

Burden and Health Loss Due to Maternal Hypertensive Disorders in Ethiopia: A systematic analysis of Global Burden of Diseases, 2019.

Bedilu Abebe^{1*}, Muluemebet Abera², Lelisa Sena², Merga Dheresa^{3,4}, Anwar Taju³, Awoke Misganaw^{3,5}

Abstract

Background: Worldwide, maternal hypertensive disorders complicate one in ten pregnancies. As a result of changes in the life styles of the society, currently, it is becoming a common public life encounter. However, Ethiopia lacks comprehensive and comparable maternal hypertensive disorders, caused burden and health loss to inform policy and practice.

Objective: To describe the incidence and prevalence of maternal hypertensive disorders and deaths, Disability Adjusted Life Years, and Years Life Lost attributable to maternal hypertensive disorders in Ethiopia and its regional distributions from 1990 to 2019 as part of a collaborative Global Burden of Diseases, 2019 Study.

Methods: The data for this study were collected from surveys, demographic surveillances, medical record reviews, health facility observations and interviews of socio-demographic, health care service utilizations, and other data sources such as case notifications, scientific literatures, and unpublished data as per the Global Burden of Diseases protocol and analysis techniques to produce national and regional estimates of maternal hypertensive disorders in Ethiopia. Cause of death ensemble modeling and Bayesian meta-regression disease modeling was employed to ascertain cause of death and morbidity. Each metric was estimated per 100,000 populations with a 95% uncertainty interval (UI).

Results: In the last thirty years, in Ethiopia, the incidence of maternal hypertensive disorders among young women was raised by 52,596 cases per 100,000 populations [199,707 (95% UI 150,261-267,221) to 252,303 (95% UI 191,335-332,524)], while decreased among adolescents from 67,206 (95% UI 46,887-90,883) to 64,622 (95% UI; 47,587-84,664) per 100,000 populations. The prevalence among women of reproductive age had increased from 94,818 (95% UI 59,434-135,332) in 1990 to 138,263 (95% UI 88,447-196,029) in 2019. Between 1990 and 2019, deaths attributable to maternal hypertensive disorders among adolescents and young women had increased by 1.5 and 1.17 times, respectively. In 2019, disability adjusted life years among adolescents, young women and women of reproductive age due to maternal hypertensive disorders was 8,493 (UI 95% 5,370-12,849), 21,812 (UI 95% 14,682-32,139) and 57,867 (UI 95% 41,751-79,165) respectively. The highest daily adjusted life years due to maternal hypertensive disorders had occurred among young women, 13,319 (UI 95% 8,592-19,931) which was 759 daily adjusted life years higher than 1990 whereas the young women years of life lost had increased by 169 cases. Regarding sub-national distributions, Oromia region has the highest burden and health loss due to maternal hypertensive disorders.

Conclusions: Based on our finding, increasingly high new cases, prevalence and burden of maternal hypertensive disorders and significant health loss were observed in the last three decades in Ethiopia. Hence, prevention of cases, disabilities, deaths and health losses caused by maternal hypertensive disorders can be properly done by advocating lifestyle modifications with specifically designed age-specific interventions. On the top of continuing prevention efforts with newly devised magnesium sulphate administration in the new ANC initiative of the ministry, contextualized, need based, localized, and targeted interventions could be reconstituted. [*Ethiop. J. Health Dev.* 2023;37 (SI-2)]

Keywords: Maternal hypertensive disorders, Global Burden of Diseases, Incidence, Prevalence, Deaths, Disability Adjusted Life Years, Years Lived with Disability, Years Life Lost, Ethiopia.

Background of the study

In the last half a century globally, Chronic Non-Communicable Diseases (CNCD) are major public health problems due to epidemiologic, demographic, obstetric and nutrition transitions (1-7). Hypertension is one of the major non-communicable disease-causing premature mortalities worldwide. In 2022, World Health Organization (WHO) estimated that about 1.28 million people aged 30-79 years suffer from hypertension globally. Two third of them are located in

sub-Saharan African countries. Approximately 46% of them are unaware of their illness and 42% are diagnosed and treated, and one in five of them as well have controlled hypertension (8).

Maternal hypertensive disorders, defined as hypertension that occurs during pregnancy, is a common non-communicable disease among pregnant women. The causes of the disease are the combination of genetic and acquired factors (9). Approximately

¹ Department of Public Health, Debre Tabor University, Ethiopia.

² Institute of Health, Jimma University, Ethiopia.

³ National Data Management and Analytic Center (NDMC), Ethiopian Public Health Institute, Ethiopia.

⁴ Haramaya University, College of Health and Medical Sciences.

⁵ Institute for Health Metrics and Evaluation, University of Washington, USA.

*Corresponding Author Email: bediluab@gmail.com

14 % of all the causes of maternal deaths are caused by maternal hypertensive disorders, and it is the second leading cause of maternal death and complications in sub-Saharan African countries (8,10). The magnitude of the problem varies with countries. According to a study conducted in 2019, among 8,420 pregnant women in India, Pakistan, Mozambique, and Nigeria, the new cases of maternal hypertensive disorders was common in the age group 23-28 years. Increased blood pressure on their first presentation had ranged from 6.5% in Pakistan to 8.4% in Mozambique. The magnitude of pre-eclampsia had ranged from 2.3% in Mozambique to 3.8% in India. Another study from Saudi Arabia in 2018, had reported an overall maternal hypertensive disorders prevalence of 2.4%. The commonest reported subtype of maternal hypertensive disorders was pre-eclampsia (54.9%). Yet, approximately one-third (29.5%) of them also had gestational hypertension (11). In sub-Saharan African countries, based on a study collected from 33 Countries in 2018, Lesotho and Burundi had the largest and the lowest magnitude of hypertension among women, respectively (12). The magnitude of maternal hypertensive disorders in Zimbabwe was as high as 19.4% (13).

In Ethiopia, maternal hypertensive disorders are one of the public health concerns. A national survey conducted in 2018 reported a 16% prevalence of overall hypertension (14) in the country and a systematic meta-analysis reported 6.1% of maternal hypertensive disorders prevalence (15). In this systematic review, the highest prevalence of hypertensive disorders, 10.0% was reported from Southern Nations, Nationalities, and Peoples' Region (SNNPR) (15). Furthermore, a Tigray region study reported an increased trend of maternal hypertensive disorders from 1.4% in 2013 to 4% in 2017 (18).

Basically, maternal hypertensive disorders are largely preventable through appropriate prevention, diagnosis and management strategies. Timely and effective care is paramount, including administration of magnesium sulphate during pregnancy (8,19). This was supported by several international, regional and national efforts to prevent and control maternal hypertensive disorders (19-22). Sustainable Development Goal Three has promised to reduce deaths by one third from non-communicable diseases including maternal hypertensive disorders, by 2030 (22). More importantly, Ethiopia has introduced various national efforts to halt maternal hypertensive disorders and had improved access to care and incorporated magnesium sulphate administration in the revised Antenatal Care guideline and is part of the community health workers' intervention in the local community in February, 2022 (23-26).

However, there is lack of comprehensive and comparable analysis on maternal hypertensive disorders at national and regional levels to inform

health policy and practice in Ethiopia. Hence, we analyzed the trends and health losses attributable to maternal hypertensive disorders by employing Global Burden of Diseases study data for Ethiopia, Institute of health metrics and evaluation (IHME), The University of Washington, as an outcome of a collaborative network for Global Burden of Diseases 2019 study for Ethiopia.

Methods

Study Setting

Ethiopia currently has eleven regions and two city administrations. GBD study data 2019, maternal hypertensive disorders data of the Sidama and South Western Ethiopia regions were collected and analyzed under South Nation, Nationalities and People's (SNNP) Region (28).

Methods

The analyses presented in this paper were produced by the Ethiopia Sub-national Burden of Disease Initiative, a collaborative endeavor between the Ethiopian Public Health Institute (EPHI) and the Institute for Health Metrics and Evaluation (IHME) part of GBD 2019. The EPHI, in collaboration with IHME, gathered all accessible data sources by location for Ethiopia and all regions and cities. This study used primary and secondary data, that were collected for risk factors, injuries, morbidity, mortality, socio-demographic, healthcare service utilization, medical record reviews, health facility observations and interviews, and other data sources from censuses, household surveys, case notifications, demographic surveillances, scientific literatures, and unpublished data in the GBD 2019 study to provide national and sub national burden of maternal hypertension estimates (29). Years Life Lost (YLL) was calculated by the multiplication of cause specific fatalities and standard life expectancy, at the time of death. Years Lived with Disability (YLD) was measured by taking the condition's prevalence multiplied by the disability weight for that condition. Disability Adjusted Life Years (DALYs) were calculated, and the total burden of risk factors, morbidity, injuries and mortality were described by age category from 15-49 years. The new cases, prevalence of maternal hypertensive disorders and YLL, YLD and DALYs attributed to maternal hypertensive disorders were analyzed using different modeling techniques in the GBD 2019 Study. Global Burden of Diseases Study instruments and tools, models, methodologies, and analysis are becoming rigorous to estimate, project, analyze, and solve global public health problems and conditions. In addition, hypertensive disorders of pregnancy are named maternal hypertensive disorders by the GBD study. We have used adolescents for those aged 10-19 years, young women, those aged 10-24, and women of reproductive age (WRA) 15-49 years (30).

Ethics Statement

This study was conducted as part of the GBD Collaborator Network and per the GBD Protocol

(IHME ID 4239-GBD2019-042022). For Global Burden of Disease studies, a waiver of informed consent was reviewed and approved by the Institutional Review Board of the University of Washington (<https://www.healthdata.org/gbd/2019>).

Results

Incidence and Prevalence of Maternal Hypertensive disorders and deaths due to Maternal Hypertensive disorders in Ethiopia, 2019.

In the past three decades, the incidence, prevalence and death attributed to maternal hypertensive disorders (MHDs) had increased in Ethiopia. Between 1990-2019, the incidence of maternal hypertensive disorders among young women was raised by 52,596 cases per 100,000 populations [199,707 (95% UI 150,261-267,221) to 252,303 (95% UI 191,335-332,524)], but it had decreased among adolescent women from 67,206 (95% UI 46,887-90,883) to 64, 622 (95% UI 47,587-84,664) per 100,000, however, the difference is not

statistically significant. Again, the new cases had increased from 560,763 (95% UI 467,909-656,773) to 808,673 (95% UI 685,726-936,843), which was 1.4 times higher.

Similar to incidence, the prevalence of maternal hypertensive disorders was raised among young women from 33,206 (95% UI 18,598-53,784) per 100,000 in 1990 to 40,648 (95% UI 22,971-65,542) per 100,000 in 2019; among adolescents' women, the prevalence of maternal hypertensive disorders was decreased from 10,383 (95% UI 4,916-17,475) in 1990 to 8,889 (95% UI 4,561-14,850) in 2019, in this period 1,494 maternal hypertensive disorders were reduced per 100,000 age standardized populations. Generally, the prevalence of maternal hypertensive disorders among women of reproductive age had increased from 94, 818 (95% UI 59,434-135,332) per 100,000 populations in 1990 to 138, 263 (95% UI 88,447-196,029) per 100,000 populations in 2019 (Table 1).

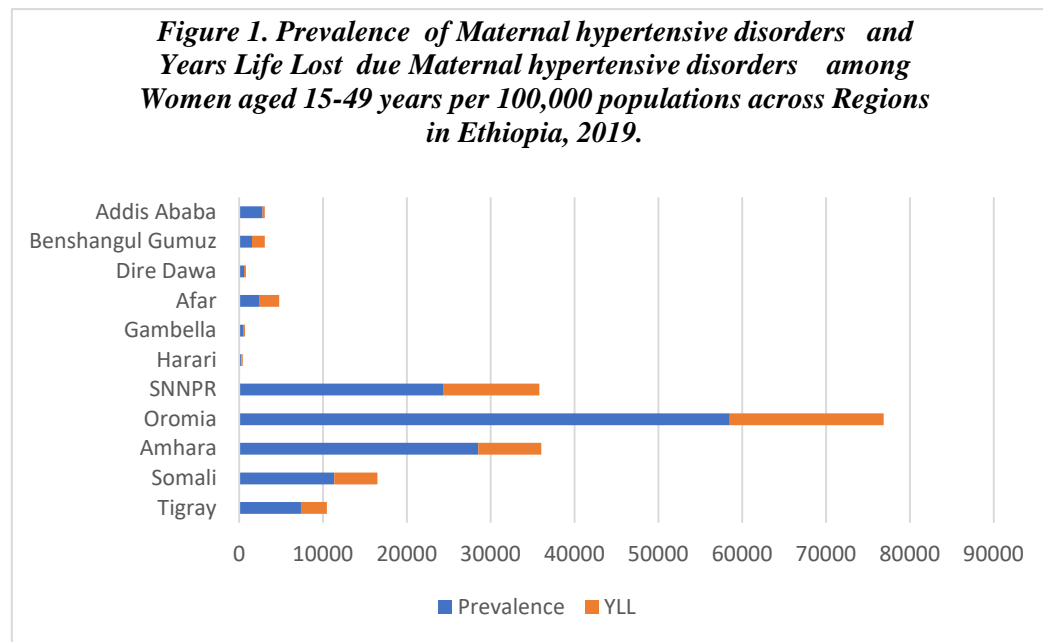
Table 1. Number of Incidence and Prevalence of Maternal Hypertensive Disorders per 100,000 populations among women aged 15-49 years in Ethiopia across Regions, 2019.

Locations	Incidence	95% UI	Prevalence	95% UI
National	808,638	685,727-936,844	138,263	88,447-196,030
Tigray	41,844	35,392-49,159	25	13-42
Afar	14,564	12,232-16,955	2,462	1,529-3,558
Amhara	166,882	140,926-194,826	28,533	18,348-40,769
Oromia	345,400	288,791-403,775	58,539	36,839-84,404
Somali	68,050	57,577-79,329	11,331	7,172-16,332
SNNPR	139,251	118,623-162,319	24,323	15,794-34,909
Benshangul Gumuz	8,721	7,268-10,261	1,524	965-2,223
Gambella	3,227	2,705-3,762	554	356-805
Harari	1,671	1,413-1,958	285	182-406
Addis Ababa	15,811	13,320-18,460	2,776	1,783-3,934
Dire Dawa	3,219	2,692-3,764	580	375-821

NB: 95% UI: 95 % Uncertainty Interval; SNNPR: Southern Nations Nationalities and Peoples Region

Deaths attributed to maternal hypertensive disorders were more pronounced among 25-29 years old women. In 1990, deaths due to maternal hypertensive disorders among adolescent, young women and Women of Reproductive Age were 74 (95% UI 45-119), 245 (95% UI 164-355) and 790 (95% UI 579-1,098) respectively. The highest number of deaths owing to maternal hypertensive disorders had occurred among 25-29

years old women and was 48 (95% UI 26-83). Within the same period, deaths attributed to adolescent maternal hypertensive disorders and young women had increased by 1.5 times, 1.17 times accordingly (Figure1).



Disability Adjusted Life Years, Years Lived with Disabilities and Years Life Lost as a result of maternal hypertensive disorders in Ethiopia, 2019.

Maternal hypertensive disorders associated age-standardized Disability Adjusted Life Years (DALYs) among adolescents, young women, and all reproductive age women were 5,847 (95% UI 3,703-9,040), 18,407 (95% UI 12,834-25,680) and 51,888 (95% UI 39,273-69,909) among 100,000 populations respectively. From 1990 to 2019, standardized DALYs attributed to maternal hypertensive disorders had increased from 5,847 (95% UI 3,703-9,040) to 8,493 (95% UI 5,370-12,849) per 100,000 populations among adolescents, from 18,407 (95% UI 12,834-25,680) to 21,812 (95% UI 14,682-32,139) per 100,000 populations among young women, and from 51,888 (95% UI 39,273-69,909) to 57,867 (95% UI 41,751-79,165) per 100,000 populations among overall women of reproductive age. Therefore, in the past three decades, the age

standardized DALYs attributable to maternal hypertensive disorders among adolescents, young women and women of reproductive age had increased by 2,646 cases between 1990-2000, by 3,405 cases within 2001 and 2010 and by 5,979 cases between 2010 and 2019 per 100,000 populations. Similarly, between 1990 and 2019, the highest DALYs attributable to maternal hypertensive disorders had occurred among young women and those 20-24 years old; which was 12,560 (95% UI 8,232-18,324) and 13,319 (95% UI 8,592-19,931) per 100,000 populations. Hence, 759 ages standardized DALYs attributable to maternal hypertensive disorders were recorded in the last thirty years. The age standardized DALYs attributable to maternal hypertensive disorders among women of reproductive age had raised from 21,812 (95% UI 14,682-32,139) in 1990 to 57,867 (95% UI 41,751-79,165) in 2019. The highest age standardized DALYs due to maternal hypertensive disorders had occurred among young women aged 20-24 years, which was 13,319 (95% UI 8,592-19,931) per 100,000 populations (Table 2).

Table 2. Deaths, Disability Adjusted Life Years and Years Live Lost per 100,000 Populations across Regions among Women aged 15-49 years in Ethiopia, 2019.

Locations	DALYs	95% UI	YLL	95% UI	Deaths	95% UI
National	57,867	41,750.77-79,165.3	50850.72	35140.23-71608.69	855	593.64-1206.7
Tigray	3,465	2,225.4-5,161	3093	1,889.26-4,788.86	40.38	24.6-64.5
Afar	2,439.290833	1,541.56-3,867.47	2314.6	1,413.32-3,737.88	41	25-65
Amhara	8,968.338706	5,892.23-13,354	7514.393197	4,541.32-11,863.35	127	78-199
Oromia	21,306.32689	14,374.53-32,481.48	183,34.49047	11,350.7-29,058.2	307	191-481
Somali	5,755.037464	3,666.69-8,302.8	5,180.78	3,120.42-	89	54-131

				7,687.31		
SNNPR	12,720.83294	7,945.52-18,930.84	11,491	6,787.3-17,540.7	188.8	113.4-287.8
Benshangul Gumuz	1,592.438353	1,065.56-2247.07	1,515.44	994,38-2180.82	25.7	16.9-36.3
Gambella	143.46	91.81-202.72	115.34	67.9-172.6	2	1.2-3
Harari	138.28	82.7-238.67	123.8	69.75-224.34	2.2	1.21-3.81
Addis Ababa	1,105.94	653.97-1,831.06	965.2	524.8-1704.1	17	9-30
Dire Dawa	231.85	151.61-375.25	202.69	123.46-344.98	3.5	2.2-6

NB: DALYs: Disability Attributed Life years per 100,000 populations; YLL: Years Life Lost; 95% UI: 95 % Uncertainty Interval, SNNPR: Southern Nations Nationalities and Peoples Region

In 1990, the Years Lived with Disabilities (YLD) caused by maternal hypertensive disorders among adolescents, young women, and women of reproductive age was 540 (95% UI 240-1,001), 1,698 (95% UI 871-2,973) and 4,800 (95% UI 2,606-7,648) respectively. In 2019, the Years Lived with disability

due to maternal hypertensive disorders was 476 (95% UI 221-870), 2,101 (95% UI 1,051-3706), 7,016 (95% UI 3,804-11,225), respectively which was 65, 597 and 4,308 higher among adolescents, young women and women of reproductive age accordingly (Table 3).

Table 3. Numbers of Years Lived with Disability due to maternal hypertensive disorders among Adolescents, Young Women and Women of Reproductive Age per 100,000 populations in Ethiopia, 1990 and 2019.

Years	Age in Years		
	10-19	10-24	15-49
1990	541 (240-1,001)	1,698 (871-2,973)	4,801 (2,606-7,648)
2019	477 (221-870)	2,101 (1,051-3,706)	7,016 (3,804-11,225)

Years Life Lost attributed to maternal hypertensive disorders among women of reproductive age had slightly increased from 47,087 (95% UI 34,512-65,116) in 1990 to 49,355 (95% UI 37,845-77,226) in 2000 and 49,444 (95% UI 38,514-60,445) in 2010. For instance, from 2010 to 2019, the Years Life Lost had slightly increased from 49,444 (UI 38,514-60,445) to 50,851 (UI 35,140-71,609) by incurring additional 1,407 YLL in the past thirty years. In 1990, the highest Years Life Lost due to maternal hypertensive disorders had occurred among women aged 25-29 years in Oromia region 4,061 (UI 2126-6919) and the lowest (1) had occurred in Gambella region among those 45-49 years. Adolescents Years Life Lost due to maternal hypertensive disorders in 1990, was 5,307 (UI 3,218-8,521), increased into 7,351 (4,608-10,603) in 2000, with increased difference of 2,044 Years of Life Lost. Between 2010 and 2019 there is almost escalated constantly then, decreased slowly from 8,553 (95% UI 5643-12,048) to 8,016 (95% UI 4,819-12,279). From 1990 to 2000, Years Life Lost secondary to maternal hypertensive disorders young women (10 to 24 years) was highly increased from 120 (95% UI 62-204) to 20,226 (95% UI 14,351-27,673) which was nearly 168 times higher. Inversely, between 2010-2019, 20,927 (95% UI 15,371-27,190) and 19,710 (95% UI 12,899-

29,610) Years Life Lost were observed secondary to maternal hypertensive disorders reduced by 1,217 Years Life Lost. In general, in the three decades, the Years of Life Lost due to maternal hypertensive disorders among young women had sharply increased by 164 times.

Discussion

This study analyzed the burden and health loss due to maternal hypertensive disorders in Ethiopia in the last three decades using the Global Burden of Diseases 2019 data. Increased new cases of maternal hypertensive disorders among young women and women of reproductive age were observed. This was also evidenced by studies from Low and Middle Income and Sub-Saharan African (SSA) countries which had reported raised new cases and prevalence of maternal hypertensive disorders (5-6,7,11). Globally, between 1990 and 2019 the new cases of maternal hypertensive disorders had increased from 16.30 to 18.08 million and are projected to increase more in SSA countries (31-33).

Equally important, in three decades, deaths owing to Maternal hypertensive disorders among adolescents and young women was increased by 1.5 times and 1.17 times respectively. The increment of Maternal hypertensive disorders in Ethiopia is also in line with

the global and regional increment (34-35). For example, EPHI, Perinatal and Maternal Death Surveillance Response report of the 2013 and 2014 EFY had reported national increment of maternal hypertensive disorders in the country (14,35).

Likewise, age standardized DALYs attributable to Maternal hypertensive disorders among adolescents, Young women and Women of Reproductive Age were increased by 2,646, 3,405 and 5,979 correspondingly. In 2019, the highest Years Lived with Disability attributed to Maternal hypertensive disorders had occurred among young women which was 164 times higher than 1990 which needs further study to explain. This is similar with the age standardized DALYs attributable to Maternal hypertensive disorders among women of reproductive age in Thailand which reported 15.4% age standardized DALYs among Adolescents attributed to pregnancy and childbirth complications (36).

Almost in all regions, there were significantly high new cases and prevalence of maternal hypertensive disorders and it's attributed age-standardized DALYs, Years Lived with Disability, and Years of Life Lost in the late twenties, i.e., 25-29 years in the Oromia region. Similarly, the highest new cases and prevalence of maternal hypertensive disorders had occurred among those aged 25-29 years, which is also shared by the findings from India, Pakistan, Mozambique, and Nigeria studies (10,12). This could be explained by the region's high populations and the peak age of reproduction in Ethiopia at that specific age group (10, 28). This was also shared by the study conducted among Africans that revealed maternal hypertensive disorders was common among younger's aged 23-28 years (5,10,12). Similarly, the Ethiopian mini-Demographic Health Surveys, 2019 reported that high (4,071) live births were delivered from women aged 20-34 (37). Almost in all regions in Ethiopia, the lowest new cases, prevalence of maternal hypertensive disorders and deaths and its attributed DALYs, Years Lived with Disability, had occurred among women aged 45-49 years. Similarly, in Ethiopia, five years preceding 2019 survey, the lowest childbirth had occurred among 35-49 years old. This is due to the decline of reproduction in the late 40's age (Ibid, 9). Furthermore, the young women Years Life Lost attributed to maternal hypertensive disorders had sharply increased by 164 times. This was far greater than the adolescents and women of reproductive age.

Implications

Between 1990-2019, the new cases and prevalence of maternal hypertensive disorders had highly increased and significant number of deaths, DALYs, YLD and YLL attributed to maternal hypertensive disorders had been observed in Ethiopia. Despite the common age for the entry of non-communicable disease including maternal hypertensive disorders in Ethiopia, adolescents and young women had been also

indifferently affected and associated with their health loss. Furthermore, the highest and the lowest maternal hypertensive disorders burden and health loss had occurred among 25-29 and 45-49 years old respectively. Oromia region had the highest share of burden and health loss due to the disease.

Conclusions and Recommendations

Taking into account the report of the increment of maternal hypertensive disorders, it will continue to be high burden and health loss in the country in the coming years. Therefore, the government and its partners must strengthen the health extension workers' prevention and control initiatives and the essential basic services related to maternal hypertensive disorders. The health sector could consider regions with high prevalence and provide contextualized interventions to highly affected segments of the women.

Conflict of Interest: The authors, declare that they have no conflict of interests.

Acknowledgements: The authors thank the National Data Management and Analytics Center for Health under the Ethiopian Public Health Institute, the Institute for Health Metrics and Evaluation at the University of Washington, and GBD Collaborators Network of Experts for the collaborative initiative to undertake this study.

Funding: Bill, and Melinda Gates Foundation funded the EPHI and IHME collaborative GBD 2019 national and sub-national burden of diseases study. The funder of this study had no role in study design, data collection, data analysis, data interpretation, or the writing of the report.

Consent for Publication: Not Applicable.

Authors' contribution: BA has conceptualized and drafted the manuscript, MA, LS, MD, AT and AM reviewed the manuscript critically for important intellectual content and approved the final manuscript,

References

1. Olshansky SJ, Ault a. B. The Fourth Stage of the Epidemiologic Transition: The Age of Delayed Degenerative Diseases. *Milbank Q.* 1986;64(3):355.
2. K. Srinath Reddy, et al. Emerging Epidemic of Cardiovascular Disease in Developing Countries. 1998;(97):596-601.
3. Caldwell JC. Populationss health in transition. *Bulletin. World Health Organization.* 2001;79(2):159-60.
4. Amuna P, Zotor FB. The epidemiological and nutrition transition in developing countries : evolving trends and their impact on public health and human development *Epidemiological and nutrition transition in Ethiop. J. Health Dev.* 2023;37(SI-2)

- developing countries: impact on human health and development. *Proc Nutr Soc.* (67):82–90.
5. Noubiap JJ, et al. The burden of hypertensive disorders of pregnancy in Africa: A systematic review and meta - analysis. 2019;(December 2018):479–88.
 6. J. Vernon Henderson, et al. Is Urbanization in Sub-Saharan Africa. Different? Policy Research Working Paper, 6481. The World Bank Development Research Group, Environment and Energy Team. June, 2013.
 7. Steven van de Vijver, et al. Status report on Hypertension in Africa - Consultative review for the 6th Session of the African Union Conference of Ministers of Health on NCD's. *Pan Afr Med J.* 2013 Oct 5; 16: 38.doi: 10.11604/pamj.2013.16.38.3100. e Collection 2013.
 8. <https://www.who.int/news-room/factsheets/detail/hypertension> accessed on November, 2022.
 9. Joseph Loscalzo, et al. *Harrisons Principle of Internal Medicine.* 21st edition, 2022.
 10. Laura A Magee et al. The new cases of pregnancy Hypertension in India , Pakistan , Mozambique , and Nigeria : A prospective populationss-level analysis. 2019;4:1–16.
 11. Subki AH, Algethami MR. Prevalence, Risk Factors, and Fetal and Maternal Outcomes of Hypertensive Disorders of Pregnancy: A Retrospective Study in Western Saudi Arabia. 2018;33(5):409–15.
 12. Yaya S, et al. Differentials in prevalence and correlates of metabolic risk factors of non-communicable diseases among women in sub-Saharan Africa: Evidence from 33 countries. *BMC Public Health.* 2018;18(1):1–13.
 13. Monica Muti1, et al. Prevalence of pregnancy induced hypertension and pregnancy outcomes among women seeking maternity services in Harare, Zimbabwe. *BMC Cardiovascular Disorders* (2015) 15:111. DOI 10.1186/s12872-015-0110-5.
 14. Ethiopian Public Health Institute. Prenatal and Maternal Death Surveillance Response. 2013 EFY report, Addis Ababa, Ethiopia, 2013.
 15. Berhe AK, et al. Prevalence of hypertensive disorders of pregnancy in Ethiopia: A systemic review and meta-analysis. *BMC Pregnancy Childbirth.* 2018;18(1):1–11.
 16. Hinkosa L,et al. Risk factors associated with hypertensive disorders in pregnancy in Nekemte referral hospital , from July 2015 to June 2017 , Ethiopia : case-control study. 2020;9:1–9.
 17. Belay AS, Wudad T. Prevalence and associated factors of pre- eclampsia among pregnant women attending anti-natal care at Mettu Karl referral hospital , Ethiopia : cross-sectional study. 2019;1–8.
 18. Kahsay HB, et al. Risk factors for hypertensive disorders of pregnancy among mothers in Tigray region, Ethiopia: Matched case-control study. *BMC Pregnancy Childbirth.* 2018;18(1):1–10.
 19. WHO recommendations for prevention and treatment of pre-eclampsia and eclampsia. Geneva: World Health Organization; 2011.
 20. United Nations. *Women's and Children' s Health.* 2010.
 21. UN. Political declaration of the High-level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases. 2011;49777(September):1
 22. Nations U. *Transforming our world: the 2030 agenda for sustainable development.* New york, 2015.
 23. MOH. FDRE. *ANC Guideline.* Addis Ababa, Ethiopia. February 2022.
 24. FDRE.MOH. *Prevention and control of non-communicable diseases; Strategic framework, 2010/2011-2014/2015,* Addis Ababa, Ethiopia, 2009.
 25. FDRE. MOH.*Health Sector Transformational Plan II 21-25.* Addis Ababa, Ethiopia,2021.
 26. FDRE.MOH. *National Reproductive Health Strategy 21-25.* Addis Ababa, Ethiopia,2021.
 27. Federal Democratic Republic of Ethiopia Ministry of Health. MOH. *Emergency Care and Mental Health Part 1 Chronic diseases and emergencies Blended Learning Module for the Health Extension Program, Part 1 and 2 20,* Addis Ababa, 2014 EDRE. MOFED. *National Country Work Plan 2021-2025,* Addis Ababa, Ethiopia.
 28. United Nations, Department of Economic and Social Affairs, Populations Division. *World Population Prospects: The 2019 Revision Ethiopia Populations* [<https://www.worldometers.info/world-populationss/ethiopia-populationss/>]
 29. IHME. *Global Burden of Diseases.* <https://www.healthdata.org/data-tools-practices/data-collection>, accessed on November 16, 2022.
 30. IHME. *Global Burden of Diseases. Data practices | Institute for Health Metrics and Evaluation (healthdata.org),* accessed on November 17, 2022.
 31. Stephen W. Bickler, et al. Urbanization in sub-Saharan Africa: Declining chronic and recurrent infection rates and their possible role in the origins of non-communicable diseases. *World J Surg.* 2018 June; 42(6): 1617–1628. doi:10.1007/s00268-017-4389-5.

32. Wang et al. *BMC Pregnancy and Childbirth* (2021) 21:364 <https://doi.org/10.1186/s12884-021-03809-2>. Adeloye D, Basquill C (2014) Estimating the Prevalence and Awareness Rates of Hypertension in Africa: A Systematic Analysis. *PLoS ONE* 9(8): e104300. Doi: 10.1371/journal.pone.0104300. Kasiye Shiferaw Gemechu, Nega Assefa and Bizatu Mengistie. Prevalence of hypertensive disorders of pregnancy and pregnancy outcomes in Sub-Saharan Africa: A systematic review and meta-analysis. *Women's Health* Volume 16: 1–25 © The Author(s) 2020 Article reuse guidelines: sagepub.com/journals-permissions DOI: 10.1177/1745506520973105.
33. Wang, W., et al. Epidemiological trends of maternal hypertensive disorders of pregnancy at the global, regional, and national levels: a population-based study. *BMC Pregnancy Childbirth* 21, 364 (2021). <https://doi.org/10.1186/s12884-021-03809-2>.
34. Wagnew M, Dessalegn M, Worku A, Nyagero J. Supplement article Trends of pre-eclampsia/eclampsia and maternal and neonatal outcomes among women delivering in Addis Ababa selected government hospitals, Ethiopia: a retrospective cross-sectional study. 2016;363(Supp 2):1–6.
35. Ethiopian Public Health Institute. Perinatal and Maternal Death Surveillance Response. 2014 EFY report, Addis Ababa, Ethiopia.
36. Ei Ei Aung, et al. Years of healthy life lost due to adverse pregnancy and childbirth outcomes among Adolescent mothers in Thailand, 2018. *AIMS Public Health*, 5(4): 463–476. DOI: 10.3934/publichealth.2018.4.463.
37. FDRE. Ethiopian mini demographic and health survey 2019. MOH. EPHI. Addis Ababa. The DHS program ICF. Rockville, USA, Maryland. May 2021.