopia, National EmONC Survey, 2016

Variables,%	National	Facility Type		Location		Managing Authority		
		Hospital/ MCH Speciality	Health Centre/ Clinics	Urban	Rural	Public/ Government	Private- for- Profit	Private- Not for Profit
	n=959	n=417	n=542	n=638	n=321	n=863	n=60	n=36
<b>Proteinuria tested registered</b>								
Yes	43.5	62.6	29.5	52.0	27.0	42.8	52.3	45.0
No	56.5	38.4	70.5	48.0	73.0	57.2	46.7	55.0
<b>Loading dose MgSO<sub>4</sub> given</b>								
Yes	33.7	56.0	16.4	40.8	19.6	33.7	27.0	39.0
No information	66.3	44.0	83.6	59.2	80.4	66.3	7.03	59.0
<b>Maintenance dose MgSO<sub>4</sub> given</b>								
Yes	29.0	9.5	3.4	37.5	22.0	28.5	30.0	36.0
No/no information	71.0	40.5	94.6	62.5	88.0	71.5	70.0	64.0
<b>Route of MgSO<sub>4</sub> given</b>								
Intramuscular (IM)	5.7	9.6	2.8	7.2	2.8	5.3	3.3	19.4
Intravenous (IV)	8.3	13.7	4.1	9.6	5.6	8.8	1.7	5.6
IM& IV	18.3	32.6	7.4	22.4	10.3	19.0	11.7	13.9
No information	67.7	44.1	85.8	60.8	81.3	66.9	83.3	61.1
<b>Tendon reflexes monitored</b>								
Yes	11	22.5	1.8	15.3	2.0	10.0	13.3	25.0
No/No information	89	77.5	98.2	84.6	98.0	90.0	86.7	75.0
<b>Mode of birth</b>								
Vaginal	50.9	63.0	42.0	51.0	51.0	53.0	27.0	36.0
Caesarean section	12.0	26.0	1.0	17.0	2.0	7.0	67.0	44.0
No information	37.1	11.0	57.0	32.0	47.0	40.0	7.0	19.0
<b>Urine output monitored</b>								
Yes	20.0	43.2	2.0	28.7	2.5	27.6	50.0	25.0
No/No information	80.0	56.8	98.0	71.3	97.5	82.4	50.0	75.0

## Discussion

This study analysed data recorded for women with preeclampsia or eclampsia who were admitted for birth in Ethiopian health-care facilities. This was the first national study that evaluated the management of women with preeclampsia/eclampsia and their newborn outcomes using a nationally representative dataset. During the analysis, we identified several services were not registered during treatment and monitoring of women with preeclampsia and eclampsia that must be corrected in order to improve maternal and foetal outcomes.

Health information is a critical element in providing health care, including maternal healthcare. This study highlighted serious gaps in the information registered at health facilities in Ethiopia, noting that a significant proportion of information was missing. The huge rate of missing information in maternal and newborn health could lead to failure in decision-making. According to the WHO framework, information is a key component of quality improvement in healthcare.<sup>21</sup> Well-documented information is important for policy makers and managers to risks experienced by women with preeclampsia and eclampsia. Disproportionate procurement of medical commodities and supplies to health facilities results in compromised service provision, and this leads to a reduced quality of service to mothers and their newborns. In health-care systems, accurate and complete information collection and registration facilitates appropriate resourcing and

**Table 4** Descriptive Statistics of Monitoring Women with Preeclampsia/Eclampsia Based on Type, Location and Authority of Health Facility in Ethiopia, National EmONC Survey, 2016

Variables	National	Facility type		Location		Managing Authority		
		Hospital/MCH Speciality Centre	Health Centre/Clinics	Urban	Rural	Public/ Government	Private-for-Profit	Private-Not for Profit
		(n=417)	(n=542)	(n=638)	(n=321)	(n=863)	(n=60)	(n=36)
<b>Time between admission and birth (n=265) (hours) <math>\mu</math> (SD), p50</b>	14 ( $\pm$ 19.9), 6	16.3 ( $\pm$ 21.4), 7	8 ( $\pm$ 14.6), 5	15.6 ( $\pm$ 21), 6	8.3 ( $\pm$ 13.8), 5	13 ( $\pm$ 19.8), 6	21.8 ( $\pm$ 20.8), 18	18.1 ( $\pm$ 18.2), 13.5
<b>Number of blood pressure check (n=609) <math>\mu</math> (SD), p50</b>	13.3 ( $\pm$ 16.9), 8	19.5 ( $\pm$ 18.9), 14	3.9 ( $\pm$ 5.7), 2	16.4 ( $\pm$ 18.3), 12	4.8 ( $\pm$ 7.7), 2	11 ( $\pm$ 14.8), 6	28.7 ( $\pm$ 25.9), 20	17 ( $\pm$ 19.7), 14
<b>Number of days hospitalized (n=394), days <math>\mu</math> (SD), p50</b>	5.6 ( $\pm$ 6.2), 4	5.6 ( $\pm$ 6.8), 4	5.6 ( $\pm$ 3.6), 8	5.6 ( $\pm$ 6.6), 4	5.6 ( $\pm$ 4.2), 5	5.3 ( $\pm$ 4), 4	6.7 ( $\pm$ 13.6), 3	7 ( $\pm$ 6.9), 5



**Table 5** Characteristics of Birth Outcomes Among Women with Preeclampsia or Eclampsia in Ethiopia, National EmONC Survey, 2016

Variables, %	National	Facility Type		Location		Managing Authority		
		Hospital/ MCH Speciality	Health Centre/ Clinics	Urban	Rural	Public/ Government	Private- for- Profit	Private- Not for Profit
	n=959	n=417	n=542	n=638	n=321	n=863	n=60	n=36
<b>Newborn morbidity</b>								
Low birth weight	9.7	16.5	4.4	11.8	5.6	9.0	15.0	16.7
Birth asphyxia	2.8	4.3	1.7	3.0	2.5	3.1	0	0
MAS <sup>b</sup>	0.9	1.9	0.2	1.3	0.3	0.8	3.3	0
Macrosomia	0.3	0.5	0.2	0.3	0.3	0.2	1.7	0
No information	86.2	76.5	93.5	83.5	91.3	86.7	80	83.3
<b>Newborn survival</b>								
Alive at discharge	48.3	65.5	35.1	50.3	44.2	45.9	71.7	66.7
Perinatal death <sup>c</sup>	9.4	15.6	4.6	11.6	5.0	9.5	6.7	11.1
No information	42.3	18.9	60.3	38.1	50.8	44.6	21.7	22.2

**Notes:** <sup>b</sup>MAS - Meconium Aspiration Syndrome. <sup>c</sup>Include both stillbirth and early neonatal death.

saves the lives of mothers and newborns. In a situation with limited resources, accurate record-keeping is more important for more efficient use of available resources to treat women with preeclampsia/eclampsia.

Perinatal mortality is one of the most sensitive indicators for obstetric care quality. In Ethiopia, the perinatal mortality rate was 33 deaths per 1000 births based on the 2016 Ethiopia Demographic Health Survey (EDHS) report, and this is one of the highest rates in the world.<sup>6</sup> In this study, the proportion of perinatal mortality among women with preeclampsia or eclampsia was 16.3%, which is slightly higher compared to a previous review of the contribution preeclampsia or eclampsia makes to perinatal mortality, which estimated that this disease precedes 15% of perinatal deaths worldwide.<sup>22</sup> Similarly, small-scale studies conducted in Ethiopia at Mettu Karl hospital<sup>23</sup> and selected hospitals in Addis Ababa<sup>24</sup> indicated that nearly 12% of perinatal mortality was reported in women with preeclampsia or eclampsia.

Overall, among the women with referral history, majority of them were admitted at hospitals and private for-profit health facilities. This could be due to women seeking more equipped health facilities and the larger facilities having more specialists to provide advanced medical care. Importantly, the majority of vital signs check-up variables such as pulse and respiratory rate during admission were unknown or not documented. Consistent with our findings, poor documentation of women's clinical status during admission was reported in a study conducted in four sub-Saharan African countries.<sup>25</sup> Only 20% of women had information recorded about urine output, with hospitals being more likely to monitor this important clinical indicator compared to other facilities. WHO has recommended that women with preeclampsia and eclampsia receive treatment in advanced health-care facilities.<sup>13</sup> In Ethiopia's health-care system, hospitals provide advanced care and high risk pregnant women are encouraged to seek services in health facilities that offer comprehensive services, such as caesarean section.<sup>16</sup> Our study also found that women admitted to hospitals were better monitored than women in health centres, and were also more likely to receive services such as administration of MgSO<sub>4</sub>. On the other hand, there was high perinatal morbidity and mortality reported from hospitals and urban-located health facilities compared to health facilities in rural areas and health centres. This may be due to the high rate of referral of mothers with complications to hospitals and better documentation in hospitals. There has been an expansion of health facilities, especially health centres, in rural parts of Ethiopia.<sup>26</sup> However, increases in access alone mean little if the services provided are not of high quality. A recent Service Availability and Readiness Assessment (SARA), 2018 survey reported that health centres, especially those located in rural areas, have been faced with several challenges, such as being poorly equipped and supervised, having unsustainable running costs, and an insufficient quality of care to deliver improved

**Table 6** Characteristics of Women with Preeclampsia or Eclampsia with Perinatal Mortality and Alive at Discharge in Ethiopia, National EmONC Survey, 2016

Variable	Perinatal Mortality	Alive at Discharge	P-value
(n=553)	(n=90)	(n=463)	
<b>Type of facility</b>			P < 0.01*
Hospital/MCH specialized hospital	72.2	59.0	
Health centre/clinic	27.8	41.0	
<b>Facility address</b>			P < 0.016 *
Urban	82.2	69.3	
Rural	17.8	30.7	
<b>Facility managing authority</b>			P < 0.247
Public/government	91.1	85.5	
Private for profit	4.4	9.3	
Private not for profit	4.4	5.2	
<b>Age (years) (n=548)</b>			P < 0.045*
15–24	48.8	45.0	
25–34	44.3	44.1	
≥35	6.8	10.9	
<b>Parity (n=493)</b>			P < 0.55
Nulliparous	47.6	53.8	
Primiparous	20.7	17.0	
Multiparous	31.7	29.2	
<b>Previous maternal complication</b>			P < 0.66
Has previous pregnancy related complication	8.9	10.4	
None/no information	91.1	89.6	
<b>Referred from another facility</b>			P < 0.007*
Yes	37.8	23.8	
No/no information	62.2	76.2	
<b>Systolic blood pressure (n=499)</b>			P < 0.001*
<160 mmHg	20.2	43.6	
≥160 mmHg	79.8	56.4	
<b>Diastolic blood pressure (n=499)</b>			P < 0.001*
<110 mmHg	30.1	52.8	
≥110 mmHg	69.9	47.2	
<b>Conscious</b>			P < 0.001*
Not conscious	30.0	9.5	
Conscious	70.0	90.5	
<b>Seizure experience</b>			P < 0.042*
Yes	27.8	18.1	
No/no information	72.2	81.9	
<b>Antihypertensive drug used (n=335)</b>			P < 0.67
Hydralazine	73.6	71.1	
Other	26.4	28.9	
<b>Loading dose of MgSO<sub>4</sub></b>			P < 0.65
Yes	45.5	43.0	
No/no information	54.4	57.0	
<b>Maintenance dose of MgSO<sub>4</sub></b>			P < 0.68
Yes	43.3	41.0	
No/no information	56.7	59.0	
<b>Proteinuria tested</b>			P < 0.74
Yes	48.9	50.8	
No	51.1	49.2	

(Continued)

**Table 6** (Continued).

Variable	Perinatal Mortality	Alive at Discharge	P-value
(n=553)	(n=90)	(n=463)	
<b>Mode of birth (n=519)</b>			P < 0.72
Caesarean section birth	17.5	19.1	
Vaginal birth	82.5	80.9	
<b>Route of MgSO<sub>4</sub> given</b>			P < 0.46
Intramuscular	7.8	7.3	
Intravenous	13.3	11.4	
IM& IV	28.9	22.5	
No information	50.0	58.8	
<b>Urine output monitored</b>			P < 0.85
Yes	27.8	28.7	
No/No information	72.2	71.3	
<b>Newborn morbidity</b>			P < 0.001*
Newborn with morbidity	39.0	18.4	
No information	61.0	81.6	
<b>Time spent before birth (hours)</b>	23 (± 25.7), 13.5 hrs	11.6 hr (± 17.2), 6 hrs	P < 0.002*
<b>Number of blood pressure check</b>	19 (±21.4), 13 times	14.5 (±16), 11 times	P < 0.04*
<b>Number of days hospitalized</b>	6 (± 4.9), 4 days	5 (± 6.8), 3 days	P < 0.37

Note: \*Statistical significant with  $p < 0.05$ .

health outcomes.<sup>27</sup> Therefore, strengthening those segments of health-care facilities could significantly reduce the complications and mortality related with preeclampsia and eclampsia in Ethiopia.

According to the national protocol for screening and management of preeclampsia and eclampsia, pregnant women should be screened for signs and symptoms of preeclampsia and eclampsia both clinically and in laboratory tests. In this study, less than half of admitted women were tested for proteinuria and this was even less among women admitted to health centres (29.5%) and in rural areas (27%). This is consistent with findings from Zambia where 23% of health facilities conducted urine tests.<sup>28</sup> The WHO recommends administration of MgSO<sub>4</sub> for women diagnosed with preeclampsia or eclampsia, in order to reduce disease progress and further complications.<sup>13</sup> In our study, again noting the high degree of missing information, a small proportion of women admitted to health centres and rural areas received both loading and maintenance doses of MgSO<sub>4</sub>. Although the majority of women with preeclampsia/eclampsia were admitted to public/government managed health facilities, snapshot evidence suggests that private for profit and not-for-profit health facilities showed a slightly better proportion in documentation than public/government managed health facilities. There might be multiple factors for the low proportion in testing and administering MgSO<sub>4</sub> that our study was not able to distinguish. These include supply chain management issues leading to stock-outs of supplies; absence of clear, up-to-date national guidelines, and/or a lack of health worker understanding of, and compliance with, guidelines.

This study revealed a huge variation in the overall survival of newborns from women with preeclampsia and eclampsia along with the characteristics of mothers and the management received. Consistent with other studies, a significant proportion of perinatal mortality was registered among women with severe diastolic and systolic blood pressure, younger age and first-time pregnancy.<sup>29,30</sup> In this study, mothers with perinatal deaths spent more hours in health facilities before giving birth as compared to those discharge with alive newborn. As outlined by Thaddeus and Maine,<sup>31</sup> delays in provision of adequate and timely care resulted in serious consequences for the mother and newborn. A lack of supplies and equipment, insufficient knowledge and skills health workers and poor leadership are key factors in delays of service provision in Ethiopia.<sup>32</sup> Therefore, this study informs to decision maker about the challenges related with care to women with preeclampsia/eclampsia and quality of services in health-care facilities.

Overall, the findings from this study provide vital evidence to inform programs and policy, and to guide investment in maternal and child health to reduce complications including death, which are related to PE/E in Ethiopia. Cognisant of

the fact that providing appropriate and standardized clinical care to women with preeclampsia/eclampsia can significantly reduce the morbidity and mortality of mothers and the newborn. Therefore, this study provides insight into the policy makers the level of clinical care to women with preeclampsia/eclampsia and the perinatal outcome in the health facilities. In addition, the importance strengthen the information registration and recording highlighted in this study.

## Strengths and Limitations of the Study

A major strength of this study is that its findings are nationally representative as cases were collected from all regions of Ethiopia. Almost all public/government health facilities that provide delivery services were included. In addition, private health facilities were included, further strengthening this study's representativeness. In addition, rigorous data collection processes were in place through the involvement of experts from national and international partners, AMDD program of Columbia University. Intensive training of data collectors, regular supervision, and continuous data quality monitoring were conducted before and during data collection.

However, this study is not without limitations. The first limitation of our study related to the design of study, cross-sectional study, which cannot determine causal relationships. A second limitation is that home delivery still significantly common in Ethiopia, especially in rural part of the country;<sup>6</sup> however, this study included only deliveries at health facilities. That is, only include women who came to health facilities to seek care and may obscure the magnitude of the problem at the community level. A third limitation is this study intended to review two cases per facility; however, during the actual data collection period, not all cases from all health facilities are not collected due to several reasons. Therefore, the result of this study must be carefully interpreted. In addition, the quality of care for newborns was not assessed, which may have contributed to high perinatal mortality. Similarly, the data collection tools lack some important indicators of perinatal outcomes, such as history of ANC visits, gestational weeks at delivery, and any interventions the newborn received during delivery. In addition, some variables mentioned as "no/no information" which not able to distinguish between the cases with no event to that particular variable and those with missing information. Furthermore, cases were not reviewed as separately collected as preeclampsia or eclampsia. Lastly, there was a high percentage of missing information due to a lack of documentation in the mother's medical records and registries; this needs to be improved in order to increase the quality of maternal and child health in Ethiopia. Despite these limitations, this study provides important evidence on gaps in management of preeclampsia/eclampsia and some insight into the newborn outcome at health facilities in Ethiopia.

## Conclusion

Perinatal mortality among women with preeclampsia or eclampsia is high in Ethiopia. In addition, a significant number of neonates experience morbidity. This study highlights the notable amount of important information on women with preeclampsia or eclampsia that was missing from medical charts and logbooks. Hence, this study underscores the need for quality control and monitoring of information registration in health facilities, as accurate and complete information helps reveal the gaps in clinical practice on managing preeclampsia and related perinatal mortality and mortality. In addition, although private health facilities have a big role in service provision, a high proportion of maternal and newborn information was missing there as well. Most importantly, improving maternal and neonatal health information management is vital to generate strong evidence for policymakers. Once the pregnant women were diagnosed with preeclampsia or eclampsia, the outcome of mother and survival of newborns were largely influenced by early screening for complications, proper management and timely referral for better treatment.<sup>13</sup> Overall, to improve the quality of management and reduce perinatal morbidity and mortality, interventions are needed to monitor women during ANC visits, identify high-risk women, and strengthen hospitals to provide quality care.

This study also indicated hospitals and health facilities located in urban areas managed a substantial number of cases compared to health centres and rural area health facilities. Furthermore, significant variation in findings on the usage of MgSO<sub>4</sub> and general monitoring of admitted mothers based on types and location of health facilities indicated the importance of further investigation. However, based on our finding it is clear that there are gaps in service delivery quality in both urban/rural and hospital/health centres that could be addressed immediately to improve access to this life-saving intervention.

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## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

## Disclosure

The authors report no conflicts of interest in this work.

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