Progress towards the 2020 Fast Track targets in Eastern sub-Saharan Africa region and in Ethiopia; using Global Burden of Disease 2017 data

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Abstract

Background

Sustainable Development Goal (SDG) 3.3, targets to eliminate HIV from being a public health threat by 2030. For better tracking of this target interim Fast Track milestones for 2020 and composite complementary measures have been indicated. This study measured the Fast Track progress in Eastern sub-Saharan Africa (ESSA) region and in Ethiopia across ages using Global Burden of Disease (GBD) 2017 data.

Methods

The National Data Management Center for health research team at Ethiopian Public Health Institute has analyzed the GBD 2017 data for the year 2010 to 2017 for Ethiopia and ESSA countries. GBD 2017 data sources were census, demographic and health surveys, prevention of mother-to-child HIV transmission and anti-retroviral treatment programs, sentinel surveillances and UNAIDS spectrum modeling. Age standardized and age specific HIV/AIDS incidence, prevalence, mortality, Disability Adjusted Life Years (DALYs), incidence:mortality ratio and incidence:prevalence ratio were calculated with corresponding 95% confidence limits.

Results

Slow progress has been recorded in reducing new HIV infection in ESSA since 2010; only Uganda would achieve the 75% target by 2020. Ethiopia, Tanzania and Uganda have already achieved 75% mortality reduction target set for 2020. With incidence: prevalence ratio of < 0.03, Ethiopia, Rwanda and Uganda are on track to end HIV by 2030. Ethiopia has an incidence: mortality ratio <1 due to high mortality; while Kenya, Rwanda, Tanzania and Uganda, have a ratio >1 due to high incidence. Ethiopia has reduced the HIV incidence rate by 76% among under 5 children and seem to be on track to attain the 2020 national target but far behind achieving the target among the 15-49 age group.

Conclusion

The ESSA countries have made remarkable progress towards achieving the 75% HIV/AIDS mortality reduction target by 2020 since 2010, although they progress poorly in reducing HIV incidence. Having an incidence:prevalence ratio of less than 0.03, Ethiopia, Rwanda and Uganda are well heading
towards epidemic control. The high HIV/AIDS mortality rate in Ethiopia for its incidence requires innovative strategies to bring undiagnosed cases to treatment and care services across age. For sustainable epidemic control, Ethiopian needs to build strong institutional capacity to generate strong evidence to support policy decision.

**Background**

Southern and Eastern Sub-Sahara Africa (ESSA) regions have been known to carry high burden of HIV/AIDS since the mid-1990s. In recent years, this situation is changing for the better. According to 2018 UNAIDS update, the burden of HIV/AIDS in the region has been steadily declining for the past 10 years [1]. In this regard, Ethiopia is leading the way and aims to control the HIV epidemic at national level. Ethiopia has reduced the adult HIV incidence by 70% in 2016 compared to 1990 and HIV/AIDS related mortality have declined by 84% in 2017 compared to the peak in 2005 [2].

Capitalizing on these sustained progresses, the ESSA countries have targeted to end the AIDS epidemic from being a public health threat by 2030 [1, 3]. The United Nation General Assembly, set targets to reduce new HIV infection and HIV/AIDS related deaths by 75% by 2020 from the 2010 baseline as interim Fast Track millstone to achieve the 2030 SDG targets [4]. In line with this the current Ethiopian Health Sector Transformation Plan (HSTP) targets to reduce the adult HIV incidence by 60% and to reduce new HIV infections among children to zero from the 2010 baseline [5, 6]. As we approach 2020, assessing progress towards the targets across the Eastern Sub-Sahara African countries is crucial to get insight how countries are performing and where efforts should be directed to achieve the targets.

Ethiopia is one of the countries long been known for having a generalized HIV epidemic fueled by unprotected sexual intercourse like many Eastern Sub-Saharan African countries. Currently, with adult HIV prevalence of 0.9%, Ethiopia has joined the counties having concentrated epidemic. Although, reducing HIV prevalence and incidence rates are big successes for the county, currently tracking new infection has presented a challenge and required extra efforts to identify highest contributors to new HIV infection, groups that carry highest burden and infected individuals who otherwise would have been missed with the existing system. To this end, the country has considered HIV/AIDS as one of the
immediately notifiable diseases and established a case based surveillance system under the Public Health Emergency Management unit at the Ethiopian Public Health Institute (EPHI). Index testing is a family-based approach to HIV testing and service delivery not only helps to identify new cases but also enables parents, adolescents and children to access care as a unit and also have a potential to improve retention in treatment and care programs as it offers a convenient service for the family. Studies have shown high HIV positive yield through index testing [7, 8]. The main drives of the HIV/AIDS epidemic in Ethiopia had been sexually active adults (15–49 years) and are the most crucial target for the national HIV/AIDS prevention and control efforts. These efforts have significantly contributed to the reduced national burden of HIV/AIDS and for the recoded positive progress the country has made. However, currently the situations on the ground seem to be changing. According to recent national data from urban HIV prevalence survey, the burden of HIV/AIDS is distributed across ages [9], which highlights the need for all-inclusive approaches. The survey uncovers the poor progress towards the 90-90-90 targets (to test 90% of the HIV cases, to put 90% of the tested positive on treatment and to achieve a 90% viral suppression among those who received treatment by 2020) among adolescent and young adults, where only 48.2% were viral suppressed and the 50–64 years old adults that recorded the highest HIV prevalence (4.4%) [9]. Lack of reliable and comprehensive data on age specific burden on HIV/AIDS precludes the Ethiopian Federal Ministry of Health (FMOH) and the Federal HIV/AIDS Prevention and Control Office (FHAPCO) and other concerned stakeholders from understanding the magnitude of the problem to institute targeted responses. This paper intends to produce evidence for policy/decision makers to show age specific burden of HIV at the national level.

Outcome and impact indicators including incidence, mortality, prevalence and Disability Adjusted Life Years (DALYs) are commonly used measures for tracking progress, estimating disease burden as well as for equitable resource allocation, policy formulation and for developing strategies. Following the calming of the HIV/AIDS epidemic globally, the UNAIDS has suggested composite measures for better tracking of countries’ progress towards the 2030 SDG target of ending AIDS as a public health threat [1]. These composite measures are incidence: mortality ratio, which measures annual change in the
number of people living with HIV within a given population to forecast how current investments will impact future resource needs and incidence: prevalence ratio, which measures the average duration of time a person lives with HIV in an epidemic that remains stable over many years and helps to track progress towards the UNAIDS objective of “Preventing HIV infections and ensuring that HIV-positive people live long and healthy lives”. Therefore, the objective of this paper is to track progress across selected ESSA countries towards the 2020 Fast Track millstones using outcome and impact indicators as well as UNAIDS suggested composite measures. The paper also presents estimates of age standardized and age specific burden of HIV/AIDS and progress that Ethiopia has made at National level since 2001.

Methods
Study settings
The Easter Sub-Saharan Africa (ESSA) region has carried highest HIV/AIDS burden in the world next to Southern Sub-Saharan African region. Currently, the region has demonstrated success in the prevention and control of the HIV/AIDS epidemic [1]. As part of the ESSA region, Ethiopia was one of the country hardest hit by the HIV epidemic. Yet, currently, the country is a leading example in controlling the HIV/AIDS epidemic. The country has achieved the Millennium Development Goal (MDG) 6 combating HIV/AIDS, recording a 90% HIV/AIDS reduction in HIV incidence between 2000 and 2015 [10]. With a population level HIV prevalence of 0.9%, Ethiopia has join countries having concentrated epidemic [3]. All these achievements did not happen in a vacuum. Country ownership of the HIV/AIDS prevention and control programs, strong political will and commitment have been instrumental for all the successes.

Ethiopia has been constantly updating its HIV/AIDS prevention and control interventions in line with global recommendations with some contextual adaptation [11-14]. The county has endorsed the UN Sustainable Development Goals (SDGs), which targets eradication of HIV/AIDS by 2030 from being a public health threat and its 2020 Fast Track interim millstones, which targets to test 90% of the HIV cases, to treat 90% of the tested and to achieve 90% viral suppression among those who received treatment. For attaining these goals, the country has developed an HIV/AIDS prevention and control
roadmap, which targets 50% reduction in new HIV infection among adults by 2020 from the 2016 baseline [3].

Ethiopia has also been known for its adherence to global and national guidelines [11–18]. The National HV testing recommendations have shifted from Voluntary HIV Counseling and Testing (VCT) to Provider Initiated HIV Counseling and Testing (PICT), which has made HIV a routine test in antenatal setting and recently index testing has been introduced. Enrollment to ART program has seen a departure from symptomatic/CD4 based to a ‘test and treat’ approach irrespective of CD4 cell count. Health facilities having HIV/AIDS diagnostic capacity such as CD4, viral load and Early Infant Diagnosing (EID) testing has become the norm not the exception.

In the past decade, Ethiopian has recorded significant improvement in basic health service coverage and is currently aiming for universal health coverage. Provision of free HIV/AIDS services including HIV testing, viral load, CD4, treatment and care in public health facilities have significantly increased access to and coverage of these services, which in turn contributed to the reduction in HIV incidence, prevalence and deaths. However, access and utilization of health services in general and HIV/AIDS care and treatment services in particular remain sub-optimal. According to HSTP midterm review, less than 50% of HIV positive women in Ethiopia have access to prophylaxis ART [5]. The situation is much worse in rural areas, where about 80% of the population live and in emerging sub-national states/regions. According to current figures, over 20% of the HIV positive people do not know that they are HIV infected [3]. This is due to poor access to HIV testing, treatment and care services; poor health seeking behavior as well as due to sociocultural and structural barriers, which includes limitations to correctly map and reach out high risk groups.

Study Methods

The Ethiopian public health institute (EPHI) has established National Data Management for health (NDMC) in 2017. The goal of the center is to collect and archive available health and health related data; undertake in-depth data analysis by integrating different data sources and applying robust statistical analytic methods; identify evidence gaps and research priorities and synthesize evidence for policy and decision. The center has strong collaboration with the Institute of Health Metrics and
Evaluation, University of Washington. The center has a Burden of Disease unit and is actively involved in the estimation of national and sub-national disease burden. This paper has been developed as part of the centers activity to provide evidence for tracking Fast Track interim targets and SDGs progress in ESSA and the burden of HIV/AIDS across ages in Ethiopia using GBD 2017 data.

This study used an open access data published by the GBD project for the year 2017. Due to the nature of the data collected, ethical approval and consent procedures were not needed. The GBD project collects published and unpublished health data from different sources including census, population and health registries, demographic and health surveys and scientific publications. For countries like Ethiopia where population and health statistics are scares, modeling techniques are employed, taking data from other years, age groups or similar settings to generate a complete set of estimates. The main data sources the GBD 2017 has incorporated for the estimation of HIV/AIDS burden were Population and Housing Census data, Demographic and Health Surveys and data from UNAIDS spectrum projection. Moreover, the GBD 2017 dataset has prevalence and incidence data from antenatal care clinics and population-based sero-prevalence surveys, CD4 progression rates, HIV/AIDS related mortality with or without antiretroviral therapy (ART) and mortality from all other causes. The estimation strategy links the GBD 2017 assessment of all-cause mortality and estimation of incidence and prevalence so that for each draw from the uncertainty distribution all assumptions used in each step are internally consistent. HIV/AIDS incidence, prevalence, and death with GBD versions of the Estimation and Projection Package (EPP) and Spectrum software were estimated. High levels of uncertainties are associated with disease burden estimates and hence use 95% uncertainty intervals (US) for all estimates. One can find detailed information on the GBD methods used for estimating Global, Regional and National HIV/AIDS Incidence, Prevalence, DALYs and Mortality published in 2016 in Lancet [19].

The GBD initiative is grouping countries into regions. The Eastern Sub-Saharan African region has 28 countries and includes all the countries in the Horn of Africa. Among these countries, Eritrea, Kenya, Rwanda, Tanzania and Uganda are close neighbors to Ethiopia, have similar HIV/AIDS epidemic burden patterns and are UNAIDS focus countries to end HIV/AIDS by 2030. This paper therefore,
tracks progress across the ESSA region and in the above listed countries. In this paper outcome and impact measures have been estimated. These include incidence which, estimates new HIV infection; prevalence, which estimates all HIV/AIDS infection and mortality, which estimates all HIV/AIDS related deaths. Moreover, this study reported Years of Life Lost (YLLs), which estimates the expected number of years of life remaining when a death occurs. Here deaths at a younger age have greater weight than deaths in old age. Years Lived with Disability (YLDs), are estimated by multiplying the HIV prevalence by its disability weight. Disability-Adjusted Life Years (DALYs), which estimates the sum of years of YLLs and YLDs. The total number of DALYs in a population for one year can be interpreted as the distance between the current health status of the population and a hypothetical, optimal scenario where the entire population has health life into old age. YLLs, YLDs and DALYs were presented in numbers. Rates for within country analysis and comparing with other countries were presented in 100,000 person-year observations. The age-adjusted rates have taken into consideration demographic changes in the population, such as population growth and ageing.

This paper presents countries progress towards the 2020 interim Fast Track milestones that the United Nations General Assembly has proposed. These are a 75% reduction in incidence and mortality rates by 2020 from the 2010 baseline [1]. The study also used UNAIDS suggested complementary measures to estimate the burden of HIV/AIDS in a country and for tracking progress [1]. One of this is incidence:mortality ratio, which helps to track progress towards the SDG goal of ending AIDS as a public health threat by 2030. Combining HIV incidence and mortality measures yield a dynamic measure of the annual change in the number of people living with HIV within a given population. The ratio helps to forecast how current investments will impact future resource needs. A ratio of > 1 indicates net increase in new HIV infections and the likely increase in the financial burden on the health system. A ratio of < 1 indicates net reduction in prevalent HIV cases due to mortality, and the likely decrease in financial burden on the health system. However, a ratio < 1 is undesirable. The other one is incidence: prevalence ratio, which indicates the average duration of time a person lives with HIV in an epidemic that remains stable over many years and helps to track progress towards the
achievement of the UNAIDS objective of “Preventing HIV infections and ensuring that HIV-positive people live long and healthy lives”. For this ratio, 0.03 has been selected by the UNAIDS as an epidemic transition benchmark, which corresponds to an average life expectancy after infection of 30 years. The assumption is that with this average life expectancy, the total HIV prevalent cases will gradually fall if the number of incident cases are less than three per 100 people living with HIV [1].

Results

Fast Track progress across Eastern Sub-Saharan African (ESSA) countries

Progress in reducing new HIV infection

To achieve SDG target 3.3, countries are expected to reduce new HIV infection by 75% between 2010 and 2020. The data has shown slow progress to achieve the 2020 millstone in the ESSA region and it is less likely that the region would achieve the 2020 target. Uganda has already achieved the 75% target set for to reduce HIV incidence by 2020. Ethiopia has reduced the HIV incidence by 13.3% while Eritrea has recorded a 13.6% increases (Fig. 1).

Figure 1. Age standardized HIV incidence and HIV/AIDS related mortality rates per 100 000 populations from 2010 to 2017 across ESSA countries.

Progress In Reducing Hiv/aids Related Deaths

All the countries have recorded significant decline in HIV/AIDS related mortality between 2010 and 2017 (Fig. 1). The ESSA region average decline was 65% in 2017, and countries need to make accelerated progress the 2020 75% mortality reduction target unless. Ethiopia, Tanzania and Uganda have already achieved, while Eritrea, Kenya and Rwanda have achieved less than 50% and are in short of the 75% target.

Progress in the number of people living with HIV

The number of people living with HIV has remained stable in the region and in most countries. Large reduction in HIV prevalence (28%) was observed in Ethiopia between 2010 and 2017.

Tracking Progress Using Incidence:prevalence Ratio

The UNAIDS has suggest a ratio of 0.03 as an epidemic transition benchmark, which corresponds to an average life expectancy after infection of 30 years. The assumption is that with this average life expectancy, the total HIV prevalent cases will gradually fall if the number of incident case is less than
three per 100 people living with HIV. The ratio for Ethiopia has been less than 0.03 since 2010, while Rwanda and Uganda have achieved it in 2017. The ratio for Eritrea has been greater than 0.03 since 2010 and has been increasing year by year (Fig. 2).

Figure 2. Age standardized HIV incidence:prevalence ratio across ESSA countries from 2010 to 2017

Tracking Resource Need Using Incidence:mortality Ratio
As shown in Fig. 3, the ESSA region and most ESSA countries have more people newly infected with HIV than those dying from HIV/AIDS, which gives a ratio of greater 1. By contrast, Ethiopia has more people dying from HIV/AIDS than those acquiring new HIV infections. In 2017, the age standardized incidence: mortality ratio for Ethiopia was 0.79, while 1.64 for Eastern Sub-Sahara Africa. Kenya, Rwanda, Tanzania and Uganda have a ratio of greater than one due to high rate of new infections and require more resource to address the problems.

Figure 3. Age standardized HIV incidence:mortality ratio across ESSA countries from 2010 to 2017

Burden of HIV/AIDS in Ethiopia across ages

Incidence across ages
The age standardized annual incidence rate has declined by 13% from 17.3 (11.9, 23.8) per 100,000 populations in 2010 to 15.0 (8.1, 24.2) in 2017. This corresponds to a 13% decline in the number of people acquiring new infection from 16,676 (12,475, 21,796) in 2010 to 14,484 (8,277, 22,958) in 2017. The HIV incidence rate was highest among under 5 children from 2010 to 2015, while in 2017 the HIV incidence rate was highest among 15–49 age group. Compared to the 2010 baseline, in 2017 the under 5 age group had recorded 77% decline in HIV incidence rate from 51.3 (40.9, 63.8) to 12.0 (8.1, 16.8), while the 15–49 age group recorded 12% increase from 21.1 (12.5, 31.6) to 23.7 (12.4, 39.1) compared to the 2010 baseline. The HIV incidence rate among 5–14 age group remained zero over the years (Table 1).

Table 1
All age, age standardized and age specific HIV/AIDS incidence, deaths, prevalence and DALY from 2001 to 2017, Ethiopia

| Measure | Age   | Metric | 2010 Estimate (CI) | 2013 Estimate (CI) | 2015 Estimate (CI) | 2017 Estimate (CI) |
|---------|-------|--------|--------------------|--------------------|--------------------|--------------------|
| DALY    | Under 5 | #      | 657740.3 (550449.0, 783721.2) | 371148.1 (294771.0, 466296.3) | 267313.7 (200555.0, 345949.0) | 197924.4 (145630.5, 261924.3) |
|         |       | Rate   | 4318.0 (3623.6, 5073.2) | 2367.2 (1860.3, 2864.2) | 1659.0 (1244.7, 2184.2) | 1190.4 (875.9, 1575.4) |
| Age Group | # | Rate |
|-----------|---|------|
| 5–14 years | | |
| Under 5 | | |
| Death | | |
| Rate | | |
| Incidence | | |
| All Ages | | |
| Rate | | |
Of the total of 14,483 (8, 277.02 -22, 958,39) new HIV infections that occurred in 2017, 13.7% (1, 991 (1,344-2,793)) were among under 5 age group and 80.8% (11,699 (6,108 – 19,306)) among 15–49 age group (Table 1).

**HIV/AIDS prevalence across ages**

The age standardized prevalence has reduced by 23% from 1,182.7 (1,025.0, 14.19.2) in 2010 to 911.0 (802.8, 1,037.6) in 2017. This corresponds to a 15% significant decline in the number of people living with HIV from 770, 657 (682,580, 887,466) in 2010 to 657, 394 (583,397–738,517) in 2017. Between 2010 and 2017, the highest significant HIV prevalence rate decline (64%) was observed among the under 5 age group, followed the 5–14 age group (54%) and 33% decline by the 15–49 age group. By the contrary, the HIV prevalence rate among the 50–69 age group has increased by 37% between 2010 to 2017. The HIV prevalence rate was highest among the 15–49 age group until 2010, since then the 50–69 age group has taken over the lead (Table 1).

Of the total 657, 394 people living with HIV/AIDS in 2017, 2.3% (15,328 (11,405 – 19,916)) were
under 5 years old children, 9.7% (640,10 (52,934 – 76,638)) were 5–14 years of age, 67.8% (445,588 (397, 219-504, 089)) were 15–49 years of age and 18.4% 121,018 (94,698 – 156, 603) were 50–69 years of age (Table 1).

Table 1. All age, age standardized and age specific HIV/AIDS incidence, deaths, prevalence and DALY from 2001 to 2017, Ethiopia

**HIV/AIDS related mortality across ages**

As shown in Table 1, The age standardized mortality rate has declined by 74% from 74.0 (65.5, 83.9) deaths per 100 000 populations in 2010 to 19.0 (16.4, 22.1) in 2017, which corresponds to a 65% significant decreased in the number of people dying from HIV/AIDS from 49, 484 (43,908, 55,643) in 2010 to 17,181 (14,600, 20,099) in 2017. Between 2010 and 2017, the HIV/AIDS related mortality has shown 70% decline among the under 5 age group, 66.7% among the 15–49 years and 63%the among 50–69 age group and 48% decline among the 5–14 age group. In 2017, an estimated 17,181 people died due to HIV/AIDS, of these 13% (2,254 (1,652-2,988)) were among < 5 age group; 13% 2,274 (1,882-2,687) were among 5–14 age group; 63% (10831 (9,062 – 12,884)) were among 15–49 age group and 10% (1,734 (1,198-2,406)) were among 50–69 age group. Over the years’ mortality remained highest among the 50–69 age group. The mortality gap across the age groups has narrowed down in recent years (Table 1).

**Disability Adjusted Life Years (DALYs) across ages**

As shown in Table 1, in 2017, the age standardized rate of DALY was 1.095.6/100 000 population, which corresponds to 1,116,408 DALYs for all ages. In 2017, the age group 15–49 had the highest (1,335/ 100,000 population) age specific rate of DALY followed by the under 5 age group (1.190/100,000 population). DALYs has shown significant decline between 2010 and 2017 in all age groups but remained highest among 15–45 age group followed by under 5 age group. Under 5 age group recorded the highest decline (72%) in rate of DALYs between 2010 and 2017, while the age group 5–14 recorded the least (55%).

**Discussion**

The objectives of this study were to track progress towards 2020 Fast Track target, which is an interim millstones for the 2030 SDGs of “ending HIV from being a public health threat” [4] across
Easter Sub-Saharan Africa countries and to estimate the burden of HIV/AIDS in Ethiopia across ages using GBD 2017 data. There has been slow progress in reducing HIV incidence across the ESSA region since 2010. The goal for reducing HIV/AIDS mortality by 75% by 2020 is within reach in most ESSA countries. Ethiopia, Rwanda and Uganda have achieved the incidence:mortality ratio of less than 0.03, which marks these countries are on track to meet the SDG 2030 target. In Ethiopia the HIV/AIDS mortality rate surpassed the incidence rate contrary to most ESSA countries, which contributed significantly to the reduction in HIV/AIDS prevalence. This is contrary to the UNAIDS’s objective of “ensuring that HIV-positive people live long and healthy lives” and needs serious considerations. At national level understanding the burden of HIV and risk factors are priority areas to control pediatric and adolescent HIV/AIDS [20]. According to the findings, next to heterosexual contact, MTCT is the major contributor to new HIV infection in Ethiopia followed by having a large proportion of HIV positive adults over 50 years who are not virally suppressed. For sustainable epidemic control where Ethiopia is heading, the source of new infections need to be targeted and addressed and there is a need to build strong institutional capacity to track and monitor progress at national and local levels.

To achieve SDG target 3.3, countries are expected to reduce new HIV infection by 75% between 2010 and 2020 [1]. According to the findings, there has been slow progress to achieve the 2020 milestone across the ESSA region. Only Uganda has achieved the 75% target set to reduce HIV incidence by 2020. Ethiopia has reduced the HIV incidence only by 13.3% between 2010 and 2017 and is unlikely to achieve not only the 2020 Fast track target but also its own HSTP plan of reducing adult HIV incidence by 60% between 2010 and 2020 [5, 6]. This is consistent with the HSTP midterm review findings, which highlighted poor progress to achieve the target set for HIV prevention and control and data gaps for progress monitoring [5, 6].

The ESSA region has recorded 73% significant decline in HIV/AIDS related mortality between 2010 and 2017 and is more likely to achieve the Fast Track target by 2020. Ethiopia, Tanzania and Uganda have already achieved the 75% mortality reduction millstone set for 2020 three years earlier. Eritrea, Tanzania and Rwanda are in short of the 75% target unless they have made accelerated progress. In Ethiopia the HIV/AIDS related mortality has shown a declining trend across ages. The under 5 age
group followed by the 15–49 age group have recorded the highest decline, while the age group 5–14 recorded the lowest decline. In recent years, the age group 50–69 years has carried the highest burden of the HIV/AIDS related mortality rate. These reflect the reality on the ground that the HIV/AIDS positive people are aging and still most HIV/AIDS prevention, care and treatment services are targeting adults (15–49 years of age) with little attention to older age groups. To realize Ethiopia’s path towards epidemic control, improving access to HIV testing, treatment and care services and retention into the care and treatment program for 50 years and older adults should be considered. In 2017, the UNAIDS has endorsed the use of incidence:prevalence ratio, a composite measure for tracking countries progress to end the HIV epidemic by 2030 from being a public health threat [1]. Along with Rwanda and Uganda, Ethiopia has already achieved the less than 0.03 epidemic transition benchmark contrary to many ESSA countries, which put Ethiopia on the lead in the HIV/AIDS epidemic control. However, the decreasing prevalence in Ethiopian due to the high rate of mortality is worrisome and needs thorough consideration.

Incidence:mortality ratio is another composite measure the UNAIDS has endorsed to estimate resources needed for future HIV/AIDS treatment and care services in a country. Since 2010, this ratio for Ethiopia has been less than 1 contrary to most ESSA countries and at the global level [1]. Although the ratio indicates that the country has fewer new infections than deaths, having high mortality is a reflection of either poor access or poor adherence to treatment and care services. Nonetheless, this finding contradicts what Ethiopia has recorded in the 90-90-90 Fast Track progress. According to EPHIA 2018 findings, Ethiopia has achieved the last two 90 s i.e putting more than 90% of the HIV diagnosed cases on ART and ensuring over 90% of the HIV/AIDS cases who received treatment achieved viral suppression among urban residents [9]. It is known that early initiation of ART and achieving significant viral suppression increases survival probability for patients infected with HIV. Despite these facts, the high mortality estimated in the present study could be attributed to the more than 40% undiagnosed HIV/AIDS cases. According to the 2016 EDHS, about 60% of the population reported that they have never tested for HIV [21]. It is partly due to limited access to HIV testing, treatment and care services, limited access to health care services in some rural and remote areas.
and low health care utilization (poor health seeking behavior). Hence, at national level Ethiopia has intensified targeted HIV testing, index testing and CBS to address the aforementioned gaps and to identify 90% of the people who are HIV infected (to achieve the first 90).

In Ethiopia the HIV incidence among children under 5 years of age has shown a 77% decline between 2010 and 2017. Hence, the country is more likely to achieve the Zero new infection target set for 2020 but requires accelerate progress [5, 6]. With regard to HIV incidence among adult (15–49 years), the recorded 12% increase by 2017 from the 2010 baseline is against the 60% reduction target the country has set for 2020. This requires to revisit current strategies and initiatives and to come up with innovative approaches to move fast forward [5, 6]. Unlike other similar settings, the HIV incidence rate in Ethiopia was highest among under 5 age group until 2015 compared to the other age groups [1]. This trend indicates the poor attention given to the PMTCT program and poor HIV/AIDS treatment and care services for under 5 children in earlier years. In response to the UNAIDS strategic target “Zero new infection” among children, Ethiopia has introduced “Option B plus” (initiating lifelong HIV treatment for all positive mothers irrespective of immunologic status and CD4 cell count) in 2013, which has brought remarkable progress in reducing MTCT (11–18). However, Option B plus works only for children whose mothers have access to antenatal care and PMTCT services. In Ethiopia, access to antenatal care and PMTCT service is still low, although access is higher in urban compared to rural areas [21]. Recent evidence revealed gaps in achieving the first 90, as it is contingent upon access to health care services where HIV testing is largely taking place. This prompted the government to consider other innovative active HIV case finding and reporting strategies and considers HIV as one of a notifiable disease. For this a case based surveillance (CBS) system integrated with index case testing and recency testing has been launched. These approaches have the potential to increase the number of HIV cases identified and put them on treatment. The next logical move for the country would be to expanding the role of CBS from being a case reporting system to a cohort by incorporating more sentinel events to ensure sustainable epidemic control and monitoring system.

Considering prevalence and DALYs absolute measures, Ethiopia still carried high burden of HIV despite the country being on the lead in the HIV epidemic control. Having high prevalent cases that
are not virally suppressed as in the case of 50–69 age group can sustain the production of new infections. According to EPHIA data, in urban settings the 50–64 age group adults have carried the highest HIV prevalence (4.4%) in the country, whereas only 72.2% of the 55–64 years were virally suppressed [9]. Focusing on the declining HIV prevalence and incidence rates as a basis for financing HIV prevention and control activities could have serious consequences in a country having over 650,000 HIV infected people, whereby about 40% them are undiagnosed.

Although, the GBD presents a special opportunity for countries having limited data on vital event registration, the GBD estimation has its own limitation as argued by Kelly and Wilson [22]. In countries like Ethiopia where there is no comprehensive vital registration data, the GBD uses different data sources, where at times some of these data are not updated. HIV being a highly evolving case, relying of years old data may provide misleading information and hence misalign HIV prevention and control efforts including resource allocation. Taking the weakness of the GBD into consideration, this study compares the HIV prevalence estimates with the 2016 EDHS data and found consistency and highlights the validity of the GBD 2017 estimates for program planning and policy formulation.

**Conclusion**

There has been remarkable progress in ESSA region to attain some of the 2020 Fast Track intern milestones set to achieve the 2030 SDG target of Ending HIV from being a public health threat. More work is needed to reduce the occurrence of new HIV infections across the region and across ages in Ethiopia. By all measures, Ethiopia’s progress in the prevention and control of the HIV epidemic has been remarkable. Compared to neighboring countries hardest hit by the epidemic, Ethiopia is leading the way towards controlling the epidemic. Understanding the burden of HIV/AIDS along the age continuum is a step forward to sustainable epidemic control on top of instituting targeted interventions to identify new cases, to put them on treatment and to ensure they all are virially suppressed. Current initiatives to scale up index testing and considering HIV as notifiable disease under the public health emergency management system show the country’s commitment and strong determination to control the epidemic. These endeavours require huge financial and human resources and strengthening the health system. Sustainable epidemic control require investment in system
building not the least to generate data and high quality evidence for monitoring outcome and impact and for tracking progress. Partners working on HIV need to direct their investment to support countries to achieve the national and international goals/targets through strengthening health and health data management systems.

Abbreviations

| Acronym | Full Form |
|---------|-----------|
| AIDS    | Acquired Immuno Deficiency syndrome |
| ART     | Anti-retroviral Treatment |
| CBS     | Case Based Surveillance |
| DALY    | Disability Adjusted Life Years |
| EPHI    | Ethiopian Public Health Institute Global Burden of Disease |
| EPHIA   | Ethiopian Population Based HIV Impact Assessment |
| ESSA    | Eastern Sub-Sahara Africa |
| FHAPCO  | Federal HIV/AIDS Prevention and Control |
| FMOH    | Federal Ministry of Health |
| GBD     | Global Burden of Disease |
| HIV     | Human Immune Deficiency Virus |
| HSTP    | Health Sector Transformation Plan |
| MTCT    | Mother to Child HIV Transmission |
| NDMC    | National Data Management Center for health |
| SDG     | Sustainable Development Goal |
| UNAIDS  | United Nations AIDS program |
| WHO     | World Health Organization |

Declarations

Ethics approval and consent to participate

The manuscript used an open access GBD 2017 data from the Institutes of Health Metrics and Evaluation (IHME), University of Washington Health Data portal.

Consent for publication

“Not applicable”

Availability of data and materials

The datasets generated and/or analysed for the study are available in the IHME data repository and can be accessed directly from http://ghdx.healthdata.org/gbd-results-tool and has also submitted as supporting file with the manuscript.

Competing interests

The authors declare that they have no competing interests.

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**Authors' Contributions**

A.H.M, S.A, E.A, A.W and A.M conceptualized the manuscript, A.H.M analysed the data. A.H.M drafted the manuscript, A.H.M, S.A, E.A, A.W and A.M reviewed the manuscript. All authors read and approved the final manuscript.

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Supplementary Files Legend

Supporting information

S1. Appendix – 2017 Global Burden of Disease HIV/AIDS estimates for tracking Fast Track progress in Eastern Sub-Saharan African countries.

Figures
Figure 1

Age standardized HIV incidence and HIV/AIDS related mortality rates per 100,000 populations from 2010 to 2017 across ESSA countries.

Figure 2

Age standardized HIV incidence:prevalence ratio across ESSA countries from 2010 to 2017

NB: The ESSA region has 28 countries
Figure 3

Age standardized HIV incidence:mortality ratio across ESSA countries from 2010 to 2017

Supplementary Files
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S1.xlsx

NB: The ESSA region has 28 countries