

# The burden of malignant neoplasms (cancer) in Ethiopia, 2000–16: analysis of Evidences from Global Burden of Disease Study 2016 and Global health estimates 2016

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## Research article

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# Abstract

**Background:** Cancer figures among the leading causes of morbidity and mortality worldwide. More than 60% of world total new annual cancer cases occur in Africa, Asia, and Central and South America. In Ethiopia, cancer accounts for about 5.8% of total national mortality. The increasing burden of common non communicable diseases such as cancer leads to epidemiological shift of disease burden to non-infectious diseases. However, lesser emphasis is given to cancer. Although, measuring the burden is important to design prevention strategy, a comprehensive estimate is lacking in Ethiopia. Hence, we aimed to systematically measure the burden of cancer in Ethiopia.

**Methods:** The research used data from Global burden of disease study (GBD 2016) and Global health Estimate 2016; that originally collected the information through vital registration, verbal autopsy, surveys, reports, published scientific articles and modeling.

**Results:** In 2016, cancer caused an estimated 50913.5 (95% CI: 36092.1–73018.8) deaths among all age and both gender groups with a crude death rate of 49.7/100,000 and ASDR of 93.5/100,000 population. It contributed for 18.5% of NCD related death and 7.3% of total death, 16.9% of NCD related ASDR and 9% of total ASDR, and 12.7% of national NCD related DALYs and 4.3% of the national total DALYs. The number of death and DALYs from cancer has been increased by 47.4% and 45.1% respectively. Whereas CDR and ASDR from cancer has been declined by 4.2% and 9.7% respectively. The top five causes of cancer related mortality was from Other malignant neoplasms, breast cancer, cervix uteri cancer, colon and rectum cancers, and leukemia whereas lymphomas along with the aforementioned cancers contribute for the highest cancer DALYs. **Conclusion and recommendation :** the burden of malignant neoplasms (cancer) is remarkably increasing throughout the periods between 2000 and 2016. It carries the higher burden of age standardized death rate (ASDR) from NCD. Specifically, other malignant neoplasms, Breast cancer, cervix uteri cancer, colon and rectum cancers, leukemia and lymphomas caused the highest burden of cancer. Therefore, the existing disease prevention strategies should incorporate NCD prevention strategies with a particular emphasis for cancer screening, prevention and care.

## Introduction

Cancer is a disease in which abnormal cells grow and reproduce uncontrollably and invade nearby tissues by spreading to other parts of the body through blood streams and lymphatic systems hindering the activities of the normal cells (1-3). Cancer incidence has increased in most countries worldwide, owing to a growing and aging population and to an expansion of key risk factors, such as smoking, obesity, and unhealthy diet (4, 5).

Cancer figure among the leading causes of morbidity and mortality worldwide, with approximately 18.1 million cases, 0.5 million new cases and 9.6 million cancer related deaths in 2018 (6). One in 5 men and one in 6 women worldwide develop cancer during

their lifetime, and one in 8 men and one in 11 women die from the disease. Worldwide, the total number of people who are alive within 5 years of a cancer diagnosis, called the 5-year prevalence, is estimated to be 43.8 million (7). The 5 most common sites of cancer diagnosed for both sexes in 2018 were lung (11.6%), breast (11.5%), colorectal (10.2%), prostate (7.1%), and stomach (5%) (6).

More than 60% of world total new annual cancer cases occur in Africa, Asia, and Central and South America. These regions account for 70% of the world cancer deaths (6). *Furthermore, the number of new cases is expected to rise to 29.5 million by the years 2040 (8). This is an alarming prospect, especially for Low-income countries (LICs), where the weak health systems are severely resource constrained and already overwhelmed by the large burden of communicable diseases (1, 7).*

Cancer is increasingly recognized as a critical public health problem in Africa. While communicable diseases continue to burden African populations, it is becoming clear that non communicable diseases also require the attention of those whose goal is to ensure the health of Africans (2, 6, 9). Today, 60% more Africans die from cancer than succumb to malaria and the number of cancer deaths is rising at an alarming rate (9).

According to GLOBOCAN forecasts, the number of estimated cancer deaths in 2015 approximately 635,400. Africa's cancer burden is projected to reach an alarming 1.4 million new cases and 1 million deaths by 2030, simply due to the aging and growth of the population and also adoption of behaviors and lifestyles associated with economic development, such as smoking, unhealthy diet, and physical inactivity (8,9). Similarly, mortality due to cancer is increasing in Africa, cancer mortality was estimated to be 542,000 with a diagnosis of 715,000 new cancer cases as of 2008 (10).

In Ethiopia, cancer accounts for about 5.8% of total national mortality. Although population-based data do not exist in the country except for Addis Ababa, it is estimated that the annual incidence of cancer is around 60,960 cases and the annual mortality is over 44,000. For people under the age of 75 years, the risk of being diagnosed with cancer is 11.3% and the risk of dying from the disease is 9.4% (11). The most prevalent cancers in Ethiopia among the adult population are breast cancer (22.2%), cancer of the cervix (9.3%) and colorectum (7%). About two-thirds of reported annual cancer deaths occur among women (12). However, most prevalent cancer in Ethiopia among children is leukemia, lymphoma, retinoblastoma, wilms' tumour (nephroblastoma), bone and soft tissue sarcomas (13).

Even though the epidemic of non-communicable disease is expected to increase, its burden is not clearly known in the country. Therefore, this study aimed to measure the burden of cancer in Ethiopia between 2000 and 2016 by using Evidence from Global Burden of Disease Study 2016 (<https://vizhub.healthdata.org/gbd-compare/>) and Global Health

Estimate 2016 ([http://www.who.int/healthinfo/global\\_health\\_estimates/en/](http://www.who.int/healthinfo/global_health_estimates/en/)), which will contribute to improve the health status of the population.

## Materials And Methods

### Study area and Source of data

The burden of disease and cause of mortality is periodically estimated by world health organization and IME since 1990. This research is based on a systematic analysis of the global burden estimates for Ethiopia. The main sources of data for this research are WHO global health estimate data base ([http://www.who.int/healthinfo/global\\_health\\_estimates/en/](http://www.who.int/healthinfo/global_health_estimates/en/)) and Institute for Health Metrics and Evaluation (IHME) (Global burden of disease study 2016) data base (<http://vizhub.healthdata.org/gbd-compare/>). The organization collects, organizes and estimates disease burden in collaboration with other United Nations agencies. The estimation is particularly based up on vital registries, surveys, researches and model estimations.

### Operational definition

**Disability:** is used broadly in disease burden analyses to refer to departures from good or ideal health in any of the important domains of health

**Disability-adjusted life year (DALY):** is a summary measure which combines time lost through premature death and time lived in states of less than optimal health, loosely referred to as “disability”.

### Statistical analysis and interpretation

This study analyzed the burden of malignant neoplasms (cancer) in Ethiopia from the general measurement of disease burden and from the burden of group II (NCD) diseases. The GBD study and GHE approaches to estimate all-cause mortality and cause-specific mortality rates by age, sex, and year has been described elsewhere (14). Causes of death by age, sex, and year for all causes were measured mainly using cause of death ensemble modeling (CODEm); that models different statistics and estimates outcomes based on the performance of fitted models (16). DALY was measured by summing years of life lost (YLL) due to premature mortality and years lived with disability (YLD), a measure of non-fatal health loss, in a single metric. YLL were estimated using standard GBD methods whereby each death is multiplied by the normative standard life expectancy at each age. YLD were estimated using sequelae prevalence and disability weights derived from population-based surveys. For most sequelae, the GBD 2016 study used a Bayesian meta-regression method,

DisMod-MR 2.1, designed to address key limitations in descriptive epidemiological data, including missing data, inconsistency, and large methodological variation between data sources (14).

## Results

Malignant neoplasms (cancer) caused an estimated 50913.5 (95% CI: 36092.1–73018.8) deaths among all age and both gender groups in 2016. Death from malignant neoplasms (cancer) also has contributed for 18.5% (50913.5/274998.8) of deaths from non-communicable diseases and 7.3% (50913.5/700108.8) of the total death reported by the same year. The number of death from malignant neoplasms has been increased by 47.4% between 2000 and 2016. By the same year the crude death rate related to cancer was estimated to be 49.7/100,000 and age-standardized death rate was 93.5/100,000 population. Both declined from the 2000's record only by 4.2% and 9.7% respectively (**Table 1 and 2**).

Among the specific types of cancers, other malignant neoplasms caused the highest number of death, 10916.3 (95% CI: 6985.9–16614). While Breast cancer with 7653.6 (95% CI: 4961.7–11508.1) deaths, cervix uteri cancer with 5013.5 (95% CI: 3197.1–7655.4) deaths and colon and rectum cancers with 3475.1(95% CI: 2116.5–5533.4) deaths ranked second to fourth places. In addition mortality from leukemia, lymphomas and myeloma, ovary cancer, trachea and lung cancers, oesophagus cancer and stomach cancer contributed significant number of deaths reported in 2016.

The crude death rate from cancer was declined by 4.2% from 51.9/100,000 population to 49.7/100,000 population between 2000 and 2016. The most common causes of death remained the same in the two periods. Other malignant neoplasms caused a CDR of 10.7/100,000 population in 2016 and ranked the first top killer and followed by breast cancer, cervix and uteri cancer, and colon and rectum cancers. The CDR from cervix uteri cancer, oesophagus cancer, stomach cancer and testicular cancer was declined by 26-40% whereas death from ovary cancer, pancreas cancer, brain and nervous system cancers, and prostate cancer raised by 20-36%.

Malignant neoplasms (cancer) were the highest contributor of age standardized death rate by the year 2016. This classification of disease contributed for 16.9% (93.5/554.7) and 9% (93.5/1048.3) per 100,000 population of ASDR from the non-communicable category and from the total deaths respectively. Among the specific type of cancers, other malignant neoplasms, breast cancer, cervix uteri cancer and colon and rectum cancers caused the highest ASDR with a rate of 18.9/100,000, 13.4/100,000, 9.9/100,000 and 6.7/100,000 population respectively by the year 2016.

Although, ASDR from testicular cancer, stomach cancer, oesophagus cancer and cervical cancer has been declined between 29-43%, the death from ovary cancer, brain and nervous system cancers, kidney cancer and pancreas cancer was increased by 12-27.5% between 2000 and 2016. While the overall cancer related mortality (ASDR) was declined by 9.7% during the specified period of time (**Table 2**).

Disability-adjusted life years lost (DALY) due to malignant neoplasms (cancer) among all ages was 2,012,500 DALYs in 2016; which is increased by 45.1% from the 2000s record of 1386700 DALYs. It accounted for 12.7% (2012500/15849800) of national NCD related DALYs and 4.3% (2012500/46507400) of the national total DALYs. The top five causes of cancer related deaths were other malignant neoplasms, breast cancer, cervix uteri cancer, leukaemia and lymphomas with 462600, 327000, 180300, 161100 and 133400 DALYs respectively.

Since 2000, DALYs due to all specific types of cancer has been increased substantially except stomach cancer (**Table 3**). DALYs from ovary cancer was doubled between 2000 and 2016. Similarly DALYs from Prostate cancer, Brain and nervous system cancers, Pancreas cancer, Liver cancer, Kidney cancer, Trachea, bronchus, lung cancers, Lymphomas, multiple myeloma, Mouth and oropharynx cancers and other malignant neoplasms has been increased by 55-94% with in the same period.

## Discussion

The burden of cancer in terms of mortality and disability adjusted life years was measured among all ages and genders for Ethiopia between 2000 and 2016 by using aggregates of data from the global health estimates. The number of death from cancer has been increased by 47.4% between 2000 and 2016. However, crude death rate and age standardized death rates were declined by 4.2% and 9.7% respectively with in the specified periods. The change in the overall cancer mortality may highlight the increasing incidence of cancer and contribution of factors leading to increased density of cancer and other non-communicable diseases such as: ageing, nutritional transition, environmental change and population growth (5, 9-13).

The contribution of cancer for the total mortality and mortality specific to non-communicable diseases was increased tremendously. In 2016 cancer has been contributed for 18.5% of deaths from non-communicable diseases and 7.3% of the total death reported in Ethiopia. It indicates a tremendous increment from the 2014s report, where cancer has been contributed for 6% of the total death reported in Ethiopia. Studies witnessed that the role of non-communicable diseases as general and cancer could significantly increases in the epidemiology of disease burden particularly in Africa, where the burden of NCD is increasing by 27% surpassing the global average of 17% (5, 11, 15-17).

Unless effective measure is taken the burden of cancer in Ethiopia as well as Africa could exceed all combined communicable diseases as the most common causes of death in the near futures (2, 5). This implies that NCDs like cancer represent a leading threat to health, economies and overall human development in the country. This is because in lower income countries, the increase in the relative burden from NCDs and the decrease in communicable disease burden are occurring more rapidly than in high-income countries. Particularly the burden of cardiovascular diseases and cancer is rapidly increasing (16-19). A research conducted in India also witnessed this finding, which the number of new cases and deaths due to cancer doubled in 26 years (15).

Although, epidemiological shift observed in most developing countries has the major role in the burden of cancer (15-18) interventions designed to address non-communicable diseases particularly cancer were poorly implemented in developing countries. Until recently the Ethiopian government has not been designed a preventive strategy to overcome the burden of cancer and non-communicable diseases at large. Also global interventions that were designed yet in the millennium and sustainable development goals were targeted on infectious diseases, maternal and child health and nutritional problems and less emphasis was given for cancer and other NCDs (5, 14-19).

Among the specific types of cancers, other malignant neoplasms, Breast cancer, cervix uteri cancer, colon and rectum cancers, and leukemia caused the highest number of death and ranked as five top causes of age standardized death rates from cancer. In addition mortality from lymphomas and myeloma, ovary cancer, trachea and lung cancers, oesophagus cancer and stomach cancer contributed significant number of deaths reported in 2016. It is nearly similar to the global epidemiology where breast, cervical, colorectal and stomach cancer are the leading cause of mortality in most countries (5, 15).

In 2016 around 2,012,500 DALYs were lost due to cancer among all ages and combined gender in Ethiopia. It was increased by 45.1% from the 2000s record of 1386700 DALYs and accounted for 12.7% of national NCD related DALYs and 4.3% of the national total DALYs. The percentage contribution cancer related DALY in this report is slightly lower than the global average and reports of India (14) while it is nearly the same with the average value of sub-Sahara countries (5). In line with the global epidemiology the major contributors of cancer related DALYs were other malignant neoplasms, breast cancer, cervix uteri cancer, leukaemia and lymphomas.

DALYs due to all specific types of cancer has been increased substantially except for stomach cancer. DALYs from ovary cancer was doubled while DALYs from Prostate cancer, Brain and nervous system cancers, Pancreas cancer, Liver cancer, Kidney cancer, Trachea, bronchus, lung cancers, Lymphomas, multiple myeloma, Mouth and oropharynx cancers and other malignant neoplasms has been increased by 55-94% with in the same

period. This may be as a result of increased burden of smoking and alcohol consumption; the major risk factors related to most cancers cases (5, 14-18) along with other predisposing factors and absence of good medical facilities.

This research is based on secondary data analysis and the primary data was based on model estimations, therefore, the potential biases related to this and the issue of validity is there. Moreover, the forecasted values from the trend may change through time due to change in intervention programs; this intern affects the reliability of the estimate. Hence all interpretations should consider these limitations.

## Abbreviations

**ASDR:** Age standardized death rate; **CODEm:** Cause of death ensemble modeling; **DALY:** disability-adjusted life years lost; **GBD:** Global Burden of Disease; **MDGs:** Millennium Development Goals; **NCDs:** Non-communicable diseases; **WHO:** World Health Organization

## Declarations

**Ethics approval and consent:** Not applicable

- **Consent for publication:** Not applicable
- **Availability of data and materials:** The GBD 2015 data is available at the GBD website (<https://vizhub.healthdata.org/gbd-compare/>) and Global Health Estimate 2018 is also available at: ([http://www.who.int/healthinfo/global\\_health\\_estimates/en/](http://www.who.int/healthinfo/global_health_estimates/en/)) both are freely accessible
- **Competing interests:** The authors declare no conflict of interest with anybody.
- **Funding:** Not applicable

**Authors Contributions:** All authors have made substantial intellectual contributions to conception, design, and acquisition of data, analysis and interpretation of data to this study. They also have been involved in drafting the manuscript, approved the final manuscript and agreed to be accountable for all aspects of the work

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## Tables

Table 1: Number of deaths from malignant neoplasms (cancer) for both sexes and all age groups in Ethiopia from 2000-16

of	Number of deaths in 2000			Number of deaths in 2016			% change
	Value	95% LL	95% UL	Value	95% LL	95% UL	
uses	981955.9	867049.4	1107745.6	700108.8	588955.7	831398.4	-28.7
	199299.9	158916.3	248625.1	274998.8	211290.2	362882.1	38.0
unicable							
es							
iant	34534.5	25677.2	46261.7	50913.5	36092.1	73018.8	47.4
isms							
. and	870.6	542.0	1344.9	1373.1	798.5	2275.8	57.7
arynx							
's							
hagus	1453.3	929.2	2191.6	1651.1	972.8	2706.9	13.6
'							
ch	1490.7	949.5	2255.6	1511.1	883.1	2494.1	1.4
'							
and	2370.5	1538.3	3525.7	3475.1	2116.5	5533.4	46.6
1							
's							
cancer	654.8	402.6	1022.6	1102.1	633.6	1844.5	68.3
neas	297.2	176.0	479.5	552.6	305.8	954.4	85.9
'							
ea, lung	1005.7	630.0	1545.0	1681.9	988.4	2762.8	67.2
's							
oma	139.3	79.4	231.9	231.4	121.6	416.1	66.1
in							
's							
cancer	5184.9	3547.7	7332.7	7653.6	4961.7	11508.1	47.6
uteri	4427.3	3014.5	6290.7	5013.5	3197.1	7655.4	13.2
'							
s uteri	183.4	109.7	293.5	246.1	135.2	427.5	34.2
'							
cancer	1200.2	779.2	1784.4	2511.2	1554.6	3940.3	109.2
te	702.9	446.6	1065.9	1384.4	833.8	2226.2	97.0
'							
ular	82.6	47.4	136.7	77.1	39.3	141.8	-6.6
'							
r cancer	741.4	459.0	1151.1	1282.4	743.9	2130.1	73.0
er	617.5	379.5	965.0	937.4	536.0	1576.2	51.8
'							
and NS	264.2	156.0	427.2	508.9	281.4	879.3	92.7

l							
ns							
adder	445.2	272.1	699.4	587.3	330.2	1001.6	31.9
liary							
?							
k cancer	137.4	78.7	228.0	180.5	94.3	325.9	31.3
id	1045.1	658.0	1598.4	1390.0	810.6	2298.5	33.0
?							
omas &	1897.3	1220.6	2844.6	3098.6	1877.3	4957.1	63.3
ma							
emia	2317.4	1502.7	3449.4	3473.7	2115.3	5531.9	49.9
	6937.3	4684.3	9937.3	10916.3	6985.9	16614.0	57.4
nant							
isms							

**Table 2: Crude and ASDR/100,000 population from malignant neoplasms (cancer) for sex and age groups, 2000-16**

Disease by group	CDR			ASDR		
	2000	2016	%Change	2000	2016	%Change
Ischaemic heart diseases	1475.8	683.7	-53.7	1816.7	1048.3	-42.3
Infectious and communicable diseases	299.5	268.5	-10.3	634.3	554.7	-12.5
Injury and violent deaths	51.9	49.7	-4.2	103.6	93.5	-9.7
Oral cavity and oropharynx cancers	1.3	1.3	2.5	2.6	2.5	-5.7
Esophagus cancer	2.2	1.6	-26.2	4.8	3.4	-29.3
Stomach cancer	2.2	1.5	-34.1	4.8	3.0	-37.1
Colon and rectum cancers	3.6	3.4	-4.7	7.4	6.7	-10.1
Prostate cancer	1.0	1.1	9.4	2.0	2.1	3.4
Breast cancer	0.4	0.5	20.8	1.0	1.2	12.2
Liver, gall bladder, bronchus, lung cancers	1.5	1.6	8.7	3.2	3.3	5.2
Melanoma and other skin cancers	0.2	0.2	7.9	0.5	0.5	-1.5
Bladder cancer	7.8	7.5	-4.1	14.8	13.4	-9.5
Cervix uteri cancer	6.7	4.9	-26.4	13.9	9.9	-29.1
Endometrium uteri cancer	0.3	0.2	-12.8	0.6	0.5	-17.9
Uterus cancer	1.8	2.5	35.9	3.6	4.6	27.5
Thyroid cancer	1.1	1.4	28.0	3.0	3.2	7.5
Testicular cancer	0.1	0.1	-39.3	0.2	0.1	-42.9
Prostate cancer	1.1	1.3	12.4	1.6	1.8	16.1
Penis cancer	0.9	0.9	-1.4	2.2	2.0	-8.9
Brain and nervous system	0.4	0.5	25.2	0.7	0.9	18.6
Other neoplasms						
Gall bladder and biliary tract	0.7	0.6	-14.3	1.3	1.1	-18.4
Other						
Bladder cancer	0.2	0.2	-14.7	0.5	0.4	-19.8
Prostate cancer	1.6	1.4	-13.6	3.6	3.0	-18.5
Lymphomas, multiple myeloma	2.9	3.0	6.1	5.3	5.4	2.4
Leukaemia	3.5	3.4	-2.6	6.0	5.6	-5.9
All malignant neoplasms	10.4	10.7	2.2	19.6	18.9	-3.7

CDR=Crude death rate, ASDR=Age-standardized death rate, NCD=Non-communicable disease

Table 3: DALY from malignant neoplasms (cancer) in thousands for both sex and all age groups in Ethiopia, 2000-16

Causes of DALY	2000	2016	% change
All Causes	71354.0	46507.4	-34.8
Non-communicable diseases	12053.5	15849.8	31.5
Malignant neoplasms	1386.7	2012.5	45.1
Mouth and oropharynx cancers	35.5	55.3	55.9
Oesophagus cancer	47.8	53.0	11.0
Stomach cancer	52.6	51.6	-1.7
Colon and rectum cancers	88.6	127.8	44.3
Liver cancer	25.1	42.4	68.9
Pancreas cancer	9.6	17.7	83.8
Trachea, bronchus, lung cancers	35.6	58.6	64.7
Breast cancer	226.9	327.0	44.2
Cervix uteri cancer	163.2	180.3	10.4
Ovary cancer	47.2	97.6	107.0
Prostate cancer	18.2	35.3	94.2
Kidney cancer	43.3	71.3	64.8
Bladder cancer	18.2	26.6	46.3
Brain and nervous system cancers	11.9	22.4	88.5
Gallbladder and biliary tract cancer	17.3	22.8	31.9
Thyroid cancer	29.0	37.5	29.3
Lymphomas, multiple myeloma	84.1	133.4	58.6
Leukaemia	112.1	161.1	43.7
Other malignant neoplasms	298.6	462.6	54.9

## Conclusion And Recommendations

Malignant neoplasms (cancer) contributed for 18.5% of deaths from non-communicable diseases and 7.3% of the total number of death. It is also responsible for 16.9% and 9% of ASDR from the non-communicable category and from the total deaths and 12.7% of national NCD related DALYs and 4.3% of the national total DALYs respectively. The number of death and DALYs from cancer has been increased by 47.4% and 45.1% respectively. Whereas CDR and ASDR from cancer has been declined by 4.2% and 9.7% respectively. Other malignant neoplasms, Breast cancer, cervix uteri cancer, colon and rectum cancers, and leukemia caused the highest number of death and ranked as top five causes of age standardized death rates from cancer. While other malignant neoplasms, breast cancer, cervix uteri cancer, leukaemia and lymphomas were the five top causes of DALYs lost due to cancer in Ethiopia by the year 2016.

Therefore, the existing disease prevention strategies should incorporate NCD prevention strategies with a particular emphasis for cancer screening, prevention and care.