

# ENDING Eclampsia

## Exploring barriers and opportunities for pre-eclampsia and eclampsia prevention and management in Ethiopia

Pooja Sripad  
Hussein Ismail  
Amy Dempsey  
Karen Kirk  
Charlotte Warren

July 2018

# ENDING Eclampsia

Ending Eclampsia seeks to expand access to proven, under-utilized interventions and commodities for the prevention, early detection, and treatment of pre-eclampsia and eclampsia and strengthen global partnerships.



The Population Council confronts critical health and development issues—from stopping the spread of HIV to improving reproductive health and ensuring that young people lead full and productive lives. Through biomedical, social science, and public health research in 50 countries, we work with our partners to deliver solutions that lead to more effective policies, programs, and technologies that improve lives around the world. Established in 1952 and headquartered in New York, the Council is a non-governmental, non-profit organization governed by an international board of trustees.

Population Council  
4301 Connecticut Avenue NW, #280  
Washington DC, 20008  
Tel: +1. 877.237.9400

[www.popcouncil.org](http://www.popcouncil.org)



The Ending Eclampsia project is made possible by the generous support of the American people through the United States Agency for International Development (USAID) under the terms of USAID APS-OAA-13-000005. The contents of this report are the sole responsibility of the Ending Eclampsia project and the Population Council and do not necessarily reflect the views of USAID or the United States Government.

## Acknowledgements

We would like to acknowledge a number of people based in the Addis Ababa office who led data collection, management and cleaning, and collaborators who supported the various analyses presented and guidance and review of local experts during the process of finalizing this report. Specifically, we would like to thank Lemi Negeri and Frehiwott Getachew for their contributions to data collection, transcription, translation and data quality assurance. We are grateful for the support of Abreham Wuzen throughout research assistant training and data collection. We acknowledge Dr. Yohannes Dibaba and Dr. Wondimu Gudu, two maternal health experts in Ethiopia for their support on the Demographic Health Survey Analyses and Desk Review. We thank Dr. Annabel Erulkar, Country Director, Population Council-Ethiopia, for her support throughout the course of this study and her critical review of earlier versions of this report. We kindly acknowledge Dr. Yonas Regassa Guta for his expert review of this report and championing maternal health in Ethiopia. Finally, we would like to thank all our study participants for being so giving of their time, experiences and ideas.

## List of Acronyms

<b>ANC</b>	<b>Antenatal Care</b>
<b>BEmONC</b>	<b>Basic Emergency Obstetric and Newborn Care</b>
<b>EDHS</b>	<b>Ethiopia Demographic and Health Survey</b>
<b>EmONC</b>	<b>Emergency Obstetric Neonatal Care</b>
<b>EMwA</b>	<b>Ethiopian Midwives Association</b>
<b>EPHI</b>	<b>Ethiopian Public Health Institute</b>
<b>ESOG</b>	<b>Ethiopian Society of Obstetricians and Gynecologists</b>
<b>FGA</b>	<b>Family Guidance Association</b>
<b>FGD</b>	<b>Focus Group Discussion</b>
<b>FMHACA</b>	<b>Food and Medicine, and Health Care Administration and Control Authority</b>
<b>FMOH</b>	<b>Federal Ministry of Health</b>
<b>HDP</b>	<b>Hypertensive Disorders of Pregnancy</b>
<b>HEP</b>	<b>Health Extension Program</b>
<b>HEW</b>	<b>Health Extension Worker</b>
<b>HIV</b>	<b>Human Immunodeficiency Virus</b>
<b>HMIS</b>	<b>Health Management Information Systems</b>
<b>HSTP</b>	<b>Health Sector Transformation Plan</b>
<b>IDI</b>	<b>In-depth Interview</b>
<b>LMIC</b>	<b>Low- and Middle-Income Countries</b>
<b>MCH</b>	<b>Maternal and Child Health</b>
<b>MgSO<sub>4</sub></b>	<b>Magnesium Sulphate</b>
<b>NGO</b>	<b>Non-governmental Organization</b>
<b>NHP</b>	<b>National Health Policy</b>
<b>PE/E</b>	<b>Pre-eclampsia and eclampsia</b>
<b>PFSA</b>	<b>Pharmaceutical Fund Supply Agency</b>
<b>PNC</b>	<b>Postnatal Care</b>
<b>SMS</b>	<b>Short Message Service</b>
<b>SNNP</b>	<b>Southern Nations, Nationalities, and People</b>
<b>SNNPR</b>	<b>Southern Nations, Nationalities, and Peoples Region</b>
<b>USAID</b>	<b>United State Agency for International Development</b>
<b>WHO</b>	<b>World Health Organization</b>

## Executive Summary

In Ethiopia an estimated 19 percent of maternal deaths result from hypertensive disorders of pregnancy (HDP). Globally, HDP—which include pre-eclampsia and eclampsia (PE/E)—are the second most common cause of maternal mortality and an underlying cause of preterm birth, stillbirth and neonatal death. Although etiological and clinical studies of PE/E at tertiary hospitals in urban centers in Ethiopia such as Addis Ababa have been conducted, the relationships of women, communities, and health systems that shape both the experience and burden of PE/E are less understood. This research aimed to understand these factors, by: 1) investigating PE/E knowledge, attitudes, and practices, at numerous levels, 2) describing the barriers to the provision and utilization of PE/E prevention and management, including antenatal care (ANC), delivery, and postnatal care (PNC), and 3) assessing the policy and health system environments for PE/E diagnosis, referral, and care, including potential supply chain bottlenecks.

This study was guided by an institutional ethnographic approach, engaging different points of view and data sources. Ending Eclampsia project researchers qualitatively investigated perspectives throughout the health system with qualitative data from Ethiopia’s Southern Nations, Nationalities, and Peoples Region (SNNPR), by conducting in-depth interviews (IDIs) with 21 policymakers and stakeholders—at national, regional, zonal, and *woreda* (district) levels—as well as with 41 health workers at health posts, health centers, and hospitals. The research team conducted 16 focus group discussions (FGDs) in communities, with men and women, as well as 17 IDIs with women who experienced HDP, specifically PE/E. A desk review of 43 documents included peer-reviewed publications and maternal health-related guidelines and policies, with subsidiary analysis of the 2016 Ethiopian Demographic and Health Survey (EDHS).

In triangulating these varied forms of data, themes of PE/E care access and quality clustered along the Three Delays model—**deciding** to seek care, **reaching** care, and **receiving** care once at a facility. Delays in seeking care involve women’s decision-making power for care seeking and awareness, by them and by their communities, of maternal health and complications. Delays in reaching care comprise access barriers and provider knowledge of maternal complications, prevention, and management. Delays in receiving quality care include its actual provision, the experience of care, supply chain process, bottlenecks, and persisting gaps in policy and programming.

Recommendations for change are described by respondents for each of the Three Delays. Based on the results of our research, we recommend:

- Enhancing community awareness for birth preparedness, healthy diet, complications during pregnancy, and ANC, delivery, and PNC options—**First Delay**.
- Improving physical access to health facilities by implementing community strategies for transporting women experiencing maternal complications—**Second Delay**.
- Increasing professionals’ skills for their roles in caring for pre-eclamptic women and improving management and referral mechanisms—**Second and Third Delays**.
- Improving health systems and supply chain functioning, budget allocation, and policy implementation by building political will and multi-sectoral efforts—**Third Delay**.
- Building capacities for including maternal complications, such as PE/E, in routine monitoring and feedback systems at the *woreda* level—**All Delays**.
- Formalizing a national policy on PE/E diagnosis, referral, and management to clarify persisting policy gaps—**All Delays**.

## Background

Pre-eclampsia and eclampsia (PE/E), with other hypertensive disorders of pregnancy (HDP), are the second most common cause of maternal mortality globally—after hemorrhage—and lead to 76,000 maternal deaths every year.<sup>1</sup> PE/E are frequently cited as an underlying cause of pre-term birth stillbirth and neonatal death.<sup>2</sup> The impact of PE/E is disproportionately higher in low- and middle income countries (LMICs), where interventions may be ineffective due to late presentation of patients and health facility constraints. A report from the World Health Organization (WHO) establishes high rates of PE/E in the Americas and Africa, with the highest burden of eclampsia in LMICs in Africa.<sup>3</sup>

Pre-eclampsia is defined as new onset of hypertension with proteinuria\* in a pregnant woman after 20 weeks' gestation; severe pre-eclampsia is defined as hypertension with signs of end organ damage; and eclampsia is the development of convulsions or coma not attributed to other causes.

The etiology of PE/E is not entirely clear, however: What is known is that both are associated with several maternal risk factors. A 2013 study from a referral hospital in Dessie, in northeast Ethiopia, found that maternal age, marital status, education, gravidity, and family history of hypertension and diabetes mellitus significantly influence pre-eclampsia. Women ages 30 to 34 and 35 years and older were 3.3 and 4.5 times, respectively, more likely to develop pre-eclampsia than women ages 25 to 29. Family history of hypertension increases maternal risk of pre-eclampsia 7.2 times. Women with a family history of diabetes mellitus are 2.4 times more likely to develop pre-eclampsia than women with either no family history of hypertension or diabetes mellitus. Unmarried women are three times more likely to develop pre-eclampsia than married counterparts<sup>4</sup>.

A cross-sectional study of maternal health care utilization, based on the 2016 EDHS, demonstrated existing low utilization of antenatal care (ANC), delivery, and postnatal care (PNC) services throughout Ethiopia. Nationally, 38 percent of women who had at least one birth in the past five years had no ANC visit, and 62% had less than four. About 26 percent of women gave birth in facilities, while 74 percent delivered at home.<sup>5</sup> Skilled birth attendants and institutional deliveries were more common among urban residents and women with greater education.<sup>6</sup> A community-based study focused on Ethiopia's Tigray Region concurred with the EDHS findings and shows that maternal age and marital status are both significantly associated with ANC service utilization and institutional delivery. The proportion of pregnant women who made at least one visit in the Tigray study was higher than the national average, as was for mothers giving birth at a health institution (27%). Despite their better indicators than in other Ethiopian studies, Tigray's overall proportions of skilled birth attendance and ANC were lower than in other low- or middle income countries (LMIC).<sup>7</sup>

Similar to rates of national utilization of formal maternal health services, in SNNPR 69% of women who gave birth in the last five years had ANC for their most recent birth, up from 41 percent in 2011; about 38 percent made four or more ANC visits, higher than the national average of 32 percent. The percentages of women who had skilled birth attendance and delivered in a health facility were 29 percent and 26 percent, respectively,

---

\* Proteinuria is the presence of excess proteins in the urine

1 Brown, M.A. 2014. Pre-eclampsia in 2014: Seven ways to make a difference. *Pregnancy Hypertens* 4(4): 249-252. doi:10.1016/j.preghy.2014.11.001.

2 Hodgins, S. 2015. Pre-eclampsia as Underlying Cause for Perinatal Deaths: Time for Action. *Glob Heal Sci Pract* 3(4): 525-527. doi:10.9745/GHSP-D-15-00350.

3 Abalos, E. et al. 2013. *Pre-eclampsia, eclampsia and adverse maternal and perinatal outcomes: a secondary analysis of the World Health Organization Multicountry Survey on Maternal and Newborn Health*. WHO.

4 Tessema, G.A. 2015. Preeclampsia and associated factors among pregnant women attending antenatal care in Dessie referral hospital, Northeast Ethiopia: a hospital-based study. *BMC Pregnancy and Childbirth* 15 (73).

5 Ethiopia Demographic and Health Survey. 2016. Central Statistical Agency, ICF International.

6 Tarekegn, S.M., L.S. Lieberman, V. Giedraitis. 2014. Determinants of maternal health service utilization in Ethiopia: an analysis of the 2011 Ethiopian Demographic and Health Survey. *BMC Pregnancy and Childbirth* 12(161), 1-13.

7 Melaku, Y.A., B. Weldearegawi, F.H. Tesfay, S.F. Abera, L. Abraham, A. Aregay. 2014. Poor linkages in maternal health care services—evidence on antenatal care and institutional delivery from a community-based. *BMC Pregnancy and Childbirth*.

similar to national averages. PNC in SNNPR is also similar to the national average: nearly 21 percent of women in SNNPR had PNC, compared to 19 percent nationally.

Most studies to date on PE/E in Ethiopia present clinical and hospital-based findings, with little data from community research. This gap leads to incomplete evidence on the challenges within the Ethiopian health system that affect PE/E care access and quality. In 2016, at least 85 percent of health facilities provided focused ANC and PNC, among other services<sup>8</sup>. Provision of PE/E care was examined in three national surveys, and in all three the basic signal function provided least was parenteral anticonvulsant drugs. Over the last 10 years, studies report, despite adequate staffing, provision of anticonvulsant drugs by only 20 to 26 percent of facilities.<sup>9,6,10</sup> Administration of these drugs is disproportionately higher in hospitals than in health centers.<sup>4</sup> A retrospective study at Dilla University Referral Hospital in SNNPR measured its quality of care for women, involving 7,702 women, of whom 172 had pre-eclampsia (2%). The study found no significant difference in how mild and severe pre-eclampsia and eclampsia were managed; caesarean sections were high at 89 percent, and use of magnesium sulphate (MgSO<sub>4</sub>) as prophylaxis was low, with only 15 percent of women with severe pre-eclampsia cases receiving it.<sup>11</sup>

## Study purpose

The Ending Eclampsia Project is a five-year cooperative agreement between United State Agency for International Development (USAID) and Population Council, in partnership with the Federal Ministry of Health Ethiopia (FMoH), which seeks to expand access to quality under-utilized interventions and commodities for the prevention and treatment of PE/E.

This report presents qualitative findings from formative research conducted to: 1) assess the policy and health systems environment related to PE/E prevention and management, 2) identify potential bottlenecks in the supply chain, 3) investigate the knowledge of, attitudes and practice toward, PE/E at policy, health system, and community levels, 4) describe the barriers for provision/utilization of prevention and management for PE/E (including ANC and PNC, at service delivery and community level), and 5) explore similarities and differences in PE/E knowledge, attitudes, and care-seeking behaviors (practice) across settings and perspectives. It also presents relevant quantitative findings from an EDHS analysis and elements of a policy desk review.

## Methods

The research uses an institutional ethnography approach, a methodology based on understanding the actualities of women's lives, probing political nature of these realities, and describing social processes. The approach engages different viewpoints and data sources around the same topic.<sup>12</sup> In this study, researchers investigated viewpoints across the health system through multiple primary data sources, a desk review of peer-reviewed publications and maternal health-related textual guidelines and policies, and an analysis of the 2016 EDHS. We incorporated this methodology by asking respondents about issues raised by other relevant groups affected or working on PE/E (e.g. in the community, from providers, etc.) and by triangulating across data sources. In describing varied and consensus perspectives in the results, we provide a cross-system lens in the discussion and recommendations.

---

<sup>8</sup> Ethiopia Federal Ministry of Health (FMoH). Health Sector Transformation Plan: 2015/16–2019/20. Addis Ababa.

<sup>9</sup> Ethiopia Service Provision Assessment Plus Survey 2014. Key Findings. Ethiopian Public Health Institute (EPHI).

<sup>10</sup> Gaym A. et.al. 2011. Disease burden due to pre-eclampsia/eclampsia and the Ethiopian health system's response. *Int J Gynaecol Obstet* 115(1): 112-116.

<sup>11</sup> Vata K. et.al. 2015. Assessment of prevalence of preeclampsia from Dilla region of Ethiopia. *BMC Res Notes* 8: 816. DOI 10.1186/s13104-015-1821-5.

<sup>12</sup> Smith, D. 2006. *Institutional Ethnography as Practice*. Lanham, MD: Rowman & Littlefield Publishers, Inc.

The qualitative study took place in rural and urban sites in the Sidama Zone in the SNNPR, one of Ethiopia's nine regional states, as well as drawing upon perspectives of key informants at the national level. According to the Ethiopian Population and Housing Census 2007, SNNPR is the third largest regional state in Ethiopia, with a population of 14,929,548. Nearly 13 million of SNNPR residents live in rural areas and engage primarily in agriculture. Of the 80 ethnic groups in Ethiopia, nearly 56 of them dwell in SNNPR.<sup>13</sup> Additionally, a significant number of people from other regions reside in SNNPR, making it a diverse sample of the nation. Given its diversity and representativeness, SNNPR was selected through consultation with USAID and the Ministry of Health (FMoH) and based on prior Population Council experience in the region.

Researchers conducted in-depth interviews (IDIs) with policymakers and stakeholders at national, regional, zonal, and *woreda* levels, as well as with health workers working at health posts, health centers, and hospitals (Table 1). Stakeholders include health officers, federal and regional Ministry/Bureau of Health representatives, implementing partner agencies, and representatives of the Ethiopian Midwives Association (EMWA) and Ethiopian Society of Obstetricians and Gynecologists (ESOG). At the community level, the study team conducted focus group discussions (FGDs) with married men and women (6 to 9 persons per group) aged 18 years or older with children, and IDIs with women aged 15 years or older who experienced PE/E. Community members were purposefully recruited by the study team through meetings with the district health bureau, local health center, and groups working in *woredas* or *kebeles*.

Data collection was conducted in Amharic or Sidaminga by research assistants trained and supervised by Population Council researchers. IDIs and FGDs were audio-recorded, transcribed, and translated into English; field notes written by data collectors were also collated and informed the analysis. A three-person analysis team read through the 95 transcripts and corresponding field notes (when applicable) and developed broad thematic categories based on the data through memo-writing and synthesis. Analysis of emerging trends and comparisons based on location, age, and type of respondent was supported through the use of NVivo 11 software.

Pre-eclampsia survivor respondents were between 22 and 30 years (median age: 27 years), had been married between the ages of 12 and 24 (median age at marriage: 16 years) and had one to five children (average of 3 children). Two respondents had no education, seven had some education (grades 1 to 6) and six had seven or more years of schooling. All of the women attended ANC for at least one of their births. The health extension workers (HEWs), health workers, and policy-makers and other stakeholders had varied levels of higher education, according to their professional requirements.

**Table 1. Interviews conducted in SNNPR**

	<b>Rural</b>	<b>Urban</b>	<b>Total</b>
<b>In-depth Interviews</b>			<b>79</b>
Women who experienced pre-eclampsia	8	9	17
Health Extension Workers (HEWs)	8	9	17
Health Workers (nurses/midwives)	6	16	24
Policymakers and stakeholders	1	20	21
<b>Focus Group Discussions</b>			<b>16</b>
Women aged 18-24 years	2	2	4
Women aged 25+ years	2	2	4
Men aged 18-24 years	2	2	4
Men aged 25+ years	2	2	4

<sup>13</sup> Central Statistical Agency: The 2007 Population and Housing Census of Ethiopia: Statistical Report for Southern Nations, Nationalities and Peoples' Region; Part I: Population Size and Characteristics. July 2010.



The desk review systematically searched scientific papers, documents on policy, guidelines and protocols, and assessed the PE/E disease burden and risk factors in Ethiopia, health facility capacities for effective management and prevention, and PE/E prevention and management barriers and facilitators at three levels—health governance systems, facility service provision, and communities. Peer-reviewed and ‘grey’ literature including journal articles, surveys, national documents (policies, legislations, standard treatment guidelines), protocols, clinical guidelines and training materials on emergency obstetric neonatal care (EmONC), and websites of organizations working on maternal health in Ethiopia were reviewed; combinations of the following search terms were applied: pre-eclampsia, eclampsia, management, magnesium, diazepam, factors/determinant, health care seeking, pregnancy-induced hypertension, aspirin, Ethiopia. Selected findings are incorporated in this report as background, with relevant policy and guideline gaps presented, with qualitative findings, in the results section. The summary desk review report is provided in Appendix A.

A subsidiary study examined 2016 EDHS data for patterns of facility-based maternal care, recognizing that Ethiopia’s preponderance of home-based care diminishes PE/E detection and treatment, with secondary analyses of individual and contextual socio-economic, demographic, and autonomy factors that influence three binary outcomes: women’s use of ANC, delivery, and PNC services. Descriptive variables explored include ANC service quality, including whether blood and urine samples were taken, blood pressure (BP) measurement, and information of detected pregnancy complications; provider type and location of ANC, as well as delivery, were also investigated. Women’s autonomy measures comprised household decision-making power and attitudes toward intimate partner violence. A composite measure of participation in household decisions was constructed from three items reflecting women’s decision-making power on health care, making large household purchases, and visits to family or relatives. A composite measure was constructed for attitudes toward intimate partner violence that captured the acceptability of a husband beating his wife if she: 1) goes out without telling him, 2) neglects the children, 3) argues with him, 4) refuses to have sex with him, and 5) burns food. Control variables explored include individual socio-demographic variables like respondent age, education, occupation, place of residence, wealth, and parity, as well as cluster covariates of poverty, education, and development region (rural agrarian, rural pastoral, urban). Exploratory, descriptive (bivariate), and multi-level (mixed effects) logistic regression analysis of the outcome variables were conducted. Relevant analyses are presented in this report, with qualitative and desk review findings. The summary EDHS analysis report is in Appendix B.

## Results

Findings related to PE/E care, access, and quality are described across perspectives of users, providers, and influencers of maternal health service delivery. Results are organized along three delays: to decide to seek care, to reach care, and to receive care once at a facility.<sup>14</sup> Delays to seek care include women’s decision-making power on care-seeking and women’s and community awareness of maternal health and related complications. Delays to reach care include access barriers and provider knowledge of maternal complications, prevention, and management. Delays in receiving quality care include themes of care provision, experiences of care, supply chain process and bottlenecks, and persistent gaps in policy and programming. Finally, recommendations for change were described by respondents around each delay.

### Delayed decisions to seek care

The first of the Three Delays refers to the length of time taken by a woman or her family to seek care from a health facility. This delay is estimated from the moment anyone recognizes a problem, ranging from minor discomfort to serious complications requiring medical interventions, during or after pregnancy.

---

<sup>14</sup> Thaddeus, S. and D. Maine. 1994. Too far to walk: Maternal mortality in context. *Social Science and Medicine* 38(8): 1091–1110. doi:10.1016/0277-9536(94)90226-7

## Women's decision-making power for maternal health care seeking

Nationally, 65 percent of women report having some level of household decision-making power, however the influence of this power on use of ANC and delivery care is less clear (and statistically insignificant). EDHS analysis showed increased use of ANC services among adolescent women aged 15 to 19 years (74%), urban women (90%), and women with secondary and above education (94%)—all of which may have implications on how decision-making power in the household is exercised. It also showed increased facility delivery associated with higher education and urban residence, and PNC use linked to education level. Our qualitative results suggest that specific types of women, such as younger pregnant women, those in poor urban areas, those with unplanned pregnancies, those who are unmarried, and those who experience complications may be dis-empowered to make health care seeking decisions.

*“Certain groups are afraid of ANC, such as students. They experience unexpected pregnancy and they might not feel ease to attend ANC visits. What they want to hide the pregnancy from their families, abort it or deliver secretly...The community does not encourage those who got pregnant unexpectedly [to seek ANC].”*

**FGD, urban women, 18 to 24 years old**

Our qualitative results concur that many women describe relative autonomy in decision-making to seek ANC, labor and delivery, and PNC, with some variability. This sentiment emerged from women who had and had not experienced pre-eclampsia, and to some extent, men and HEWs.

*“I decide by myself and come to the health facility. Previously, people may have had different ideas, but I do not follow that.”*

**IDI, pre-eclampsia survivor, rural, 22 years old**

*Anything that happens to my body affects only me. Therefore, nobody can make decisions on my life. Sometimes [my husband] encourages and helps me...he comes with me, gives me transportation money...[HEWs] encourage and counsel us when we go there for [pregnancy] check up. Even they remind us of check up days.”*

**FGD, rural women, 18 to 24 years old**

Policymakers felt that women's decision-making power in maternal health could be strengthened by building on existing equality frameworks advocating economic empowerment of women in Ethiopia.<sup>15</sup>

*“It is better...[to] empower them [women] economically so that they can seek health services on their own...Women's equality in making decisions in a family setting has been included in a legal framework...Women should be aware about their rights provided by the government...about what they mean and what to do when there is too much male influence. There is a system where government takes action on men who ignore their wives' health and prevent from going to health centers.”*

**IDI, rural woreda, Maternal and Children Health Care Service Coordinator**

Despite women's descriptions of being the main decision-maker on seeking ANC and delivery care, they reported significant social influence on these decisions. Facilitators included spouses, mothers-in-law, family members, HEWs, community members, cultural leaders (e.g. Maheber, Iddir, church, mosque), and assorted government-supported women's groups, including 'ande le-amist' (One-to-Five), 'limat buden' (development group), 'yelemat serawit' (development army), 'ye budin meri' (block leaders).<sup>16</sup> HEWs, women's groups, and supportive husbands are often described as direct influencers during the pregnancy stage. Traditional wisdom and apprehension expressed by community members of mothers-in-law and older family members discouraging women from attending ANC did not always deter access from the perspective of PE/E survivors. Spouses and neighbors become pivotal at the stage of labor and delivery. Community members and health providers sometimes felt that women's decisions at this stage be limited by cultural pressure for home birth, as well as their relationship quality with their husbands. Many community members describe collective efforts to facilitate access, including pooling funds.

<sup>15</sup> Baych, E. 2015. Human Rights in Ethiopia: An Assessment on the Law and Practice of Women's Rights. *Humanities and Social Sciences* 3(2): 83-87. Doi: 10.11648/j.hss.20150302.13.

<sup>16</sup> These are existing social, health and development groups -voluntary and grassroots in nature- that supported by the national and regional governments as a part of expanding access to hard-to-reach areas.

*“The primary one who motivates her to go to the health institution are HEWs...They follow up the pregnant mother from the beginning up to the time of delivery. The second one is the husband and it is a must for him. He is responsible to motivate her to go there. The neighbors are secondary...they should motivate and follow up this way.”*

**FGD, urban men, 25+ years old**

*“Development leaders in the community through One-to-Five leaderships help and push all pregnant women to visit health facilities for check-ups...In the household, my husband encourages me to go to the health facilities. However, the family of my husband [i.e. elders] do not encourage me to go to the health facilities for check-ups. In the community, women development army representatives mainly encourage us...”*

**IDI, pre-eclampsia survivor, rural, 25 years old**

Though some participants describe home delivery and traditional birth attendants as previously preferred, nearly all respondents describe a shift towards facility births.

*“Sometimes pregnant women face problems like high blood pressure. HEWs advise them to stop eating salty food and start eating healthier—they create awareness on the causes and consequences of high blood pressure. Earlier, pregnant women delivered in their home without any help of health professionals—now they deliver in hospitals.”*

**FGD, rural women, 24+ years old**

Two challenges affecting women’s choices to access ANC include 1) the cultural practice of hiding one’s pregnancy until the fourth or fifth month and 2) health centers consistently turning women away if they arrive at a facility for ANC ‘too early.’ In urban settings, in which women typically seek ANC services earlier, many report being turned away and told to return at their fourth month of pregnancy; this also discourages HEWs from referring pregnant women to health centers early in their pregnancies.

*“We don’t tell the pregnant mother to go to the health center at her second month as we know that they are not going to provide her with services...but we don’t know why. There are pregnant mothers who we send to the health center at their second or third month of pregnancy; but they come back telling us to refer at the fourth month of pregnancy.”*

**HEW, urban health post, female**

### **Women’s and community awareness of maternal health and complications, including PE/E**

Women and men in SNNPR’s rural and urban settings are moderately knowledgeable about pregnancy-related problems and when to seek maternal care. Respondents consistently described the need to seek emergency obstetric care (EmONC—i.e. go to a hospital) when complications manifested during labor and delivery to protect the mother and baby. Though communities often lacked an understanding of formal PE/E definitions, they were aware of high blood pressure (BP) as problematic during pregnancy and warranting treatment during pregnancy and at birth. They had moderate to high knowledge of PE/E-related danger signs and symptoms (headache, blurry vision, dizziness, fever, swelling, energy loss, sweating, and convulsions). The more direct exposure men and women had to a survivor of high BP during pregnancy and its consequences (self or others), the greater their awareness of the complication’s potential effects. Communities, providers, and policy stakeholders shared common understandings of malnutrition, stress (induced by family relationships, work, fear of childbirth), poverty, anemia, and malaria as related to pregnancy complications, such as pre-eclampsia.

*“I had blurred vision and swelling of my hands and legs, and headaches, so I decided to go to the health center. I recognized what I had been taught before...I was tested and it was blood pressure what I guessed.”*

**IDI, pre-eclampsia survivor, rural, about 28 Years old**

*“High blood pressure and convulsions can be managed by improving our nutritional status and visiting health centers...Women should receive prenatal and postnatal care. A woman and her husband should be aware of the problem and regularly follow up.”*

**FGD, urban men, 18 to 24 years old**

In contrast to women’s and community-reported moderate awareness, health providers at the hospitals, health center and health posts (including HEWs,) and policy-makers painted a mixed picture. These groups felt that communities had low awareness of pregnancy complications, PE/E, timely care seeking, and follow up PNC.

*“The community attributes pre-eclampsia and eclampsia to evil spirits. They don’t know that the woman with pre-eclampsia and eclampsia is pregnant...the community fails to bring the woman to a health center.”*

**Health worker, rural health post, male**

*“[Women] do not pay attention to pregnancy—they just work and do not take it seriously until the last stage. When we visit their house, there are women who do not want to go to a health center...and want to deliver their baby at home. It is very difficult...The community does not even want to talk about [pregnancy] with others.”*

**HEW, urban health post, female**

While communities and pre-eclampsia survivors described using herbal or self-care remedies to treat high blood pressure, including reducing salt and coffee intake and increasing consumption of lemon and garlic, they did not attribute PE/E to the supernatural nor describe current religious practices impeding a woman’s access to health care as suggested by providers at all levels.

All respondents describe influences by HEWs and community groups as integral to enhancing community awareness of maternal complications and counseling about healthy versus risky behaviors during pregnancy, reminding them of ANC days, signs and symptoms requiring skilled birth assistance, and immunization. At the community level, peer-to-peer learning networks were emphasized. Men describe the importance of HEWs reaching beyond pregnant women, to educating husbands on supporting their wives in appropriate and timely maternal care-seeking.

*“Our major role is giving health education in the community. We encourage the mother to come here directly and get the tests for HIV, blood group...get her blood pressure check up—you cannot identify the hypertension condition only by observing.”*

**HEW, urban health post, female**

*“When women attend antenatal care at health centers, they are told to come immediately if they see body swelling, have blurred vision, feel dizzy, and gain weight. They have this information because they are told during antenatal care [by development group and One-to-Five leaders]...When there is high blood pressure, they will feel these...They know that [symptoms could result in death].”*

**FGD, urban women, 25+ years old**

Few distinctions between rural and urban community awareness and ways of learning about maternal health complications emerged. Women and men in urban settings—many of whom are migrants from rural villages—working outside the home, describe having less knowledge of pregnancy-related complications given they often miss health promotion visits during the day. Policy perspectives suggest communities have low awareness, but describe different modalities of education—i.e. radio and direct health professional access in urban areas and HEWs in rural settings. EDHS adjusted analyses showed that women’s exposure to radio or television is associated with 48 percent and 35 percent increased likelihood of attending ANC and facility deliveries, respectively.

*“I didn’t have awareness [of this complication]...I stay the whole day at work, which doesn’t allow me to meet people. After selling injera, I also worked as a domestic worker in a mill house weighing grains. It was a company and I couldn’t go outside during working hours. So, I didn’t have the exposure to such information.”*

**IDI, pre-eclampsia survivor, urban, about 30 years old**

*“I don’t think that urban and rural communities have awareness on the signs and symptoms of pre-eclampsia. There is no difference between either community.”*

**IDI, regional policymaker**

## **Delays in reaching care**

In the Three Delays model, the second delay refers to the time spent reaching a facility after making a decision to seek health services. This delay is often influenced by the location and geographical distribution of these facilities, as well as the intermediate steps of moving through a referral system.

## Access barriers

Our qualitative work in SNNPR supports studies from other regions in Ethiopia about the distance and transport challenges preventing care-seeking for maternal complications.<sup>17,18</sup> All respondent types agree that physical access to health services, including distance to and from health facilities, varied road conditions and terrain, transport options, and cost serve as barriers to seeking maternal health services. Some of these are more pronounced at night, in rural settings or in the rainy season. In rural and urban settings, hospitals able to treat maternal complications were considerably far away.

*“The distance to health facilities is a barrier to me...For example, last time when I was referred to the hospital, I could not walk since I had body swelling, and then I returned back to home.”*

**IDI, PE/E Patient, rural, 30 years old**

*“When they come from their kebele to the health facility, the chance of getting transportation is limited. The kebele road is not accessible in some areas. It is too far... They travel hills and slopes to come to health center in some kebeles.”*

**Health center head, rural health center, male**

Ambulances existed in our SNNPR study catchment area and are regularly used in rural and urban settings. At the time of data collection, there were approximately two ambulances and three drivers per *woreda* serving 11 health centers and 36 health posts. Providers, *woreda* and regional policy-makers, and communities describe challenges in ensuring their timeliness and availability, echoing a national estimate of 17 percent of facilities have their own dedicated functioning ambulance.<sup>19</sup> During pregnancy forums hosted by HEWs in SNNPR, women are given the ambulance drivers' contact information. Nationally, mobile phone ownership at the household level is 56 percent; 88 percent of urban and 47 percent of rural households own a mobile phone.<sup>20</sup> The low supply and high demand described in our SNNPR setting often results in multiple women needing the ambulance at the same time. Policy makers describe *woreda* governments as tasked with overseeing transport systems and supplying ambulances with gasoline if needed. Communities also describe church, *kebele* leaders, spouses and neighbors as enablers to fund transport for women when insufficient money had been set aside (by woman and spouse) for transport and miscellaneous needs when taking a laboring woman to a facility.

*“The ambulance might be called for another duty and couldn't reach the mother in labor...Some people might not have money to pay for a bajaj [auto-rikshaw]...For instance, one mother called for an ambulance but the driver informed [the family] that he was picking up another mother in labor. I then called and woke up another bajaj to go to this laboring woman. While on his way, she delivered her baby at home.”*

**HEW, rural health post, female**

*“The neighborhood donates money if the husband is poor, otherwise the husband escorts his wife to the health center—sometimes with two or three friends.”*

**FGD, rural men, 18 to 24 years of age**

## Provider knowledge of maternal complications, how to prevent and treat pre-eclampsia

Provider knowledge and capacity for detection and management of pre-eclampsia is described as mixed across community, HEW, nurse-midwife, and policymaker and stakeholder perspectives. HEWs are relatively knowledgeable in their role of community health promoters, educating women on danger signs and symptoms during pregnancy and serving as trusted intermediaries to the health center. HEW perspectives show that some correctly identify at least two symptoms of hypertension and report counseling women on prevention measures—e.g. reducing salt intake—but did not know at what point pre-eclampsia can occur during pregnancy. HEWs expressed frustration and reported a need for medical supplies, specifically BP monitors, which would enhance their ability to detect hypertension.

<sup>17</sup> Gudu W. 2017. Prodromal Symptoms, Health Care seeking in Response to Symptoms and associated Factors in eclamptic Patients. *BMC Pregnancy and Childbirth* 17: 87 DOI 10.1186/s12884-017-1272

<sup>18</sup> Worku, A.G., A.W. Yalew, M.F. Afework. 2013. Maternal Complications and Women's Behavior in Seeking Care from Skilled Providers in North Gondar, Ethiopia. *PLoS ONE* 8(3): e60171. doi:10.1371/journal.pone.0060171

<sup>19</sup> Emergency Obstetric and Newborn Care (EmONC) Assessment 2016. Final Report. Ethiopian Public Health Institute. Addis Ababa.

<sup>20</sup> Central Statistical Agency (CSA) [Ethiopia] and ICF. 2016. Ethiopia Demographic and Health Survey 2016. Addis Ababa and Rockville, MD, USA: CSA and ICF.

*“If there is swelling in the woman’s body and if there is something different in her health like shaking or something like that, we send her to the health center. We don’t do further check-ups from our side. After the woman is referred, we then get the feedback as a report from the health center regarding the specific woman’s condition.”*

**HEW, rural health center, female**

*“We require health equipment so that no mother dies because of such dangerous causes...We have to be able to test their [blood pressure] so that we can escort them to hospital. If this equipment is supplied, we would not lose any mother’s life.”*

**HEW, urban health post, female**

Skilled providers in SNNPR, including nurses and midwives, are slightly more aware of HDP, signs and symptoms, and clinical management through antihypertensive and anticonvulsant drugs, including a basic understanding of MgSO<sub>4</sub>. These providers at the health centers have received training to administer the loading dose and refer to hospitals. Nationally, while only some nurses and midwives received Basic Emergency Obstetric and Newborn Care (BEmONC) training, including anticonvulsant drugs, 20 percent said they would never administer a loading dose of MgSO<sub>4</sub>.<sup>21,22</sup> Our qualitative sample corroborates this gap. Despite their theoretical knowledge, providers are often absent at health centers, lack confidence in administering the drug, face drug shortages, and subsequently only provide direct referrals. Similar accounts of hospitals, with a lack of skills and younger providers’ inability to effectively address maternal health complications, were reported.

*“It is advised that the first dose [of MgSO<sub>4</sub>] should be given in the health centers. After they give the mother the first dose...they should immediately refer her to a hospital since she needs a skilled follow up in a better facility.”*

**Gynecologist, urban health center**

*“Even the most senior and experienced people are unwilling to administer the drug...at the health centers...This plays a decisive role. A health worker gave referral letter to the woman without administering a [loading] dose. Then she was not given proper care in the hospital in time. She had convulsions at home and died.”*

**IDI, regional midwife mentor/supervisor**

In the national context where the BEmONC Training Module provides information and recommendations for the use of MgSO<sub>4</sub>,<sup>23</sup> the Ethiopian Public Health Institute’s 2016 EmONC assessment and qualitative reflections from community members in SNNPR describe insufficient practical training for nurses and midwives. They attribute their limited functionality to staff turnover, demotivation, and system shortages. Though policy stakeholders and mentors are working to build nurse/midwife confidence, providers’ fear of administering MgSO<sub>4</sub> limits their ability to effectively manage pre-eclampsia.

*“Experienced health service providers are not available in the health centers...nowadays...there are many stillbirths...At hospitals, if a few experienced doctors worked with the new ones...they could share their information, skills, and knowledge.”*

**FGD, urban women, 18 to 24 years old**

*“Commitment, turnover, knowledge—there are many gaps...If you at least don’t capacitate the fresh graduate very much in such trainings and if she is not committed when joining the institution, then it would be difficult.”*

**IDI, zonal MCH and Nutrition Coordinator**

## **Delays to receive care once at facility**

Delays in the delivery of maternal care are indicative of the inadequacy in the health care delivery system and may be due to shortage of supplies, equipment, lack of trained personnel, and general lack of competence among available staff.

### **Care Provision**

Maternal care quality, for management of pregnancy conditions such as pre-eclampsia, health system structure, capacity, and resources, were consistently described for different respondent categories.

<sup>21</sup> Emergency Obstetric and Newborn Care (EmONC) Assessment 2016. Final Report. Ethiopian Public Health Institute. Addis Ababa.

<sup>22</sup> Federal Democratic Republic of Ethiopia Ministry of Health (FMoH). 2015. Health Sector Transformation Plan: 2015/16–2019/20.

<sup>23</sup> Federal Ministry of Health. Basic Emergency Obstetric & newborn Care Training manual Jan 2018.s

HEWs' community activities are perceived as highly functional and merit increased support and expansion. Health centers are considered moderately capable of providing ANC, but less so in managing delivery complications, and highly functional in referrals. Hospitals are equipped to treat pre-eclampsia, although under-resourced in staffing and drugs. The referral system is praised, as long as transportation is available. Challenges emerge when providers at various levels fail to communicate clearly women's health statuses as they proceed through the system. Some community members prefer to avoid health posts and centers in favor of zonal hospitals for urgent care, which they know, from experience, is unavailable at those facilities.

*"During the ninth month of my pregnancy, I got dizzy, lost my balance, had blurred vision and came here. [Providers at health center] measured the level of my blood pressure, and immediately they brought an ambulance and sent me to the hospital...I received an injection to reduce my blood pressure...I also bought medication [tablets] with 300 birr from outside of the hospital...After I took the tablet, I started to have abdominal pain and became weak. They said, 'we should not lose this mother' and surgically delivered my child."*

**IDI, PE/E survivor, rural, 30 years old**

*"If it is beyond their capacity, the health center does refer them to the zonal hospital immediately. Then they are going to get their medication there. There are mothers who are there currently and I talked to them yesterday. They told me that they have gone to the health center based on the referral linkage we wrote for them."*

**HEW, urban health post, female**

Our qualitative SNNPR findings underscore the paucity of data on the referral process for PE/E patients, as seen in the desk review. Of the 73 percent of women with obstetric complications admitted and referred to a higher level of care, HDPs were the third leading cause of referral. Although referral worked well in SNNPR, nationally only 18 percent of *woredas* had a liaison officer in every facility, which is integral in promoting referral.<sup>24</sup>

Female respondents—PE/E survivors and others—describe quality counseling and check-ins from HEWs, including encouragement to deliver at a facility, seek ANC, and information on potential problems during pregnancy. HEWs serve as key agents in observing symptoms of pre-eclampsia and referring women for BP checks. Expressed health post challenges include a lack of equipment (e.g. BP monitors) that would help in their referral of urgent cases.

*"[HEWs] inform us the danger of home delivery: if there is severe bleeding, it is difficult to control at home; it is difficult to know fetal presentation [whether normal or abnormal]. But, all these problems can be managed if we deliver at the health center. If serious, the health center can refer the woman to the hospital."*

**IDI, PE/E survivor, rural, 25 years old**

Mixed perceptions of service quality at health centers was described across respondents. Sub-optimal quality was viewed as facilities 'only being able to do so much,' given an under-resourced system. This is consistent with observations at the federal level, where only half the number of maternity beds at referral hospitals and health centers were according to national standard<sup>25</sup> and only two percent of hospitals reported having functioning adult intensive care unit for the care of women with PE/E<sup>26</sup>. Nationally, 88 percent of facilities had a source of electricity, but 22 percent of facilities reported no water source.<sup>23</sup> Regionally, met need for EmONC ranged from three percent in Gambella to 83% in Addis Ababa, with most regions at 33 percent met need.

*"In health centers there is a shortage of drugs. That is why they are always referring patients to the hospital...to the higher institution beyond their capacity. Health centers also do not have sufficient equipment for that reason we cannot blame them."*

**FGD, rural men, 18 to 24 years old**

During pregnancy, pre-eclampsia survivors describe gaps in provision of ANC, particularly in detection and management of pre-eclampsia. Providers are reported as listening to the fetus, weighing the mother, and providing vaccinations and pills (e.g. iron supplementation). They only occasionally measure BP, rarely conduct urinalysis, and infrequently explain test results or why a medication was being given. These gaps were attributed

<sup>24</sup> Emergency Obstetric and Newborn Care (EmONC) Assessment 2016. Final Report. Ethiopian Public Health Institute. Addis Ababa.

<sup>25</sup> Ethiopia Service Provision Assessment Plus Survey 2014. Key Findings. Ethiopian Public Health Institute (EPHI). [www.eph.gov.et](http://www.eph.gov.et)

<sup>26</sup> Gaym A. et.al. 2011. Disease burden due to pre-eclampsia/eclampsia and the Ethiopian health system's response. *Int J Gynaecol Obstet* 115(1): 112-116.

by most respondents to lack of functioning BP monitors, lack of medications (antihypertensive drugs and others), expired medications (including MgSO<sub>4</sub>), misplaced tools (e.g. partograph), and limited diagnostic equipment and laboratory services. The lack of BP monitors at lower health service delivery points make it difficult to effectively detect and refer for PE/E. As such, effective management occurs only at hospitals. These functionality gaps resonate nationally, where despite 87 percent of facilities having anticonvulsant drugs in stock (48% MgSO<sub>4</sub> and 68% diazepam), only 26 percent actually administer them.<sup>22</sup>

*“MgSO<sub>4</sub> is given at hospitals...professionals need to calculate the dosage in advance and give it...The medicine alone is not useful...will expire.”*

**Health worker, rural health center, male**

*“We have also observed the shortage during on site supportive supervision...lack of blood pressure monitors in health centers.”*

**IDI, Ethiopian Midwives Association representative**

*“These drug shortages lead to purchases from the private sector. We all know how expensive one dose of a drug outside is...Financial capacity of all people is not the same...If the mother had surgery and needs antibiotics...there are none at the health organization...her family tries to buy the drugs from outside at high price.”*

**IDI, urban woreda, regional pharmacist**

Human resource shortages were described by all regional respondents as having direct influence on quality of care. While they recognized the need to build capacity and replenish health professional staff to effectively manage PE/E, zonal, regional, and federal policy makers see turnover and the favoritism of managers as opposed to training practicing HEWs or nurses as implementation challenges. Finally, improved oversight at the woreda level may improve health worker functioning at, and links between, health centers and posts.

*“There is high turnover. They don’t stay for more than two years due to various reasons like education...they leave to look for something better.”*

**NGO worker, urban**

*“Twenty-one day training provided for BEmONC is very costly. The first problem is selecting the right participants...people at the managerial level are sent for training instead...The second problem is high employee turnover...the government should focus on retaining mechanisms at higher and lower level departments.”*

**IDI, federal policy-maker**

## **Experiences of Care**

Most women and community members describe positive interactions with health providers throughout their pregnancy at health posts, health centers, and hospitals. Examples include the respect afforded women by HEWs during general health promotion and antenatal care education sessions in communities (e.g. provide food), the effectiveness of the referral system in responding to urgent situations (e.g. PE/E) and friendly and culturally sensitive treatment at hospitals during delivery and PNC follow up.

*“Currently, there are lots of changes at health centers; there is a coffee ceremony...in the waiting room for laboring mothers just to make them feel like they are at home...to make them feel comfortable.”*

**FGD, urban women, 18 to 24 years old**

Despite the largely positive report from survivors of pre-eclampsia, some community accounts reveal instances of mistreatment. Some respondents described health workers as unresponsive to women’s concerns, being turned away for ANC, pain ignored during labor, care without consent, and negligence.

*“At the health center, they gave me 50 pills...[but] did not tell me what exactly my problem was. They only said to take the medicine always at night.”*

**IDI, pre-eclampsia survivor, rural, 28 years old**

*“The nurses in the health centers sit without doing anything, and they don’t provide care to their patients. I was afraid of such problems here, so I delivered my baby in Hawassa. I went there on Sunday and got back home after one week. I did all this because I didn’t see the care and the good service given in the health centers.”*

**IDI, pre-eclampsia survivor, urban, 28 years old**

Women who are younger, students, or unmarried, in urban areas, or of lower socio-economic status, may be particularly vulnerable to poorer quality of care and mistreatment during childbirth. Often these women, who may not receive routine ANC, describe being shouted at by midwives during childbirth. Many may have no support



systems to mitigate harsh treatment, illustrated by the following quote from an urban female describing her experience accompanying a teenager giving birth.

*“Without following up at the early stages of pregnancy, she went to a health center for delivery [with a neighbor] and the professionals got very mad and mistreated us...Everyone insulted her for not having a patient card and for not attending any ANC. Especially those students who get pregnant and hide...they drop out of school and stay at home.”*  
**FGD, urban women, 25+ years old**

Health workers and policymakers recognize, to some extent, that mistreatment occurs and believe that negative experiences discourage women from seeking health services, resulting in negative impacts on health and birth outcomes. Health workers at all levels also experience variable levels of disrespect and de-motivating circumstances in their work—from communities and the health system.

*“When I [went] to supervise...[the husband] took my notebook and tore it. He said he wouldn’t participate...warned us to never approach his door again.”*  
**HEW, urban, health post, female**

*“There were things that forced me to hate my job. For instance, we were not paid enough and not given any educational opportunities. The risk money given to us was minimal even though we were exposed to HIV and hepatitis more than other departments. The government didn’t even give us prophylaxis for free.”*  
**IDI, midwife, urban health center**

### Supply chain process and bottlenecks

Commodity shortages including lack of BP monitors and absent or expired essential medicines for maternal health, such as MgSO<sub>4</sub>, at health posts and centers are described by all respondents. Limited national assessments of facility BP monitors and urine dipsticks blur hospital and health center differences, and essential supplies (including anticonvulsant and antihypertensive drugs) rely on a public procurement mechanism involving FMOH and the Pharmaceutical Fund Service Agency (PFSA) prescribed by the Food and Medicine and Health Care Administration and Control Authority (FMHACA).<sup>27,28</sup> While these life-saving drugs are supposed to be available at health centers, and free, and BP monitors ought to be supplied to HEWs, gaps remain in public allocation and distribution mechanisms, as seen in our qualitative work in SNNPR. This leads to depreciating perceptions of quality of care provision and a need to improve the supply chain.

*“We have not raised this issue [lack of BP monitor] to the kebele administrator but we have informed... kebele officers, heads of health centers, and everyone who comes to the kebele. We are ashamed that we cannot provide services we are supposed to. The women know their blood should be tested before being sent to a hospital and they speak about it. We would love to have that equipment in our facility. We have reported it to the director of the health center but are yet to get a response...We are waiting...”*  
**HEW, urban health post, female, 25 years old**

*“When there’s a shortage of drugs...[health centers and hospitals] refer people to private pharmacies... Sometimes we are skeptical of whether providers are using drugs themselves or the shortage arises from the government distribution mechanisms.”*  
**FGD, rural men, 18 to 24 years old**

The public supply chain process described by SNNPR and federal respondents involves a range of figures involved in 1) product selection (FMOH, FMHACA, PFSA), 2) forecasting (PFSA, pharmacists at regional and zonal hospitals, *woreda* office with inputs from health centers/posts), 3) procurement (PFSA), distribution—storage and transportation—(PFSA and zonal and *woreda* counterparts), and 4) monitoring (regional stakeholders and PFSA). The process begins with *woreda* annual plans and projections combined with quarterly requests and inventory reports submitted by health centers. *Woredas* then work through zonal offices to make requests to PFSA, which procures and supplies these medicines—through the zonal level to *woredas*, with *woreda* offices storing and then distributing the drugs to health centers and *kebeles*, who then distribute them to health posts, where they are subsequently prescribed or administered.

<sup>27</sup> Emergency Obstetric and Newborn Care (EmONC) Assessment 2016. Final Report. Ethiopian Public Health Institute. Addis Ababa.

<sup>28</sup> Food, Medicine and Health Care Administration and Control Authority. 2014. Standard Treatment Guidelines for General Hospitals—Ethiopia.

*“First we identify the services that will be provided for prenatal health care and what mothers require after delivery...As a woreda level office, to prevent shortage of supplies, in collaboration with the concerned bodies, our role is to prepare, plan, follow up and control...supply...to check if mothers have received the service as it was planned by the government, or not, at local grassroots level.”*

**IDI, rural woreda, MCH Service Coordinator**

When supply is short, the woreda office, health centers, and beneficiaries pursue alternative sources including non-governmental organizations (NGOs), facilities who had fewer pre-eclampsia cases, or private pharmacies. As shopkeepers learn of stock-outs at public health facilities and families begin purchasing drugs on the market, they raise the prices. Regional oversight of requests, supplies, and reimbursements exist and act as a parallel process to the supply chain when health centers use their internal cash flows to procure drugs.

*“The shortage of magnesium sulphate supply occurs not really because the medication is not available. At some locations [it] expires before use [due to absence of the occurrence of these health problems]. To resolve this problem, we have established linking systems among the health centers in Addis Ababa to communicate and start sharing the medication from where it's available...one health facility might not have treated any hypertensive cases and the other might have a lot of such cases at that time.”*

**IDI, federal policymaker**

*“This policy is to reimburse the supplies...provided for maternal health care during delivery and postnatal stage...health institutions supply the medications with their own budget—from their internal income...[When needed] they use the money they received from the other services for maternal health care service and present a reimbursement inquiry to our bureau...Our bureau crosschecks if the listed mothers have given birth and in what case they have given birth. We then write a query letter to PSFA so [health centers] get reimbursed the amount of medication...used...”*

**IDI, regional policymaker**

Bottlenecks to the supply chain manifest as delays in essential medicines reaching their beneficiaries or reaching them too late. Bottlenecks stem in part from the long and multi-directional requisition and response process, as well as substantial exceptions to this pathway. There is a range of exceptions in terms of procurement and distribution that face health providers and managers about who can directly contact PFSA (e.g. health centers), who is involved in brokering that communication (e.g. zonal hospitals), who can override and replenish from other sources (FMOH, other health centers), and which health facility level is allowed which drugs.

*“There is a big gap between our request and what we are provided [by PFSA]...it was mentioned at meeting we had yesterday with the hospital management...The payment was complete...money taken, but nothing has been provided this year in terms of equipment and medicines.”*

**Gynecologist, urban health center**

*“Currently, according to the new logistics system, all health centers can get the medicines from the PFSA directly by skipping these steps. That means they go to the PFSA directly for programing and buying the medicines. If waiting times are long—there are times when they stay there for more than a week—they fill in the logistic supply and request form, but there are times when they don't get it in time or when there are other gaps.”*

**IDI, zonal MCH and Nutrition Officer**

Distribution and monitoring bottlenecks in the MgSO<sub>4</sub> supply chain compound the challenges in procurement and reimbursement process and result in expired or nearly-expired drugs at health centers. The quality of drugs distributed by PFSA are perceived as low, given the majority expire within three months; this may in part be related to delays in procurement from foreign sources. Sub-par storage mechanisms at health centers, packaging, and transportation lead to medications not reaching facilities or reaching them too late. Bottlenecks are revealed during monitoring, and more recently through facility audits.

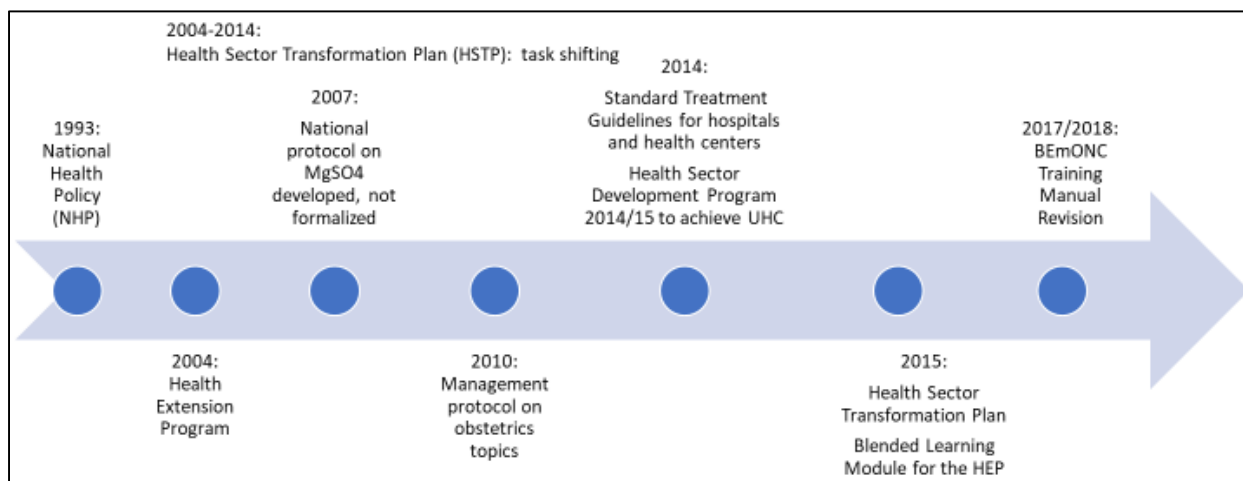
*“Where [health centers] store the drugs are not built for drug storage. They are given one room to store the drugs...There are no shelves and they keep drugs on the floor...When transporting drugs, drivers keep medicines with other stuff [furniture, fuel] on the vehicle. When we go for supervision, we observe how [health centers] store the medical equipment outside on the veranda, and it is easy to steal.”*

**IDI, regional policymaker, pharmacist**

## Despite policy and programming in maternal health, gaps remain

The desk review highlights the range of national policies, guidelines, and manuals (Figure 1) that have direct implication on the provision of maternal health care, including management of PE/E, in Ethiopia. The National Health Policy (NHP) promotes health rights and needs of less advantaged populations, while task shifting emphasis stems from the Health Extension Program's (HEP) focus on increasing health service access in rural areas. The Ethiopian Society of Obstetricians and Gynecologists (ESOG), in collaboration with UNICEF and FMOH, developed, but never formalized, a national MgSO<sub>4</sub> protocol. The FMOH-led management protocol (2010)<sup>29</sup> advocated for the use of anticonvulsant drugs (prioritizing diazepam over MgSO<sub>4</sub>) and antihypertensive drugs (nifedipine, labetalol, hydralazine, atenolol). Preferences toward use of MgSO<sub>4</sub> somewhat shifted between 2014 and 2018 with guideline revisions, training modules, and the Health Sector Transformation Plan (HSTP). Across all the documents, there remains ambiguity of health worker roles in the process of PE/E diagnosis, providing an anticonvulsant drug and referring patients to the next level of care. No document explicitly states whether HEWs could administer the loading dose of MgSO<sub>4</sub>, describes cadres permitted to provide antihypertensive drugs to manage mild/severe hypertension, nor details pre-referral care and referral processes sufficiently. Effective PE/E care provision may depend on how visible management guidelines and protocols are at the facility level.<sup>30,31</sup>

**Figure 1. Pre-eclampsia and eclampsia policy and programming in Ethiopia**



\*Details can be found in the summary and full desk review

Our SNNPR-based study reveals somewhat consistent findings with an emphasis on how PE/E is integrated into the recent focused care guidelines as a part of HSTP, but also indicate practice norms related to who can and should be providing aspects of care. Focused ANC care, considered an implementation effort to push women's right to health care, was described at *woreda*, zonal, and regional levels among those who involved in managing health workers providing direct care.

*"The [focused ANC] policy states every maternal health problem should be identified and provided treatment on time...Eclampsia and pre-eclampsia is included in that. Accordingly, mothers meet twice a month, discuss all their health problems with a provider, and action is taken...The advantage of [focused ANC] is that it will save her from getting fed up with the cost and effort of repeated transportation to the health center...Services are time-bound...in the time allocated, she receives all services at once and can arrange her next check up appointment."*

**IDI, rural woreda, Maternal and Children Health Care Service Coordinator**

<sup>29</sup> Federal Ministry of Health. 2010. *Management protocol on selected obstetrics topics*, 176-192

<sup>30</sup> Vata K. et.al. 2015. Assessment of prevalence of preeclampsia from Dilla region of Ethiopia. *BMC Res Notes* 8: 816. doi: 10.1186/s13104-015-1821-5

<sup>31</sup> Desalegn, N. and H. Merga. 2015. Causes of Admission and Outcomes Among Preeclampsia and Eclampsia Mothers Admitted to Jimma University Specialized Hospital Intensive Care Unit. *Clinical Medicine Research* 4(5): 154-159. doi: 10.11648/j.cmr.20150405.16

Although international guidelines around administration of the MgSO<sub>4</sub> loading dose at health centers (with referral to hospitals) have partially been incorporated, at least from a policy perspective, implementation is less clear. In some (rare) cases, the second dose is provided at a health center, depending on progress of a woman's condition. Although BP should be measured at health posts, according to federal policymakers it is not always feasible. Similarly, at the federal level, there may be some resistance to WHO recommendations for community provision of MgSO<sub>4</sub>.

*"International guidelines have been incorporated into the national protocol. BEmONC trainings related to anticonvulsant drugs are conducted and health centers have the power to provide pre-referral dose...but health workers are scared to give MgSO<sub>4</sub>...Recently we had an incident where the health worker was afraid to give a patient the drug and the woman passed away. We have tried to assess this fear...[Nurses and midwives] said that they could endanger human life giving the drug without training."*

**IDI, regional, midwife mentor/supervisor**

Moderate knowledge of policies related to PE/E among policymakers at the regional and zonal levels, as well as health workers, leads to implementation gaps. MgSO<sub>4</sub> is rarely administered at health centers, as normal practice, despite federal policy, likely because of a shortage of nurse-midwives and supplies. According to some zonal stakeholders, there is no written policy on PE/E prevention and management. When they know certain policies, there is a sense that there are implementation challenges, including budgetary and political barriers.

*"Guidelines are not executed appropriately at lower levels...The one that needs first aid will be given first aid, if it is beyond one's capacity, they go to the senior health worker. Eclampsia and pre-eclampsia has not been given special attention—there is a big gap in health centers...Magnesium sulphate is not available or not provided. Most health centers treat such cases by sending them to a hospital on referral."*

**IDI, rural woreda, MCH Service Coordinator**

*I do not know [about PE/E policies]...At bureau level, we have worked on providing supply (medicines) and trainings at health center level. We supervise the medication supply to control maternal problems that emanates from these health problems [hypertensive diseases] and results in maternal death. Health centers give one free dose to a mother before referring her so that she can stop convulsing and prevent death."*

**IDI, urban, officer regional bureau**

NGOs in the region support some technical assistance for strengthening HEWs, including but not limited to nutritional counseling, promoting exercise, and ANC. NGOs concur on the need for managing PE/E at health posts, given these intermediaries have the highest coverage compared to other health providers. There was agreement among NGOs to support guideline visibility at facilities (e.g. storing them in mini-libraries), revisit the essential medicines list (EML), and re-focus on PE/E by strengthening health system responsiveness using community approaches.

*"There is a health policy protects maternal health and a related Reproductive Health Strategy that focuses on pre-eclampsia and eclampsia in mothers, blood pressure, anemia, and bleeding. There is no specific policy that is meant for pre-eclampsia and eclampsia. it could be included in the strategy."*

**IDI, federal policymaker**

*"As an organization, we do not have a different guideline. We use WHO and Ministry of Health guidelines. Any service provider who is employed here, whether he receives training before or not, gets training by Family Guidance Association. We do this to make sure they have the necessary skills. After he/she receives the training, they provide the service based on the guidelines by Ministry of Health. All the guidelines are available in the place where he/she provides the service."*

**IDI, urban, NGO clinic**

*"Apart from the fact eclampsia is managed at hospital level. It is better if the management is provided at lower level...A situation where cases are managed at the lower level of health service delivery before it develops to eclampsia. It is better if it is provided at health post level."*

**IDI, urban, NGO clinic**

## Respondent recommendations

Reinforcing community awareness around birth preparedness, healthy diet, complications during pregnancy, and ANC, delivery, and PNC options emerged as a key recommendation from all respondents. Multiple avenues for knowledge building were described, including HEW-dissemination of information during door-to-door visits in the community and ANC forums provided at health posts and health centers. Integrating maternal health and PE/E messaging into existing community health and development forums for women and youth (e.g. *ande-le-amist/limat buden/ande-le-selasa* cooperative groups) is unanimously encouraged. Communities and providers emphasize the need to engage men and women in community awareness building efforts and incorporate cultural aspects to group forums (e.g. coffee ceremonies). Communities in SNNPR described the influence of women who have suffered from complications in serving as ambassadors to others living in their community. The use of diverse media, including television programs (e.g. “Tena Bebetiwo”/“Health at your home” or “Andeshikenat”/“One Thousand Days”), informational flyers, community theater/drama, and the Lucy short message service (SMS) text intervention that encourages mothers to seek follow up care were described as helpful to target specific audiences (e.g. youth, families, unmarried women). Urban and rural respondents made similar recommendations.

*“I will teach the women about the importance of visiting health facility. I plan to educate unmarried young girls and inform the community to go to health post and health centers for these problems.”*

**IDI, PE/E survivor, rural, 30 years old**

*“Strengthening the system...from higher health system to community level...We implemented ‘Lucy SMS text’ to increase community health seeking behavior of mothers through integrative work of health centers-HEWs-mothers-community volunteer.”*

**IDI, NGO maternal health advisor**

The DHS analysis concurs that media exposure promotes maternal care use. Eighty-eight percent of women exposed to radio and TV sought ANC, compared to 59 percent who were unexposed. Seventy-seven percent of women exposed to media delivered in a facility, compared to 20 percent who were not.

A second set of recommendations focuses on improving physical access to health facilities, namely implementing community strategies to transport women experiencing maternal complications. All respondents cited collective interest of getting a woman to emergency care that could be harnessed into specific actions to mitigate transportation and referral challenges. Financial preparedness or developing contingency options should be integrated into community awareness activities. Additionally, increasing *kebele* support to religious, development groups, and other leaders not only spreads messages about PE/E danger signs, birth and postpartum, but also serves as a safety net for supporting transportation of vulnerable groups, such as widowed, unmarried, or poor women.

*“There is trade off with the number of women delivering in a health center and a hospital. If I for instance call and tell the ambulance to take my pregnant wife, he would directly take her to the health center—not the hospital...some complain about those patients who should be referred to hospitals but kept longer in the health centers...the system should quickly refer mothers to the hospital with enough beds...health centers are really crowded.”*

**FGD, urban men, 25+ years old**

*“The kebele leaders...are not selecting the person who needs help. There is nepotism...Widows are not getting donations they should from the safety-net.”*

**FGD, rural women, 25+ years old**

A third set of recommendations center around the need to increase capacity of health professionals on their roles in the pathway to caring for pre-eclamptic women. Part of this requires bolstering nurse-midwives’ and HEWs’ skills on management of maternal complications, such as PE/E, at health centers and health posts. Respondents of all types felt that nurse-midwives working at health centers would benefit from 1) refresher trainings on effective administration of the loading dose of MgSO<sub>4</sub> and referral to higher level facilities, and 2) increased visibility of ethical standards and protocols. Trainings and routine supportive supervision—potentially by the Ethiopian Midwives Association (EMWA)—were described as mechanisms to motivate providers who may feel less supported in the health system to close knowledge gap and build confidence of providers at both levels

of the health system. Respondents felt it important to empower HEWs at health posts with BP monitors and the authority to prescribe antihypertensive drugs and make direct referrals to higher level facilities. Community members feel that HEW trainings should emphasize improvement in postnatal follow up care.

*"[Health workers] are getting refresher trainings usually and annually in 16 health extension packages and other necessary skills; their capacity is built this way."*

**IDI, urban, zonal policymaker**

*"Strengthen activities on organizing facility and enhancing commitment of health center medical directors. Refreshers training for those trained health care professionals since they may forget if they did not expose for frequent cases. And availing necessary materials are things to be done further."*

**IDI, Ethiopian Midwives Association representative**

A fourth set of recommendations revolve around improving health systems and supply chain functioning, budget allocation, and policy implementation—all of which require increased political will and multi-sectorial efforts. Improving budget allocations for increased human and material resources at the *woreda* and *kebele* to health and health posts, respectively is integral to ensuring adequate numbers of providers and sufficient supplies (e.g. beds, BP monitors, laboratory service equipment, drugs like MgSO<sub>4</sub> and antihypertensive drugs) to provide quality care for PE/E. Provider retention may require considering policy change around remuneration structures to motivate experienced nurses-midwives to continue working at health centers. Recognizing that supply chain gaps affect all facility types, it is important to bolster the process by securing vehicles for regional pharmacy departments to work with PFSA to transport PE/E drugs and supplies in a timely way. Respondents describe the need to enhance political will to ensure adequacy of budgets through multi-sectoral engagement and elevating maternal health issues in larger national and sub-national dissemination forums (including Safe Motherhood Technical Working Groups and attending Parliament).

*"When she should stay and receive treatment, they send her back home because there is shortage of beds or the maternity rooms are small...government has been talking, it is in the budget allocation, but nothing has been done."*

**IDI, urban, regional policy maker/pharmacist**

*"There is unequal distribution of health care workers in health facilities. Some facilities have a lot of professionals and others do not. The health bureau is aware...and provides in-service trainings [BEMONC]."*

**IDI, federal policymaker**

A fifth set of recommendations emerged from regional and national policy perspectives for monitoring and data: improving service quality, access, and maternal health outcomes. Better monitoring and reporting of maternal health statistics is needed, as respondents describe misreporting at facilities on ANC, delivery, and PNC. Policy-makers believe that if conditions like PE/E are more accurately included and harmonized into the routine health information system and evidence informs national and sub-national discussions on programming, the more effective use of this information for better service delivery for complications is possible. For example, if routine information on the burden and service use of women with pre-eclampsia—unlike the current system that does not document these conditions explicitly—clinical management would improve.

*"The reporting should be accurate and should include the reality...some false reporting indicates that the number of mothers who gave birth in health facilities has reached 80, while it is only 10...When I did door-to-door visits, I found mothers who delivered at home; and on the other side, there is a false report that indicated that she has given birth at a health facility. And on PNC report, it indicates that postnatal care follow up had been given. But from my visit, I learned that no health workers had visited the mothers to provide postnatal care follow ups."*

**IDI, regional policymaker**

*"Last time, it was indicated that health management information system will be revised to include causes of maternal death...We recently have provided comment that these should be included on starting from the federal bureau...At policy level, if causes of deaths were identified and included in the reporting system, it would be easier to take action. Regional bureaus cannot create system on their own. We use the federal system and implement the policy that is directed to us. In general, the policy is not inclusive of these things."*

**IDI, regional policymaker**

## Discussion

This study sought to understand the Ethiopian context—the relationships among women, communities, and health systems—shaping maternal health complication experiences and burdens, particularly for PE/E. We investigated PE/E knowledge and attitudes at numerous levels, and describe the barriers of use of appropriate care during pregnancy, delivery, and postpartum including PE/E prevention and management, and assess the structural—policy and health system—environment, including supply chain bottlenecks affecting pre-eclampsia diagnosis, referral, and care. The similarity of themes in both rural and urban settings, and complementary findings in the SNNPR qualitative study, DHS analyses, and desk review, suggest that our findings are transferrable to other parts of the country.

Although PE/E knowledge, attitudes, and practices among policymakers, facilities, community health workers, and within communities themselves vary, a general imperative for seeking skilled birth attendance for maternal complications was widely recognized and accepted as an emerging norm in the region. Community awareness of danger signs and symptoms are generally higher than what is perceived by providers at health centers, hospitals, and policy stakeholders, likely attributable to health promotion by HEWs and development groups. While HEW awareness of prevention and referral for maternal complications is moderate to high, health worker awareness of how to manage complications at health centers, particularly administration of MgSO<sub>4</sub>, is relatively low. Community and HEW perceptions of quality of care at health centers emerges as potential barrier to seeking ANC, delivery, and PNC.

Barriers to timely maternal health care access are tied to women's decision-making power, physical and financial access constraints, and experiences of care. Despite their relative autonomy in decision-making for ANC, labor and delivery, and PNC, many women often described significant influences of family and social networks serving both as barriers and enablers for access. While terrain and distance to health facilities, especially during the rainy season and at night, for those in urban areas, pose barriers to reaching health facilities, communities in both settings describe hospitals with capacities to treat maternal complications as considerably far away. Positive experiences of pre-eclampsia care by survivors involve HEWs and an effective referral system for urgent situations. Communities also, however, describe instances of disrespect in the health system more frequently affecting women who are younger, unmarried, in urban areas, and of low socio-economic status.

The health system environment for PE/E diagnosis, referral, and treatment unanimously described bottlenecks for provision of quality maternal care for complications like pre-eclampsia. Inadequate human resources and lack of experience among health service providers pose a challenge at all health system levels. Similarly, supply chain gaps are evident in frontline service delivery. Rural and urban HEWs do not have reliable access to BP monitors for effectively referring women with hypertension during pregnancy, labor, and postpartum. In addition to knowledge gaps among nurses and midwives, health managers, and policymakers describe a lack of drugs (including MgSO<sub>4</sub>) or expired medications at health centers and even at the zonal hospital. The lengthy requisition process, relying on a sole source (PFSA), combined with delays at national, regional, zonal, and *woreda* levels in procurement, transportation, and storage of drugs and supplies combine to create the supply chain bottlenecks that prevent resources from reaching health centers.

Persistent gaps in policy (e.g. lack of an explicit PE/E policy) and budget allocation to health systems—including health worker remuneration, HEW support, and supply chain functioning—limit the extent to which PE/E can be effectively addressed. For several decades Ethiopia's anticonvulsant for women with HDP was diazepam, but its adverse effects and poor efficacy in convulsion prevention resulted in sustained high levels of maternal and perinatal complication and death.<sup>32</sup> The current international standard is MgSO<sub>4</sub> as the preferred anticonvulsant,

---

<sup>32</sup> Berhan, Y. and A. Berhan. 2014. Reasons for persistently high maternal and perinatal mortalities in Ethiopia: Part I – Health system factors. *Ethiopian Journal of Health Sciences* (special issue) 1: 105-117.



efficacious in preventing convulsions with minimal side effects (to mothers and babies).<sup>33,34,35</sup> Although we see a normative shift in Ethiopia's clinical practice (via the desk review and qualitative SNNPR findings) in emphasizing MgSO<sub>4</sub> to health centers, a clear policy gap remains for a cadre of health workers and their ability to provide this life-saving drug. Revisiting task shifting in the HEP could also be considered as part of reviving discussion of a national protocol for PE/E diagnosis, referral, and management.

## Recommendations

In consideration of the qualitative study findings from maternal health care user, provider, and environment influencer perspectives, desk review, and DHS analyses, we recommend:

- Enhance community awareness around birth preparedness, healthy diet, complications during pregnancy, and ANC, delivery, and PNC options through multiple avenues. Support door-to-door visits and ANC forums held by HEWs at health posts and health centers, integrate pre-eclampsia into community health and development forums for women and youth, increase male engagement and incorporate cultural sensitivity (e.g. coffee ceremonies) to group forums, and use diverse media including television programs, informational flyers, and community theater to target specific audiences.
- Improve physical access to health facilities by implementing community strategies for transporting women in the context of maternal complications. Leverage the collective interest of getting a woman to emergency care by implementing community efforts (e.g. pooling funds for auto-rikshaws) to mitigate challenges like ambulance shortages and the lack of providers at health centers. Increase *kebele* funds and encourage a family's financial preparedness and contingency planning for birth during community-based health promotion activities. *Kebele* support should be used as a safety net for supporting transport for particularly vulnerable groups such as widows, unmarried or poor women.
- Increase skills of health professionals on their roles in the pathway to caring for pre-eclamptic women and improve management and referral. Increase or modify in-service training opportunities (formal trainings or supportive supervision visits) for nurse-midwives and HEWs at health centers and health posts on the management and referral of maternal complications, such as PE/E, and generally review ethical standards and protocols. Emphasize practical training to strengthen nurse-midwife capacity to effectively administer the loading dose of MgSO<sub>4</sub> and HEW capacity to monitor BP, prescribe antihypertensive drugs, and make direct referrals to higher level facilities, and carry out postnatal BP checks.
- Improve health systems and supply chain functioning, budget allocation, and policy implementation by building political will and multi-sectoral efforts. Improve budget allocations for increased human and material resources to health centers and health posts would increase health system functioning and ensure adequate numbers of providers and sufficient supplies to provide quality care for pre-eclampsia and other maternal complications. Specifically, provide BP monitors for HEWs at health posts. Consider policy changes to promote provider retention to ensure experienced nurses-midwives continue working at health centers. Bolster the supply chain by providing regional pharmacy departments vehicles to transport drugs and supplies in a timely way to facilities from PFSA and other suppliers. Enhance political will to ensure adequacy of budgets to maternal health through multi-sectoral engagement in dissemination forums at national and sub-national levels.

---

<sup>33</sup> Tukur, J. 2009. The use of magnesium sulphate for the treatment of severe preeclampsia and eclampsia. *Annals of African Medicine* 8: 76-80.

<sup>34</sup> Altman, D, G, Carroli, L, Duley, et al.; Magpie Trial Collaboration Group. 2002. Do women with preeclampsia and their babies, benefit from magnesium sulphate? The Magpie trial: a randomised and placebo-controlled trial. *Lancet* 359: 1877-1890.

<sup>35</sup> Duley, L, A.M. Gulmezoglu, D.J. Henderson-Smart. 2007. Mag. sulphate and other anticonvulsants for women with pre-eclampsia (Cochrane Review). Oxford: WHO Reproductive Health Library CD-ROM 10.



- Build capacity of routine monitoring and feedback systems at *woreda* level to incorporate maternal complications such as PE/E. Improving stakeholder understanding of the burden of maternal complications will help improve health service use, reduce adverse maternal and newborn outcomes, and empower communities to use existing legal redress mechanisms for poor care.
- Consider formalizing a national policy on PE/E diagnosis, referral and management to clarify persisting policy gaps. Engage in a participatory approach with technical experts working on PE/E in Ethiopia (e.g. members of the Safe Motherhood Technical Working Group), professional organizations (e.g. ESOG, EMwA), national and sub-national health bureaus, FMoH, reproductive, maternal, newborn health and health systems implementing partners, and other key stakeholders to draft, review, and advocate for a national protocol.

# Appendix A. Summary Desk Review of Pre-eclampsia/Eclampsia Burden, Risk Factors, and Management in Ethiopia

## Introduction

Maternal mortality and morbidity remains high in Ethiopia despite efforts to improve access to health services. World Health Organization (WHO) reported statistics (2017) place Ethiopia's maternal mortality ratio (MMR) at 353 deaths per 100,000 live births and neonatal mortality 27.7 per 1,000 births with 28 percent of women delivering in facilities. The 2016 EDHS results show an MMR of 412 deaths per 100,000 live births, 26 percent institutional delivery, 62 percent of women receiving at least one antenatal care visit by a skilled provider, and 17 percent of women reported a PNC check up in the first two days after birth.

Although there are no representative community data on its magnitude, PE/E is a major maternal complication in Ethiopia. The relative contribution of eclampsia for maternal deaths in hospital studies has increased from 6.5 percent in 1983 to 35.7 percent in 2008. In the most recent national survey (2016), pre-eclampsia was the third leading cause of death accounting for 11 percent of all direct maternal deaths.

This study reviews scientific papers, policy documents, guidelines and protocols to assess the disease burden, risk factors, and management of PE/E in Ethiopia. Prevention and effective management of PE/E was explored, including barriers and facilitators at various levels of the health system, including policy structure, service provision/facilities, and communities.

## Methodology

A mixed methods approach of a desk review and in-depth interviews was employed. The desk review of available evidence from published and grey literature, included journal articles, surveys, national policies, legislations, standard treatment guidelines (STGs), protocols/clinical guidelines, training materials on emergency obstetric neonatal care (EmONC), and search for websites of organizations working on maternal health in Ethiopia. English language documents published between 1997 and 2017 were included. Search terms included various combinations (including MeSH terms): “pre-eclampsia”, “eclampsia management”, “magnesium”, “diazepam”, “factors/determinants”, “health care seeking”, “pregnancy induced hypertension”, “aspirin”, and “Ethiopia”.

## Results

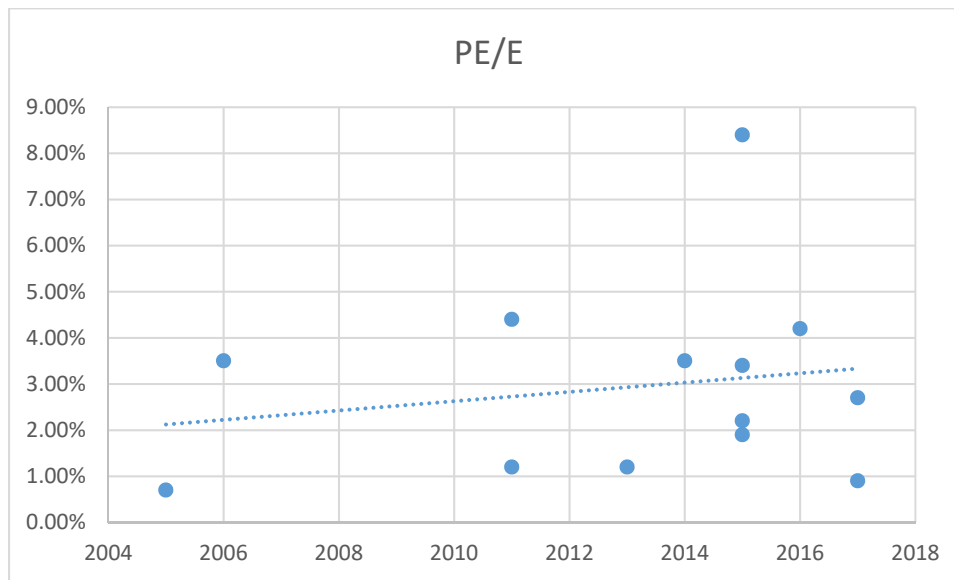
Forty-three documents were identified, including articles (n=29), national surveys (n=3), national documents: policy (n=2); legislations (2); STG (n=4); protocols (n=1), and training materials on EmONC (n=2). All studies were facility based (most in district and tertiary hospitals) except a single study on knowledge of emergency maternal conditions in Gondar. Most were conducted in major towns in the different regions of Ethiopia (primarily in Addis Ababa). One study was a secondary data analysis from a national EmONC survey and one paper was an editorial communication. Four studies were analytic (case control); while the rest were descriptive. Only one research study was a prospective design.

The findings are synthesized under three themes, which emerged primarily from the study outcomes of the journal articles. The fourth theme was based on review of national documents and grey literature on PE/E. The themes are: Burden of PE/E, determinants of PE/E, clinical management of PE/E, as well as barriers/facilitators in the detection, management, and prevention of PE/E.

### Disease burden

Thirteen studies reported on the magnitude of PE/E. The reported rates of pre-eclampsia ranged from 1.9 percent to 8.4 percent, and eclampsia ranged from 0.7 percent to 2.7 percent. Despite the apparently non-uniform pattern, there is an increasing trend in the measured incidence of PE/E (*Figure 1*).

**Figure 1: Pre-eclampsia & Eclampsia Trend line**



### **Maternal mortality and morbidity**

Since almost all of the studies were health facility-based, representative maternal mortality could not be determined; instead case fatality rates were observed. Case fatality varied based on the type and severity of hypertensive disorder of pregnancy (HDP), the highest (7.4% to 27%) reported in women with severe PE/E admitted to an intensive care unit. Case fatality among all women with HDP was between 1.3 percent in Jimma to 6.7 percent in Debrebirhan. Generally, the relative contribution of PE/E to maternal mortality is reported to be progressively increasing in Ethiopia from 6.5 percent in 1983 to 35.7 percent in 2008.

### **Perinatal morbidity and mortality**

The perinatal mortality rates range from 120 per 1,000 to 317 per 1,000, and is higher in women with severe PE/E. Despite an increase in institutional delivery and better management of PE/E, there is no improvement in the perinatal mortality over the last 15 years including the increased utilization of MgSO<sub>4</sub> as an anticonvulsant.

### **Risk and protective factors of pre-eclampsia**

Eight studies addressed risk factors for the development of pre-eclampsia. All except one describe and evaluate sociodemographic and clinical characteristics predisposing women to pre-eclampsia. The most common risk factors reported include obesity/high mid-upper arm circumference (three studies); previous history of pre-eclampsia and primigravida old age (two studies). Regular dietary intake of vegetables/fruits and compliance with iron-folic acid supplements during pregnancy were found to be associated with reduced risk of pre-eclampsia in two studies and a serum laboratory test for proteins as predictor of pre-eclampsia was reported in one study.

### **Management and prevention of pre-eclampsia and eclampsia**

Only three articles focused on the availability, use and the safety of MgSO<sub>4</sub>. A clinical study, conducted at three teaching hospitals in Addis Ababa in 2008 after the introduction of MgSO<sub>4</sub> in the Ethiopian health care system, showed appropriate selection of clients (94%), correct administration of loading dose (90%) and few instances of magnesium toxicity (1.1%). A study in Jimma compared the use of MgSO<sub>4</sub> and diazepam in the management of severe PE/E and concluded that MgSO<sub>4</sub> is more effective.

There were no studies done to explore the administration of the loading dose of MgSO<sub>4</sub> by frontline health workers—namely, HEWs, at health post and health center levels. Similarly, there are no studies addressing the prevention of pre-eclampsia through evidence-based recommendations (aspirin or calcium).

### **National Health Policy and Health Sector Development Program (HSDP)**

The Government of Ethiopia aims to increase skilled birth attendance from 62 to 90 percent by 2020 and increase access to ANC services. The goals concerning emergency obstetric and newborn care (EmONC) are: Increase met need for EmONC to 100 percent, increase the percentage of health centers providing BEmONC from 56 to 100 percent; increase the percentage of hospitals providing EmONC from 83 to 100 percent; reduce maternal mortality from 420 deaths per 100,000 live births to 199 deaths per 100,000 live births; and reduce the neonatal mortality rate from 28 per 1,000 live births to 10 by 2020.

To increase health service access and improve the health status of the most vulnerable rural population, the government of the country started the implementation of the health extension program (HEP) in 2004. The philosophy of the HEP is to transfer ownership and responsibility for preserving people's own health to households by better increasing individuals' health knowledge and skills. It is designed to improve equitable access to preventive essential health interventions through community-based health services.

Although no national policy document exclusively exists on the prevention and management of PE/E, all maternal health policies mention PE/E as a major problem that needs to be addressed. Though drugs required for the management of PE/E have been included in the revised 2014 National Essential Medicine List of Ethiopia, no reviewed national document indicated the pharmaceutical registration of MgSO<sub>4</sub>.

The 2016 national EmONC assessment showed that since 2008, there has been substantial improvement in the availability of EmONC facilities per 500,000 population (UN-recommended standard). The proportion of fully functioning EmONC facilities increased from just 11 percent in 2008 to 40 percent in 2016. Despite this improvement, a gap remains to meet the government's target of 100 percent treatment of obstetric complications in health facilities—only 18 percent received necessary treatment according. While met need for EmONC ranged from three percent in Gambella to 83 percent in Addis Ababa, most regions had a met need for EmONC of less than 33 percent.

#### **Facility readiness**

Referral hospitals and health centers had half the number of maternity beds they need when compared to international standards. Only two percent reported to have functioning adult ICU for women with PE/E. Eighty-eight percent of facilities had a source of electricity, 63 percent of which had power from the grid. While 22 percent of facilities nationally reported no water source; more than half of the facilities in Afar had no source of water.

Ethiopia has implemented the concept of task shifting in the health sector as a strategy to improve the effective utilization of the limited high-level health providers and increase service provision at various facility levels. In health centers/clinics, there is a gap between the number of established positions and the actual number of employees for every health worker cadre. The magnitude of the gap varies depending on the standards used and the use of multiple standards complicate planning. While the assessment indicated that many obstetric services and procedures are highly dependent on obstetricians/gynecologists, emergency surgical officers, and midwives, in practice, most pregnant women depend on the midwife.

Studies based on the national EmONC surveys on readiness of the Ethiopian health system to respond to the PE/E disease burden showed the limited availability of urine test strips, anticonvulsants and antihypertensives as challenges, especially at Health centers. There was improvement in the availability of equipment and drugs necessary for the diagnosis and management of PE/E between 2008 and 2016. The most widely available basic equipment in the maternity area were stethoscope for adults (98%), blood pressure cuff (94%), fetal stethoscope (92%), and clinical thermometer (92%). Essential drug supplies were available in 97% of the facilities with human resource for administration being available in 98 percent. But the stock out at time of survey was high (53%).

## **Guidelines, protocols and training materials**

Standard treatment guidelines have been developed by the Food, Medicine, and Health Care Administration and Control Authority (FMHACA) on common diseases, including selected obstetric and gynecologic disorders such as PE/E. The first-ever national protocol on the administration of MgSO<sub>4</sub> was developed by ESOG in collaboration with UNICEF and FMOH in 2007. Although it is used widely in many higher level facilities, there was no information on its use in mid- and lower level facilities. The FMOH-approved management protocol on selected obstetrics and gynecology topics (2010) includes the diagnosis and management of HDP. The protocol incorporated the use of antihypertensive drugs (nifedipine, labetalol, hydralazine, atenolol), but promoted the use of diazepam over MgSO<sub>4</sub> for convulsions because of the unavailability of MgSO<sub>4</sub> at that time.

The most recently revised national training manual on BEmONC (Jan 2018) includes a dedicated module on HDP with updated guidelines on PE/E diagnosis, management, and prevention. The training manual for HEWs also includes the diagnosis and early referral of pre-eclampsia. The administration of the loading dose of MgSO<sub>4</sub> at lower health facilities (including by HEW) is not mentioned in any of the materials reviewed. Moreover, it is not clearly stated in any of the documents, the level of providers who are mandated to administer anticonvulsants and antihypertensive drugs in patients with PE/E. Details of referral process of patients and the range of pre-referral care that should be provided to patients is lacking.

## **Health service provision and provider level**

In 2016, according to the HSTP, 85 percent or more of facilities provided focused ANC, PNC, FP, diagnosis and treatment for STIs, and PMTCT. Care provision for PE/E was explored in three national surveys. In all studies the least provided basic signal function was parenteral anticonvulsants. Despite a majority of the facilities being well staffed, only 22 percent, 20 percent, and 26 percent of facilities, respectively, in 2008, 2014, 2016 provided anticonvulsants. The administration was higher in hospitals compared to HCs.

The availability of providers with specific EmONC training was limited, with the shortage more pronounced at health centers. Overall, approximately two-thirds of the facilities reported having staff that could provide parenteral anticonvulsants in 2008, while it was 86 percent in 2016. Interviews with health providers revealed that a substantial proportion of providers (13%) indicated that they would never give a loading dose of MgSO<sub>4</sub>, including 20 percent of nurses. This may be associated with lack of experience with management of PE/E and/or fears and poor perceptions about MgSO<sub>4</sub>.

## **Community level**

There are very few studies addressing the influence of community (individual) factors on the early detection and management of PE/E. The available data from the limited studies is not comprehensive enough to help understand the effect of individual level factors on PE/E care on health seeking behaviors of mothers for emergency obstetric conditions, including PE/E was explored in four studies. The 2008 national EmONC baseline survey showed that only estimated 3.8 percent of women with eclampsia received care at health facilities.

The other study in Gondar revealed that 50 percent of women with emergency obstetric complications failed to seek care from a skilled birth attendant. The study explored health care seeking of eclamptic women in Eastern Ethiopia and revealed that only 43 percent of eclamptic women visited a health facility after experiencing prodromal symptoms of eclampsia. There was also considerable delay in presentation of the patients after developing convulsions. The significant factors associated with failure to seek health care were illiteracy, rural residency, and long distance (inaccessibility) of health facilities.

## References

1. World Health Organization. 2017. The Global Health Observatory (GHO): Monitoring health for the SDGs. [www.who.int/gho/en](http://www.who.int/gho/en)
2. Coppage K, BM Sibai BM. 2010. Glob. Lib. Women's med. (ISSN: 1756-2228) 200; doi: 10.3843/GLOWM. 10158.
3. Osungbade KO and KI Olusimbo. 2011. Public Health Perspectives of Preeclampsia in Developing Countries: Implication for Health System strengthening. *J Preg*. doi: 10.1155/2011/481095
4. Sibai BM. 2005. Diagnosis, prevention, and management of eclampsia. *Obstet Gynecol* 105(2): 402-410.
5. Cunningham G, N Gant, K Leveno, L Gilstrap, Williams. *Obstetrics*. 21<sup>st</sup> ed. New York: McGraw-Hill. 2001.
6. Goldenberg RL, EM McClure, ER Macguire, BD Kamath, AH Jobe. 2011. Lessons for low income regions following the reduction in hypertension-related maternal mortality in high-income countries. *Int J Gynecol Obstet* 113(2): 91-95.
7. Changole J. 2013. Perspectives of first level health care providers on the management of pre-eclampsia and eclampsia in Blantyre, Malawi. Masters Thesis. doi: <http://urn.nb.no/URN:NBN:no-37429>
8. Liu CM et al. 2005. Comparison of Referral and Non-Referral Hypertensive Disorders during Pregnancy: Analysis of 271 Consecutive Cases at a Tertiary Hospital. *Chang Gung Med J* 28: 326-334.
9. Emergency Obstetric and Newborn Care (EmONC) Assessment 2016. Final Report. Ethiopian Public Health Institute. Addis Ababa.
10. Abdella A. 2010. Maternal Mortality Trend in Ethiopia. *Ethiop J Health Dev* 24 (special issue, 1): 115-122.
11. Federal Democratic Republic of Ethiopia Ministry of Health (FMoH). 2015. Health Sector Transformation Plan: 2015/16-2019/20. Addis Ababa.
12. Seyum et al. 2015. Maternal and fetal outcome of pregnancy related hypertension in Mettu Karl Referral Hospital, Ethiopia. *J Ovarian Res* 8: 10-12.
13. Wodajo S and PS Reddy. 2016. Hypertensive disorders of pregnancy and associated factors among admitted pregnant cases in Dessie town referral hospital, north east Ethiopia. *Med Res Chron* 3(3): 297-306.
14. Terefe W et al. 2015. Patterns of hypertensive disorders of pregnancy and associated factors at Debre Berhan referral hospital, North Shoa, Amhara region. *Ethiop Med J* 2 (suppl): 57-65.
15. Teklu S and A Gaym. 2006. Prevalence and clinical correlates of the hypertensive disorders of pregnancy at Tikur Anbessa Hospital, Addis Ababa. *Ethiop Med J* 44(1): 17-26.
16. Zenebe W. et al. 2011. Hypertensive disorders of pregnancy in jimma University specialized hospital. *Ethiop J Health Sci* 21(3).
17. Selamawit Dufera. 2015. Maternal and perinatal outcomes of pregnancies complicated by preeclampsia/eclampsia at zewditu memorial hospital.
18. Tessema et al. 2015. Preeclampsia and associated factors among pregnant women attending antenatal care in Dessie referral hospital, Northeast Ethiopia: a hospital-based study. *BMC Pregnancy and Childbirth* 15: 73
19. Vata K. et al. 2015. Assessment of prevalence of preeclampsia from Dilla region of Ethiopia. *BMC Res Notes* 8: 816. DOI 10.1186/s13104-015-1821-5

20. Wagnew M. et al. 2016. Trends of preeclampsia/eclampsia and maternal and neonatal outcomes among women delivering in Addis Ababa selected government hospitals, Ethiopia: a retrospective cross-sectional study. *Pan Afr Med J* 25 (supp 2): 12. DOI: 10.11604/pamj.supp.2016.25.2.9716
21. Gaym A. et al. 2011. Disease burden due to pre-eclampsia/eclampsia and the Ethiopian health system's response. *Int J Gynaecol Obstet* 115 (1): 112-116.
22. Abate M, Lakew Z. 2006. Eclampsia: a 5 years retrospective review of 216 cases managed in two teaching hospitals in Addis Ababa. *Ethiop Med J* 44(1): 27-31.
23. Endeshaw M. et al. 2016. Obesity in young age is a risk factor for preeclampsia: a facility based case-control study, northwest Ethiopia. *BMC Preg Childbirth* 16: 237
24. Tomas. A one year review of eclampsia in an Ethiopian Tertiary Care Center (Saint Paul's Hospital Millennium Medical College, SPHMMC). *J Perinatal Med* 45(7): 903–907, ISSN (Online) 1619-3997, ISSN (Print) 0300-5577, doi: <https://doi.org/10.1515/jpm-2017-0118>
25. Gudu W. 2017. Prodromal Symptoms, Health Care seeking in Response to Symptoms and associated Factors in eclamptic Patients. *BMC Preg Childbirth* 17: 87. doi: 10.1186/s12884-017-1272
26. Desalegn N and M Haile. 2015. Causes of Admission and out Comes Among Preeclampsia and Eclampsia Mothers Admitted to Jimma University Specialized Hospital Intensive Care Unit. *Clin Med Res* 4(5): 154-159. doi: 10.11648/j.cmr.20150405.16
27. Birhan Y. et al. 2015. A five years retrospective study of risk factors associated with maternal mortality among eclamptic women in Hawassa University referral hospital. *Ethiop J Rep Health* 8.
28. Berihun E, A Gaym. 2007. Risk factors for mortality among eclamptics admitted to the surgical intensive careunit at Tikur Anbessa Hospital, Addis Ababa. *Ethiop J Rep Health* 1(1).
29. Mekbib T. 1990. The association of serum proteins with preeclampsia. *Ethiop Med J* 28(1): 9-14. [www.ncbi.nlm.nih.gov/pubmed/2307159](http://www.ncbi.nlm.nih.gov/pubmed/2307159)
30. Daniel T. 2011. Does preeclampsia/eclampsia pose a higher disease burden to mothers in pastoralist communities in Ethiopia? *Ethiop Med J* 49 (2): 17-26.
31. Endeshaw M. 2015. Diet and pre-eclampsia: A prospective multicentre case-control study in Ethiopia *Health Midwifery* 31(6): 617- 624. <http://dx.doi.org/10.4172/2375-4273.C1.008>
32. Girum T. et al. 2017. Determinants of pre-eclampsia/Eclampsia among women attending delivery Services in Selected Public Hospitals of Addis Ababa, Ethiopia: a case control study. *BMC Preg Childbirth* 17(1): 307.
33. Agedew E and S Lema. 2016. Factors Associated with Hypertension during Pregnancy in Derashie Woreda South Ethiopia, Case Control. *Quality in Primary Care* 24(5): 207-213.
34. Workineh G and S Kumbi. 2008. Use of magnesium sulfate in pre-eclampsia and eclampsia in teaching hospitals in Addis Ababa: a practice audit. *Ethiop Med J* 48(2): 147-152.
35. Kassie G. 2014. Maternal outcomes of magnesium sulphate and diazepam use in women with severe pre-eclampsia and eclampsia. *Ethiopia Pharm Pract* 12(2): 400.
36. Fentahun M. 2011. The use of magnesium sulphate in Eclampsia. *Ethiop Med J*.
37. Federal Democratic Republic of Ethiopia Ministry of Health (FMoH). Health Sector Transformation Plan: 2015/16–2019/20. Addis Ababa, 2015.
38. Sultan Suleman et.al. 2016. Pharmaceutical Regulatory Framework in Ethiopia: A Critical Evaluation of Its Legal Basis and Implementation. *Ethiop J Health Sci* 26(3).

39. Food, Medicine and Health Care Administration and Control Authority. 2014. National Essential Medicine List. 5<sup>th</sup> ed. Addis Ababa.
40. Drug Administration & Control Authority of Ethiopia. 2010. Standard Treatment Guidelines for Health Centers Ethiopia: 254-256.
41. Food, Medicine and Health Care Administration and Control Authority (2014): Standard Treatment Guidelines for General Hospitals Ethiopia, 546-553.
42. Food, Medicine and Health Care Administration and Control Authority (2014): Standard Treatment Guidelines for General Hospitals Ethiopia, 492-498.
43. Management protocol on selected obstetrics topics, 176-192.
44. Federal Ministry of Health. 2018. Basic Emergency Obstetric and Newborn Care Training Manual.
45. Federal Ministry of Health of Ethiopia. 2015. Blended Learning Module for the Health Extension Programme. Chapter 17: Pregnancy Induced Hypertension.
46. Ethiopia Service Provision Assessment Plus Survey 2014. Key Findings. Ethiopian Public Health Institute (EPHI). [www.ephi.gov.et](http://www.ephi.gov.et)
47. Worku AG, AW Yalew, MF Afework. 2013. Maternal Complications and Women's Behavior in Seeking Care from Skilled Providers in North Gondar, Ethiopia. *PLoS ONE* 8(3): e60171. doi: 10.1371/journal.pone.0060171
48. Fekenssa H. 2017. Knowledge on preeclampsia and its associated factors among pregnant women visiting public health facilities in Dire Dawa city administration. Haromaya Univ MSc thesis, unpublished.

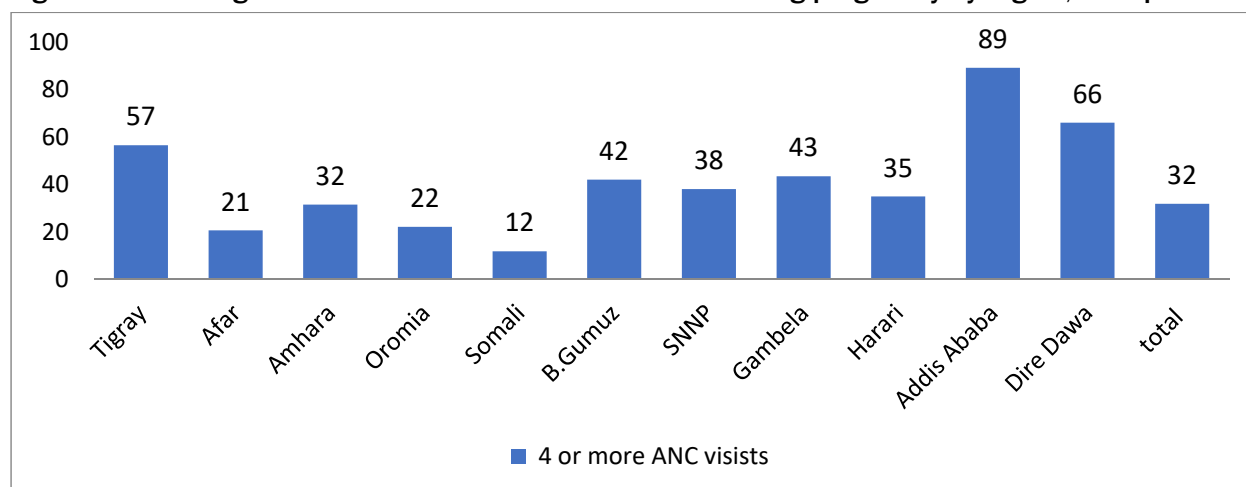


## Appendix B. Subsidiary DHS Analysis Summary: Maternal Health Service Use in Ethiopia

### Background

Despite efforts to reduce preventable cause of pregnancy and childbirth-related deaths, Ethiopia's maternal mortality ratio remains high (412 deaths per 100,000 live births). The use of antenatal and skilled delivery care, and postnatal care is associated with both improved maternal health and reduced maternal mortality—and Ethiopia has experienced a sustained improvement in maternal health care since the first EDHS was conducted in 2000. Use of any ANC has increased from 27 percent in 2000 to 62 percent in 2016—skilled care in EDHS 2016 includes Health Extension Workers (HEWs), unlike the previous EDHS reports. Nearly 32 percent of women in 2016 compared to five percent in 2000 had four or more visits during their recent pregnancy. Skilled attendance at delivery has increased from six percent to 28 percent in 2016, while the proportion of women who give birth in a health facility increased from five percent to 26 percent in 2016. As seen from these trends and given service use varies across different regions of the country (Figure 1) and likely in various population sub-groups use of these services remains low and depends on many factors. **We examine the individual and cluster level factors, including socioeconomic, demographic, autonomy and relational factors that influence women's utilization of antenatal (ANC), delivery, and postnatal (PNC) services in Ethiopia.**

Figure 1. Percentage of women with 4 or more ANC visits during pregnancy by region, Ethiopia 2016



### Data Source & Sample

We use data from the 2016 Ethiopia Demographic and Health Survey (EDHS), which applies a multistage cluster sampling procedure to select clusters (enumeration areas) at the first stage followed by selection of households. EDHS 2016 included 645 clusters from the 11 regions of Ethiopia. The current analysis focuses on a weighted sub-sample of 7,590 women of ages 15 to 49 years who had a live birth in the five years preceding the survey and provided detailed information on use of antenatal care services for their most recent pregnancy, pooled with delivery care data from occurrent 11,023 births during the same time span. The smaller PNC sample (n=4,308) drew from women who gave birth in the two years preceding the survey.

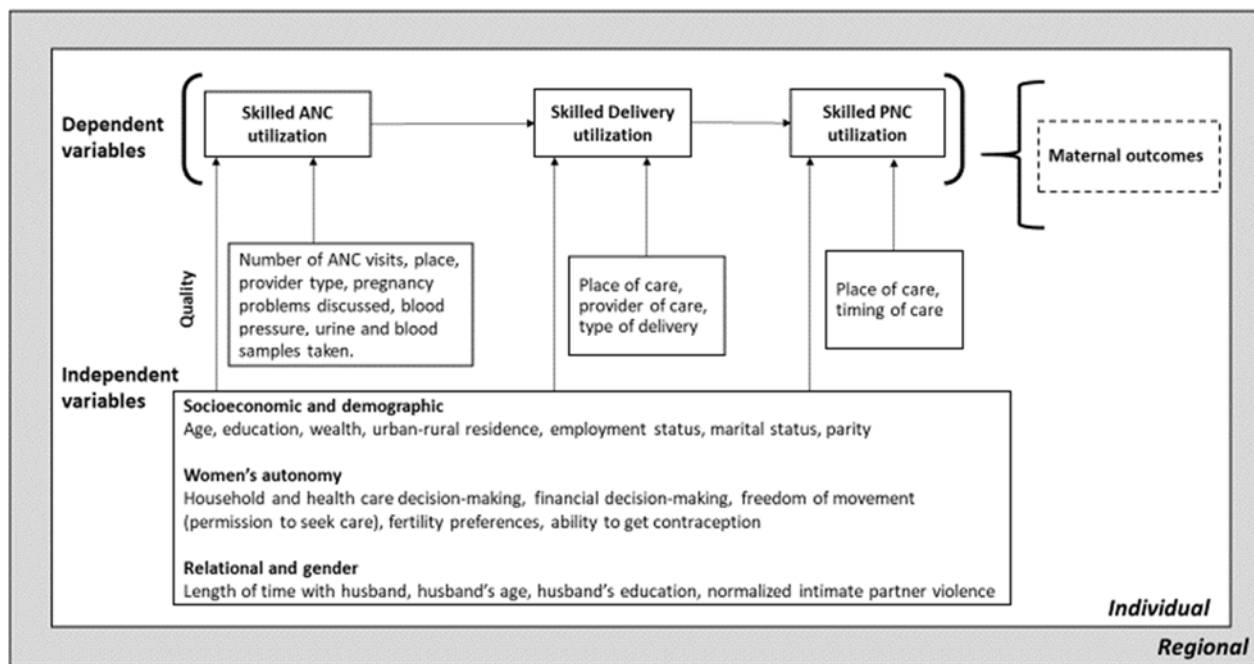
### Measures

We analyze three outcomes of maternal health service use measured as binary (1:0) variables that describe whether a woman received ANC or not, whether she gave birth at health facility with the assistance of a skilled provider or not, and whether she had a PNC check up or not.

The following explanatory variables, based on prior literature, are measured at the individual level. Socio-demographic variables included respondent's age—measured categorically in five year increments from 15 to 49 years, education (categorical: none, primary, secondary or more), occupation, place of residence measured as binary (rural, urban), wealth status (index/quintiles), parity, and exposure to media (radio, TV or both). Women's autonomy was measured through a dichotomized composite three point index that classifies women's participation in household decision making around health care, purchase, and mobility (high participation v. low participation), categorical decisions on spending her own earnings and a dichotomized composite five point index that shows higher acceptability versus lower acceptability towards intimate partner violence toward women. Relational measures served as a proxy for gender dynamics and women's empowerment include spousal age difference, duration of marriage and husband's education. A composite measure for service quality of ANC draws on questions on care given at ANC visits including whether blood and urine samples were taken, blood pressure measured, and whether women were told about pregnancy complications—this was then categorized as none, one or two, and three and four services. Service quality indicators also included the number of ANC visits, type of ANC provider, place of ANC and the type of provider who assisted the woman during delivery.

Community level explanatory measures are created by aggregating individual level data to the cluster level and include education (low, medium, high) and development region. Development clusters were categorized as areas with similar economic activities, settings and socio-economic characteristics in to a group or region: 'rural and agrarian', 'rural and pastoral' and 'urban'. Tigray, Amhara, Oromiya, SNNP, Gambella and Benshangul, Gumuz regions were coded as 'rural and agrarian'; Somali and Afar regions were classified as 'rural and pastoral' and the city administrations of Addis Ababa, Dire Dawa and Harari were named 'urban'.

**Figure 2. Conceptual Framework**



## Data Analysis

We conduct exploratory, descriptive (bivariate) and multivariate regression analyses to understand the independent associations of explanatory variables with the outcomes of interest as guided by our conceptual framework (Figure 2). A multilevel (mixed effects) logistic regression model is applied because of structure of DHS data as well as our exploration of cluster effects. Multilevel models, are built stepwise starting with socio-economic, demographic measures, followed by autonomy/relational measures, and finally cluster level

indicators and service quality controls. This summary presents select bivariate associations of descriptive characteristics of women using ANC, delivery at health facilities, and PNC (Table 1) as well as a full regression model showing independent associations of all explanatory variables with the select outcomes.

**Table 1. Characteristics of women using maternal health services in Ethiopia, 2016**

Socio-demographic Variables	Any antenatal care use (n=7590)		Health facility delivery (n=11,023 births)		Postnatal care use (n=4308)	
	%	p-value	%	p-value	%	p-value
Mother's age, years						
15-19	74.2	0.0001	38.7	0.0001	15.6	0.035
20-29	67.2		29.6		20.5	
30-39	59.3		23.3		15.3	
40+	50.3		15.4			
Educational status						
No education	53.9	0.0001	15.9	0.0001	13.0	0.0001
Primary	73.4		36.8		23.2	
Secondary & above	94.7		82.3		45.9	
Residence						
Urban	90.3	0.0001	79.2	0.0001	47.1	0.0001
Rural	58.9		19.7		15.2	
Religion						
Christian	67.8	0.0001	31.6	0.0001	25.0	0.0001
Muslim	55.7		20.1		12.2	
Other	48.2		6.0		3.7	
Wealth index						
Poorest	48.1	0.0001	10.6	0.0001	8.6	0.0001
Poorer	56.5		18.6		13.7	
Middle	62.7		22.3		16.2	
Richer	67.8		27.3		20.6	
Richest	85.0		68.6		44.9	
Parity						
1	77.2	0.0001	52.1	0.0001	25.0	0.0001
2-3	66.2		30.5		21.7	
4-5	57.8		18.0		18.2	
6+	49.9		13.5		10.4	
Exposure to media						
None	58.6	0.0001	20.3	0.0001	15.5	0.0001
Radio or TV	78.5		46.6		29.9	
Both radio & TV	88.4		77.1		51.5	
Employment						
Not working	59.4	0.0000	25.2	0.9715	17.0	0.0001
Working but not paid	63.3		26.1		16.1	
Working and paid in cash	72.4		25.5		31.2	
Participation in household decisions						
No	57.2	0.0001	23.5	0.0001	18.2	0.5108
Yes	65.9		27.7		19.5	
Total	62.9		26.2		19.1	

## Results

**Descriptive associations** (Table 1) show that ANC, health facility delivery and PNC service use varies by socio-economic, demographic and autonomy/relational and media exposure characteristics. Use of ANC is significantly higher among adolescent girls of ages 15 to 19 than all other age groups and the proportion of women using ANC declines as with increasing age. Women with secondary and above education, who are employed, urban residents, higher wealth quintiles, with fewer children, who participate in all household decisions and women who have access to two or more media types comprise a greater proportion antenatal care users compared to those with primary or no education, unemployed, living in rural areas, lower wealth status, greater parity, lower household decision-making power and less access to media. Similar to ANC use, the proportion health facility births varied significantly with socio-demographic, wealth, and women's autonomy and media exposure status; though there was no significant difference by employment status. Unlike ANC and health facility delivery, improvements in PNC has been slower (62.9%, 26.2%, and 19.1%, respectively). PNC use varied significantly with women's age, education, place of residence, wealth, religion, parity, exposure to media and employment status. There was no significance difference in PNC use by women's participation in decision making.

**Multilevel regression analyses** of the three outcome variables—any ANC use, health facility delivery, PNC use—are shown in Table 2. At the individual explanatory level, adjusted odds ratios (aORs) show that women's age, education, place of residence, wealth, and exposure to media are among the socio-demographic and economic factors significantly associated with use of antenatal care for the most recent pregnancy in the last five years before the survey. The odds of using ANC was significantly lower among older women compared to adolescent women of ages 15 to 19, higher among women with secondary and above education, compared with women with no education. The odds of using ANC was higher among women in the highest wealth quintile compared to women in the lowest wealth quintile, for women living in urban areas compared to their rural counter parts and women with exposure to either radio or TV. Among autonomy and relational factors, higher husband's education and difficulty in getting permission to seek health care were significantly associated with use of antenatal care. Health facility delivery is significantly and similarly associated in the expected direction with most socio-economic demographic, and media exposure variables (minus age) are significantly associated with delivery care women's education, household wealth status, exposure to media, and parity. Higher husband's education level and women who receive higher ANC quality (three or four services compared to none) are significantly associated with increase in health facility delivery. Factors significantly associated with PNC use include women's education level, wealth, media exposure, employment status, husband's education level and ANC quality.

At the cluster or community level, variables are significantly associated with all maternal service use. ANC Compared to women living in rural agrarian areas, women living in pastoralist areas are less likely to use ANC services. On average, the higher a community's education level is, the more likely a woman is to use ANC services. Similar directional associations persist around delivery care, where the urban advantage and higher education becomes more salient in predicting the odds of a woman giving birth at a health facility. Development region has a cluster level effect; namely those living in urban regions are have higher odds of using PNC compared to dominantly agrarian regions.

## Conclusion

There is substantial variation in patterns and determinants of maternal health service use in Ethiopia. The strong associations of service use with education—both of women and their spouses, wealth, media exposure suggest that community focused multi-sectoral strategies may encourage positive care-seeking. The fact that higher quality ANC (given 3 to 4 services: blood and urine samples, BP measured, information on pregnancy complications) increased the likelihood of skilled assistance at delivery and PNC, suggests a need to emphasize quality. Finally, strong cluster effects suggest that community protective factors can influence maternal service use, could be leveraged, and offer the policy recommendation of a need for sub-national targeted health programming efforts in pastoralist regions and educational supplementation in areas where, on average, communities have lower access to schooling.



**Table 2. Multilevel analysis of the association between individual and cluster level variables with maternal service use in Ethiopia, 2016**

Variables	Any antenatal care use aOR(95%CI)	Health facility delivery aOR(95%CI)	Postnatal care use aOR(95%CI)
<b>Socio-demographic variables</b>			
Age at birth (ref= $\leq 19$ years)			
40-49	0.57(0.34-0.94)**		
Education (ref= no formal)			
Primary education	1.61(1.34-1.94)**		1.33(1.04-1.70)*
Secondary and above	2.41(1.62-3.60)***	2.16(1.49-3.14)**	1.77(1.05-3.01)**
Residence (ref =urban)			
Rural	0.37(0.21-0.65)**	0.19(0.11-0.32)**	
Wealth ( ref= poorest)	1.38(1.12-1.69)**		
Poorer	1.58(1.25-1.99)**	1.53(1.17-2.01)**	1.60(1.14-2.25)*
Middle	1.61(1.24-2.09)**	1.39(1.04-1.86)**	1.49(1.04-2.12)*
Richer	2.21(1.52-2.22)**	1.44(1.05-1.96)**	1.49(1.03-2.13)*
Richest		1.88(1.26-2.80)**	2.34(1.50-3.65)**
Exposure to Media (ref=none)	1.48(1.16-1.87)*		
Radio or TV only		1.32(1.03-1.70)*	1.02(0.76-1.33)*
Both Radio & TV		1.76(1.04-2.98)**	1.98(1.29-3.02)**
Employment (ref= not working)			
Working but not paid			
Paid in cash			1.31(1.02-1.69)*
Parity (ref==1)			
2-3		0.48(0.37-0.63)**	
4-5		0.42(0.31-0.57)**	
6+		0.48(0.34-0.68)**	
<b>Autonomy/relational variables</b>			
Participation in decisions(ref=no)			Not assessed (N.S. in bivariate)
Participates in all decisions			
Attitudes towards wife beating (ref=rejects)			
Approves			
Husband's education (=none)			
Primary	1.36(1.15-1.60)**		
Secondary and above	1.49(1.14-1.94)**	1.68(1.26-2.23)**	1.58(1.25-1.99)**
Permission to seek health care is difficult	0.73(0.63-0.85)**		
Husband-wife age differences			
<b>Cluster variables</b>			
Development region (ref: agrarian)			
Dominantly rural and pastoral	0.48(0.35-0.68)*	0.56(0.38-0.81)**	
Dominantly urban		1.65(1.12-2.43)**	1.48(1.10-2.01)*
Community education (ref=low)			
Medium	1.83(1.38-2.42)*	1.46(1.11-1.93)**	
High	1.74(1.65-6.48)*	2.13(1.22-3.71)**	
<b>Service quality</b>			
ANC quality (ref=none)			
1-2 services			
3-4 services		2.65(1.88-3.75)***	3.74(2.15-6.54)**
Number of ANC visits (ref=none)			
1-3 visits			
4 or more			
ANC provider (ref=doctor)			
Mid-level (Nurse/midwife/HO)			
HEW			

Note: Only significant associations shown in summary multilevel regression results for ease of reader interpretation.