Trend analysis of hospital admissions, outpatient consultations; and both hospital and community based mortality related to HIV, TB and Malaria in Ethiopia

Report

Ethiopian Public Health Institute

Ministry of Health

Trend analysis of hospital admissions, outpatient consultations and; both hospital and community based mortality related to HIV, TB and Malaria in Ethiopia

Report

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Acronyms and Abbreviations

AAMSP	Addis Ababa Mortality Surveillance Program
ART	Anti- Retroviral drugs
CD4	cluster of differentiation 4
CSA	Central Statistical Agency
FMOH	Federal Ministry of Health
HDSS	Health and Demographic Surveillance System
HIV/AIDS	Human Immunodeficiency Virus infection and Acquired Immune Deficiency Syndrome
ICD	International Classification of Diseases
MASL	Meter Above Sea Level
MDG	Millennium Development Goals
MDR	Multi Drug Resistant
MYP	Mid-Year Population
SSA	Sub-Saharan Africa
SUFI	Scale up For Impact
TB	Tuberculosis
UNAIDS	United Nations program on HIV/AIDS
VA	Verbal Autopsy
WHO	World Health Organization

Foreword

The report of this study provides information on trend of hospital admissions, outpatient consultations and; both hospital and community based mortality related to HIV/AIDS, TB and Malaria.

The general objective of the study was to assess the trends in hospital admissions, outpatient consultations and mortalities related to HIV/AIDS, TB and Malaria in selected hospitals from all regions, six Health and Demographic Surveillance Sites (HDSS); and Addis Ababa Mortality Surveillance Program (AAMSP) in Ethiopia.

It is our hope that the study key findings, conclusion and recommendations will be taken into consideration by the government, health development partners and all stakeholders to design better interventions on how to reduce cases and mortality due to HIV/AIDS, TB and Malaria.

Finally, EPHI would like to acknowledge several organizations that contributed to the successful completion of this study including FMOH, The Global Fund, WHO, Universities of Addis Ababa, Jimma, Haramaya, Gondar, Mekelle and Arbaminch, Ethiopian University Research Centers Network, CDC-Ethiopia and EPHA. Special thanks also go to The Global Fund, for their both financial and technical support.

Dr. Ebba Abate, Director General of EPHI

Executive Summary

Introduction: According to 2017 UNAIDS report, since the start of the HIV epidemic, an estimated 78 million people have become infected with HIV and 35 million people have died of AIDS-related illnesses; and in 2016, 1 million people died of AIDS-related illnesses. Ethiopia is among the countries hard-hit by the HIV/AIDS epidemic. The epidemic has claimed the life of citizens, particularly young adults that would have contributed immensely to the country's development. Ever since the start of the epidemic numerous efforts have been exerted both by the government and partners to reduce the effect of the disease.

According to the WHO report, Ethiopia is among the 30 high burden countries for TB, TB/HIV, and MDR-TB with estimated TB prevalence and incidence rates of 200 and 207 per 100,000 populations respectively in 2014. By scaling up high impact interventions, the country has achieved tuberculosis related MDG targets by halting and reversing the incidence rate from 369 in 1990 to 224 per 100,000 populations in 2014. It has also reduced TB prevalence and mortality rate by more than half compared to the 1990 baseline values. Despite the significant progress, one-third of incident TB cases remained undetected and only a third of estimated MDR TB cases are getting proper treatment every year. Hence, tuberculosis remains among the top ten causes of mortality in the country. Cognizant of the facts, Ethiopia is required to exert much more effort to detect the missed one-third of new TB cases and effectively treat at least 90% of the notified TB cases.

Malaria has a long history of claiming countless lives in Ethiopia, mainly through major cyclical outbreaks, and it is endemic in the country with marked seasonal and geographic variations. *Plasmodium falciparum* and *P. vivax* are the two most dominant malaria parasites in Ethiopia. Over the past ten years, Ethiopia has significantly intensified efforts against malaria by scaling up the implementation of internationally accepted strategies and best practices for malaria prevention, treatment, and care. As a result of the successful scale-up for impact (SUFI) of the globally recommended interventions, the country has witnessed dramatic declines in outpatient consultations, inpatient admissions and deaths, and the frequency of epidemics has been halted throughout the country.

Objective: The aim of the study was to assess the trends in hospital admissions, outpatient consultations and mortalities related to HIV/AIDS, TB and Malaria at selected hospitals, Health and Demographic Surveillance Sites (HDSS); and Addis Ababa Mortality Surveillance Program (AAMSP) in Ethiopia.

Method: This study employed retrospective facility-based register review, and review of HDSS longitudinal data and Mortality Surveillance Program data. For facility-based register review, retrospective data over the last fifteen year-period from 2001/2 to 2015/16 was collected from HIV/AIDS, TB and Malaria patients' registers of 31 purposively selected hospitals from all regions.

With regard to the HDSS data, deaths and person-years of observation were analysed for the population of six HDSS in Ethiopia, for the period from 2009/10 to 2015/16. Causes of death were determined by verbal autopsy (VA) coding system using physician reviews and WHO ICD-10 disease classification. Two physicians assigned the most probable underlying causes of death independently. If two physicians disagreed on the assigned cause of death, a third physician conducted an independent review to assign the cause. The final cause of death was determined when two of the three physicians assigned the same underlying cause of death; otherwise, the cause was labeled as undetermined.

In the case of Addis Ababa Mortality Surveillance Program (AAMSP), all registered deaths from the burial data collected by cemetery clerks were entered into a database system, and a 10% random sample was drawn for VA interview. Both the interview and physician assigned cause of death were entered into a database and exported to STATA for analysis.

Results: Findings from the retrospective facility-based register review showed an increasing trend in the number of new HIV cases registered in those hospitals between the years 2001/2 and 2014/15; however, marked decline in the number of registered new HIV cases was observed in 2015/16; especially for females. The number of HIV patients discharged with improvement after admission increased dramatically from 2001/2 to 2015/16, while death among admitted HIV cases continued to increase between the years 2001/2 to 2015/16. The number of patients enrolled in HIV care and treatment in the selected hospitals was only 71 at the beginning of 2001/2 and increased to 20,598 in 2006/7; then has been constantly decreasing until 2015/16. Across the years, the most affected population categories were women; and people in age group 25-34 of both genders. Among all HIV patients on ART follow up, 44% were still alive, 12% died, 23% were transferred out, and 14% were lost to follow up.

Regarding the HDSS results, a total of 13,650 deaths were registered and causes of death were assigned. During the seven-year period, of all causes of death, 254(1.9%) were due to HIV/AIDS. Relatively, higher proportion of death due to HIV/AIDS (13.2%) was observed in the age group of 30-49 years. Overall, declining trends of mortality was observed. However, in the last two years, mortality due to HIV/AIDS displayed increasing trend from 5 per 100,000 mid-year population (MYP) in 2014/15 to 10 per 100,000 MYP in 2015/16. In Addis Ababa, the proportionate mortality ratio of HIV/AIDS was 10.8%. Proportionate HIV/AIDS mortality ratio is higher among females (12.1%) as compared to males (9.5%).

In the hospital study, the proportion of TB consultation among total showed a declining trend from nearly 5 % to 1.5% over the period of 2001/2 to 2015/16.The proportion of elderly among admitted primarily TB cases has steadily increased from 2.6 in 2001/2 to 9.4 in 2014/2015 and slightly declined to 8.2% in 2015/2016. The percent of admitted males was higher than female throughout the period between 2001 and 2015.

From HDSS, of the total of 13,650 deaths registered during the seven-year period 1,198(8.8%) were due to TB. Relatively, higher proportion of death due to TB (14.9%) was observed in the age group of 50 and above. In Addis Ababa, of the total 9,905 deaths for which the causes were assigned, the proportionate mortality ratio of TB was 6.0%. Both the number and proportionate mortality ratio due to TB was higher among males (6.8%) than females (5.1%).

Regarding proportion of admission among outpatient consultation, malaria as a primary diagnosis accounted for two (2%) to six (6%) percent across the years 2001/2 to 2015/16 and reaches the peak in the year 20015/16. It was higher as compared to HIV and TB from the year 2007/8 onwards. Most of the malaria case admissions were accounted for by males showing variability across different period in the last 15 years and well explained in the age group 15 and above. Malaria death rate has declined by 80% over the past 15 years, from 10% in 200/21 to 2% in 20015/16. The highest proportion of deaths due to malaria was documented in the year 2002/03 (14%).

Conclusion and Recommendations: Females shouldered higher burden of HIV consistently over the time of the study compared to males. HIV-related hospital mortality has shown a rise in terms of absolute numbers, but the proportion of deaths among HIV admissions was declining compared with the rising the rate of discharge. Individuals of age 25-49 are disproportionately affected by HIV at all given times. To reduce mortality due to HIV/AIDS, women and peoples with age group 25-49 years there should be given a special attention in which enable them utilizing the existing health care service from nearby facilities.

HDSS data showed that the proportion of death due to HIV/AIDS were high among adults age 30 to 49 years. Though decline in the proportion of deaths due to HIV/AIDS was observed in the first six years there seems to be a reversal in this trend since 2015, and it has started rising again; this is a warning sign for the control and prevention activities. National and local actions will be needed to effectively address this emerging trend. Health care institutions should be supported to work towards innovative approaches to increase the access to and uptake of HIV prevention, care and treatment services and improve retention on antiretroviral treatment. Public health authorities need to work on measures that would improve the availability and uptake of HIV services by the community via a well-designed behavioral change communication and community conversations that suit local contexts. A further study on the raise of deaths due to HIV/AIDS need to be done.
The proportion of tuberculosis cases among all consultations in studied hospitals was persistently declining but the magnitude and the rising trend in the number of tuberculosis cases indicates that TB remains one of the major public health problems in Ethiopia. The case fatality ratio among admitted TB cases was unacceptably high in the studied hospitals; this may be due to late diagnosis or because hospitals receive and manage more

complicated and severely ill cases than other health facilities do. Integration of TB control and care with other health services can help hospitals to detect more TB cases and detect them early. Further studies (TB mortality audit) should be considered to know the reasons for high mortality rates and gender disparity observed among hospitalized TB cases. The HDSS and AAMSP study showed a consistent declining trend of mortality rates due to TB. Death due to tuberculosis was high among females, urban residents and in the age group 30 to 49 years in the surveillance sites. There is an urgent need for innovative community mechanism to improve the extent and speed of TB case detection, so delayed or no diagnosis and subsequent TB death will be meaningfully averted.

Malaria deaths in hospitals exhibited a consistently declining trend over the last fifteen years. Relatively low deaths of malaria have also been observed from the total admission in the last 15 years. In relative terms higher proportion of malaria cases were consulted and admitted than TB and HIV. Males and age group above 15-year-old accounted for the majority of malaria admissions. Hence, to maintain this achievement, case management and quality of care need to be improved at all level of the health system and not to mention, sustaining a high coverage of major interventions.

1. Introduction

Evidences on the global epidemiology of infectious diseases revealed that HIV/AIDS, tuberculosis, and malaria remain the leading causes of communicable diseases mortality. It was reported that, as of 2009 about 5 million people died per year of these illnesses worldwide with substantial humanitarian, economic, and social impacts, that were still not yet fully quantified [1].

In addition, the health burdens of these diseases have significant macroeconomic effects due to the likely decrease in productivity among people in the most reproductive and productive age groups mainly in sub-Saharan Africa (SSA). Sub Saharan Africa countries including Ethiopia are not only economically disadvantaged, but also the most HIV, TB and Malaria affected countries in the world. Although these diseases are considered major public health concerns worldwide, HIV and malaria are more concentrated in Sub-Saharan Africa (SSA) while tuberculosis is predominantly high in South-East Asia and Western Pacific Regions [2].

Furthermore, in many developing countries including Ethiopia ,HIV/AIDS ,TB and Malaria epidemics threaten the health of the poorest segments of the population, and more than 95% of all deaths from the three diseases worldwide occur in these countries [2].

The high global priority according to these epidemics in developing countries was confirmed through the establishment of the Global Fund to Fight AIDS TB and Malaria in 2002. In addition, in the newly developed Global agenda of Sustainable Development Goals, Goal 3 of "Ensure healthy lives and promote well-being for all at all ages " has a specific call to end the epidemics of HIV, TB and malaria by 2030 [3].

The fight against these three diseases of public health significance requires continuous efforts to generating evidence to inform decisions. Data generated from various sources such as routine facility records, surveys, surveillance, vital registration systems and focused research should be systematically analyzed and triangulated to enable monitoring the trends and measuring the impact of interventions against these diseases. Hospital records and health and demographic surveillance sites (HDSS) represent some of these important sources of data to track progress and impact of disease control efforts.

1.1 HIV/AIDS

HIV /AIDS is one of the most destructive pandemics human kind has ever faced [4]. The multifaceted tragedy arising from HIV / AIDS is one of the biggest health and development challenges the World has ever noticed

in modern history [5]. It is a critical development issue that affects the lives of millions of people and a global crisis with consequences that will be felt for the upcoming decades [6, 7].

HIV/AIDS remains complex and incurable and devastates individuals, communities and nations. Despite millennia of epidemics, war and famine, never before in history have death rates of this magnitude been seen among young adults of both sexes and from all walks of life [8, 9].

According to UNAIDS report, globally, an estimated 36.7 million people were living with HIV in 2016 [10]. . Since the start of the global HIV pandemic, women have been disproportionately affected by HIV in many regions. Today, women constitute more than half of all people living with HIV [11, 12]. In addition, it was reported that, since the start of the HIV epidemic, an estimated 78 million people have become infected with HIV and 35 million people have died of AIDS-related illnesses with 1 million deaths in 2016 [13].

The effects of the HIV epidemic are felt most severely in some of the world's poorest countries in sub-Saharan Africa. [14,15]. Ethiopia is among the countries most affected by the HIV epidemic. With an estimated adult prevalence of 1.5%, it has a large number of people living with HIV (approximately 800,000) and about 1 million AIDS orphans [16].

While AIDS-related deaths are declining due to biomedical interventions supported through social protection mechanisms, a study on the Global Burden of Diseases, Injuries, and Risk Factors showed that in 2010 AIDS remained to be the fifth-leading cause of disease-related deaths, with an estimated 1.5 million AIDS-related deaths [17].

The national HIV prevalence among adult people in Ethiopia has marked variability across the age group, sex, and geographical location. The prevalence among females was almost twice (1.9%) that of males (1.0%). In addition, the adult HIV prevalence of the country is much higher in urban areas (4.2%) than in rural areas (0.6%) [18].

Furthermore, since the first case of HIV was reported in 1986, numerous efforts have been exerted in Ethiopia both by the government and its partners working in the area to reduce the effect of the disease. Ethiopia took a big leap by starting the provision of antiretroviral therapy (ART) in 2003/04, and rapidly scaling up free ART

for all eligible patients ever since. This rapid ART scale up has been considered as one of the most remarkable achievements in combating the effects including mortality due to HIV/AIDS and related causes among different population segments [19, 20].

Thus, conducting the study on trends of hospital admissions, consultations and HIV-related mortality using various data sources (e.g health and demography surveillance sites under the local universities; also pertinent records of selected hospitals) was believed to play pivotal role in evaluating the effects of various interventions against HIV /AIDS epidemic by different sectors and actors in the country. This study is also expected to contribute significantly towards evidence-based strategic and operational decisions.

1.2 Tuberculosis

According to WHO report, Ethiopia is among the 30 high burden countries for TB, TB/HIV and MDR-TB with estimated TB prevalence and incidence rates of 200 and 207 per 100,000 population in 2014 [21].Considering TB as one of the major public health challenges for the country, the FMOH has given due attention and include TB prevention and control among major priority programs [22]

Since 1997, much has been done to improve accessibility of TB diagnostic and treatment services to rural communities by equipping and staffing newly constructed primary health care units with microscopes, GeneXpert machines and trained health manpower [23, 24]. Community based TB care intervention has been implemented as part of health extension program package since 2004, to decentralize TB case finding and treatment supervision to the level of health posts [25]

As a result, the country has achieved tuberculosis related MDG targets by halting and reversing the incidence rate from 369 in 1990 to 224 per 100,000 population in 2014. It has also reduced TB prevalence and mortality rate by more than half compared to the 1990 baseline values.

Despite these achievements one-third of incident TB cases remained undetected and only a third of estimated drug-resistant TB cases are getting proper treatment every year [21]. Hence, Tuberculosis remains among the top ten causes of mortality in the country [24].

Cognizant of the facts, Ethiopia is required to exert much more effort to detect the missed one-third new TB cases and effectively treat at least 90% of notified TB cases.

1.3 Malaria

Malaria has been a major public health problem in tropical and subtropical regions of the world. Globally, annual malaria deaths remained just less than half a million, rendering it a disease of public health importance[25, 26].Moreover, resurgence of the disease has been noticed both in some African countries [27-31] and in areas where it had been previously eliminated [32]

Sub-Saharan Africa (SSA) is a home to the deadly species, *Plasmodium falciparum (Pf)*, and two-third of the population is at risk of acquiring the disease [33]. In the year 2015, 90% of 212 million malaria cases and 92% of 429 thousand deaths, mostly (71%) among children under the age of five years, were from the Africa region [34].

To curb this devastating disease, a series of actions have been taken in a wake of the failure of the Global Malaria Eradication Program, including efforts to form global partnership and funding mechanisms to sustain control programs. Among the notable ones are the Harare declaration in 1997, and subsequent Abuja declaration in 1998signed by African heads of state to redefine and materialize the Harare declaration. This was followed by African Submit of 2000 on role back malaria (RBM) as well as the Millennium Development Goals (MDGs) in 2000, when strategic plan was drawn and commitment realized to halve malaria mortality by 2015, through the establishment of the Global Fund in 2002 and the US President's Malaria Initiative in 2005.Furthermore, the Sustainable Development Goals (SDGs) put an ambitious goal to eliminate malaria by 2030 and to end malaria by 2040[35].

Consequently, there have been remarkable achievements in reducing the number of malaria cases and death in most parts of the world, including the African region.

Malaria mortality rates are estimated to have fallen by 69% globally between 2000 and 2015 and by 35% globally between 2010 and 2015, including a 38% decline in the WHO African Region between 2010 and 2015 [34].

Studies conducted in different African countries showed generally decreasing trends of malaria burden. For instance, population based studies in Tanzania demonstrated decline trend of malaria in different geographical zones of the country, where malaria mortality and cumulative probability of deaths evidently reduced over a decade from 2000 to 2010 [36]. Health facility based study conducted in South Africa, showed that, males were reported to have been more affected than females [37]. A similarly study conducted in Mozambique also showed the average malaria mortality rate over five-years period was higher among males than females [38].

Historically, malaria in Ethiopia has been the leading cause of outpatient visits, hospitalization and inpatient deaths. Malaria prevention and control is a high priority of the Ethiopia government. In line with this, a huge scale up of anti-malaria interventions has been implemented since 2005[39]

As a result of the successful scale-up for impact (SUFI) of the globally recommended interventions, massive expansion of health facilities and the effective implementation of the innovative Health Extension Program (HEP), trends in outpatient and inpatient admissions and deaths has dramatically declined and the frequency of epidemics has halted throughout the country [40].

Sustained high coverage of such interventions has led to a monumental reduction of health facility based malaria morbidity and mortality by more than 47% and more than 84%, respectively, between 2012 and 2017 [41]. Similarly, the most recent world malaria report indicates that in Ethiopia malaria incidence and death decreased by 50% and 60% respectively, between 2010 -2015 [34]. Ethiopia has achieved a remarkable decrease in malaria-related deaths by 73% during the MDGs era [42, 43]. Furthermore, the intensity of transmission in most parts of the country is now low and even very low in some areas. The latest malaria indicator survey revealed a microscopy parasite prevalence of 0.5% in areas < 2,000 masl [44]. However, it is to be noted that the decrease in malaria burden has not been uniform throughout the country.

According to the annual performance report of the FMoH 2017, the total malaria cases treated in health facilities were 1,820,967 and the Case Fatality Rate (CFR) was reported to be 0.02 percent. Out of the confirmed malaria cases 1,088,495 (68.5%) were Plasmodium falciparum (PF) and 499,302 (31.5%) were Plasmodium vivax (PV) [40].

Thus, encouraged by the gains following the SUFI, the Federal Ministry of Health (FMOH) declared and committed itself to implement sub-national malaria elimination in areas of low transmission where feasible and scale up to the national level to eliminate malaria by 2030 using a step wise approach strategy [39, 45].

1.4 Objective

The aim of the study was to assess the trends in hospital admissions, outpatient consultations and mortalities related to HIV/AIDS, TB and Malaria at selected hospitals, Health and Demographic Surveillance Sites; and Addis Ababa Mortality Surveillance Program in Ethiopia.

Specific Objectives

1. To analyze trends in HIV, TB and Malaria hospital admissions and outpatient consultations over the years (2001/2 – 2015/16).
2. To assess trends in hospital deaths related to HIV, TB and Malaria over the years (2001/2 – 2015/16)
3. To assess trends in community based deaths due to HIV, TB and Malaria from verbal autopsy data over the years (2009/10 – 2015/16)

2. Methods

2.1 Study Period and Design

The hospital based study employed a retrospective facility-based register review of data for the period of 2001/2 – 2015/16.

The HDSS sites employed an open dynamic cohort study design in which deaths are registered continuously among all population groups by local community field workers and local guides over the period of 2009/10 to 2015/16. Longitudinal data from geographically defined six networked University-led Health and Demographic Surveillance Sites (HDSS) and Addis Ababa mortality surveillance program were used to estimate proportionate mortalities specifically due to HIV, TB and Malaria, using verbal autopsy (VA) to determine causes of death.

2.2 Data Sources and study population

The hospital based study made use of retrospectively collected data from 31 purposively selected and geographically diverse set of hospitals for HIV/AIDS, TB and Malaria, over the period 2001/2 to 2015/16. All patient records of the above mentioned hospitals were included in the study for the period specified above. Data abstraction was done from all registers of HIV/AIDS, TB and Malaria inpatient and outpatient departments of respective selected hospitals. Routine health service registers were reviewed and data collected on hospital deaths, admissions and outpatient consultations related to HIV/AIDS, TB and Malaria. Compatibly designed data collection sheets were used to extract data from routine facility registry for outpatient consultations, treatment follow-up, admissions and outcomes for each disease category. Experienced individuals from each facility were selected, trained and assigned to capture data in data collection sheets designed for the study.

For the HDSS community based VA data, causes of deaths were assessed and those due to HIV/AIDS, TB and Malaria were considered. These VA data was compiled from each HDSS sites to generate evidence on death at the community level, attributable to the three major infectious diseases in Ethiopia from 2009/10 to 2015/16. Regarding Addis Ababa Mortality Surveillance Program (AAMSP), the mortality was analyzed by considering data from the period 2007 to 2016 though the data for 2013-2014 was not available by registering deaths from the burial by cemetery clerks.

2.3 Sampling

The data was collected from thirty one purposively selected hospitals from all regional states and two city administrations.

The selection of hospitals is made from all regions and two cities administrative, the inclusion of reasonable number of hospitals from all regions were also considered. With regard to HDSS, all sites in the country were included, while each site sufficiently represents specific localities, the surveillance sites are established and managed by six major public universities located in different corners of Ethiopia. Besides, Addis Ababa Mortality Surveillance Program was also included.

2.4 Inclusion criterion

- All records of patients on treatment follow up at TB and ART clinic
- All outpatient and inpatient HIV, TB and Malaria cases.
- All complete patient's record.
- Patients died of any cause of death during treatment follow up of TB.

2.5 Data collection tools and procedures

For hospital based study, in each case a standardized data collection tools or/and checklists (Annex) were prepared to collect information on individual patients from hospital registers. Gender and age disaggregated data were collected from hospital registers, treatment records and patient cards on overall and HIV/AIDS, TB and Malaria outcomes, outpatient consultations and admissions as per the above inclusion criteria.

For HDSS, after the recorded deaths by local guides and field data collectors were reported to verbal autopsy interviewers, interviewing of family members who closely cared for the deceased or close relatives was done by verbal autopsy interviewers. For data collection, three age specific verbal autopsy questionnaires that included deaths occurred during the first 28 days of life, children between four weeks and 14 years of age and deaths to persons aged 15 years and above were used. The questionnaires were translated into *Amharic, Oromifa and Tigrigna* for site specific uses as interview is conducted using local languages. The questionnaires included information on age, sex, place of death, cause of death, a short narrative history of illness about signs, symptoms with durations, signs and symptom different conditions and health services use in the period before death.

Locally accepted mourning period, that is 30 to 45 days, was considered before conducting the VA interview. On the day of interview, trained VA interviewer arrived at the residence of the deceased and interviewed the person who was mostly involved in caring for the deceased during the illness prior to death or close relative. In case of absence of an appropriate respondent, up to three revisits were made to conduct the interview. VA data

collectors put all efforts to collect accurate and completed data, then; the filled questionnaires were submitted to supervisors for checking, approval and submitting to physicians for cause of death assignment.

Cause of death assignment: Two physicians, trained in VA diagnosis and coding procedures assigned VA codes and titles as well as cause of death using the WHO International Classification of Diseases (ICD) version 10 for the most probable underlying cause of death independently using information in VA questionnaires and based on VA coding system. Cause of death was assigned if the two independent coders agree on the same VA code and title. If the two physicians disagreed the third tie breaker physician conducted an independent review of the disagreed cases. If the tie breaker agreed to either one of the previous two physicians again with VA code and title, the underlying cause of death was assigned, otherwise it was labeled as undetermined.

2.6 Recruitment and Training of Field Staff

For data collection from hospitals, EPHI identified and recruited health professionals working in Outpatient Department, ART and TB clinics of the respective selected hospital as data collectors and the hospital head as supervisor/team leader besides timely supervision from concerned EPHI Staff.

Although the field staffs were assumed to have knowledge of patients' data organization and setup, two days intensive training was given on the objectives of the assessment, methodological approaches, data tracking tools and procedures to be followed.

The six HDSS sites and AAMSP have got respective research team members, local guides, field data collectors, data entry clerks, data managers and verbal autopsy interviewers. All field workers received basic and refresher trainings on how to manage field activities and interview the respondents.

2.7 Data Management and Analysis

Regarding data collected from hospitals, for the data entry team, orientation has been given on the survey questionnaires, the nature of the data to be computerized, and the data entry template. Double Data entry, cleaning and analyses were done using software SPSS 20. In order to control for possible errors during data entry, validation techniques such as supervision and running intermediate frequencies were employed. Tabulation and analysis were also done based on trend finding from each disease category over predefined period.

In each HDSS site both the verbal autopsy interviews and physician assigned causes of death data were entered into EPI Data entry, excel or SPSS databases and exported to STATA. Before conducting data analysis, network and site level variables were standardized and coded with agreed classification and labels and merged

together for pooled analysis. STATA version 14 was used for cleaning and description of the pooled data. Results were summarized in tables and graphs based on causes of death, time and background characteristics of the deceased. Proportionate mortality of cause specific mortality ratio and cause specific mortality rates were calculated to measure the magnitude of cause of death from reported deaths and mid-year population of all sites.

2.8 Ethical considerations

The content of the proposal for the study on hospitals were reviewed and approved by scientific and ethical review committee of the Ethiopian Public Health Institute (EPHI) for its conformity with basic guidelines for ethical clearance of the Institute.

The HDSS and AAMSP received ethical clearance from Ethical Review Committee of their respective universities, Ethiopian Public Health Association (EPHA), and US Centers for Disease Control and Prevention (CDC). During the recording of deaths by local community members or guides or verbal autopsy interviewers, head of household or adult member of the family was interviewed and informed verbal consent was obtained. From each site de-identified data was shared for the pooled analysis and no identification variable was reported.

2.9 Limitations of the assessment

The study considered secondary data kept as a routine patient care at the hospitals. In addition we have attempted to collect patient data over the last fifteen years in the face of poor documentation practices. Thus the quality of information obtained from these finding is to some extent affected by incompleteness and unavailability of patient data. Another anticipated limitation of the current assessment could be patients lost to follow-up among which mortality tends to be always underestimated.

For VA data, there is no “pathognomonic” or unique sign or symptom for TB, verbal autopsy do not distinguish TB well, especially in very young children. Exceptionally for Addis Ababa Mortality Program the causes of death identification using VA has been dependent on cemetery based, it might not include all death of neonatal age groups due to unregistered burial practice.

3. Key findings by source

3.1 Key findings from Hospitals

- The trend of HIV cases was increased from 2001/2 to 2014/15; but slightly decreased in 2010/11 and 2013/14; however, major decline of HIV cases was observed in 2015/16 especially for females.
- The age groups, most infected by HIV in the year between 2001/2 to 2015/16 were 25-34 years and 35-49 years respectively. The least affected age groups by HIV between the year 2001/2 to 2015/16 was people who were >=65 years old.
- The annual number of new HIV patients enrolled to HIV care and treatment in the selected hospitals increased from 71 at the beginning of 2001/2 to 20,598 in 2006/7 then decreased constantly until 2015/16. Across the years, more women than men were registered with HIV.
- Among people who were enrolled on ART over the past 15 years, half (50%) of them were alive, a quarter (23%) of them were transferred out to another facility, and only 11% were reported to have died.
- The proportion of hospital consultations with primary diagnosis of tuberculosis showed a declining trend from 5.5 % in 2003 to 1.2% in 2014.
- The proportion of children <15 years and elderly above 64 years among admitted TB cases was low compared to other age groups.
- The percentage of elderly people among those admitted primarily due to TB showed an increasing trend from 2.3% in 2002/3 to 9.4 in 2015/16.
- The percentage of males among admitted TB cases was higher than that of females throughout the study period from 2001 to 2015.
- Proportion of admitted TB cases with unknown treatment outcome showed declining trend starting from 2006.
- The case fatality rate among admitted TB cases varied from 10% to 18%.
- The pattern of patients who were lost to follow up steadily decreased during the years 2014/15-2015/16.
- The proportion of Malaria as a primary diagnosis ranges from 2 to 6% across the 2001/2 to 2015/16 study years and reached to pick on the year 20015/16.
- The proportion of Malaria as a primary diagnosis was higher as compared to HIV and TB from the year 2007/8 onwards.
- Most of the malaria case admissions were accounted by males showing variability across different period in the last 15 years.
- The variability of malaria cases admissions was noted to be higher among males and in the age category 15 and above.

- A total of 1,575 malaria deaths were documented out of the 29,376 malaria cases admitted, representing in-patient case fatality rate of 5.4%.
- The highest proportion of death due to malaria was documented during 2002/03 (14% of malaria admission).

3.2 Key findings from Health and Demographic Surveillance sites

- Relatively higher proportion of death due to HIV/AIDS (13.2%) was observed in the age group 30-49 years.
- Majority of the deaths due to HIV /AIDS (84.5%) occurred at home and among the rural residents.
- HIV/AIDS mortality rates showed a declining trend by an amount of 39.8% from 2009/10 to 2015/16. Between 2009/10 and 2014/15 the decline was even more marked reaching 70.0%. However in recent years, mortality rate due to HIV/AIDS has exhibited alarmingly increasing tendency, from 4.9 deaths per 100,000 population in 2014/15to 9.8 per 100,000 population in 2015/16.
- Proportionate HIV/AIDS mortality ratio is higher among females (12.1%) as compared to males (9.5%).
- Of all child deaths of age under 15 years, deaths caused by HIV/AIDS constituted 1%. HIV/AIDS related proportionate mortality ratio is highest among those who are in the age range of 25-49 years. The figure for youths of age 15-24 (17.2%) is also higher than the overall average
- The AAMSP showed that, more than three in five (63.0%) of the deaths occurred at home.
- The proportionate mortality ratio due to HIV/AIDS in Addis Ababa showed significant decline throughout the observation period
- Death rates due to TB showed a significant decline of 41.0%from 2009/10 (59.3 per 100,000 population) to 2015/16. (35.0 per 100,000 population).
- Deaths due to TB were higher among females than males.
- Death due to TB in rural residents was higher than urban residence.
- Deaths due to TB were high in the age group 30 to 49 years in the HDSS sites mirroring that of HIV deaths in these age groups.
- Malaria related mortality rate had shown a significant declining trend of 79.8% from 2009/10 (43.0 per 100,000) to 2015/16 (8.7 per 100,000)
- Out of the total 13,650 deaths, during the seven-year period, of all causes of death, 522 (3.8%) were due to malaria
- Over the seven year period, there was a marked variation of mortality due to malaria among the HDSS sites, higher malaria mortality rates were documented in Gilgel Gibe and Arba-Minch HDSS sites.

- The number of deaths due to malaria was relatively higher in rural (443) compared to urban(79) areas,
- There was no remarkable difference between male (256) and female (266) malaria deaths, whereas relatively higher number of deaths were recorded among children less than 5 years of age (132) and elders >50 years (166) compared to other age groups.

4. Result from Hospitals

4.1 Outpatient consultation

Table 1 below presents the percent distribution of HIV/AIDS, TB and Malaria from 2001/2 to 2015/16.

The proportion of Tuberculosis as a primary diagnosis was 5% followed by malaria (3%) and HIV/AIDS (< 1%) from the total number of outpatient consultation in selected hospitals in 2001/2. In 2015/16, the percentage of malaria as primary diagnosis from total consultation was higher (6%) compared to both HIV/AIDS and TB (1%) (Table 1 and Figure 2).

Table 1 Percentage distribution of HIV/AIDS, TB and Malaria as primary diagnosis from total number of outpatient consultation by year, Ethiopia 2001/2-2015/16

Year	HIV Primary diagnosis		TB Primary diagnosis		Malaria Primary diagnosis		Total consultation
	n	%	n	%	n	%	N
2001/2	603	0	9692	5	6179	3	199645
2002/3	1298	1	11617	5	5088	2	236765
2003/4	1361	0	22142	5	12126	3	403116
2004/5	4461	1	13767	3	9772	2	480917
2005/6	11080	3	13296	3	13128	3	440644
2006/7	13175	3	11153	2	10700	2	468581
2007/8	13742	2	11812	2	18195	3	565454
2008/9	12072	2	13565	2	19860	3	629794
2009/10	12761	2	24086	3	40193	5	739983
2010/11	13198	1	27762	2	51824	3	1844792
2011/12	12968	1	25799	2	54672	4	1258309
2012/13	13249	1	25562	2	52202	4	1241463
2013/14	12357	1	25856	2	56571	4	1372090
2014/15	11146	1	20144	1	77399	5	1674115
2015/16	11250	1	21512	1	101161	6	1604186

The overall trend of HIV/AIDS, Tuberculosis and Malaria as primary diagnosis from the total consultation in selected hospitals registrations is presented on Figure 1.

From 2001/2-2004/5, it is clearly observed that proportion of Tuberculosis as a primary diagnosis from total number of consultations was relatively high followed by malaria and HIV/AIDS.

From the year 2009/10-2015/16 of the total number of consultation, the proportion of malaria as a primary diagnosis was relatively high followed by Tuberculosis and HIV/AIDS.

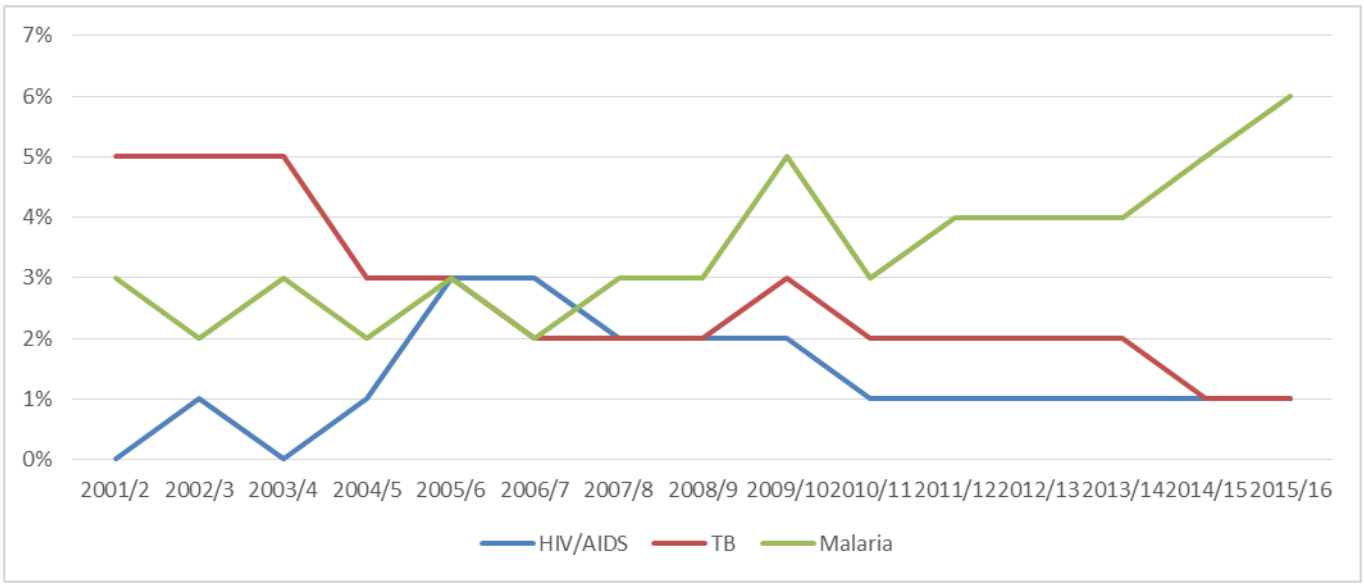

Figure 1 Percent of HIV/AIDS, TB and Malaria outpatient primary diagnosis from total number of consultation by year, Ethiopia 2001/2-2015/16

4.2 Number of admissions

Table 2 below depicts the percent distribution of HIV/AIDS, TB and Malaria patients in medical, pediatric, emergency and other wards to show the trend of their number of admissions by year.

The admission proportion of HIV/AIDS patients were higher (8%) in medical ward and relatively lower in pediatrics ward (less than one percent) in 2001/2. Similarly, in 2015/16 the percentage admissions of HIV/AIDS patients were higher (31%) in medical ward, and less than one percent in other wards.

Figure 2 below depicted the overall trend of HIV/AIDS in medical, pediatrics, emergency and other wards. Accordingly, it is clearly observed that proportion of HIV/AIDS patient admission in medical ward was higher than admissions from all other wards from 2001/2-2015/16.From 2002/3-2008/9, there was no admissions of HIV/AIDS patients in emergency and other wards. The trend of HIV admissions in pediatrics ward was increasing from 2002/3-2006/7, it showed decrement pattern during 2008/9-2009/10.

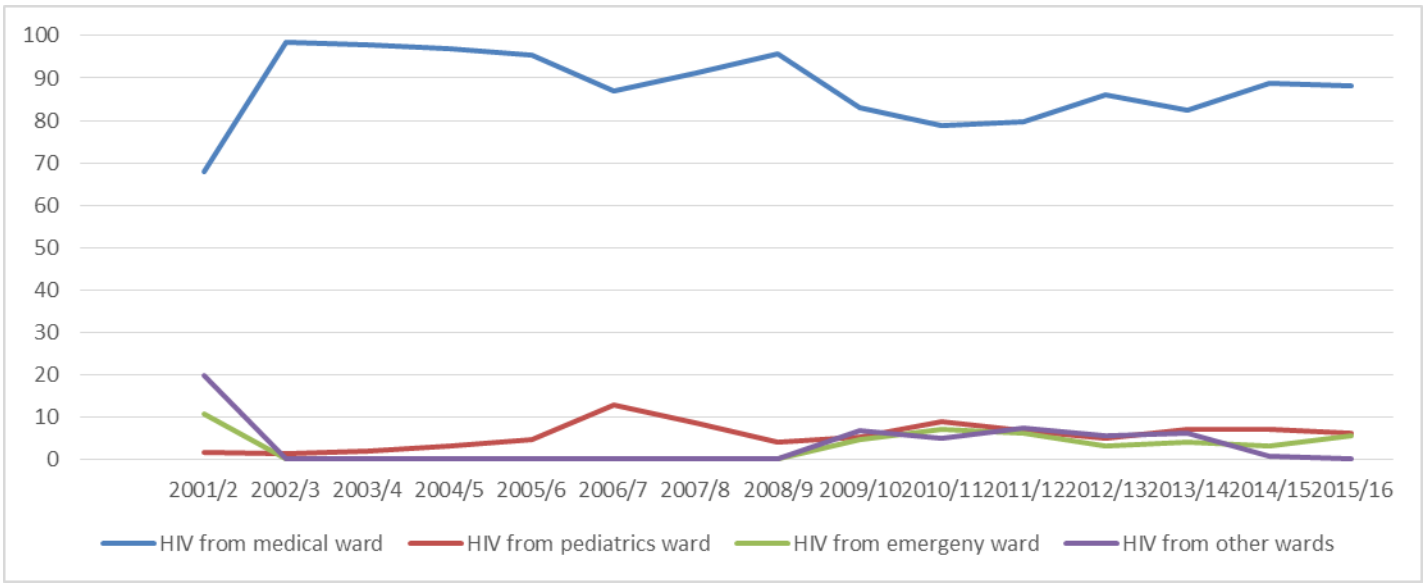

Figure 2 Trend in proportion of HIV/AIDS admissions by wards and year, Ethiopia 2001/2-2015/16

The proportion of admissions of TB patients were higher (25%) in medical ward and relatively lower in emergency ward (1%) in 2001/2. While in 2015/16 the percentage of admissions were higher in medical ward (32%), and one percent in emergency ward.

Figure 3 below described the overall trend of TB patient admission in medical, pediatrics, emergency and other wards. Hence, it is clearly observed that proportion of TB patients admission in medical ward were higher than admissions in all other wards from 2001/2-2015/16. From 2002/3-2008/9, the percentage of TB patient admission in emergency and other wards was less than one percent. Generally, the trend of TB admissions in medical ward shows increment pattern from 2011/12-2015/16.

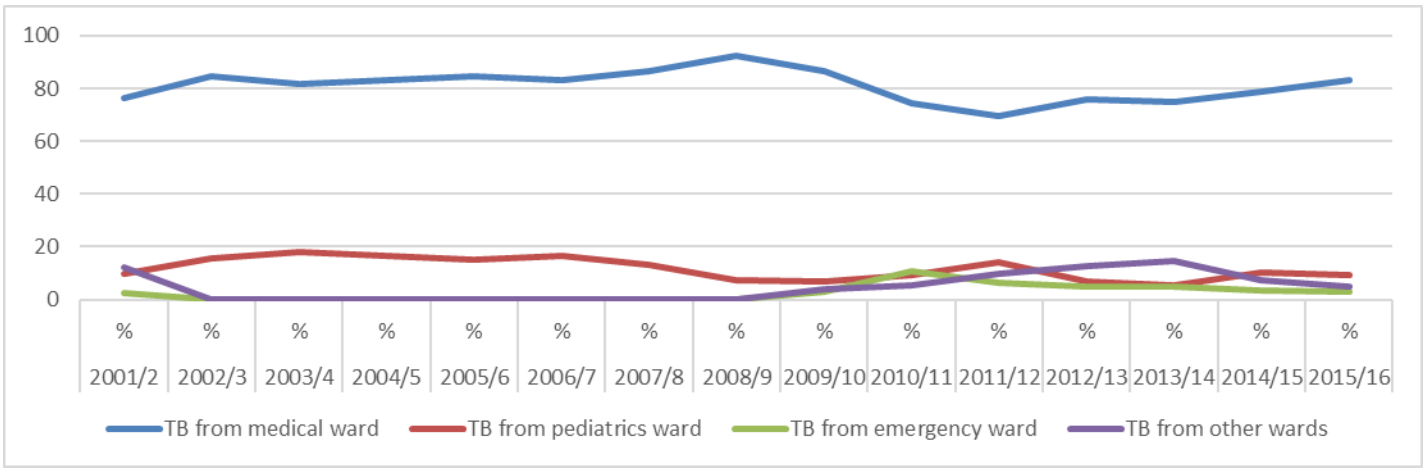

Figure 3 Trend in proportion of TB patient admission by wards and year, 2001/2-2015/16

The proportion of malaria patients admission were higher (34%) in medical ward and relatively lower in emergency ward (less than one percent) in 2001/2. Likewise, in 2015/16 the percentage of admissions on malaria was higher (13%) in medical ward, and less than one percent in emergency wards.

Figure 4 below depicted the trend of malaria patient admission in medical, pediatrics, emergency and other wards. Hence, it is clearly observed that proportion of admissions of malaria in medical ward were high, followed by pediatrics ward from 2001/2-2015/16. From 2001/2-2009/10, the percentage of malaria admissions in emergency ward was less than one percent.

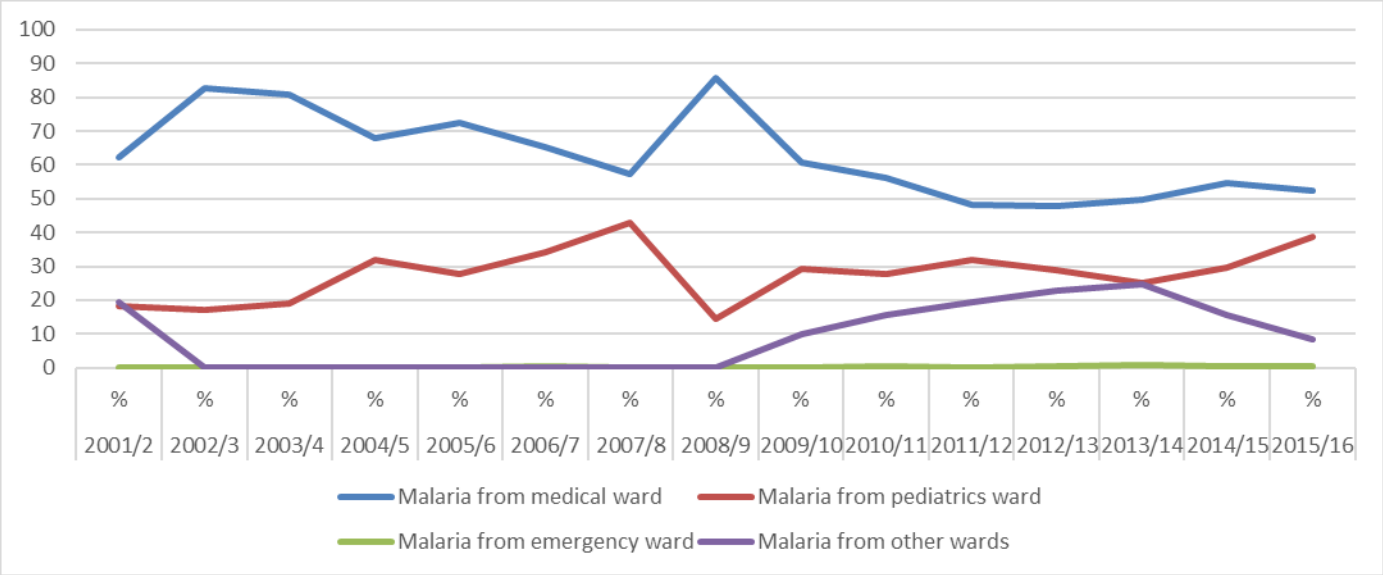

Figure 4 Trend in proportion of malaria patient admission by wards and year, Ethiopia 2001/2-2015/16

Table 2 Percentage distribution of HIV/AIDS, TB and Malaria admissions by ward and year, Ethiopia 2001/2-2015/16

	Year																													
	2001/2		2002/3		2003/4		2004/5		2005/6		2006/7		2007/8		2008/9		2009/10		2010/11		2011/12		2012/13		2013/14		2014/15		2015/16	
	n	%	N	%	N	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
HIV from medical ward	206	8	205	8	196	7	343	10	705	24	771	21	1234	26	1854	29	1787	20	1502	19	2192	22	2742	28	2345	27	2635	30	2757	31
TB from medical ward	639	25	896	36	693	26	924	28	829	28	1157	31	1327	28	1865	29	1920	22	1429	18	1556	16	2209	23	2511	29	2525	29	2833	32
Malaria from medical ward	864	34	1000	40	1299	49	1264	38	875	30	934	25	1106	23	2106	33	2674	30	2326	29	2353	24	1716	18	1185	14	1410	16	1177	13
HIV from pediatrics ward	5	0	3	0	4	0	11	0	34	1	115	3	118	2	81	1	116	1	171	2	189	2	162	2	204	2	213	2	195	2
TB from pediatrics ward	80	3	164	7	153	6	185	6	148	5	228	6	204	4	148	2	147	2	178	2	317	3	195	2	187	2	323	4	309	4
Malaria from pediatrics ward	255	10	209	8	307	12	595	18	334	11	490	13	828	17	353	6	1282	15	1138	14	1551	16	1040	11	592	7	764	9	872	10
HIV from emergeny ward	33	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	101	1	136	2	168	2	101	1	115	1	94	1	173	2
TB from emergency ward	19	1	0	0	0	0	0	0	0	0	2	0	0	0	2	0	69	1	207	3	147	1	148	2	168	2	105	1	93	1
Malaria from emergency ward	0	0	0	0	0	0	0	0	1	0	5	0	0	0	0	0	6	0	22	0	12	0	19	0	17	0	8	0	10	0
HIV from other wards	60	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	147	2	96	1	204	2	178	2	180	2	25	0	0	0
TB from other wards	101	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	86	1	105	1	219	2	364	4	490	6	242	3	174	2
Malaria from other wards	268	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	441	5	644	8	945	10	816	8	583	7	400	5	190	2

4.3 HIV/AIDS cases and deaths

Figure 5 shows trends of HIV from 2001/2 to 2015/16 by sex. The trend of HIV cases increased during the period 2001/2 to 2014/15; slowing down in 2010/11 and 2013/14; followed by a major decline in 2015/16 especially for females. The trend was consistent between both sexes; except less cases of HIV infection in males than females in the years from 2004/5 to 2015/16.

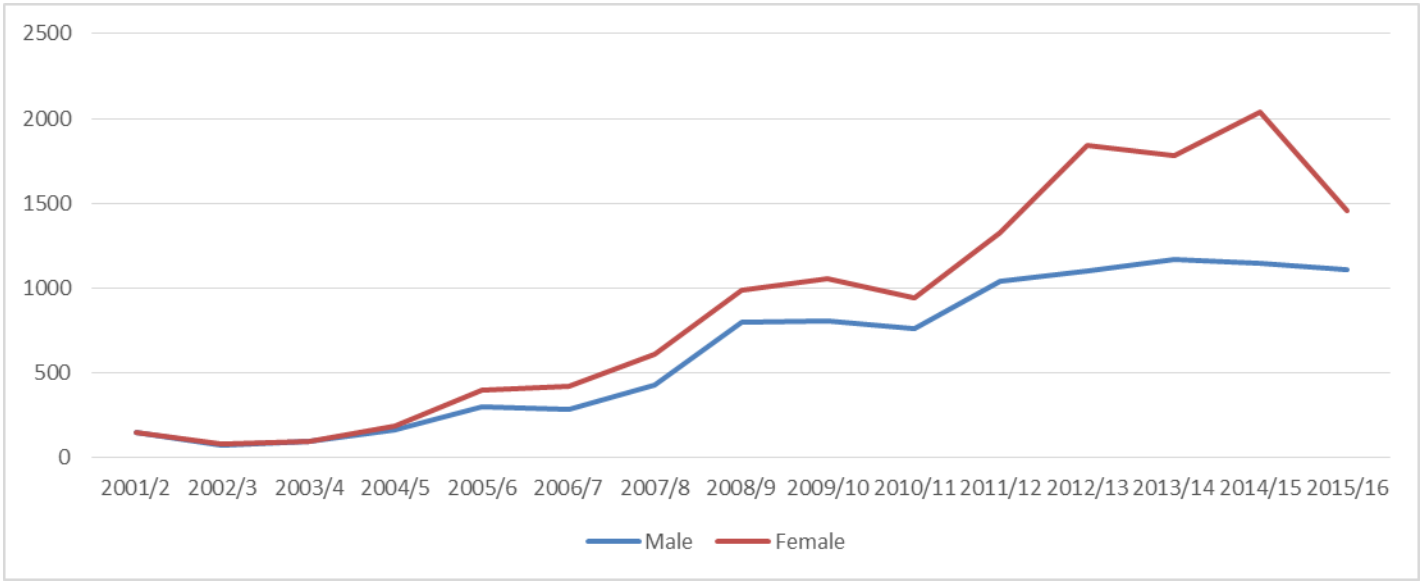

Figure 5 Number of HIV cases by Sex, Ethiopia 2001/2-2015/16

Figure 6 shows outcome of HIV patients after admission. As shown on the figure the number of HIV patients discharged with improvement after admission was increased dramatically from 2001/2 to 2015/16; except a minor decrease in 2010/11 and 2015/16. Death from HIV exhibited gradual increase between the years 2001/2 to 2012/13 (partly due to improved coding and reporting of HIV deaths), and has plateaued since then.

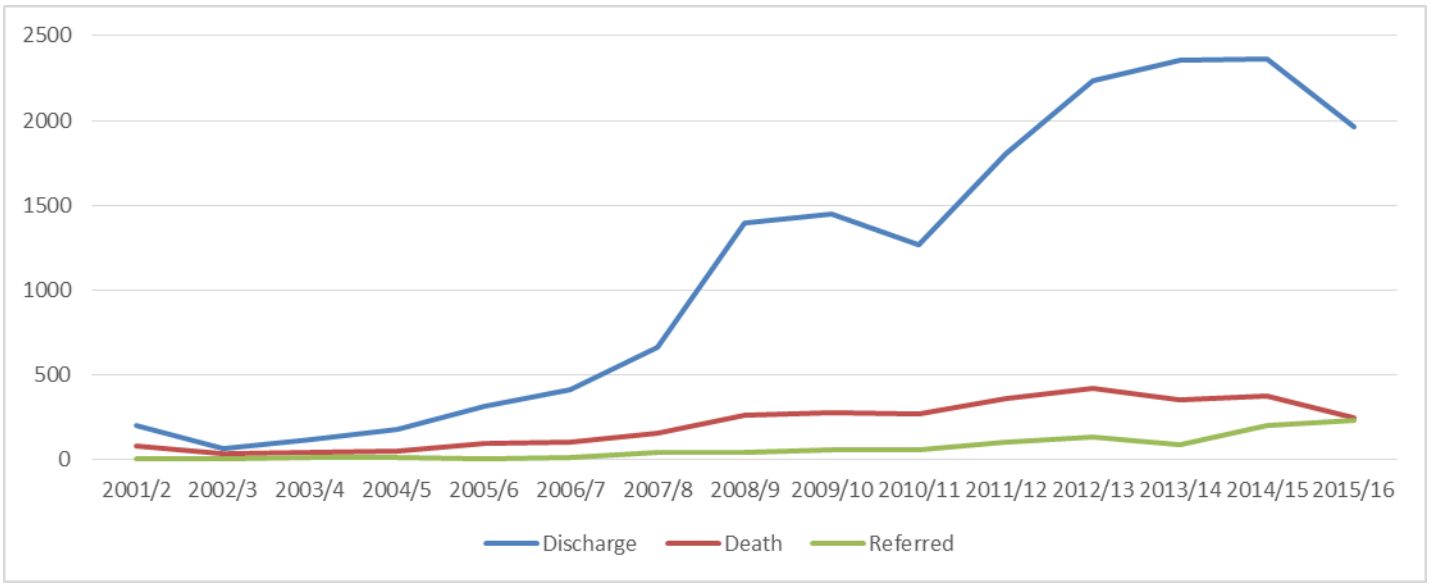

Figure 6 Percentage of HIV cases by outcome, Ethiopia 2001/2-2015/16

Figure 7 presents the percentage distribution of HIV infections among different age groups from the year 2001/2 to 2015/16. As it is presented on the graph, the most HIV affected age group in the year between 2001/2 to 2015/16 were 25-34 years and 35-49 years respectively; for instance, in the year 2005/6 among the total cases of HIV infection about 47% of cases were observed between 25-34 years; while about 31% of cases were observed in people with age group 35-49 years. And the least affected age group by HIV between the year 2001/2 to 2015/16 was people who were >=65 years old, followed by those who were <=14, and 50-64 years old respectively. Proportion of HIV cases in the age group 15-24 has steadily declined, with minor fluctuations, from 17% of total HIV cases in 2003/4 to 11% in 2015/16. This trend is a good news for the program, as reported HIV in this age group serves as a proxy to new HIV infections.

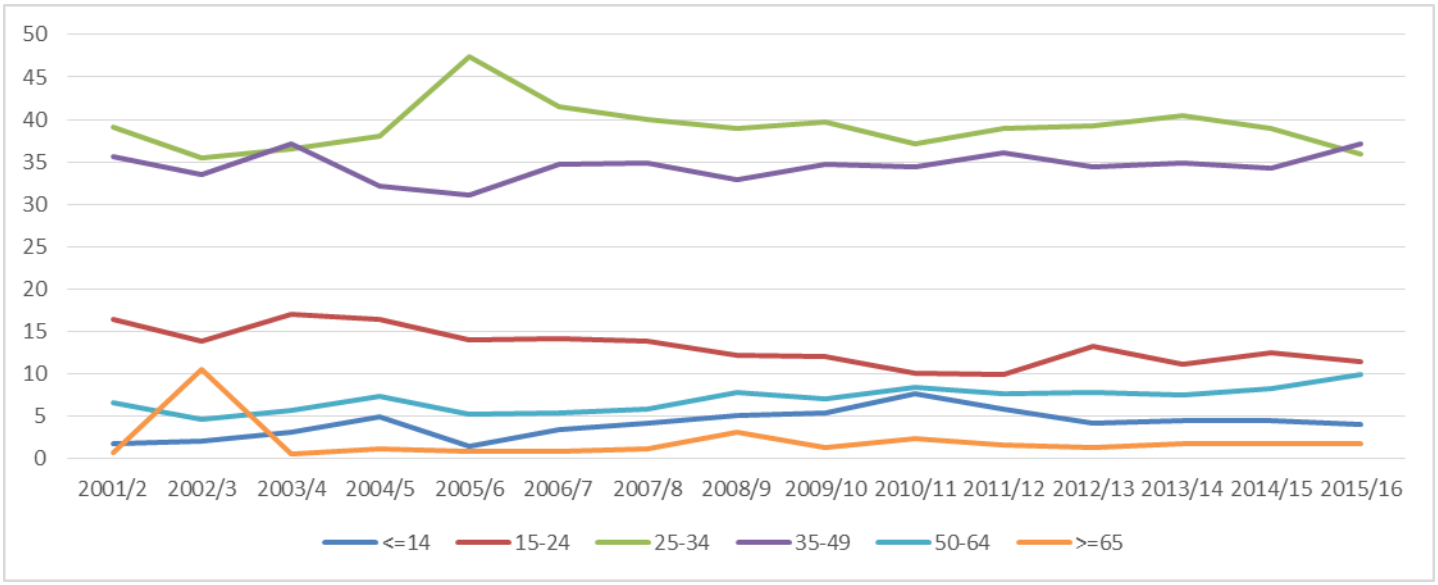

Figure 7 Percentage of HIV cases by age category, Ethiopia 2001/2-2015/16

Table 3 Hospital admission to hospitals primarily due to HIV/AIDS by year, Ethiopia 2001/2-2015/16

	Year																													
	2001/2		2002/3		2003/4		2004/5		2005/6		2006/7		2007/8		2008/9		2009/10		2010/11		2011/12		2012/13		2013/14		2014/15		2015/16	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Age																														
<=14	5	2	3	2	6	3	17	5	10	1	24	3	43	4	91	5	100	5	130	8	137	6	120	4	130	4	144	5	103	4
15-24	48	16	21	14	33	17	56	16	97	14	99	14	144	14	217	12	224	12	170	10	236	10	388	13	328	11	397	12	294	11
25-34	114	39	54	36	71	37	130	38	331	47	290	42	415	40	695	39	742	40	632	37	924	39	1153	39	1191	40	1238	39	920	36
35-49	104	36	51	34	72	37	110	32	217	31	242	35	362	35	587	33	649	35	586	34	855	36	1013	34	1028	35	1088	34	951	37
50-64	19	7	7	5	11	6	25	7	36	5	37	5	61	6	140	8	130	7	142	8	183	8	228	8	220	7	260	8	255	10
>=65	2	1	16	11	1	1	4	1	6	1	6	1	12	1	54	3	23	1	40	2	39	2	37	1	50	2	55	2	43	2
Sex																														
Male	144	49	73	48	96	49	160	47	302	43	282	40	431	42	796	45	809	43	757	45	1043	44	1097	37	1167	40	1146	36	1109	43
Female	148	51	79	52	98	51	182	53	395	57	416	60	606	58	987	55	1058	57	943	55	1330	56	1840	63	1779	60	2036	64	1457	57
Outcome																														
Discharge	203	70	63	42	117	60	175	51	312	46	415	65	659	66	1399	80	1448	78	1270	75	1800	77	2235	77	2352	81	2362	76	1965	78
Death	79	27	32	21	41	21	48	14	97	14	104	16	153	15	259	15	278	15	270	16	356	15	417	14	349	12	376	12	245	10
Referred	5	2	4	3	9	5	8	2	6	1	9	1	42	4	45	3	54	3	60	4	103	4	135	5	90	3	203	7	234	9
Unknown	5	2	52	34	27	14	111	32	261	39	110	17	138	14	44	3	83	4	91	5	92	4	110	4	126	4	167	5	83	3

Figures 8 and 9 depict HIV test result for TB patients over time. HIV test result for TB patients has been documented on TB register with three categories; Reactive, Non-Reactive, and Unknown. As it is presented on the graph the trend of HIV positive test result among TB patients in the selected hospitals shown increment over time. The proposition of reactive cases were very few at the beginning of HIV testing and treatment in the country. It was found to be almost null at the starting of 2001/2 to 2004/5. Dramatic change of proportion of reactive case has been observed during the time of 2005/6 onwards. Increment of reactive cases were observed than non-reactive and unknown cases, though there are few results that were not documented on the register. Highest proportion of Reactive cases among TB patients were docuemnted in the year 2012/13. The proportion of TB cases who tested for HIV have decreased over time. Since 2012/13 the propostion of HIV Reactive TB paitents has been declined from 25% to 19% in the year 2012/13 & 2015/16, respectively.

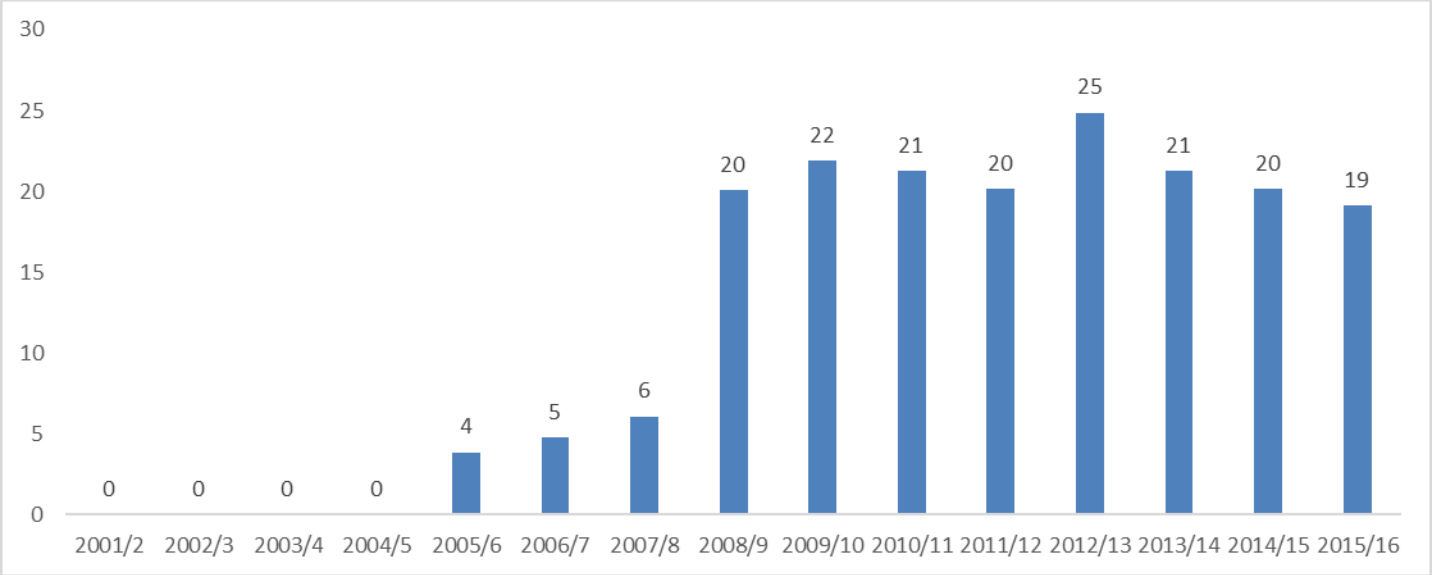

Figure 8 Trends of HIV Re-active TB patients in selected hospitals, Ethiopia 2001/2-2015/16

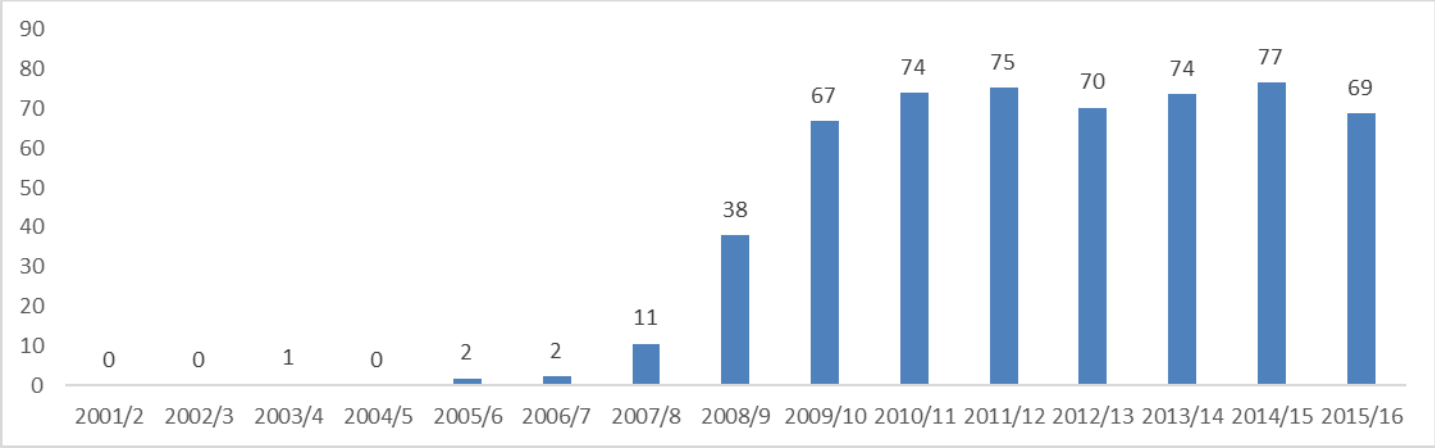

Figure 9 Trends of HIV Non-reactive TB patients in selected hospitals, Ethiopia 2001/2-2015/16

Table 4 HIV Re-active TB patients in selected hospitals, Ethiopia 2001/2-2015/16

	Year																											
	2001/2		2002/3		2003/4		2004/5		2005/6		2006/7		2007/8		2008/9		2009/10		2010/11		2011/12		2012/13		2013/14		2014/15		2015/16	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Outcome																														
Cured	1273	15.3	1266	16.0	1017	14.2	813	10.9	701	10.1	731	10.8	646	12.4	829	12.2	757	10.6	858	9.6	845	11.3	717	13.8	710	13.1	766	16.1	559	15.3
Txcompleted	3441	41.3	3365	42.5	2760	38.7	3307	44.2	2980	42.7	3323	49.2	2532	48.7	3008	44.2	3025	42.2	3552	39.6	2850	38.2	2276	43.7	2264	41.7	2232	47.0	1160	31.8
TxFailure	48	0.6	37	0.5	45	0.6	32	0.4	30	0.4	13	0.2	25	0.5	20	0.3	31	0.4	42	0.5	32	0.4	21	0.4	37	0.7	12	0.3	5	0.1
Died	601	7.2	504	6.4	515	7.2	465	6.2	431	6.2	343	5.1	305	5.9	371	5.5	361	5.0	378	4.2	273	3.7	195	3.7	170	3.1	161	3.4	141	3.9
LTFU	356	4.3	355	4.5	298	4.2	388	5.2	461	6.6	391	5.8	157	3.0	321	4.7	155	2.2	164	1.8	123	1.6	189	3.6	177	3.3	158	3.3	51	1.4
Transferred out	1331	16.0	1301	16.4	1372	19.2	1693	22.6	1534	22.0	1328	19.6	1053	20.2	1582	23.3	2035	28.4	2989	33.4	2761	37.0	1411	27.1	1785	32.9	1288	27.1	1339	36.7
Not evaluated	1285	15.4	1089	13.8	1132	15.9	789	10.5	835	12.0	630	9.3	484	9.3	670	9.9	808	11.3	978	10.9	575	7.7	402	7.7	280	5.2	136	2.9	394	10.8
HIV result																														
Reactive	1	0.0	3	0.0	15	0.2	5	0.1	283	3.9	346	4.7	348	6.1	1432	20.1	1675	21.9	2062	21.2	1601	20.1	1399	24.9	1201	21.3	1027	20.1	790	19.1
NR	1	0.0	1	0.0	39	0.5	9	0.1	131	1.8	158	2.2	604	10.5	2715	38.0	5111	66.8	7190	74.1	5991	75.3	3953	70.3	4169	73.8	3905	76.6	2840	68.8
Unknown	8062	100.0	8093	100.0	7569	99.3	7804	99.8	6932	94.4	6788	93.1	4787	83.4	2991	41.9	861	11.3	453	4.7	362	4.6	274	4.9	280	5.0	169	3.3	498	12.1

The number of patients newly enrolled to HIV care and treatment in the selected hospitals starts from 71 at the beginning of 2001/2 and increased to 20,598 in 2006/7 then decreased constantly until 2015/16. Across the year, mostly women are more affected than men, and the age category shows the age group of 25-34 are the most affected constantly from 2001/2 to 2015/16 (Table 5).

On the HIV register, outcome of HIV patients is register as Alive, Death, and Lost to follow-up and transferred out. The trend of unfavorable outcome show similar figure across the years reaching climax in 2005/6 and decreases constantly up to 2015/16. (Figure 10)

Figure 10 Trends of HIV outcomes in selected hospitals, Ethiopia 2001/2-2015/16

Table 5 Trends of HIV outcome and related variables, Ethiopia 2001/2-2015/16

		Year																											
		2001/2		2002/3		2003/4		2004/5		2005/6		2006/7		2007/8		2008/9		2009/10		2010/11		2011/12		2012/13		2013/14		2014/15		2015/16	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Outcome	Alive	11	12	245	27	901	30	3436	43	7630	37	9684	43	8528	46	6572	47	5709	50	4445	51	3930	53	3410	56	2991	59	2810	64	2856	77
	Died	26	29	184	20	420	14	1090	14	3309	16	2864	13	1951	11	1270	9	1014	9	671	8	564	8	418	7	351	7	253	6	160	4
	Transferred out	7	8	238	26	914	31	1760	22	5529	27	5866	26	4528	24	3016	22	2297	20	1729	20	1319	18	1089	18	738	15	617	14	337	9
	LTFU	38	43	129	14	533	18	1120	14	2509	12	2548	11	2225	12	2142	15	1593	14	1405	16	1101	15	944	15	826	16	585	13	316	9
	NA	7	8	107	12	194	7	549	7	1532	7	1444	6	1251	7	870	6	802	7	543	6	437	6	255	4	141	3	101	2	34	1
Sex	Male	45	45	549	61	1783	60	3999	49	9745	45	10110	43	8444	42	6400	43	5277	43	4080	42	3514	44	2770	42	2185	42	1942	43	1602	41
	Female	54	55	358	39	1207	40	4173	51	11897	55	13623	57	11670	58	8505	57	7099	57	5666	58	4474	56	3831	58	3062	58	2612	57	2274	59
Age	<=14	9	9	8	1	29	1	173	2	1054	5	1372	6	1588	8	1262	8	951	8	710	7	554	7	436	7	389	7	374	8	275	7
	15-24	7	7	63	7	159	5	614	7	1932	9	2478	10	2180	11	1569	11	1426	12	1226	13	912	11	822	12	701	13	663	15	476	12
	25-34	42	42	334	37	1022	34	2949	36	8089	37	8955	38	7408	37	5604	38	4566	37	3665	38	3081	39	2515	38	2027	39	1681	37	1459	38
	35-49	36	36	413	46	1431	48	3677	45	8696	40	8954	38	7284	36	5319	36	4347	35	3394	35	2825	35	2311	35	1751	33	1493	33	1352	35
	50-64	3	3	80	9	300	10	695	8	1692	8	1760	7	1484	7	1013	7	963	8	668	7	523	7	450	7	327	6	304	7	285	7
	>=65	2	2	9	1	66	2	92	1	201	1	233	1	182	1	154	1	135	1	107	1	93	1	70	1	53	1	41	1	29	1
ART status	On ART	71	72	733	81	2734	91	7532	92	18797	89	20598	88	16724	85	12142	83	10129	82	7663	79	6290	79	5321	81	4526	86	3977	88	3420	88
	Pre-ART	28	28	174	19	255	9	624	8	2377	11	2685	12	2830	14	2549	17	2210	18	2079	21	1681	21	1252	19	697	13	549	12	447	12
	NA	0	0	0	0	0	0	0	0	65		13		19		4		4		2		4		6		21		6		1	
CD4	<49	4	4	187	21	589	20	1027	13	2985	14	3294	14	2497	12	1676	11	1248	10	957	10	851	11	592	9	518	10	385	8	387	10
	50-99	2	2	163	18	570	19	1060	13	3280	15	3227	14	2665	13	1620	11	1155	9	900	9	774	10	598	9	531	10	400	9	359	9
	100-199	6	6	227	25	701	23	1694	21	5521	25	5825	25	4759	24	3262	22	2507	20	1846	19	1560	20	1203	18	863	16	712	16	569	15
	200-349	7	7	44	5	179	6	627	8	2532	12	3803	16	3430	17	2615	18	2108	17	1724	18	1464	18	1362	21	988	19	708	16	621	16
	350-499	1	1	17	2	34	1	174	2	528	2	766	3	743	4	628	4	550	4	510	5	407	5	436	7	650	12	576	13	392	10
	>=500	79	80	269	30	934	31	3618	44	6818	31	6837	29	6032	30	5120	34	4820	39	3833	39	2932	37	2413	37	1698	32	1775	39	1548	40

Figure 11 describes the outcome of people under the ART follow up. Among the total males, 44% were still alive, 12% were died 23% transferred out, and 14% were lost to follow up. Forty-nine percent of females were alive, 10%, 23%, and 13% of females died, transferred out, and lost to follow up respectively.

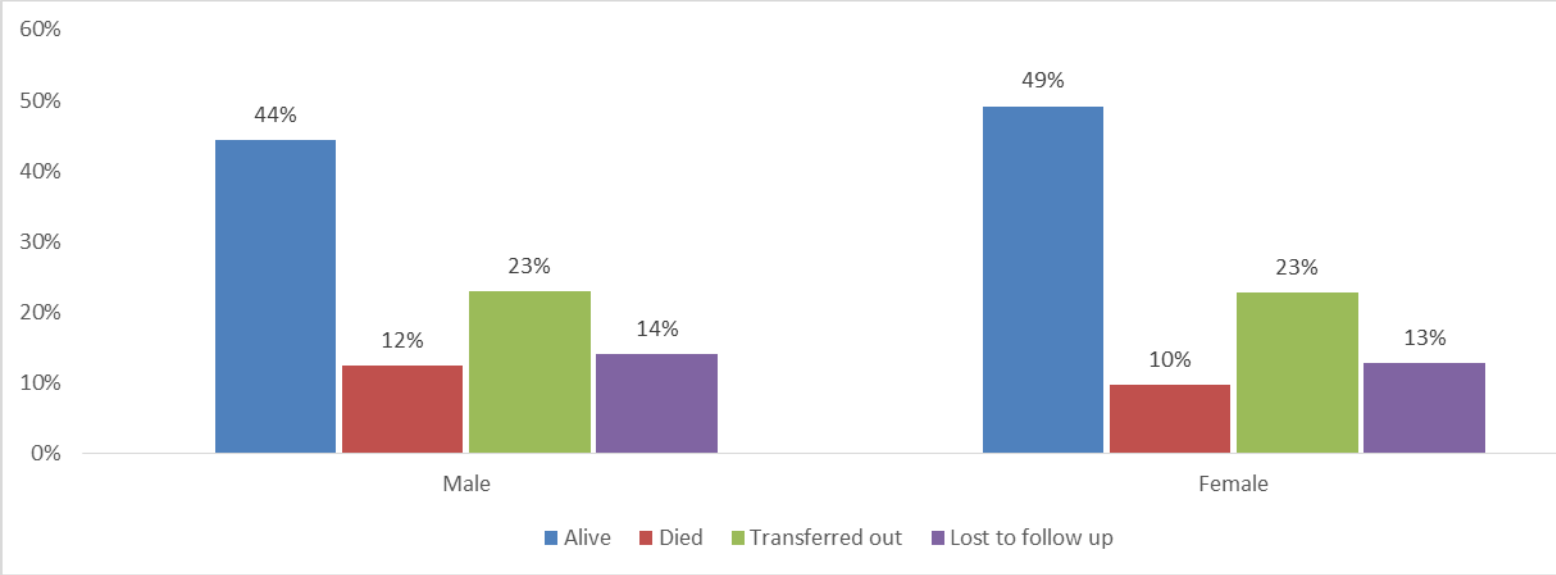

Figure 11 HIV outcome status by sex in selected hospitals, Ethiopia 2001/2-2015/16

Among all age groups about one out of ten died. Among peoples who are on ART, half (50%) were alive, a quarter (23%) of was transferred out to another facility, and only 11% died. Among individuals whose CD4 count was less than 50 at treatment initiation, 19% died, and one-fourth were transferred out (Table 6).

Table 6 HIV outcome by patient's background characteristics, 2001/2-2015/16

		Outcome									
		Alive		Died		Transferred out		Lost to follow up		NA	
		Count	%	Count	%	Count	%	Count	%	Count	%
Sex	Male	27270	44	7678	12	14122	23	8645	14	3830	6
	Female	38596	49	7609	10	17861	23	9997	13	4459	6
Age	<=14	4463	51	791	9	2173	25	956	11	446	5
	15-24	5541	39	1329	9	3411	24	2556	18	1191	8
	25-34	22187	42	5928	11	13050	25	7688	15	3440	7
	35-49	27236	51	5769	11	11237	21	6178	12	2657	5
	50-64	5796	55	1310	12	1900	18	1105	10	476	4
	>=65	685	49	175	13	257	19	193	14	79	6
ART status	On ART	62984	50	13729	11	29319	23	14503	12	4486	4
	Pre-ART	2248	17	1330	10	2311	17	3866	29	3785	28
	NA	13	20	10	15	2	3	29	44	12	18
CD4l_group	<49	6682	38	3305	19	4187	24	2522	14	824	5
	50-99	7791	43	2490	14	4618	26	2236	12	841	5
	100-199	16144	50	3019	9	8242	25	3826	12	1238	4
	200-349	13300	58	1364	6	5206	23	2420	11	711	3
	350-499	4599	68	273	4	1182	18	588	9	100	1
	>=500	17392	41	4851	11	8593	20	7084	17	4575	11

4.4 Tuberculosis cases and deaths

Data on admission to hospitals primarily due to TB was collected. The percentages of admitted TB patients less than or equal to 14 years age varied from the lowest 6% in 2001 and 2013/14 to the highest 19% in 2004/5. Similarly, percent of admitted TB patients in the age group 15 to 24 lay in the range 17% (in 2009/10, 2014/15 and 2015/16) to 22% (in 2003/4). There was no significant percentage variation of admitted patients in this age group in the 15 years period. The percent of patients in the age group 25 to 34 varied from the lowest 22% in 2010/11 and 2011/12 to the highest 35% both in 2001/2. The percentage of admitted patients for age 65 and above stayed a constant of 3% from 2001/2 to 2005/6. Then the proportion of admitted TB patients slowly increased from 5% in 2006/7 to 9% in 2011/12. The percentage of patients from 2012/13 to 2015/16 fluctuated in the range 8% to 9%.

Percent distribution of admitted patients primarily due to TB by sex was also analyzed. In general the percent of admitted male was higher than female throughout in the period 2001/2 to 2015/16. The percent of admitted male patient varied in the range 58% in 2012/13 to 51% in 2005/6. Similarly, the percent of admitted female patients laid in the range 49% in 2005/6 to 42% in 2012/13. (See Table 7 below)

Table 7 Hospital admission to hospitals primarily due to TB by year, Ethiopia 2001/2-2015/16

		Year																											
		2001/2		2002/3		2003/4		2004/5		2005/6		2006/7		2007/8		2008/9		2009/10		2010/11		2011/12		2012/13		2013/14		2014/15		2015/16	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	N	%	n	%	n	%	n	%	n	%
Age	<=14	82	9	165	15	125	14	159	19	62	9	136	15	93	9	105	6	138	8	178	12	243	14	186	7	200	6	290	9	295	9
	15-24	193	21	217	20	196	22	151	18	126	18	192	21	207	19	316	19	295	17	250	18	315	18	458	18	559	18	526	17	560	17
	25-34	314	35	333	31	265	29	237	29	228	33	233	25	308	28	480	28	478	28	317	22	395	22	658	26	830	26	744	24	824	25
	35-49	226	25	247	23	222	25	181	22	186	27	225	24	287	27	439	26	414	24	360	25	426	24	682	27	890	28	815	26	822	25
	50-64	71	8	90	8	67	7	73	9	72	10	93	10	125	12	222	13	273	16	211	15	246	14	331	13	417	13	486	15	573	17
	>=65	24	3	27	3	31	3	25	3	23	3	45	5	61	6	138	8	139	8	112	8	152	9	193	8	261	8	298	9	275	8
Sex	Male	509	56	589	55	508	56	443	54	354	51	505	55	567	53	952	56	960	55	770	54	939	53	1448	58	1741	55	1766	56	1777	53
	Female	400	44	489	45	398	44	380	46	343	49	419	45	513	48	745	44	775	45	658	46	838	47	1060	42	1416	45	1389	44	1572	47
Outcome	Discharge	756	84	842	78	701	78	573	71	403	60	583	65	698	69	1261	75	1419	82	1159	82	1395	79	1933	78	2429	78	2461	79	2686	81
	Death	129	14	206	19	175	19	145	18	71	11	95	11	112	11	187	11	185	11	138	10	204	12	297	12	395	13	303	10	321	10
	Referred	7	1	22	2	12	1	20	2	9	1	8	1	17	2	62	4	61	4	64	5	112	6	124	5	161	5	202	6	210	6
	Unknown	7	1	6	1	12	1	65	8	188	28	216	24	183	18	181	11	58	3	59	4	46	3	133	5	142	5	169	5	91	3

The outcomes of patients admitted mainly due to TB during the study period depicted in the figure 12 below. Percentage of discharged TB patients varied from the highest 84% in 2001/2 to the lowest 60% in 2005/6. The percentage of discharged TB patients' rate alarmingly declined from 84% to 60% in the period 2001/2 to 2005/6. Then it gradually increased from 60% in 2005/6 to 82% in 2010/11. Lastly, the percent fluctuated in the range 78% to 81% in the period 2011/12 to 2015/16. Percentage of death of admitted patients due to TB disease fluctuated in the range 19% both in 2002/3 and 2003/4 to 10% both in 2013/14 and 2015/16. Percentage of deaths primarily due to TB increased from 14% in 2001/2 to 18 % in 2004/5, declined to 10 % in 2010/11, then it fluctuated in the range 10% to 13% in the period 2011/12 to 2015/16. Percentage of transferred out TB patients showed increment from 1% in 2006/7 to 6% in 2011/12 and then it almost remained constant from 2012/13 to 2015/16. The status of some of admitted TB patients were not recorded or not found in patient's registers. The percentage of admitted TB patients whose outcomes were unknown increased from 1% in 2001/2 to 28% in 2005/6, then it slowly declined to 3% in 2011/12, and finally almost it remained constant from 2011/12 to 2015/16 (laid in the range 3% to 5%). It was clearly depicted in the figure that the percentage of discharged TB patients was higher than other outcomes throughout the period. (See Figure 12 below)

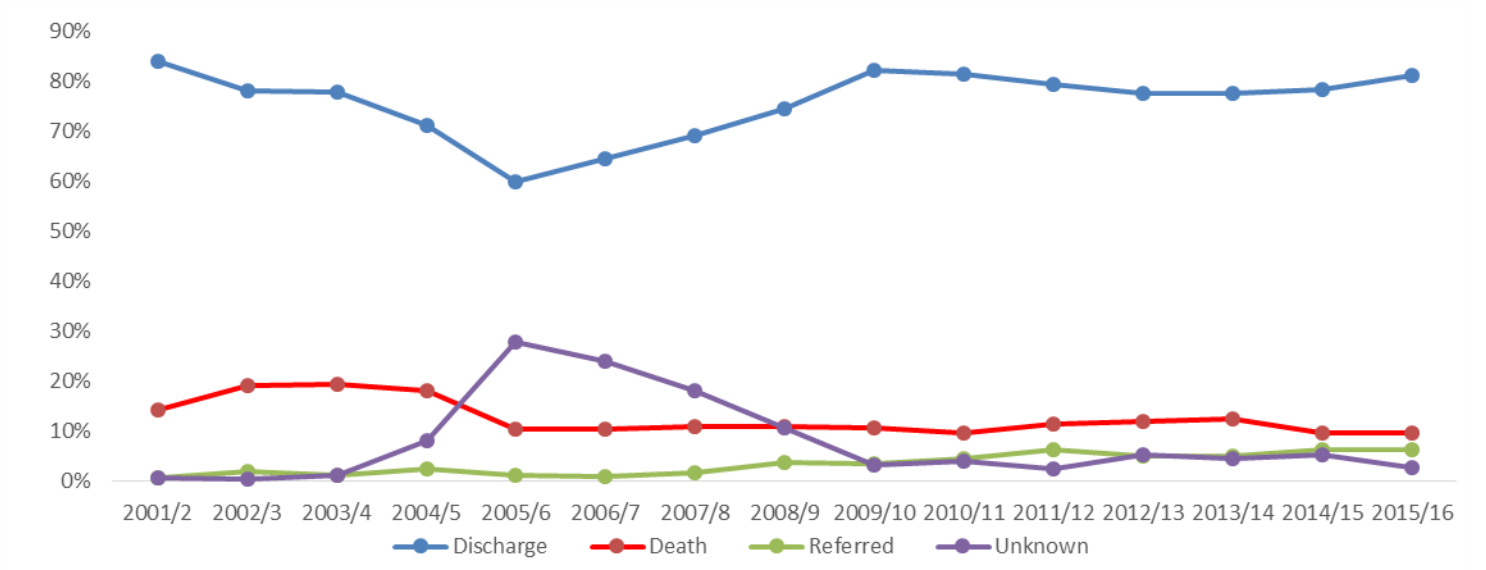

Figure 12 Percent of patients' outcome of admission mainly due TB, Ethiopia 2001/2-2015/16

As shown in the following figure, generally from year 2001/2 to 2015/16 the admitted TB cases proportion in the selected hospitals was high in age group 15-34 followed by age groups 35-64, < 15 and >64 years, respectively.

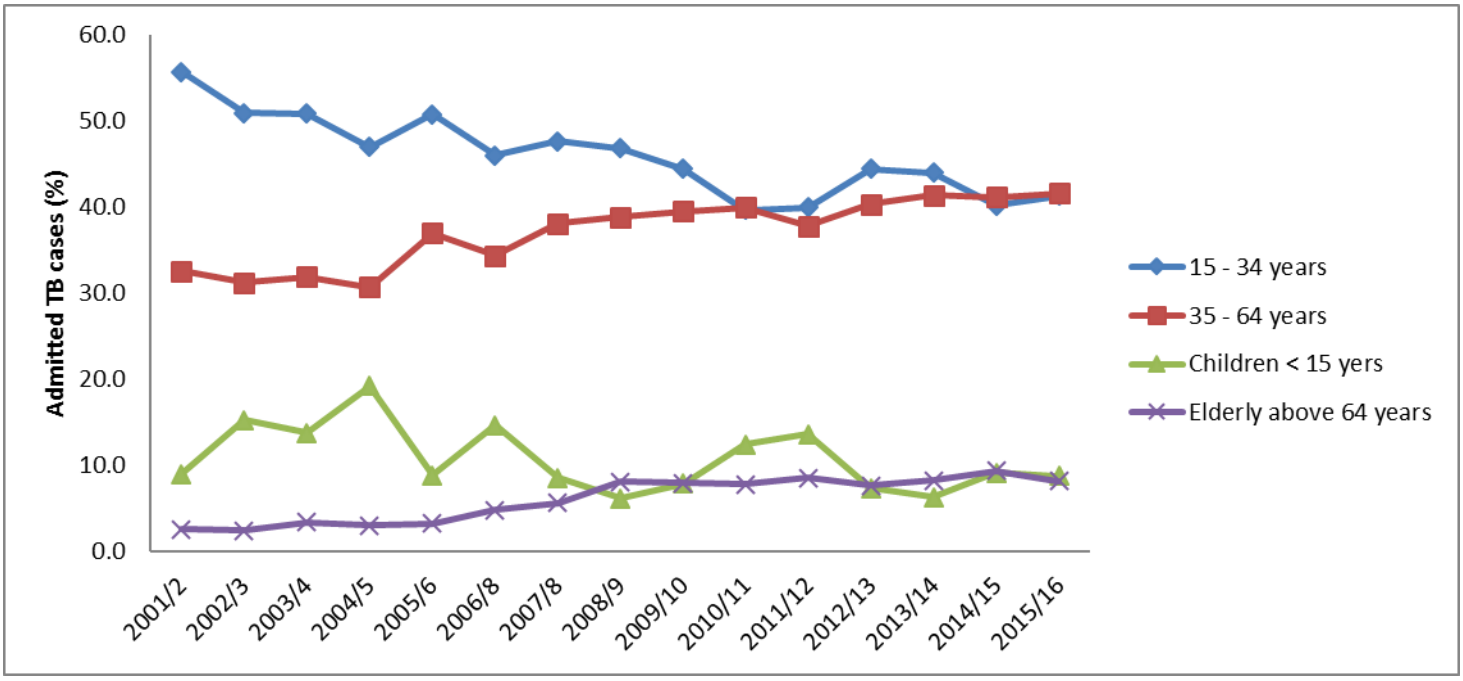

Figure 13 Percent of admitted TB cases by age, Ethiopia 2001/2-2015/16

Table 8 below depicted Tuberculosis patient follow up outcome by their sex, age with smear and presumptive MDR TB.

From selected hospitals TB registry data summary during a period of 2001/2 to 2015/16, there were a total of 99,126 patients registered for TB treatment follow up with Male to Female proportion of 55,359 (56%) to 43,767(44%). From the total of 96,186 patients evaluated using one of the three bacteriologic diagnostic methods for bacteriological confirmations and classifications of TB ,a total of 23,209 patients were registered with bacteriologically confirmed TB cases and 48,297 were registered with non-bacteriologically confirmed TB cases. From the following figure, we can observe that the smear, culture or Gen xpert positive result was 24% while a presumptive MDR TB of 2%.

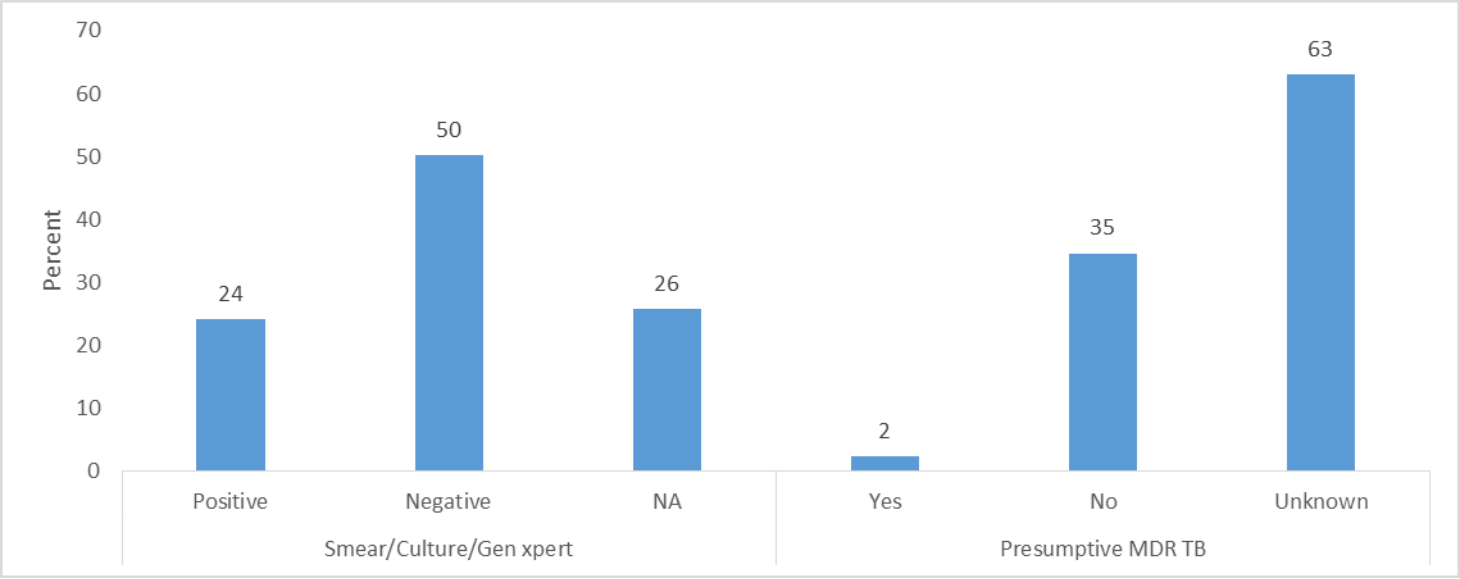

Figure 14 Percent of patients TB test result and presumptive MDR TB, Ethiopia 2001/2-2015/16

From this total 99,126 patients enrolled for 1st line anti TB treatment follow up and out come monitoring, there were a total of 12,375 patients cured with the rate of 13% for both sex groups and 49% cure rate among total 11,429 bacteriological confirmed patients categories. Of the total registered, 42,038 patients completed treatment, representing 41% and 44% treatment completion for male and female treatment cohorts, respectively.

Unfavorable TB treatment outcome data indicates that from total 99,126 patients enrolled during the period 5207 patients died, which accounts for death rate of 5% among both male and female treatment cohort. Death rate was observed to be consistently high in the most productive age groups of 25-34 years (6 %) 35-49 years (7 %) while the highest death toll of 9% was documented in the age category of above 65 years old.

The second most unfavorable TB treatment outcome and an indicator for patient adherence to treatment of good quality is treatment failure. From the total of 99,126 Patients enrolled during the period, 429 patients had treatment failure, representing failure rate of less than 1% for both sexes. Among bacteriologically confirmed treatment groups, treatment failure rate was about 1%. The highest treatment failure rate of 2% was documented among the 2,206 Presumptive MDR TB patients of all age and sex groups.

Of the 99,126 Patients enrolled in anti-TB treatment 3,742 patients lost to follow up, representing a 4% LTFU in both sexes. The highest rate of loss to follow up of 5% was at the age group above 65 years old.

Transferred out rate as a key indicator of service availability near to the patient's residence or family support data were also summarized for total 99,126 patients enrolled during the period of 2001/2 to 2015/16. The data shows that there were a total of 24,768 patients registered for Anti-TB treatments that were transferred out, with the rate

of 25% and 24% for male and female patients respectively. For age category, the highest transfer out rate of 28% was observed in the age group under 15, age group 50-64 and those above 65 years old.

In addition to transferred out rate there were a total of 10,460 patients the status of the outcome is not evaluated, the rate indicates that 11 % and 10 % for male and female anti TB treatment cohorts during the period. This is an important indicator of recording and reporting quality, with the outcome status totally unknown for one-tenth of the entire treatment cohort.

Table 8 TB outcome by patient's background characteristics, 2001/2-2015/16

		Outcome													
		Cured		Txcompleted		TxFailure		Died		LTFU		Transferred out		Not evaluated	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%
Sex	Male	7057	13	22610	41	256	0	2965	5	2146	4	14113	25	6212	11
	Female	5425	12	19428	44	173	0	2242	5	1596	4	10655	24	4248	10
Age	<=14	510	4	6308	50	35	0	454	4	444	4	3497	28	1408	11
	15-24	4264	17	10788	43	113	0	787	3	801	3	5875	24	2331	9
	25-34	4140	15	11272	40	129	0	1609	6	1085	4	6640	24	3135	11
	35-49	2497	12	8594	41	95	0	1480	7	859	4	5332	25	2268	11
	50-64	826	9	3638	41	37	0	574	6	370	4	2448	28	974	11
	>=65	251	7	1475	41	21	1	310	9	185	5	1010	28	371	10
Smear, culture or Gen xpert	Positive	11429	49	2919	13	206	1	1089	5	748	3	4713	20	2105	9
	Negative	708	1	25117	52	133	0	2756	6	1965	4	12349	26	5269	11
	NA	238	1	12437	50	41	0	1206	5	968	4	7179	29	2611	11
Presumptive MDR TB	Yes	551	25	732	33	42	2	150	7	47	2	602	27	82	4
	No	4817	15	13841	43	67	0	1783	6	983	3	8565	26	2286	7
	Unknown	6765	11	25404	43	304	1	3178	5	2690	5	15124	26	5483	9

Data was also collected for HIV positive patients who were diagnosed for TB during the last 15 years from the selected hospitals of the country to know the trend of TB-HIV co-infection. Besides, the status of patients who were diagnosed for TB and were co-infected with HIV was collected to explore the trend of these patients status during the years 2001/2-2015/16. Figure 1 depicts that, in the early years (2001/2-2004/5), there was no death recorded due to TB among the HIV positive patients. Moreover, those HIV positive patients diagnosed for TB were cured starting from 2003/4 and goes on up to 2015/16, but no one was cured in 2004/5. As could be seen in the figure, slightly more than 15% of HIV positive patients who were diagnosed for TB were constantly cured for the last fifteen years. Likewise, on average nearly 15% of HIV positive patients who were diagnosed for TB died during the years 2007/8-2012/13. Death among HIV positive TB patients increased during the years 2013/14-2015/16. Loss to follow up was fluctuated between 1.5% in 2015/16 and 9.8% in 2008/9; it showed a steady decrement pattern during the years 2014/15-2015/16.

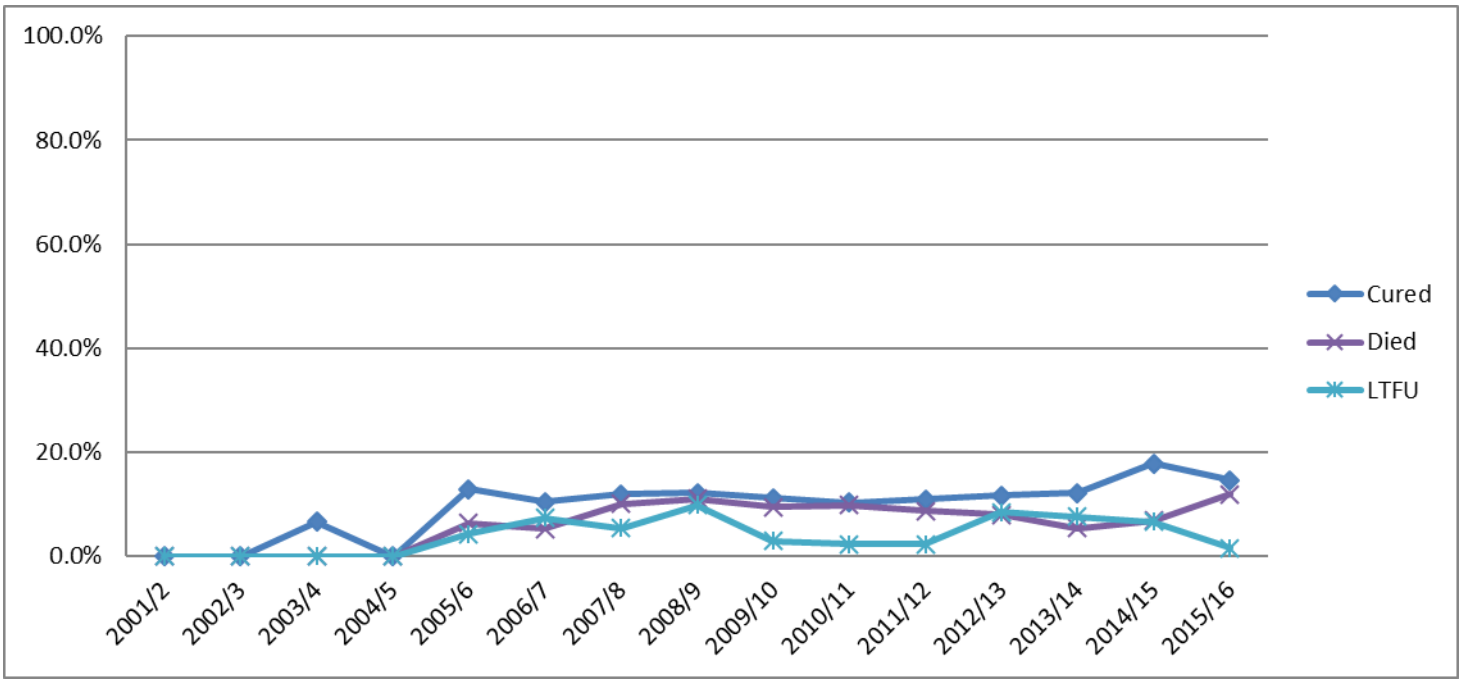

Figure 15 Trend for the outcome variables in TB for HIV positive patients, Ethiopia 2001/2-2015/16

Table 9 TB outcomes by year for HIV/TB confection, Ethiopia 2001/2-2015/16

		Year																											
		2001/2		2002/3		2003/4		2004/5		2005/6		2006/7		2007/8		2008/9		2009/10		2010/11		2011/12		2012/13		2013/14		2014/15		2015/16	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Outcome	Cured	0	0	0	0	1	7	0	0	12	13	20	10	20	12	146	12	167	11	186	10	158	11	148	12	140	12	170	18	104	15
	Txcompleted	1	100	0	0	11	73	5	100	59	63	104	54	89	53	511	42	652	44	713	39	561	39	569	45	503	44	396	42	182	26
	TxFailure	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1		7		8		8	1	7	1	5		1		1	
	Died	0	0	0	0	0	0	0	0	6	6	10	5	17	10	133	11	140	9	177	10	126	9	101	8	62	5	66	7	85	12
	LTFU	0	0	0	0	0	0	0	0	4	4	14	7	9	5	118	10	44	3	43	2	33	2	107	8	87	8	63	7	11	2
	Transferred out	0	0	1	100	3	20	0	0	10	11	26	14	21	13	216	18	303	20	511	28	445	31	269	21	301	26	233	25	257	36
	Not evaluated	0	0	0	0	0	0	0	0	1	1	17	9	11	7	78	6	170	11	168	9	109	8	64	5	47	4	22	2	70	10

4.5 Malaria cases and deaths

Between 2001/2 and 2015/16, a total of 1,575 malaria deaths were documented among the 29,376 malaria cases admitted to the selected hospitals (Table 10). On average, 5.4% malaria deaths were recorded among admitted cases in the last 15 years in which the highest proportion occurred between 2001/2 and 2007/8 (range 8-14%), except 2005/6 when it was 5%. Low proportion of malaria deaths were recorded between 2008/9 and 2015/16 in which the lowest was 2% in 2015/16. As it is clearly showed in the table below, death attributed due to malaria declined by 80% between 2001/2002 and 2015/16.

Table 10 Malaria cases admission and outcome by year, Ethiopia 2001/2-2015/16

		Year																													
		2001/2		2002/3		2003/4		2004/5		2005/6		2006/7		2007/8		2008/9		2009/10		2010/11		2011/12		2012/13		2013/14		2014/15		2015/16	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Age	<=4	115	12	63	7	97	9	300	22	170	22	227	21	238	16	474	16	684	19	529	20	687	20	591	20	364	18	368	15	512	20
	5-9	56	6	44	5	66	6	114	8	89	12	78	7	127	8	160	5	246	7	191	7	315	9	272	9	147	7	173	7	165	6
	10-14	38	4	26	3	39	4	65	5	44	6	71	7	108	7	161	5	159	4	162	6	248	7	190	6	130	6	139	6	136	5
	15-29	429	44	414	48	445	42	471	34	242	32	411	39	543	36	1287	43	1466	41	999	38	1342	39	1179	40	881	42	1156	47	1142	44
	>=30	339	35	319	37	420	39	435	31	223	29	273	26	502	33	894	30	994	28	735	28	859	25	745	25	551	27	627	25	614	24
Sex	Male	546	56	447	52	501	47	673	49	428	56	569	54	764	50	1505	51	1911	54	1474	56	1906	55	1626	55	1175	57	1327	54	1301	51
	Female	431	44	413	48	566	53	712	51	339	44	490	46	753	50	1456	49	1636	46	1141	44	1545	45	1350	45	897	43	1136	46	1268	49
Outcome	Discharge	859	88	739	85	910	86	1249	91	670	91	915	89	1293	90	2859	96	3359	95	2430	93	3173	93	2730	93	1894	92	2266	94	2455	97
	Death	100	10	122	14	141	13	109	8	36	5	98	10	110	8	78	3	144	4	133	5	185	5	116	4	91	4	68	3	44	2
	Referred	3		1		3		6		4	1	9	1	18	1	13		22	1	16	1	36	1	43	1	41	2	28	1	24	1
	Unknown	9	1	3		2		14	1	30	4	9	1	8	1	18	1	17		31	1	35	1	60	2	42	2	39	2	19	1

As figure 14 illustrates the variation in admission due to malarial between males and females, most of the malaria case admissions were accounted for by males, with significant variability across the years. Exceptionally, females accounted for more than half of the malaria admissions during 2003/4 and 2004/5. Malaria admissions among males remained above half consistently since 2009/10.

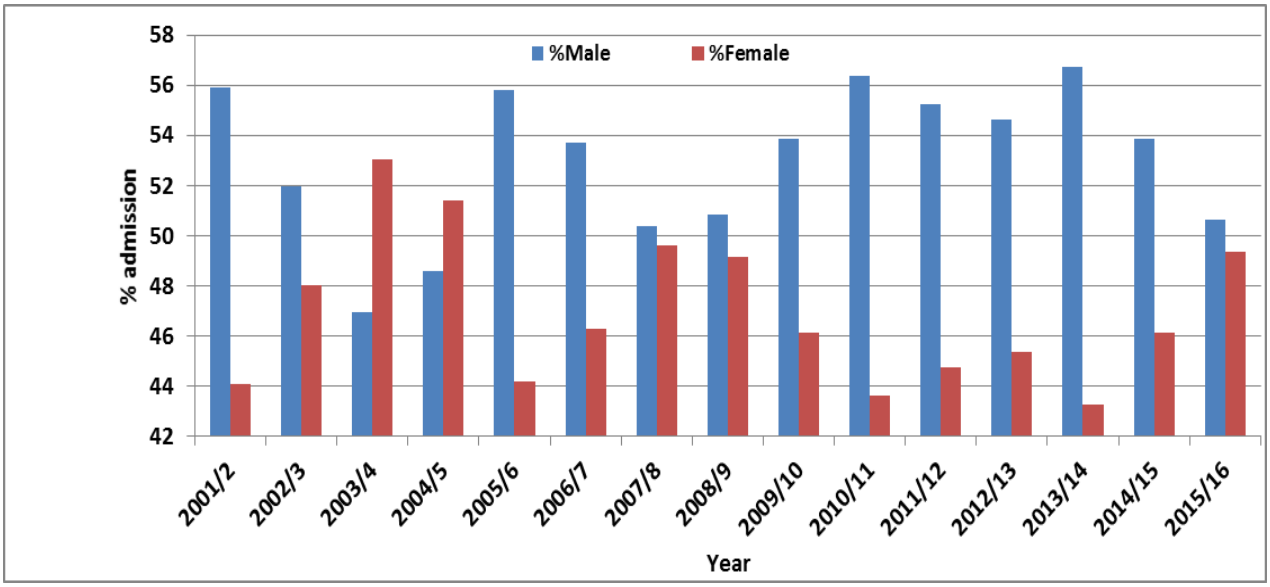

Figure 16 Malaria admission by sex and year, Ethiopia 2001/2-2015/16

The extent of admission due to malaria in the last 15 years varies across different age groups. The admission remained below 10 percent throughout (except in 2005/6) for age groups of 5-9 and 10-14. More than one-fifth of the malaria case admission was in age group above 15 years. It appears that a slight declining trend of malaria admission among age categories 30 years and above was observed since 2003/04 (Figure 17).

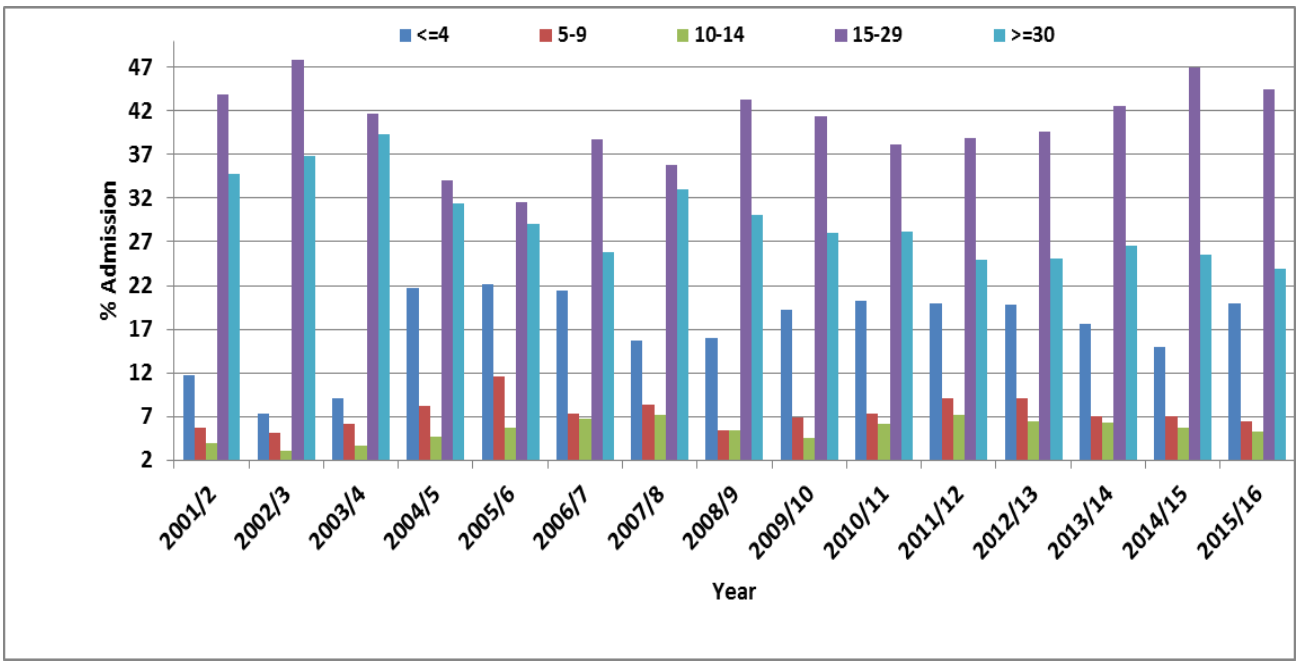

Figure 17 Malaria cases admission by age and year. Ethiopia 2001/2-2015/16

Figure below shows annual distribution of malaria-related deaths recorded in selected hospitals between 2001/2 and 2015/16 (Figure 18). Among 1,575 malaria-related deaths recorded, the highest proportion (12%; 185 of 1575) was during 2011/12. The rate was 9% (144 of 1575) during 2002, and 2003/4; and 8% (133 of 1575) during 2010/11 and 2002/3, whereas it was 7% in 2012/13, and 2004/5. Overall, malaria-related death has sharply declined between 2011/12 and 2015/16.

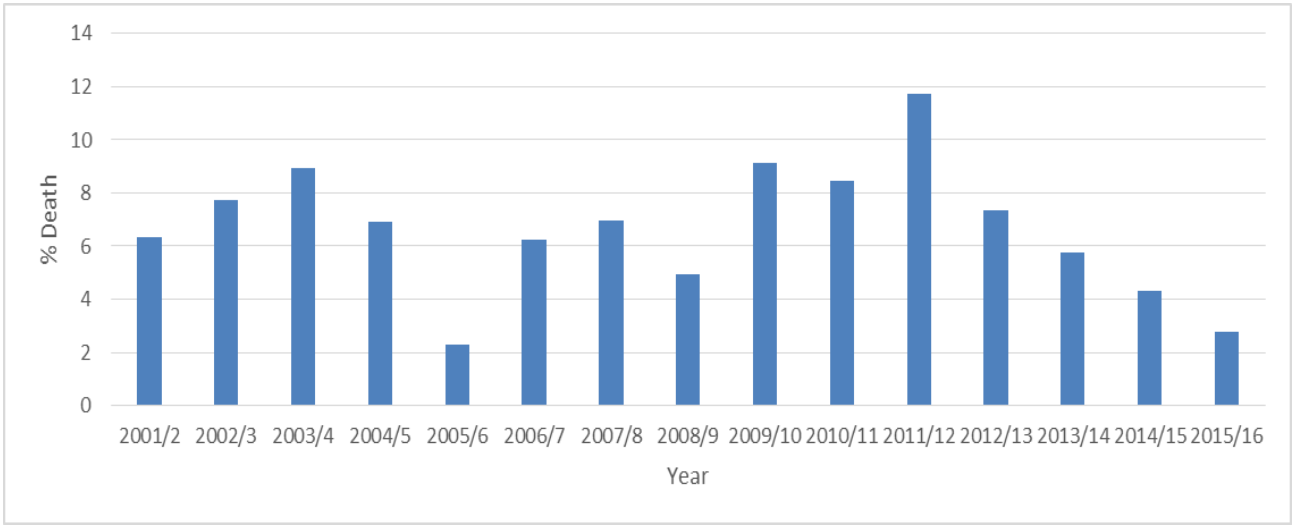

Figure 18 Annual distribution of malaria-related deaths among various age categories in selected hospitals, Ethiopia 2001/2-2015/16

5. Result from Demographic and Health Surveillance Sites

Proportionate Mortality ratio for different causes of death for a given background variable was calculated using the following formula, for example:

$$\text{Proportionate mortality due to HIV/AIDS for males} = \frac{\#\text{ of HIV/AIDS related deaths among males}}{\text{Total \# of Male Deaths due to all causes}} \times 100$$

Total 13,650 deaths were registered and causes of death were assigned during the seven year period. Among the identified causes of death, tuberculosis, HIV/AIDS and Malaria contributed 1,974 (14.5%) of all causes of death with the proportionate mortality due to TB being 1,198 (8.8%), HIV/AIDS 254(1.9%)and Malaria 522(3.8%).

The proportionate mortality due to HIV/AIDS, TB and malaria was relatively higher in urban compared to rural areas, and among females than males. Proportionate mortality due to HIV/AIDS was higher among the age group 15-29 years (3.6%) and 30-49 years (7.2%). TB proportionate mortality was higher among adults aged 30-49 years (13.2%) and 50 and above year olds (14.9%). On the other hand, the proportionate mortality due to malaria was relatively higher among 5-14 year olds (8.3%) followed by 15-29 year olds (6.8%). Over the seven year period, there was a marked variation among the HDSS sites with respect to the proportionate mortality due to malaria, higher value were documented in GilgelGibe (9.7%) and Arba-Minch (7.5%) sites (Table 1).

With respect to educational status of the deceased, HIV/AIDS and TB related proportionate mortality was observed to be higher among those with higher level of education (14.5% and 17.4%), whereas malaria was relatively higher among illiterates (4.4%) and individuals with primary education (4.9%). In terms of occupation, those involved in daily labor work (11.1%) were reported to have higher proportionate mortality due to HIV/AIDS whereas TB showed almost similar distribution across the different occupational groups. Similarly, malaria related proportionate mortality was also similar across occupational categories though it was slightly higher among daily laborers (6.1%) and unemployed (5.2%). Overall, 15.5% of all deaths occurred at health facilities. Specifically, 20.9% of HIV/AIDS, 13.6% of TB and14.6% of malaria deaths occurred at health institutions during the seven years observation period. HIV/AIDS related deaths didn't show change between seasons whereas TB and malaria related proportionate mortality were both higher during Sep-Nov (9.4% and 4.8%) and lower in Jun-Aug (7.6% and 3.6%) (Table 1).

Table 11 Number and Proportionate Mortality from HIV/AIDS, Tuberculosis, Malaria and other causes in Ethiopian Health and Demographic Surveillance Sites, 2009/10 to 2015/16

Variables	HIV/AIDS		Tuberculosis		Malaria		All others		Total
	No.	%	No.	%	No.	%	No.	%	No.
Year of death									
2009/10	57	2.6	208	9.6	151	7.0	1,744	80.7	2,160
2010/11	51	2.2	185	8.1	115	5.1	1,922	84.6	2,273
2011/12	27	1.3	211	10.5	63	3.1	1,700	85.0	2,001
2012/13	31	1.6	147	7.8	60	3.2	1,656	87.4	1,894
2013/14	21	1.2	123	7.0	48	2.7	1,555	89.0	1,747
2014/15	20	1.1	156	8.6	43	2.4	1,602	88.0	1,821
2015/16	47	2.7	168	9.6	42	2.4	1,497	85.3	1,754
Surveillance site									
Butajira	18	1.2	130	8.5	23	1.5	1,352	88.8	1,523
Dabat	102	4.5	243	10.7	33	1.5	1,885	83.3	2,263
Gilgel Gibe	22	0.8	291	10.1	279	9.7	2,292	79.5	2,884
Kersa	12	0.4	161	4.7	54	1.6	3,184	93.3	3,411
Kilte-Awlaelo	50	2.5	236	11.6	18	0.9	1,726	85.0	2,030
Arba Minch	50	3.2	137	8.9	115	7.5	1,237	80.4	1,539
Residence									
Urban	87	4.3	201	9.8	79	3.9	1,679	82.1	2,046
Rural	167	1.4	997	8.6	443	3.8	9,997	86.2	11,604
Sex of the deceased									
Male	108	1.5	564	7.9	256	3.6	6,222	87.0	7,150
Female	146	2.3	634	9.8	266	4.1	5,427	83.8	6,473
Not specified							27	100.0	27
Total	254	1.9	1,198	8.8	522	3.8	11,676	85.5	13,650
Age at death									
< 5	16	0.3	96	2.0	132	2.7	4,657	95.0	4,901
5-14	7	0.7	40	4.2	79	8.3	822	86.7	948
15-29	39	3.6	87	8.1	73	6.8	881	81.6	1,080
30-49	116	7.2	211	13.2	72	4.5	1,204	75.1	1,603
≥ 50	76	1.5	764	14.9	166	3.2	4,111	80.3	5,117
Total	254	1.9	1,198	8.8	522	3.8	11,675	85.5	13,649

Table 1: Continued …

Education									
Illiterate	76	1.4	714	13.5	235	4.4	4,280	80.7	5,305
Primary	105	4.8	259	11.9	106	4.9	1,714	78.5	2,184
Secondary	27	4.8	72	12.7	13	2.3	453	80.2	565
Higher	25	14.5	30	17.4	1	0.6	116	67.4	172
Unknown	1	0.7	4	2.9	4	2.9	130	93.5	139
Under age	16	0.4	67	1.7	58	1.5	3,746	96.4	3,887
Total	250	2.0	1,146	9.4	417	3.4	10,439	85.2	12,252
Marital status									
Married	91	2.2	589	14.0	185	4.4	3,342	79.4	4,207
Widowed	50	3.2	196	12.7	41	2.7	1,256	81.4	1,543
Single	42	3.6	124	10.7	71	6.1	922	79.6	1,159
Divorced	31	3.5	125	14.1	37	4.2	692	78.2	885
Unknown	19	6.9	25	9.1	3	1.1	228	82.9	275
Under age	20	0.4	131	2.4	183	3.3	5,211	94.0	5,545
Total	253	1.9	1,190	8.7	520	3.8	11,651	85.6	13,614
Occupation									
Farmer	93	2.7	476	14.0	135	4.0	2,707	79.4	3,411
Unemployed*	63	2.5	327	13.1	130	5.2	1971	79.1	2491
Employed♂	23	4.9	58	12.2	19	4.0	374	78.9	474
Daily work♒	44	11.1	49	12.4	24	6.1	279	70.5	396
Other	10	0.8	158	12.1	34	2.6	1,100	84.5	1,302
Under age	21	0.4	130	2.3	180	3.2	5,245	94.1	5,576
Total	254	1.9	1,198	8.8	522	3.8	11,676	85.5	13,650
Place of death									
Home	197	77.6	1,012	84.6	427	82.0	9,047	77.6	10,683
HF	53	20.9	163	13.6	76	14.6	1,816	15.6	2,108
Other/DK	4	1.6	21	1.8	18	3.5	791	6.8	834
Total	254	100.0	1,196	100.0	521	100.0	11,654	100.0	13,625
Months of death									
	62	1.9	299	9.4	154	4.8	2,674	83.9	3,189
Dec-Feb	63	1.9	305	9.4	121	3.7	2,763	85.0	3,252
Mar-May	60	1.7	316	8.9	115	3.2	3,072	86.2	3,563
Jun-Aug	69	1.9	278	7.6	132	3.6	3,167	86.9	3,646
Total	254	1.9	1198	8.8	521	3.8	11,676	85.5	13,650

*Unemployed = Housewife, Students and Unemployed, ♂Employed = Private and civil servant

♒Daily work = Daily labourer and Shepherd

5.1 Trends in Cause Specific Death Rates

Death rate due to specific categories was calculated using the following definition, for example:

$$\text{TB related death rate for males} = \frac{\text{Number of male deaths due to TB for the year}}{\text{Mid - year male population for the same year}} \times 100{,}000$$

During the seven years period, HIV/AIDS mortality rates showed a declining trend of 39.8% from 2009/10 to 2015/16. Between 2009/10 and 2014/15, the decline was 70.0%. In recent years, mortality rate due to HIV/AIDs began to increase again, from 4.9 per 100,000 population in2014/15to 9.8per 100,000 population in 2015/16. Death rates due to TB also showed a significant decline of 41.0%from 2009/10 (59.3 per 100,000) to 2015/16 (35.0 per 100,000), despite fluctuations in 2011/12 (57.8 per 100,000) and 2014/15 (38 per 100,000).Malaria related mortality rate significantly declining from 43.0 per 100,000 2009/10 to 8.7 per 100,000 in 2015/16.

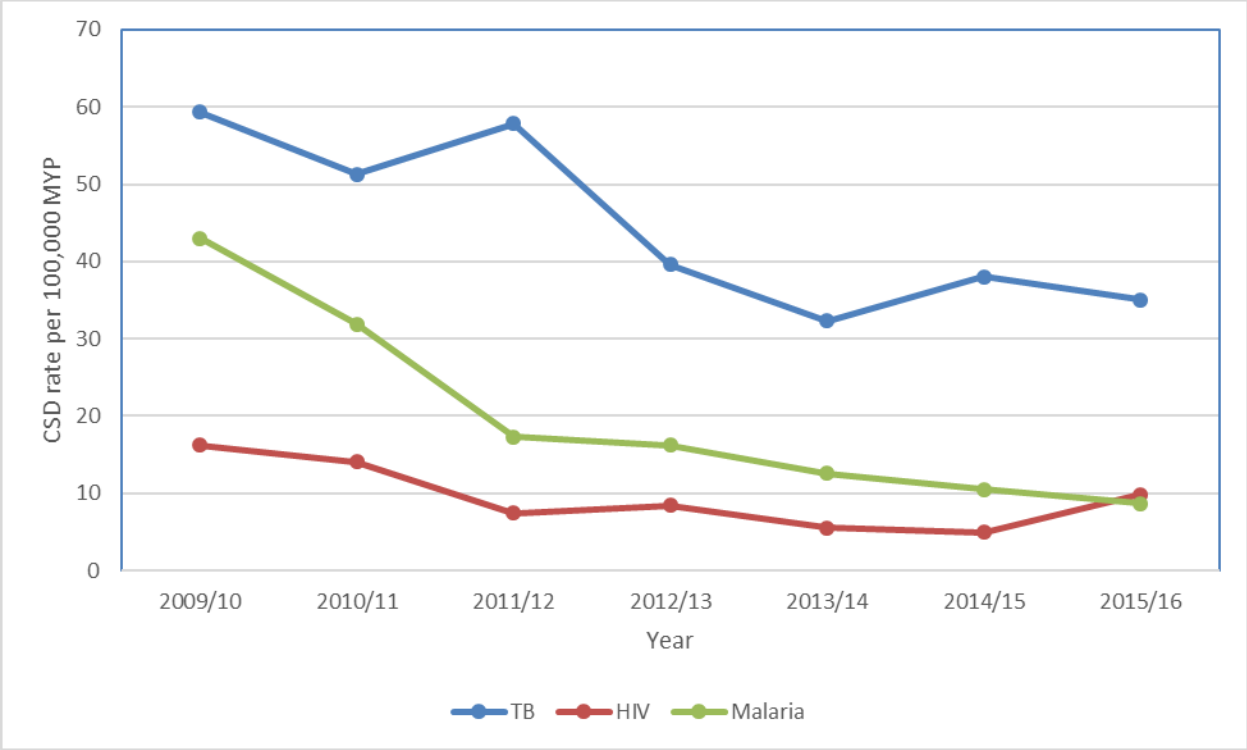

Figure 19 Causes specific Death rates in Ethiopian Health and Demographic Surveillance Sites, 2009/10–2015/16

5.2 Trends in Sex, Residence and Cause specific death rate

Death rates with respect to causes of death and sex and residence were determined based on the data where residence was classified as urban and rural based on the CSA classification.

Accordingly, except in 2011/12 and 2015/16, HIV/AIDS related death rate was relatively higher in females compared to males. On the other hand, for the first five years tuberculosis related death rate was higher in females than males that became even in the years 2014/15 and 2015/16.With respect malaria, in the first two years, 2009/10 and 2010/11., the rate of death was higher in females than males whereas between 2012/13 and 2014/15, the reverse happened. (Figure 20).

Similarly, cause specific death rates of urban and rural residents were also determined. Accordingly, except for the first two years, 2009/10 and 2010/11., HIV/AIDS related death rate was relatively higher among urban residents compared to the rural ones. On the other hand, tuberculosis related death rate was higher in rural compared to urban residents throughout the observation period. But the reverse happened for malaria related death rate in that the death rate was higher in rural areas compared to urban throughout the reporting period (Figure 21).

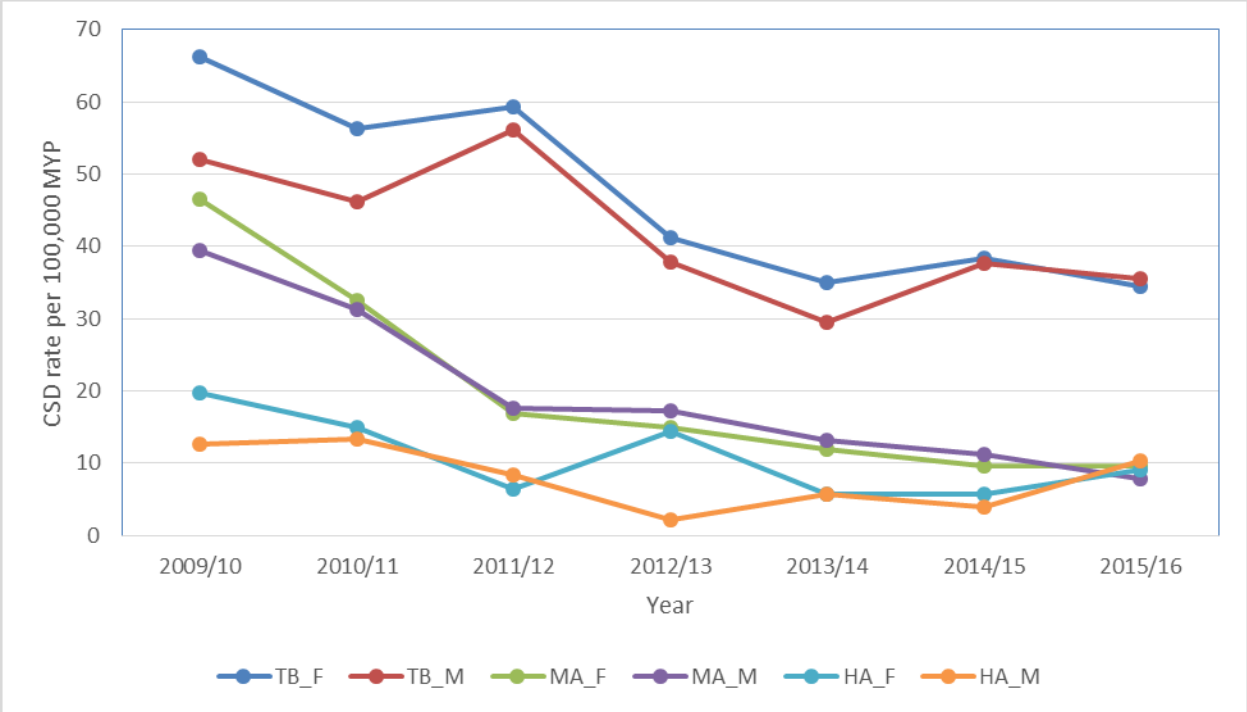

Figure 20 Trends in Cause-Specific Death Rates by Sex in Ethiopian Health and Demographic Surveillance Sites, 2009/10– 2015/16

HA=HIV/AIDS, TB=Tuberculosis, MA=Malaria, M=Male, F=Female

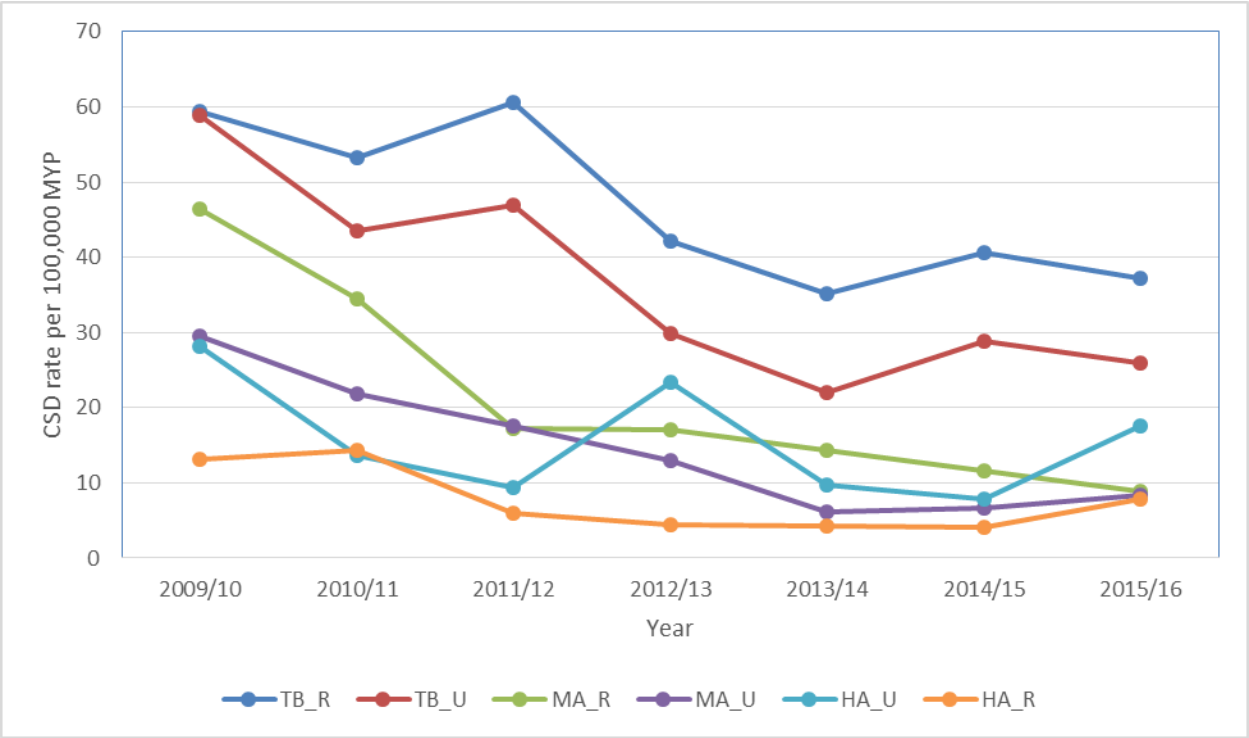

Figure 21 Trends in Cause-Specific Death rates by residence in Ethiopian Health and Demographic Surveillance Sites, 2009/10– 2015/16

HA=HIV/AIDS, TB=Tuberculosis, MA=Malaria, U=Urban, R=Rural

6. Result from Addis Ababa Mortality Surveillance Program

From January 01, 2007 to September 11, 2016 a total of 116,531 deaths were registered from all cemeteries of Addis Ababa. Among these deaths, 99,051 of them were eligible for verbal autopsy (VA). From the eligible death records, a random sample of 10% (n=9,905) was drawn for VA interview and 7,739 (78.1%) of them were completed successfully. The remaining 21.9% of them were not completed due to different reasons such as; addresses were lost, caregiver not available or family members refused to respond. Therefore, this report is organized from a total of 7,739 both adult and child completed verbal autopsy cases.

Among the deceased, 51.9% were males. Children of age less than 15 years consisted of 3.8% of the sample. The elderlies (age 65 or above years) constituted more than two in five (45.4%) while those who in the age 50-64 made up 18.5% of the sample. One in ten of the samples (10.8%) were in the age group 25 to 34 years. With regard to educational status of the deceased, 30% did not attend any formal education, two in ten (19.1%) attended primary education and nearly a quarter of them (23.2%) had an at least secondary level of education. Three in ten (31.7%) of the sample were married, 22.4% were widowed and 14.9 were single and 8.2% were divorced (Table 2.1).

Proportionate mortality ratio of HIV/AIDS, TB and Malaria causes of deaths were 10.8%, 6.0% and 0.2%, respectively. Proportionate HIV/AIDS mortality ratio is higher among females (12.1%) as compared to males (9.5%). Both the number and proportionate mortality ratio due to TB is higher among males (6.8%) than females (5.1%). Of all child deaths of age under 15 years, deaths caused by HIV/AIDS constituted 1%. HIV/AIDS related proportionate mortality ratio is highest among those who are in the age range of 25-49 years. The figure for youths of age 15-24 (17.2%) is also higher than the overall average. Similarly, TB related mortality was higher than the overall average in all age groups with the exception of children and the elderlies (4.0%) (Table 2.1).

Though a large number of the deaths were among illiterates, HIV/AIDS and TB related proportionate mortality ratios were higher among those who had primary and secondary level of education. Further, proportionate mortality ratio due to HIV/AIDS and TB is higher among single individuals and those who were separated (Table 2.1)

Table 12 Causes of Deaths by Socio-demographic characteristics of the deceased, AAMSP, 2007-2016 [Proportionate Mortality Ratio]

Characteristics	Causes of Deaths				Number of Deaths (%)
	HIV/AIDS	TB	Malaria	Others	
Sex*					
Male	382(9.5)	273(6.8)	12(0.3)	3342(83.4)	4009(51.9)
Female	449(12.1)	191(5.1)	5(0.1)	3076(82.7)	3721(48.1)
Age group					
<15	3(1.0)	-	-	292(99.0)	295(3.8)
15-24	51(17.2)	22(7.4)	1(0.3)	222(75.0)	296(3.8)
25-34	272(32.5)	79(9.4)	5(0.6)	482(57.5)	838(10.8)
35-49	385(28.1)	124(9.0)	9(0.7)	853(62.2)	1371(17.7)
50-64	93(6.5)	100(7.0)	2(0.1)	1234(86.4)	1429(18.5)
65+	29(0.8)	139(4.0)	-	3342(95.2)	3510(45.4)
Education					
Illiterate	111(4.8)	113(4.9)	-	2097(90.3)	2321(30.0)
Primary	276(18.7)	115(7.8)	3(0.2)	1085(73.4)	1479(19.1)
Secondary	273(22.1)	118(9.6)	6(0.5)	836(67.8)	1233(15.9)
Above Secondary	70(12.4)	21(3.7)	5(0.9)	469(83.0)	565(7.3)
Other/Unknown	103(4.8)	97(4.5)	3(0.1)	1938(90.5)	2141(27.7)
Marital status					
Single	262(22.7)	106(9.2)	9(0.8)	779(67.4)	1156(14.9)
Married	260(10.6)	163(6.6)	5(0.2)	2029(82.6)	2457(31.7)
Separated	114(18.0)	49(7.7)	-	471(74.3)	634(8.2)
Widowed	144(8.3)	76(4.4)	1(0.1)	1514(87.3)	1735(22.4)
Unknown	53(3.0)	70(4.0)	2(0.1)	1632(92.9)	1757(22.7)
Total	833(10.8)	464(6.0)	17(0.2)	6425(83.0)	7739(100.0)

** Sex had 9 missing records*

Trends in proportionate mortality ratio over the period 2007 to 2016 are shown in table 2 above for HIV/AIDS, TB and malaria. The number of deaths over the years is nearly similar except for the year 2016, which is exceptionally lower. The trend for malaria is nearly stable over the indicated period. However, the proportionate mortality ratio had shown a declining trend for HIV/AIDS from 21.8% in 2007 to 1.4% in 2016. The ratio had shown a slight increase during the year 2012 to 9.2% from 7.6% in 2011 and had fallen to 3.8% in 2015. The trend for TB, on the other hand, had not shown a clear trend. The proportionate mortality ratio showed a steady increase in the early years from 4.4% in 2007 to 8.2% in 2009. From 2009 onward the ratio for TB showed a fall and rise alternating every year (Table 2.2).

A large number of the deaths had occurred outside health institutions. More than three in five (63.0%) of the deaths occurred at home and still another 5.8% of all the deaths happened neither at a health facility nor at home. Proportionate mortality ratio due to HIV/AIDS were higher for those who died at health institution (14.6%) than deaths that happened at home (9.5%). A similar result is observed for deaths due to TB, health institution (7.3%) vs home (5.8%) (Table 2.2).

The proportionate mortality ratio due to HIV/AIDS in Addis Ababa showed significant decline throughout the observation period. Deaths due to tuberculosis also exhibited a gradual decline but not as marked changes as that of HIV over the years (Figure 22).

Table 13 Causes of Deaths by Year of death, AAMSP, 2007-2016 [Proportionate Mortality Ratio]

Characteristics	Causes of Deaths				Total n (%)
	HIV/AIDS	TB	Malaria	Others	
Year[1]					
2007	221(21.8)	45(4.4)	2(0.2)	747(73.6)	1015(13.1)
2008	180(17.9)	62(6.2)	3(0.3)	759(75.6)	1004(13.0)
2009	110(10.0)	90(8.2)	3(0.3)	897(81.5)	1100(14.2)
2010	93(8.8)	72(6.8)	3(0.3)	888(84.1)	1,056(13.6)
2011	81(7.6)	75(7.1)	3(0.3)	900(85.0)	1,059(13.7)
2012	95(9.2)	50(4.8)	1(0.1)	887(85.9)	1,033(13.4)
2015	51(3.8)	68(5.1)	2(0.2)	1211(90.9)	1332(17.2)
2016	2(1.4)	2(1.4)	-	136(97.1)	140(1.8)
Place of death					
Home	462(9.5)	281(5.8)	2(0.04)	4134(84.7)	4879(63.0)
Health Institution	345(14.6)	173(7.3)	14(0.6)	1835(77.5)	2367(30.6)
Others	24(5.3)	10(2.2)	1(0.2)	416(92.2)	451(5.8)
Unknown	2(4.8)	-	-	40(95.2)	42(0.5)
Total	(**10.8**)	(**6.0**)	(**0.2**)	(**83.0**)	**7739(100.0)**

[1] In 2013 and 2014 data were not collected

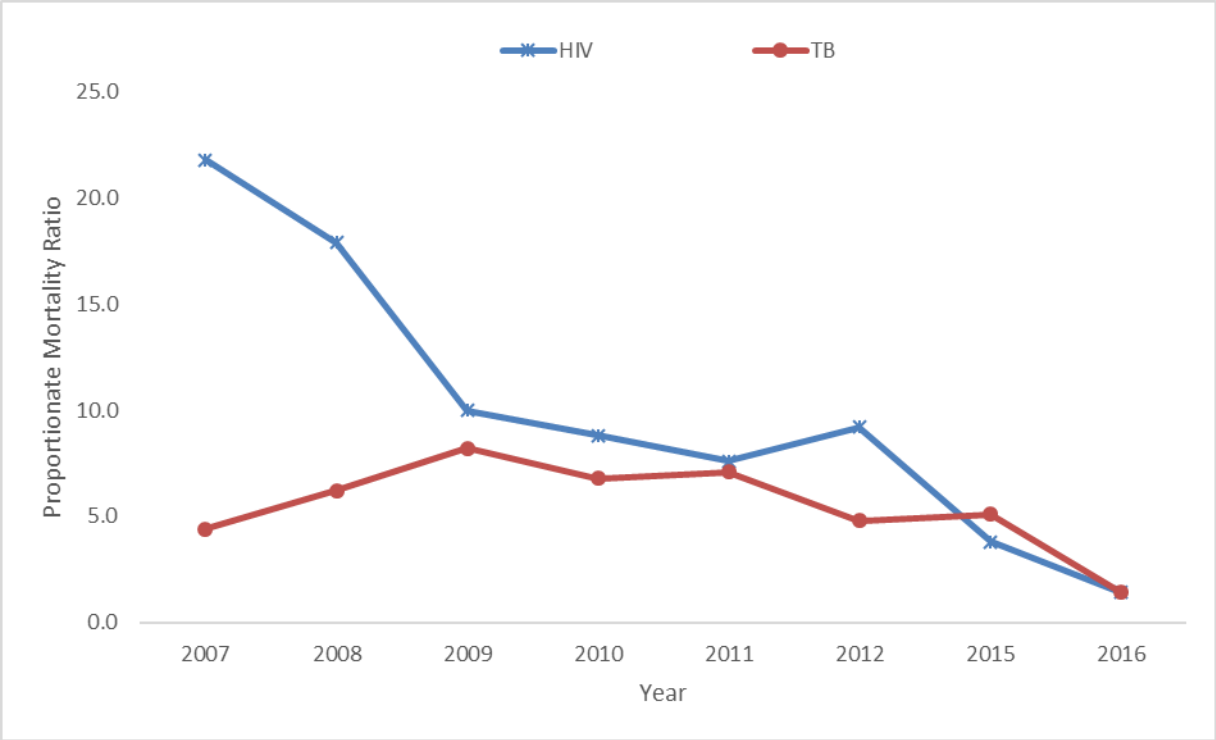

Figure 22 Trends in HID/AIDS and TB related proportionate mortality ratio, AAMSP, 2007-2016

7. Conclusion

The percent of hospital outpatient consultation for HIV/AIDS has shown a rise and subsequent fall in the period 2001/2 to 2015/16, the figure peaked at around 2005/6 and began falling after 2006/7.

Relatively high proportion of HIV/AIDS as a primary diagnosis from the total number of consultation (3%) were observed in 2005/6 and 2006/7.

A significant number of HIV/AIDS patient hospital admissions were from medical ward. The number of HIV/AIDS patient hospital admissions has shown a rising trend over the period 2001/2 to 2015/6

The number of HIV cases had shown a consistent increase with a widening gap between the sexes over time, females being highly affected.

The proportion of discharge after admission had shown an increase over time. The number of HIV related mortality has also shown a rise though it is at a lower rate when compared with the rate of discharge.

Individuals of age 25-49 are disproportionately affected by HIV at all given times whereas the elderlies (65+) were the least affected groups.

The number of HIV patients enrolled in care and treatment showed an increasing trend and reached its peak in 2006/7; the number has been steadily declining since then.

From 2002/3 through 2012/13 the number of deaths due to HIV/AIDS showed an increasing trend, and then from 2014/15 to 2015/16 it declined.

HIV/AIDS specific death rate per 100,000 mid-year population from 2009/10 through 2014/15 except 2012/13 revealed a decline trend, and increased again in 2015/16.

In all years except 2011/12, 2013/14 and 2015/16, HIV specific death rate per 100,000 mid-year population among females were relatively high compared to males.

In all years except 2010/11, HIV/AIDS specific death rates per 100,000 mid-year population were higher among urban residents compared to rural residents.

From the total 254 deaths due to HIV/AIDS observed in the six surveillance sites, 116 were from age group 30-49 followed by 76 from age >= 50.

Deaths due to HIV/AIDS are rising in the year 2015/16 in the six HDSS sites but in Addis Ababa there was a consistent decline.

Death due to HIV/AIDS was high among females, urban residents and in the age group 30 to 49 years in the six HDSS sites.

Deaths due to HIV/AIDS in Addis Ababa surveillance site showed decline across the reporting period though the change was marked in HIV/AIDS related deaths.

The proportion of tuberculosis cases among all consultations in studied hospitals was persistently declining but the magnitude and the rising trend of diagnosed tuberculosis cases indicates that TB remains in the list among priority public health problem for Ethiopia in the coming years. The proportion of elderly people among admitted TB cases has increased through time and the trend implies that it will continue to rise in the years to come. More males were admitted due to TB than females indicating the presence of gender disparity among hospitalized TB cases. The case fatality ratio among admitted TB cases was high in studied hospitals; this may be due to late diagnosis or because hospitals receive and manage more complicated and severely ill cases than other health facilities do.

The HDSS and AAMSP study showed a consistent declining trend of mortality rates due to TB. Death due to Tuberculosis was high among females, urban residents and in the age group 30 to 49 years in the surveillance sites.

Trend of malaria death shows a decline over the last fifteen years. Relatively low deaths of malaria cases have also been observed from the total admission in the last fifteen years. In relative terms higher proportion of malaria cases were consulted and admitted than TB and HIV. Males and age above 15-year-old accounted for the majority of the admissions for malaria.

The total number of deaths due to malaria decreased from 151 in 2009/10 to 42 deaths in 2015/16, representing a 72% reduction in malaria deaths in the DHSS sites.

The percentage of malaria related death was higher in rural (85%) areas compared to urban (15%) throughout the reporting period and children less than five years and adult above 50 years old were the most affected ones. Unlike the age group, no remarkable difference between male and female in malaria related death was observed.

8. Recommendations

To reduce mortality due to HIV/AIDS, for women and urban residents it should be given a special attention in which enable them utilizing the existing health care service from nearby facilities.

Providing successful treatment and increased interventions for HIV are of supreme importance, and health care institutions should raise the health seeking behavior of the community via a well-designed behavioral change communication that suits local contexts.

To reduce deaths due to HIV/AIDS special attention should be given for middle and old age groups.

Integration of TB control and care with other health services, particularly strengthening the HIV-TB collaborative activities, can help hospitals detect more TB cases and detect them early. Health facilities are required to implement globally and nationally recommended interventions i.e. cough triage, screening of all hospital visitors for TB symptoms despite their primary complaints and demands, regular screening of staffs for active tuberculosis. Infection control measures should be part of hospitals' action plan to halt the transmission of tuberculosis within their premises. Further studies should be conducted to know the reasons for high mortality rates and gender disparity observed among hospitalized TB cases.

Health care institutions should raise the health seeking behavior of the community via a well-designed behavioral change communication that suits local contexts.

The significant reduction in the burden of malaria (admission and deaths), and effort to strengthen quality of care are commendable. However, the country should accelerate quality-assured evidenced-based malaria control activities to reach the elimination targets by 2030.

The current study revealed a marked reduction in malaria admissions, death, and consultation over the last decade. Hence, to maintain this achievement, case management and quality of care need to be improved at all level of the health system and not to mention, sustaining a high coverage of major interventions and building strong surveillance system.

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Appendix B: Data sheets used to collect data from Hospitals

Data sheet 1: Information on number of outpatient consultations (N) (2001/2 – 2015/16)*

1. Hospital_____ 2. Region_____ 3. Zone _____

Year	Primary Diagnosis			Total consultation (N)
	HIV (N)	TB (N)	Malaria (N)	
2001/2				
2002/3				
2003/4				
2004/5				
2005/6				
2006/7				
2007/8				
2008/9				
2009/10				
2010/11				
2011/12				
2012/13				
2013/14				
2014/15				
2015/16				

*Aggregated annual data from medical, surgical, pediatrics, obstetrics and gynecology, delivery, emergency and other departments

Data collector Name and Signature_____ Supervisor Name and Signature_____

Data sheet 2: Information on number of admissions (N) (2001/2 – 2015/16)

1. Hospital_____ 2. Region_____ 3. Zone _____

Year	Medical (N)			Pediatrics (N)			Surgical (N)			Gyn/obs. (N)			Delivery (N)			Emergency (N)			Other (N)*		
	HIV	TB	Malaria	HIV	TB	Malaria	HIV	TB	Malaria	HIV	TB	Malaria	HIV	TB	Malaria	HIV	TB	Malaria	HIV	TB	Malaria
2001/2																					
2002/3																					
2003/4																					
2004/5																					
2005/6																					
2006/7																					
2007/8																					
2008/9																					
2009/10																					
2010/11																					
2011/12																					
2012/13																					
2013/14																					
2014/15																					
2015/16																					

* Ophthalmology, dentistry, psychiatry, etc.

Data collector Name and Signature_____ Supervisor Name and Signature_____

Data Sheet 3: Admissions, outcomes and length of hospital stay (2001/2 – 2015/16)

1. Hospital_____ 2. Region_____ 3. Zone _____

Year	Reg. No**	Sex (M/F)	Age	Primary Reason for Admission 1. HIV/AIDS 2. TB 3. Malaria	Date of admission (**DD/MM/YY**)	Outcome: 1. discharge 2. death 3. transfer out	Date of discharge/ death/ transfer out (**DD/MM/YY**)	Condition on discharge: 1. improved 2. same 3. worsened 4. NA (if died)

** Registration number on the admission book

Data collector Name and Signature_____ Supervisor Name and Signature_____

Data sheet 4: Information on HIV patients treatment follow up (2001/2 – 2015/16)

1. Hospital_____ 2. Region_____ 3. Zone _____

Sr. No	Enrolment to care (Year)	Age	Sex M/ F	ART Status	Date of ART initiation (DD/MM/ YY)	Clinical stage ART initiation	Original regimen	CD4 count at ART initiation (if available)	**Status at Outcome**					
									Outcome	FS	Wt/ Ht	TxReg	CD4 count on outcome	Date of out come

ART Status 1. On ART 2. Pre-ART 3. NA

Outcome 1. Alive 2. Died 3. transferred out 4. lost to follow-up

Functional Status (FS) 1. Working 2. Bed Ridden 3. Ambulatory

Data sheet 5: Information on TB patients treatment follow up (2001/2 – 2015/16)

1. Hospital_____ 2. Region_____ 3. Zone _____

Year	Unit TB Number	Start Date	Sex M/F	Age	work HF/ non HF	Baseline Wt	Smear /culture result	Presumptive MDR TB	HIV-test Result	Outcome	Date of Outcome
					1. HF		1. Positive	1.Yes	1. Reactive	A	
					2.Non HF		2. Negative	2. No	2.NR		

Outcome (A) 1. Cured 3-Tx Failure 5. LTFU 7.Not evaluated
2-Tx completed 4. Died 6. Transferred out

Data collector Name and Signature_____ Supervisor Name and Signature_____

Appendix C: Mid-year population by year for the six Health and Demographic Surveillance sites

	year						
Age	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	/2014/2015	2015/2016
0--4	50,250	48,984	46,866	45,393	46,878	51,964	61,080
5--14	102,942	105,165	106,756	107,324	107,495	111,435	133,082
15--29	99,018	103,016	104,321	106,986	110,294	119,013	134,898
30--49	63,523	66,775	69,099	72,477	75,863	83,612	99,772
50+	35,159	36,918	37,894	38,939	40,239	43,999	51,444
Total	350,892	360,858	364,936	371,119	380,769	410,023	480,276