

# Burden of and Health Loss Due to the Effect of Maternal Hypertensive disorders in Ethiopia: A systematic analysis of Global burden of diseases, 2019

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## Abstract

**Background:** Worldwide, maternal hypertensive disorders complicate one in ten pregnancies. As a result of changes in the life styles of society, currently, it is becoming a common public life encounter. However, Ethiopia lacks comprehensive and comparable maternal hypertensive disorders, causing 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 socio-demographic, health care service utilization, and other data sources such as case notifications, scientific literature, and unpublished data as per the Global Burden of Disease protocol and analysis techniques to produce national and regional estimates of maternal hypertensive disorders in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 population [199,707 (95% UI 150,261-267,221) to 252,303 (95% UI 191,335-332,524)], while 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 population. 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 adolescent, 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 higher than 1990 whereas the young women years of life lost had increased.

**Conclusions:** Based on the 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 prevented by properly 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, 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% were diagnosed and treated, and one in five have of them

46% are unaware of their illness, 42% are diagnosed and treated, and one in five have controlled hypertension (8).

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

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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, reported an overall maternal hypertensive disorder 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 disorder is 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 disorder prevalence (15). In this systematic review, the highest prevalence of hypertensive disorder, 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 before 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 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 intra-muscular 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 2019 study data for Ethiopia.

Institute of health metrics and evaluation (IHME) collaborative 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 observation and interviews, and other data sources from census, household surveys, case notifications, demographic surveillances, scientific literature, 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) is 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 Disease 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

### *Magnitude of incidence Prevalence of Maternal Hypertensive disorders and deaths in Ethiopia*

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 population [199,707 (95% UI 150,261-267,221) to 252,303 (95% UI 191,335-332,524)], but it 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, 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 10000 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 disorder were reduced per 100000 population. Generally, the prevalence of maternal hypertensive disorders among women of reproductive age increased from 94, 818 (95% UI 59,434-135,332) per 100,000 population in 1990 to 138, 263 (95% UI 88,447-196,029) per 100,000 population in 2019 (Table 1).

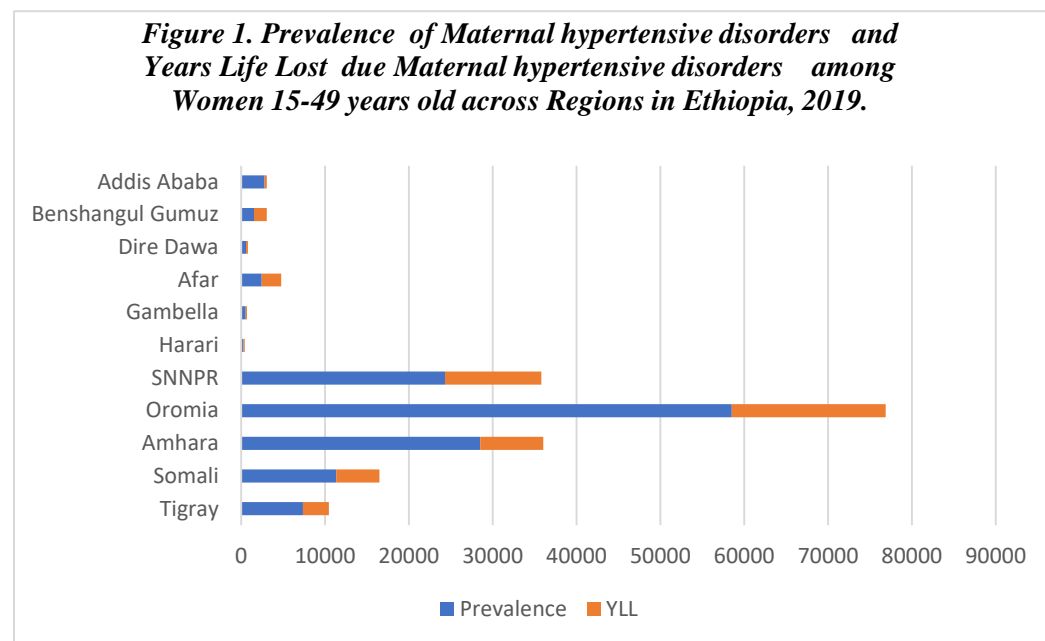
**Table 1. Number of Incidence and Prevalence of Maternal Hypertensive Disorder per 100,000 populations among women 15-49 years old in Ethiopia across Regions, 2019.**

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 disorder were more pronounced among 25-29 years older 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 disorder had occurred among

25-29 years and 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 (DALYs), Years Lived with Disabilities and Years Life Lost (YLL) as a result of maternal hypertensive disorders in Ethiopia.**

Maternal hypertensive disorders associated age-standardized Disability Adjusted Life Years (DALYs) among adolescent, 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 was increased from 5,847 (95% UI 3,703-9,040) to 8,493 (95% UI 5,370-12,849) per 100,000 population among adolescents, from 18,407 (95% UI 12,834-25,680) to 21,812 (95% UI 14,682-32,139) per 100,000 population 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 adolescent, young women and women of reproductive age had increased by 2,646 between 1990-2000, 3,405 within 2001 and 2010 and 5,979 between 2010 and 2019 per 100,000 populations. Similarly, between 1990 and 2019, the highest DALYs attributable to maternal hypertensive disorders had occurred among similar young women and 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 young women and women of reproductive age had ranged from 8,493 (95% UI 5,370-12,849), 21,812 (95% UI 14,682-32,139) and 57,867 (95% UI 41,751-79,165) respectively. The highest age standardized DALYs due to maternal hypertensive disorders had occurred among young women aged 20-24 years 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 15-49 years old in Ethiopia, 2019.**

Location	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	7514.39319	4,541.32-11,863.35	127	78-199
Oromia	21,306.32689	14,374.53-32,481.48	183,34.490	11,350.7-29,058.2	307	191-481
Somali	5,755.037464	3,666.69-8,302.8	5,180.78	3,120.42-7,687.31	89	54-131

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 100,00 population; 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 in Ethiopia, 1990 and 2019**

Years	Age (Years)		
	10-19	10-24	15-49
<b>1990</b>	541 (240-1001)	1698 (871-2973)	4801(2606-7648)
<b>2019</b>	477 (221-870)	2101(1051-3706)	7016(3804-11225)

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, 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 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- 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). Other studies also depict this; hence, we can slightly accord that adolescence is becoming the entry point to non-communicable diseases, including maternal hypertensive disorders in Ethiopia (5,7,12). In the same way, a study done in northern Ethiopia, Tigray region reported that pre-pregnancy overweight was a risk factor for Hypertensive Disorders of Pregnancy (15).

Similarly, the prevalence of maternal hypertensive disorders among young women and women of reproductive age had increased by 1.25 times and 1.45 times respectively. As mentioned earlier, this was also evidenced by studies from low and middle-income countries (5-6,7,11). This could also be explained by the observed and shared global epidemiologic, nutrition, demographic, and obstetric transitions in the past half a century, that is characterized by change in

socio-economic conditions and life styles such as escalated sedentary life, rapid urbanizations and increased aging communities in Africa and Ethiopia (1-6,7,31). Consequently, previous family history of Hypertension and improved women's employment status have contributed to the rise of maternal hypertensive disorders in SSA countries including Ethiopia (5,7,9). However, in Ethiopia maternal hypertensive disorders had highly heightened among aged 25-29 Years. This finding was also shared by global and regional studies (3). Equally important, it is similar with the study conducted in India, Pakistan, Mozambique and Nigeria, which revealed a high burden of maternal hypertensive disorders among this age group (10,12).

Equally, in three decades, deaths owing to maternal hypertensive disorders among adolescents and young women were increased by 1.5 times and 1.17 times respectively. The increment of maternal hypertensive disorders in Ethiopia also aligns with the global and regional increment (34-35). For example, EPHI, Prenatal, and Maternal Death Surveillance Response reports of the 2013 and 2014 EFY had reported a 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 respectively. In 2019, the highest Years Lived with Disability attributed to maternal hypertensive disorders had occurred among young women, which was 164 times higher than in 1990, which needs further study to explain. This is similar to 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). In addition, between 1990--2019, the Years Lived with Disability attributed to maternal hypertensive disorders was 476 (UI 221-870), 2,101 (UI 1051-3706), 7,016 (UI 3,804-11,225) respectively which was 65, 597 and 4,308 higher.

Almost in all regions, there were significantly high new cases and prevalence of maternal hypertensive disorders and its attributed age-standardized DALYs, Years Lived with Disability, and Years of Life Lost in the late 20's, 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 population 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 Survey, 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, occurred among women of reproductive 45-49 years of age. 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, Years Lived with Disability and Years Life Lost 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 respectively.

### **Conclusions and Recommendations**

Taking into account the report of the increment of maternal hypertensive disorders, maternal hypertensive disorders will continue to be high burden and health loss of 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 interest.

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