Trends and Contributing Factors of the Change of HIV Prevalence Over Time Among Reproductive Age Group Women in Ethiopia Evidenced by Ethiopian Demographic and Health Survey (EDHS) Data: a Cross-sectional Study: Multivariate Decomposition Analysis.

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Trends and contributing factors of the change of HIV prevalence over time among reproductive age group women in Ethiopia evidenced by Ethiopian demographic and health survey (EDHS) data: a cross-sectional study: Multivariate decomposition analysis.

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Abstracts

Background: Human immunodeficiency virus remains the leading cause of morbidity and mortality throughout the world. At the beginning of the epidemic, around 76.1 million people were infected and 32 million people died from AIDS-related illnesses in the world. Sub-Saharan Africa regions are the most affected regions and accounted for 67% of HIV infections worldwide, and 72% of the world's AIDS-related deaths.

Objective: To show trends and contributing factors for the change of HIV prevalence over time among reproductive age group women in Ethiopia.

Methods: This study was conducted based on Ethiopian Demographic and Health Surveys data. A total of 10423 in 2005, 15153 in 2011, and 14159 in 2016 women were involved in the study. Multivariate decomposition analysis was performed using the **mvdcmp** Stata package to identify the contributing factors of change of HIV prevalence over time. The 95% confidence interval was used for the test of significance.

Results: This study showed that 90.4 % of the change in HIV prevalence over time was attributable to behavioral change over time, particularly in women who were rural residents and not exposed to media. The behavioral change of women who live in rural areas was the major factor for the decline of HIV for the last ten years. The behavioral change of women who hadn't exposure to media contributed 98.4% to the decline of HIV prevalence over the past ten years.

Conclusion: The prevalence of HIV among reproductive age group women in Ethiopia was significantly declined over the last ten years and the decline was due to behavioral change over time. The major factor for the reduction of HIV prevalence overtime was the behavioral change of rural resident women. Therefore Ethiopian government should primarily focus on the strengthening and scaling up of behavioral change packages related to HIV prevention and control methods.

Keywords: Trends, HIV, decomposition analysis, EDHS's data.

Introduction

The human immunodeficiency virus (HIV) is a type of virus that affects the immune system of the human cell and results in a decline in CD4⁺ cell count and immune function, which can lead to life-threatening opportunistic infections, and finally acquired immunodeficiency syndrome (AIDS) (1). Human immunodeficiency virus infection remains the leading cause of morbidity and mortality throughout the world. At the beginning of the epidemic, around 76.1 million people were infected and 32 million people died from AIDS-related illnesses in the world (2). Sub-Saharan Africa region is the most affected region by HIV/AIDS and accounted for 67% of HIV infections worldwide, and for 72% of the world's AIDS-related deaths (3). Even though the prevalence rate of HIV in Ethiopia is the lowest as compared to East African countries, still more than one million people are living with HIV(4). Several factors have been linked to the risk of HIV infection in sub-Saharan Africa, ranging from individual demographic characteristics (gender, age, marital status) to socioeconomic status (e.g. education, wealth), cultural practices (e.g. religion, circumcision), and sexual behavior risk factors. Available evidence suggests that women in sub-Saharan Africa are disproportionately affected in comparison with men, accounting for 60% of all HIV infections(5).

In 2002/03 Ethiopia introduced a new initiative program called Health Extension Program (HEP) to provide comprehensive, universal, equitable, and affordable health services for the rural population. The program was provided as sixteen packages focused on health promotion and education supported by demonstration targeting households, particularly mothers and women through the house to house visits(6). based on promotive, preventive, and basic curative services for both communicable and non-communicable diseases (6).

The introduction of antiretroviral programs in Ethiopia has made a tremendous impact in reducing HIV-related deaths and has been available in Ethiopia since 2003. The scale-up of free antiretroviral therapies (ART) services has been one of the greatest achievements of the HIV program response over the last decade (7). Even though still morbidity and mortality due to HIV is high in Ethiopia; the prevalence of HIV among reproductive age group women was decreased from 2005 to 2016 (8). The decrement of HIV prevalence over time could be explained by (a) behavioral change among women (b) change in the proportion of women over time. The question of substantive interest in this context is: how much of the change is actually due to the

improvement of behavior suggesting the actual decrease in HIV prevalence and how much is due to a compositional change in the population distribution. So to prevent and control HIV, it is necessary to know the source of variation and the contributing factors for the change in prevalence of HIV precisely using an appropriate statistical method of analysis. But there is no evidence at the national level that examines the contributing factors for the change in HIV prevalence over time via decomposition analysis. Therefore, this study aimed to describe trends, identify the factors that contributed positively or negatively to the change in HIV prevalence among reproductive age group women for the last ten years in Ethiopia based on data of 2005, 2011, and 2016 Ethiopian Demographic and Health Surveys.

Methods and Materials

Data source and population

We used 2005, 2011, and 2016 Ethiopian Demographic and Health surveys (EDHSs) data. This EDHSs are nationally representative cross-sectional surveys performed in 9 regions and 2 country city administrations every five years. In each of the surveys, stratified two-stage sampling of clusters was carried out. Stratification was achieved by separating each region into urban and rural areas. Accordingly, a total of 21 sampling strata have been created. In the first stage, a total of 539 Enumeration Areas (EAs) for EDHS 2000, 540 EAs for EDHS 2005, and 645 EAs for EDHS 2016 were randomly selected proportional to the EA size. At the second stage, on average 27 to 32 households per EA were selected (9-11). The data was accessed from the Measure DHS website (<http://www.dhs program.com>) after permission was granted through an online request by explaining the objective of our study. A total weighted sample of 10423, 15153, and 14159 women used in EDHS 2005, 2011, and 2016 respectively for this study. The comprehensive procedure for sampling was described in the complete EDHS report (9-11).

Variables

The outcome variable of this study was having HIV in their blood (Yes/No). Whereas place of residence, region, marital status, educational level, occupation, sex of household head, desire for children, heard about HIV, and media exposure were considered as independent variables.

Statistical analysis

After the data set was downloaded from the Measure DHS website (<http://www.dhs program.com>) the variables of this study were extracted using STATA version 14.2. Before any statistical

analysis, the data were weighted using sampling weight for probability sampling and non-response to restore the representativeness of the survey and get reliable statistical estimates.

Trends and decomposition analysis

STATA version 14.2 was used for Editing, recoding, descriptive and multivariate decomposition analysis. After the data were cleaned, categorized, coded, and weighted, we explored the descriptive statistics by using the frequencies and percentages and presented them by using tables and graphs. The trend of HIV prevalence among reproductive age group women was shown by using different characteristics. The trend period was divided into three phases; the first phase (2005-2011), the second phase (2011-2016), and the overall or third phase (2005-2016) to see the differences in HIV prevalence over time. The data from EDHS 2005, 2011, and 2016 were appended together to perform decomposition analysis.

The aim of using decomposition analysis was to compare the difference in two time periods and identify the sources of variations of HIV/AIDS prevalence among 15-49 age group women in Ethiopia. The difference between any two surveys was explained by the compositional changes or characteristics of surveys (endowments), which is explained, and by the effects of those characteristics (coefficients), which is not explained(12). Therefore, the observed change in prevalence of HIV between the two surveys was additively decomposed in the endowment (characteristics) component and coefficient (effect of characteristics) component using the recently developed **mvdcmp** Stata package. In the nonlinear model, the response variable is a function of a linear combination of predictors and regression coefficients (12).

$$Y = F(X\beta) = \text{logit}(Y) = X\beta$$

Where Y represent the dependent variable

X represents a set of predictor variables

β denote set of regression coefficients

The proportion difference in Y between the two surveys of A and B can be decomposed as

$$Y_A - Y_B = F(X_A\beta_A) - (X_B\beta_B) \text{ (12).}$$

Let the recent 2016 EDHS and reference 2005 EDHS datasets can be denoted by A and B respectively.

For logistic regression, the log-odds or logit of the prevalence of HIV is given by(12).

$$\begin{aligned}\text{logit}(A) - \text{logit}(B) &= F(X_A\beta_A) - F(X_B\beta_B) \\ &= \underbrace{[F(X_A\beta_A) - F(X_B\beta_A)]}_E + \underbrace{[F(X_B\beta_A) - F(X_B\beta_B)]}_C\end{aligned}$$

Where; E represents endowments, which is explained by characteristics. An endowment is a change in HIV prevalence due to differences in characteristics. C denotes coefficients or effect of characteristics which is unexplained (12). The coefficient is the change in HIV prevalence due to the effect of predictor variables.

The equation can be presented as:

$$\text{logit}(A) - \text{logit}(B) = [\beta_{0A} - \beta_{0B}] + \sum X_{ijB} * [\beta_{ijA} - \beta_{ijB}] + \sum \beta_{ijB} * [X_{ijA} - X_{ijB}]$$

Where; β_{0B} is the intercept in the regression equation for EDHS 2000

β_{0A} is the intercept in the regression equation for EDHS 2016.

β_{ijB} is the coefficient of the j^{th} category of the i^{th} determinant in EDHS 2000

β_{ijA} is the coefficient of the j^{th} category of the i^{th} determinant in EDHS 2016

X_{ijB} is the proportion of the j^{th} category of the i^{th} determinant in the EDHS 2000

X_{ijA} is the proportion of the j^{th} category of the i^{th} determinant in EDHS 2016

To determine the specific contribution of each independent variable to each component of differences in the prevalence of HIV we partitioned the endowment and coefficients denoted by C and E into a portion of C_k and E_k , which represent the specific contribution of K^{th} independent variables for each component of C and E respectively.

Results

Characteristics of the Study Population

Based on socio-demographic reports of EDHS data, more than 75% of women were living in rural areas. More than three fourth of the total households; 75.9% in 2005, 75.4% in 2011, and 75.8% in 2016 were led by males. Regarding education, the proportion of maternal higher educational status was 0.7% in 2005, 4.6% in 2011, and 5.5 % in 2016. About one-third (34.4%) of the women had work in 2005. Likewise, in 2011 and 2016, 57.4% and 47.7 had work respectively. Regarding the marital status of women, 65.7% in 2005, 61.7% in 2011, and 64.9% were married. In all three surveys, more than 93% of women had heard about HIV. And also 17.6%, 32.6%, and 27.5% of women in 2005, 2011, and 2016 were exposed to media respectively (Table 1).

Table 1: Frequency and percentage distribution of characteristics of reproductive age group women in Ethiopia.

Variables	Characteristics	Frequency and percentage distribution of characteristics		
		EDHS 2005	EDHS 2011	EDHS 2016
		No (%)	No (%)	No (%)
Residence	Urban	2473 (23.7)	3848 (25.4)	3373 (23.8)
	Rural	7951 (76.3)	11323 (74.6)	10788 (76.2)
Region	Tigray	1077 (10.3)	996 (6.7)	984 (6.9)
	Afar	655 (6.3)	136 (0.9)	124 (0.9)
	Amhara	1378 (13.2)	4074 (26.9)	3115 (22)
	Oromia	2009 (19.3)	5350 (35.3)	5234 (37)
	Somali	652 (6.2)	351 (2.3)	469 (3.3)
	B/Gumuz	661 (6.3)	158 (1)	151 (1.1)
	SNNP	1496 (14.3)	2984 (19.7)	2670 (21)
	Gambella	610 (5.8)	64 (0.4)	40 (0.3)
	Harari	739 (7.1)	51 (0.3)	45 (0.3)
	Addis Ababa	1151 (11)	941 (6.2)	936 (6.6)
	Dire-Dawa	612 (5.6)	69 (0.5)	97 (0.7)
Educational level	No formal education	7508 (72)	7642 (50.4)	6666 (47.1)
	Primary	1691 (16.2)	5772 (38)	4968 (35.1)
	Secondary	1147 (11)	1063 (7)	1695 (12)
	Higher	78 (0.7)	693 (4.6)	834 (5.9)
Occupation	Had work	3569 (34.4)	8640 (57.4)	6751 (47.7)
	Had no work	6818 (65.6)	6419 (42.6)	7410 (52.3)
Marriage	Married	6847 (65.7)	9364 (61.7)	9184 (64.9)
	Never married	2505 (24)	4171 (27.5)	3693 (26.1)
	Separated	191 (1.8)	316 (2.1)	216 (1.5)
	Divorced	489 (4.7)	819 (5.4)	679 (4.8)
	Widowed	393 (3.8)	501 (3.3)	391 (2.8)
Sex of household head	Male	7909 (75.9)	11445 (75.4)	10731 (75.8)
	Female	2514 (24.1)	3725 (24.6)	3430 (24.2)
Desire for children	Yes	5867 (57.8)	9485 (65.3)	8417 (65.4)
	No	4307 (42.3)	5047 (34.7)	4445 (34.6)
Media exposure	Yes	1827 (17.6)	4923 (32.6)	3901 (27.5)
	No	8583 (82.4)	10194 (67.4)	10261 (72.5)
Heard about HIV	Yes	9453 (90.3)	14655 (96.6)	13168 (93)
	No	1009 (9.7)	514 (3.4)	993 (7)

Overall trends of HIV prevalence over time among reproductive age group women in Ethiopia

Ethiopia has been shown a decrement in HIV prevalence among women over the study period, from 1.45 % in 2005 to 0.85% in 2016 (Fig1).

Figure 1: Trends of HIV prevalence among women in Ethiopia from 2005 to 2016.

Trends of HIV prevalence over time in Ethiopia by selected characteristics

The trends of HIV prevalence among reproductive age group women showed variation based on different characteristics. HIV prevalence decrement was observed in most of the characteristics and increment in some of the characteristics in each phase. Among rural residents, the largest decrement was observed during the first phase of the study period (2005-2011) with 0.6% point change followed by the second phases (2011-2016) with 0.1% point changes and the overall change (2005-2016) was 0.1% point change. Similarly, based on region, the largest decrement in the first phase was observed in Benishangul-Gumuz regional state with 1.4% point change followed by southern nation nationalities and people of Ethiopia (SNNP) regional state with 0.6% point change. On the contrary, the largest increment was observed in the Gambella region and Addis Ababa city administration (Fig 2). Almost all regions showed a decrement in HIV prevalence in the year 2016 as compared to the year 2011(Fig2). In the second phase, the prevalence of HIV was decreased in Gambella regional state by 2.2% point change, in Benishangul-Gumuz by 0.4% point change, and in Tigray by 0.3% point change. In the third phase (overall phase) it was increased by 2.3%, 1.9 %, and 1.1% point change in Addis Ababa, Dire-Dawa, and Afar regional state respectively. On the other hand, the overall change in a decrement of HIV prevalence based on the region was higher in Benishangul-Gumuz regional state with 1.8% point change followed by southern nation nationalities and people of Ethiopia (SNNP) regional state with 1.2% point change (Table 2).

Figure 2: Trends of HIV prevalence in Ethiopia from 2005 to 2016

Table 2: Trends of HIV prevalence among reproductive age group women by selected characteristics over time in Ethiopia.

Variables	Characteristics	Point difference in HIV prevalence					
		2005 N=10423	2011 N=15153	2016 N=14159	Phase1 2011-2005	Phase2 2016 -2011	Over all 2016 -2005
Residence	Urban	1.5	4.6	2.4	3.1	-2.5	0.9
	Rural	1.1	0.5	0.4	-0.6	-0.1	-0.1
Region	Tigray	1.8	1.6	1.3	-0.2	-0.3	-0.5
	Afar	0.1	1.4	1.2	1.3	-0.2	1.1
	Amhara	1.2	1.5	1.1	0.3	-0.4	-0.1
	Oromia	1	0.9	0.4	-0.1	-0.5	-0.6
	Somali	0.8	1.5	0.05	0.7	-1.45	-0.75
	B/Gumuz	2.8	1.4	1	-1.4	-0.4	-1.8
	SNNP	1.6	1	0.4	-0.6	-0.6	-1.2
	Gambella	0.9	6.1	3.9	5.2	-2.2	3
	Harari	2.7	3.2	3	0.5	-0.2	-0.3
	Addis Ababa	1.3	5.8	3.6	4.5	-2.2	2.3
	Dire-Dawa	1	4.4	2.9	3.4	-1.5	1.9
Educational level	No formal education	1.5	1	0.4	-0.5	-0.6	-1.1
	Primary	1	0.9	0.8	-0.1	-0.9	-0.2
	Secondary	1.6	4.6	2.2	3	-2.4	2.2
	Higher	1.2	3.5	1.7	2.3	-1.8	0.5
Occupation	Had work	1.9	1.6	0.9	-0.3	-0.7	-1
	Had no work	1.2	1.3	0.8	0.1	-0.5	-0.4
Marriage	Married	1.2	1.4	0.7	0.2	-0.7	-0.5
	Never married	1.6	1.4	0.9	-0.2	-0.5	-0.7
	Separated	3.5	2.7	2.6	-0.8	-0.1	-0.9
	Divorced	2.6	3.3	1.2	0.7	-2.1	-1.4
	Widowed	2.9	1	1.9	-1.9	0.9	-1
Sex of household head	Male	1.4	1.2	0.7	-0.2	-0.5	-0.7
	Female	1.2	2.5	1.3	1.3	-1.2	0.1
Desire for children	Yes	1.2	1.3	0.7	0.1	-0.6	-0.5
	No	1.7	1.6	1.1	-0.1	-0.5	-0.6
Media exposure	Yes	1	2.3	1.7	1.3	-0.6	0.7
	No	1.6	1.1	0.5	-0.5	-0.6	-1.6
Heard about HIV	Yes	1.6	1.5	1	-0.1	-0.5	-0.6
	No	0.3	0.6	0.3	0.3	-0.3	0

Decomposition analysis

Overall from 2005 to 2016, there has been a significant decline in the prevalence of HIV in Ethiopia. The overall decomposition result showed that 90.4% of the decline in the prevalence of HIV over time was due to a difference in the effects of characteristics (behavioral difference or change) between the surveys. About 9.6% of the decline was due to differences in characteristics (compositional factors) but the change due to differences in characteristics (compositional factors or change in population proportion) was not significant (Table3).

Residence of women and exposure to media showed a significant effect on the decline of HIV prevalence over time. Keeping compositional changes constant, changes in the behavior of women who live in rural areas contributed more than 100% to the decline of HIV prevalence over the past ten years as compared to women who live in the urban areas. Similarly, behavioral change of women who were exposed to media contributed 98.4% to the decline of HIV prevalence for the last ten years as compared to women who were not exposed to media (Table 3).

Table 3: Decomposition of change in HIV prevalence among reproductive age group women in Ethiopia, from 2005 to 2016

Variables	Characteristics	Difference due to characteristics		Difference due to coefficient	
		Coef	Pct.	Coef	Pct.
Residence	Urban (ref)	1		1	
	Rural	-0.0001 [-0.001, 0.0003]	1.9	-0.006*[-0.01, -0.02]	106.2
Occupation	Had work (ref)	1		1	
	Had no work	0.0001[-0.0004, 0.0006]	-1.6	0.002[-0.001, 0.005]	-37.7
Educational level	No formal education	1		1	
	Primary	0.0000[-0.0004, 0.0004]	3	0.0005[-0.001, 0.002]	-9.7
	Secondary	-0.0000[-0.000, 0.0002]	0.2	0.0002[-0.001, 0.001]	-4.1
	Higher (ref)	-0.000[-0.000, 0.001]	0.9	0.000[-0.000, 0.001]	-0.1
Marriage	Married (ref)	1		1	
	Never married	-0.0000[-0.0000, 0.0001]	0.004	-0.0003[-0.001, 0.0007]	5.7
	Separated	0.0000[-0.0000, 0.0001]	-0.4	0.0000[-0.0002, 0.0002]	-0.4
	Divorced	-0.0000[-0.0000,0.0000]	0.01	-0.0001[-0.0004, 0.0002]	2.02
	Widowed	0.0000[-0.0001,0.0001]	-0.3	-0.0000[-0.0004,0.0003]	0.7
Sex of household head	Male (ref)	1		1	
	Female	-0.0000[-0.0000, 0.0000]	0.001	-0.0003[-0.001, 0.0007]	5.6
Desire for children	No (ref)	1		1	
	Yes (ref)	0.0001[-0.0004, 0.0001]	-2.4	-0.001[-0.004, 0.0006]	25.1
Media exposure	Yes (ref)	1		1	
	No	-0.0002[-0.001, 0.0005]	2.8	-0.006*[-0.01, -0.0003]	98.4
Heard about HIV	Yes (ref)	1		1	
	No	-0.0000[-0.0002, 0.0001]	0.6	-0.0006[-0.0005, 0.002]	-10.2
Constant				0.01[-0.02, 0.2]	-91.2

(* = significant at 5% level of significance)

Discussion

Human immunodeficiency virus infection remains the leading cause of morbidity and mortality throughout the world. At beginning of the epidemic, more than 76.1 million people were infected and 32 million people died from AIDS-related illnesses in the world (2). Ethiopia is one of the Sub-Saharan countries and is known for the epidemic of HIV.

The overall prevalence of HIV among reproductive age group women in Ethiopia was found 1.45, 1.5, and 0.85 in 2005, 2011, and 2016 respectively. The decline from 1.45 [95% CI 1.2, 1.7] in 2005 to 0.85 [0.07, 1] in 2016 was significant. This value is lower as compared to the pooled estimates of the Sub-Saharan Africa regions (13). This variation could be due to the launching of the Health Extension Program (HEP), improving access to health care, implementation of different programs, including education and stigma-reduction programs, behavior change initiatives, and expansion of HIV testing for all age groups across the territory. And also 90% of people who know their status receiving treatment in Ethiopia reached 90%; in which Ethiopia achieved one of the targets on the HIV treatment cascade: 90% of people living with HIV (PLHIV) knowing their HIV status, 90% of people who know their status receiving treatment, and 90% of people on treatment having a suppressed viral load (14). The country also has committed to reducing new HIV infections by 50 percent by 2020 and to ending AIDS as a public health threat by 2030. This is reflected in the Country's Health Sector Transformation Plan II 2015-2020, where one of the major indicators is a reduction of HIV incidence rate(15).

When we decompose the change of HIV prevalence over time, the behavioral change of the respondents between the surveys contributed 90.4% to the decline of HIV prevalence over the last ten years. Surprisingly behavioral change of rural resident women contributed more than 100% to the change of HIV prevalence over time as compared to urban residents. This could be due to the increment of access to health facilities, access to transportation, and the government's commitment to improving awareness of the community through health education and enabling them to use health services. In addition to this increased access to information and education over time through health extension workers help rural residents to know about the negative health consequences of HIV (16, 17).

The behavioral change of women who were not exposed to media contributed 98.4% for the change of HIV prevalence over the last ten years. Even though they didn't have access either to Television, Radio, Newspapers, or Internet, now a day's information is near to their house in all rural areas of Ethiopia. Because, in addition to health extension workers, many governmental and

non-governmental organizations work closely with the community to reduce the prevalence and negative impacts of HIV by giving health education about HIV prevention, and control methods(18, 19).

Strength and limitations of the study

This study had several strengths. The first is, the study was based on nationally representative large datasets and all estimates of the study were done after the data were weighted for probability sampling and non-response. Therefore it had adequate statistical power and generalized to all women in Ethiopia. Lastly, multivariate decomposition was applied to identify factors contributing to the change of HIV prevalence over time in Ethiopia. As a limitation, some variables were not collected in all EDHS's data like wealth index, and are not used for decomposition analysis.

Conclusion and recommendations

The prevalence of HIV among reproductive age group women in Ethiopia was significantly declined over the last ten years and the decline was due to differences in coefficients (behavioral changes) between the surveys. Behavioral changes of women who live in rural areas and are not exposed to media over time were the source of the decrease in HIV prevalence over the last ten years in Ethiopia. Therefore Ethiopian government should primarily focus on the strengthening and scaling up of behavioral change packages related to HIV prevention and control methods.

Abbreviations

Coef: Coefficient; DHS: Demographic Health Survey; EA: Enumeration Area; EDHS: Ethiopian Demographic and Health Survey; HIV: Human Immune deficiency Virus; Pct: Percent.

Declarations

Ethics approval and consent to participate

Ethical clearance for the survey (2000-2016) was provided by the Ethiopian Health and Nutrition Research Institute (EHNRI) Review Board and the National Research Ethics Review Committee (NRERC) at the Ministry of Science. Respondents were informed about the survey and verbal consent was taken. The detail about ethical approval and consent to participate available in the EDHS's report(20).

Consent for Publication

Not applicable

Availability of Data and Materials

The EDHS data sets are open and can be accessed from the Measure DHS website (http://www.dhs_program.com) through an online request by explaining the objective of the study. The datasets analyzed during the current study are available from the corresponding author upon reasonable request.

Conflict of Interests

The authors declare that they have no competing interests.

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We did not receive any funds for this research.

Authors' Contribution

YN, DA, MS, WW, AA, SG, BB, TY, and GF were involved in this study from the inception to design, acquisition of data, data cleaning, data analysis and interpretation, and drafting and revising of the manuscript. YN prepared the final draft of the manuscript. All authors read and approved the final manuscript.

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Appendixes

Figure Legends

Figure1: *Trend of HIV prevalence among reproductive age group women in Ethiopia from 2005 to 2016.*

Figure2: *The trends of HIV prevalence among reproductive age group women over time across regions in Ethiopia from 2005 to 2016.*

Figures

Figure 1

Trend of HIV prevalence among reproductive age group women in Ethiopia from 2005 to 2016.

Figure 2

The trends of HIV prevalence among reproductive age group women over time across regions in Ethiopia from 2005 to 2016.