Original Research Article

Magnitude of HIV testing and socio demographic factors associated with it among adults age 15-49 years in Ethiopia

Eleni Tesfaye Tegegne1, Mekbib Kassa Tessema2, Kaleab Tesfaye Tegegne3*

1School of Nursing, College of Medicine and Health Science, University of Gondar, Gondar, Ethiopia
2Leishmania Research and Treatment Center, University of Gondar, Gondar, Ethiopia
3Department of Public Health, Hawassa College of Health Science, Hawassa, Ethiopia

Received: 17 September 2020
Revised: 12 November 2020
Accepted: 01 December 2020

*Correspondence:
Kaleab Tesfaye Tegegne,
E-mail: kaleabtesfaye35@gmail.com

ABSTRACT

Background: Survey data in Sub-Saharan African countries in the 2005 to 2010 period showed that only 10% men and 15% women aged 15 to 24 years were aware of their human-immunodeficiency virus (HIV) status. This study aims to assess: magnitude of HIV testing, and socio demographic factors associated with it among adults age 15-49 years.

Methods: Demographic and health surveys in 2016, in Ethiopia were analyzed in SPSS, using multivariate logistic regression. We used HIV testing as the outcome variable using the recommended definition by Ethiopia demographic and health survey (EDHS) 2016. Descriptive statistics were employed to show the distribution of socio-demographic characteristics.

Results: Of the total sample of 27289 of men and women 15-49 years at the time of survey, 19.4% (n=5295) have been tested for HIV in the past 12 months and received the results of the last test. Men and women in the 15-19 age group 9.952 (AOR 9.952; 95% CI 6.156-16.091) and men and women age 15-49 years in urban areas (AOR 34.040; 95% CI: 21.028-55.105) were found significant predictors of HIV testing.

Conclusions: HIV testing among adults age 15-49 years in Ethiopia was low. Age and place of residence were found significant predictors of HIV testing there remain a high proportion of undiagnosed HIV-infected persons and for the Ethiopian government there is a need for innovative strategies aimed at increasing HIV-testing, particularly for rural areas and those beyond adolescent age.

Keywords: HIV testing, EDHS, Socio demographic, Ethiopia

INTRODUCTION

Survey data in sub-Saharan African countries in the 2005 to 2010 period showed that only 10% men and 15% women aged 15 to 24 years were aware of their human-immunodeficiency virus (HIV) status. About 30% of people living with HIV in the European Union (EU) are not aware of their serum status. In this framework it is clear that HIV testing, early diagnosis and access to treatment are key to tackling the HIV/AIDS epidemic. Later HIV diagnosis in rural areas suggests that rural persons are less likely to have an HIV test during the early, generally-asymptomatic years of infection, and indicates a need for strategies to increase HIV testing in rural populations.

Ethiopia has also been implementing HIV voluntary counselling and testing (VCT) as a key strategy in its effort to prevent and control HIV/AIDS in the country. However, the utilization of VCT service among males, females, adults and people living in rural areas of the country is still low.
Understanding the magnitude and socio demographic factors affecting HIV testing helps policy makers in an effort to design effective strategies toward preventing and control of HIV/AIDS including improving the coverage of HIV testing in general public and among specific groups of population.

In Ethiopia information on factors determining HIV testing among men and women age 15-49 years is not sufficiently available at national level.

The current study aimed at identifying socio demographic factors preventing men and women aged 15-49 years from HIV testing.

METHODS

Study areas

The survey was conducted in nine regional states and two city administrations of Ethiopia.

Study design

The study was a population-based crossectional study.

Study period

Data collection took place from 18 January 2016 to 27 June 2016.

Inclusion and exclusions criteria

All women age 15-49 and all men age 15-59 who were either permanent residents of the selected households or visitors who stayed in the household the night before the survey and who consented to HIV testing were eligible to be interviewed were selected for the study.

Sample size calculation

Further details on sampling size can be found in the demographic and health survey (DHS) manual.7

Sampling technique

The sampling frame used for the 2016 EDHS is the Ethiopia population and housing census (PHC), which was conducted in 2007 by the Ethiopia.

The 2016 EDHS sample was stratified and selected in two stages. Each region was stratified into urban and rural areas, yielding 21 sampling strata. Samples of EAs were selected independently in each stratum in two stages. Implicit stratification and proportional allocation were achieved at each of the lower administrative levels by sorting the sampling frame within each sampling stratum before sample selection.

According to administrative units in different levels, and by using a probability proportional to size selection at the first stage of sampling.

In the first stage, a total of 645 EAs (202 in urban areas and 443 in rural areas) were selected with probability proportional to EA size (based on the 2007 PHC) and with independent selection in each sampling stratum. A household listing operation was carried out in all of the selected EAs from September 2015 to December 2015.

The resulting lists of households served as a sampling frame for the selection of households in the second stage. Some of the selected EAs were large, consisting of more than 300 households. To minimize the task of household listing, each large EA selected for the 2016 EDHS was segmented. Only one segment was selected for the survey with probability proportional to segment size. Household listing was conducted only in the selected segment; that is, a 2016 EDHS cluster is either an EA or a segment of an EA.

In the second stage of selection, a fixed number of 28 households per cluster were selected with an equal probability systematic selection from the newly created household listing.

Data source, sampling and data collection

The data for this study was extracted from the 2016 EDHS. The 2016 EDHS is the fourth and most recent in the DHS series in Ethiopia.13 The survey was conducted in nine regional states and two city administrations of Ethiopia.13 Samples were collected for HIV testing in the laboratory from women age 15-49 and men age 15-59 who consented to testing.13

A total of 16,583 eligible women and 11,606 eligible men between 15 and 49 years were approached to be interviewed. A response rate of 95% was observed with 15,683 women completing the interviews and response rate 86% among 11,606 men interviewed. The interviews included several standard questionnaires recording information ranging from basic socio-demographic information to detailed bio-medical information. Our analysis included all men and women age 15-49 years which resulted in a total weighted sample of 27,289.

Outcome variable

According to EDHS all men and women age 15-49 years asked whether they have been tested for HIV in the past 12 months and received the results of the last test (1 if they have been tested for HIV in the past 12 months and received the results of last test, 0 otherwise).

Co-variates

The basic socio-demographic variables were selected based on their availability in the dataset. The included basic
socio-demographic factors are highest education level (categorized as “no education”, “primary”, “secondary”, “more than secondary”) and working status in the past 12 months (“not working” or “working and occupation status (“not working”, “non-agriculture” and “agriculture”), marital status (“never married”, “currently married”, “living together”, “divorced/separated” and “widowed”) age (“15–19 years”, “20–24 years”, “25–29 years” “30–34 years” “35–39 years” “40–45 years” and “45–49 years”) and mothers exposure to mass media (“no” or “yes”).

Number of living children (“1”, “1-2”, “3-4” and “5+”), literacy (“cannot read at all”, “can read part/whole sentence” and “other”). Household factors included household wealth index (categorized as “poorest”, “poorer”, “middle”, “richer” and “richest”).

The household wealth index was calculated using scores based on household assets with analyses conducted by the National Population Commission and Inner City Fund (ICF) International based on a methodology developed from previous DHSs. Community level factors recorded were the place of residence (“rural” or “urban”) and geographical region.

The geographical regions were grouped into nine regional states of Ethiopia: namely Afar, Amhara, Benishangul-Gumuz, Gambella, Harari, Oromia, Somali, Southern Nations Nationalities and Peoples’ Region (SNNP), and Tigray, and two city administrations named Addis Ababa and Dire Dawa.

Statistical analysis

Sampling weights provided with the EDHS dataset were used during analysis. Further details on sample weights can be found in the EDHS report.

Descriptive statistics were employed to show the distribution of background characteristics. We used logistic regression model to determine the true association between HIV testing and basic socio-demographic factors. Both unadjusted and adjusted odds ratios (ORs) were reported with 95% confidence intervals (95% CI). Besides, diagnostic tests were done, particularly goodness of fit of the model by the Hosmer and Lemeshow test; (where p value of 1.000 was found). The Cronbach’s alpha result of the variables is 0.0.900. The Nagelkerke R Square shows that about 72. 7% of the variation in the outcome variable (HIV testing) is explained by this logistic model. The overall accuracy of this model to predict subjects that have HIV testing (with a predicted probability of 0.5 or greater) is 89.1%. All analyses were performed using statistical software SPSS (version 16.0).

Ethics approval

This study is a secondary analysis of publicly available dataset where permission was obtained through registering with the DHS website and therefore no ethics approval was required.

RESULTS

Baseline characteristics

Of the total sample of 27289 of men and women 15-49 years at the time of survey, 19.4% (n=5295) have HIV testing.

As summarized in Table 1, majority (57.5%) of the respondents were female and a predominant percentage of the men and women 15-49 years lived in rural areas (78.8%), respondents in the regions of Oromiya were (37.1%) and Amhara (24.3%), 32.1% of men and women 15-49 years reported not working in the past 12 months at the time of survey, and 39.2% did not have any formal education. In addition to education status, around 45.9% of men and women 15-49 years reported having poor literacy skills and could not read at all.

Table 1: Individual, household and community level characteristics of men and women 15-49 years, Ethiopia 2016.

| Socio-demographic factors | N (%) |
|---------------------------|-------|
| **Sex**                   |       |
| Male                      | 11606 (42.5) |
| Female                    | 15683 (57.5) |
| **Wealth index**          |       |
| Lowest                    | 4472 (16.4) |
| Second                    | 4927 (18.1) |
| Middle                    | 5224 (19.1) |
| Fourth                    | 5566 (20.4) |
| Highest                   | 7098 (26.0) |
| **Residence**             |       |
| Urban                     | 5779 (21.2) |
| Rural                     | 21509 (78.8) |

Continued.
| Socio-demographic factors                             | N (%)     |
|------------------------------------------------------|-----------|
| **Age category (in years)**                          |           |
| 15-19                                                | 5953 (21.8) |
| 20-24                                                | 4645 (17.0) |
| 25-29                                                | 4934 (18.1) |
| 30-34                                                | 3980 (14.6) |
| 35-39                                                | 3318 (12.2) |
| 40-44                                                | 2496 (9.1)  |
| 45-49                                                | 1961 (7.2)  |
| **Religion**                                         |           |
| Orthodox                                             | 11946 (43.8) |
| **Working status (past 12 months)**                  |           |
| Working                                              | 18518 (67.9) |
| **Marital status**                                   |           |
| Married                                              | 16059 (58.9) |
| **Literacy**                                         |           |
| Cannot read at all                                   | 12530 (45.9) |
| **Number of living children**                        |           |
| 0                                                    | 10843 (39.7) |
| 1-2                                                  | 5972 (21.9)  |
| 3-4                                                  | 4834 (17.7)  |
| >5                                                   | 5640 (20.7)  |
| **Frequency of reading newspaper**                   |           |
| Yes                                                  | 1703 (6.2)  |
| No                                                   | 25586 (93.8) |
| **Frequency of listening to the radio**              |           |
| Yes                                                  | 5919 (21.7)  |
| No                                                   | 21370 (78.3) |
| **Frequency of watching TV**                         |           |
| Yes                                                  | 4938 (18.1)  |
| No                                                   | 22351 (81.9) |
| **Region**                                           |           |
| Tigray                                               | 1837 (6.7)  |
| Afar                                                 | 210 (0.8)   |
| Amhara                                               | 6628 (24.3) |
| Oromiya                                              | 10110 (37.1) |
| Somali                                               | 760 (2.8)   |
| Benishangul-Gumuz                                    | 278 (1.0)   |
| SNNPR                                                | 5659 (20.7) |
| Gambela                                              | 79 (0.3)    |
| Harari                                               | 67 (0.2)    |
| Addis Ababa                                          | 1503 (5.5)  |
| Dire Dawa                                            | 156 (0.6)   |
| **Occupation**                                       |           |
| Not working                                          | 8746 (32.0) |
| Non-agriculture                                      | 7669 (28.1) |
| Agriculture                                          | 10874 (39.8) |
| **Educational status**                               |           |
| No education                                         | 10701 (39.2) |
| Primary                                              | 11098 (40.7) |
| Secondary                                            | 3602 (13.2) |
| More than secondary                                  | 1887 (6.9)  |
| N                                                    | 27289       |
Regarding exposure to mass media, 6.2% read newspapers, 21.8% watch TV and 21.7% listen to radio.

### Table 2: Unadjusted and adjusted odds ratio for HIV testing in Ethiopia 2016.

| Variable                      | Unadjusted OR       | P value | Adjusted OR       | P value |
|-------------------------------|---------------------|---------|-------------------|---------|
| Age                           | 0.189 (0.180-0.199) | 0.000   | 9.952 (6.156-16.091) | 0.000   |
| Residence                     |                     |         |                   |         |
| Urban                         | 16.338 (15.21-17.54) | 0.000   | 34.040 (21.028-55.105) | 0.000   |
| Rural                         | 1.00                |         |                   |         |
| Region                        |                     |         |                   |         |
| Tigray                        | 0.979 (0.730-1.312)  | 0.886   | not retained in model |       |
| Afar                          | 0.799 (0.719-0.888)  | 0.000   | not retained in model |       |
| Amhara                        | 0.021 (0.018-0.024)  | 0.000   | not retained in model |       |
| Wealth quintile               |                     |         |                   |         |
| Lowest                        | 0.821 (0.75-0.89)    | 0.000   | not retained in model |       |
| Second                        | 1.00                |         |                   |         |
| Marital status                |                     |         |                   |         |
| Never married                 | 0.103 (0.096-0.110)  | 0.000   | not retained in model |       |
| Married                       | 1.00                |         |                   |         |
| Number of living children     | 0.020 (0.016-0.024)  | 0.000   | 0.000 (0.000-3.949)  | 0.955   |

Backward stepwise model with dichotomous outcome of (0=no HIV testing; 1=HIV testing), CI=confidence intervals

### Table 3: Socio demographic characteristics of men and women age 15-49 years according to according to HIV testing, Ethiopia 2016.

| Variable | Wealth quintile (%) | Residence (%) | Number of living children (%) | Region (%) | Age (%) | Marital status (%) |
|----------|---------------------|---------------|--------------------------------|------------|---------|-------------------|
|          | Lowest (5295)       | Urban (27289) | Rura-1 | 1-2 | Tigray | Afa-raf | Amhara | Oromia | 15-19 | 20-24 | Never married | Married |
| Overall  | 4472 (16.4)         | 5779 (21.2)   | 10843 (39.7) | 5972 (21.9) | 1837 (6.7) | 210.8 (0.8) | 6628 (24.3) | 10110 (37.1) | 5953 (21.8) | 4645 (17.0) | 8918 (32.7) | 16059 (58.9) |
| HIV testing yes (n=21994) | 2633 (49.7)    | 3476 (65.6)   | 5185 (97.9) | 110 (2.1)  | 1129 (21.3) | 128 (2.4)  | 3714 (70.1) | 324 (6.1)  | 3381 (63.9) | 1914 (36.1) | 4036 (76.2) | 1259 (23.8) |
| No (n=21994) | 1839 (8.3)     | 2265 (10.3)   | 2303 (89.5)  | 5658 (25.7) | 5862 (26.7) | 708 (3.2)  | 82 (0.4)   | 2914 (13.3) | 9786 (44.5) | 2572 (11.7) | 2731 (12.4) | 4882 (22.2) | 14800 (67.3) |
| Majorities (39.8%) of the respondent’s occupation were agriculture, 28.1% were non agriculture employee in addition, and 43.8% of the respondents were orthodox religion followers. Overall 21.8% of men and women were between 15 and 19 years of age.

Most men and women 15-49 years (58.9%) reported as currently married at the time of the survey. Of the total, only 16.4% were in lowest wealth quintile and 26.0% were in the highest wealth quintile.

In terms of the number of living children, about 39.7% of men and women 15-49 years reported to have one living children and 20.7% had more than 5 number of living children during survey.

Regarding exposure to mass media, 6.2% read newsletter, 18.1% watch TV and 21.7% listen to radio.

### Bi-variable analysis

An increase in one-year in age (COR=0.189; 95% CI: 0.180-0.199) were less likely to have HIV testing.

Odds of having HIV testing among men and women age 15-49 years in urban areas were 16.338 (COR=16.338; 95% CI: 15.214-17.545) times higher than rural areas.

Men and women age 15-49 years in afar are 0.799 (COR=0.799; 95% CI: 0.719-0.888) times less likely to have HIV testing than Tigray region of Ethiopia.

Men and women age 15-49 years in Amhara are 0.021 (COR=0.021; 95% CI: 0.018-0.024) times less likely to have HIV testing than Tigray region of Ethiopia.
Men and women age 15-49 years in poorest category are 0.821 (COR=0.821; 95% CI: 0.756–0.891) less likely to have HIV testing than poorer categories.

Men and women age 15-49 years who were never married 0.103 (COR=0.103; 95% CI: 0.096–0.110) less likely to have HIV testing than married.

An increase in one number of living children 0.020 (COR=0.020; 95% CI: 0.016–0.024) were less likely to have HIV testing.

**Multivariable analysis**

Residence they live had significant association with men and women 15-49 years living in urban areas were 34.040 times higher odds of having HIV testing (AOR=34.040; 95% CI: 21.028–55.105) compared to men and women 15-49 years who had live in rural areas.

Demographically, since age is a quantitative numerical variable, an increase in one-year in age has 9.952 (AOR=9.95295% CI 6.156–16.091) times decrease in odds of having HIV testing.

**DISCUSSION**

The main objectives of this study were to identify socioeconomic factors associated with HIV testing among adults age 15-49 years in Ethiopia.

Of the total sample of 27289 of men and women 15-49 years at the time of survey, 19.4% (n=5295) have been tested for HIV in the past 12 months and received the results of the last test which is higher compared to 5%.7% and lower compared to 60.1%, .62%.50%, .62% 76% 50% 33 % respectively.10-18

This may reflect methodological differences between the present study and other studies. It is, however, worth noting that this study applied different sampling and data collection methods which may account for the differences in findings.

**HIV testing and residence**

This study demonstrated that residence they live had significant association with men and women 15-49 years living in urban areas were 34.040 times higher odds of having HIV testing (AOR=34.040; 95% CI: 21.028–55.105) compared to men and women 15-49 years who had live in rural areas. Our finding is similar compared to previous studies.10,19,23

The reason for this may be better availability and accessibility of HIV testing facilities in urban settings.24 Rural residence is associated with lower uptake of HIV testing.4,25,26 Prior studies have described effective models for delivering high-quality HIV care in rural settings.6-11

Persons diagnosed at a later stage of HIV infection experience worse outcomes than persons diagnosed early and may unknowingly transmit infection to others.27

Similar findings have also been reported that women who live in urban areas were more likely to get tested for HIV compared with rural women elsewhere.11,28

Urban areas offer greater access to HCT services and thereby increased communication about HIV compared with rural areas. Ethiopia should make HIV testing facilities and services more accessible to the rural community.

**HIV testing and age**

In this study an increase in one-year in age has 9.952 (AOR=9.952; 95% CI 6.156–16.091) times decrease in odds of having HIV testing which is contrarily with women aged 20-24 years had increased odds of getting tested for HIV as compared when women aged 15-19 years, with previous studies and older adults have more lifetime exposure to the possibility of being tested.11,19,29-32 This study finding is similar compared to previous studies.10,25

This could be that older adults may have already experienced feeling of isolation due to illness or loss of someone they know who died of HIV.33

Older people may have less knowledge of HIV and are less likely to protect themselves than younger people. Older people are less likely than younger people to discuss their sexual health with the doctors. In addition, significantly fewer participants aged 50 years or older accepted HIV testing when it was offered by a health care provider, compared to younger participants.34

Also consistent with our findings are studies that showed older adults are more likely than younger adults to be diagnosed with HIV later in the disease course.35 Research also has suggested that older adults view HIV as a disease experienced primarily by young adults.36 This perception may contribute to older adults’ lower likelihood of receiving testing and lower perceptions of HIV risk.

This study has several limitations. We relied on self-report of HIV testing. The use of self-reported data may have introduced social desirability bias and thereby affected the reported findings and to reduce respondents’ problem of recall of prior HIV testing we include those tested for HIV in the past 12 months.

**Limitations**

This survey was subject to many of the same limitations found in other cross sectional surveys. Finally, no casual inferences should be drawn from a cross sectional study such as this.
CONCLUSION

HIV testing among adults age 15-49 years in Ethiopia was low. Age and place of residence were found significant predictors of HIV testing. There remain a high proportion of undiagnosed HIV-infected persons and for the Ethiopian government there is a need for innovative strategies aimed at increasing HIV-testing, particularly for rural areas and those beyond adolescent age.

ACKNOWLEDGEMENTS

Authors would like to thank DHS, ICF International Rockville, Maryland, USA for providing the 2016 EDHS data for this analysis.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. UNICEF. Promoting equity for children living in a world with HIV and AIDS. United Nations Children’s Fund. 2012.
2. European Centre for Disease Prevention and Control/WHO. HIV/AIDS surveillance in Europe 2013. Stockholm: European Centre for Disease Prevention and Control. 2013.
3. Centre for Disease Prevention and Control. Advancing HIV Prevention: New Strategies for a Changing Epidemic 2003. Morbidity and Mortality Weekly Report MMWR. 2003;52:329-32.
4. Ohl and Perencevich Frequency of human immunodeficiency virus (HIV) testing in urban vs. rural areas of the United States: Results from a nationally-representative sample BMC Public Health. 2011;11:681.
5. Leta TH, Sandøy IF, Fylkesnes K. Factors affecting voluntary HIV counseling and testing among men in Ethiopia: a cross-sectional survey. BMC Public Health. 2012;12(1):438.
6. Teklehaimanot HD, Teklehaimanot A, Yohannes M, Biratu D. Factors influencing the uptake of voluntary HIV counseling and testing in rural Ethiopia: a cross sectional study. BMC Public Health. 2016;16:239
7. Central Statistical Agency (CSA) and ICF. 2016 Ethiopia Demographic and Health Survey Key Findings. 2017. Available at: https://dhsprogram.com/pubs/pdf/SR241/SR241.pdf. Accessed on: 18 June 2018.
8. Central Statistical Authority/Ethiopia and ORC Macro. Ethiopia Demographic and Health Survey 2000. Addis Ababa, Ethiopia. 2001. Available at: https://www.dhsprogram.com/pubs/pdf/FR118/FR118.pdf. Accessed on: 11 July 2018.
9. Central Statistical Authority/Ethiopia and ORC Macro. Ethiopia Demographic and Health Survey 2005. Addis Ababa, Ethiopia; 2006. Available at: https://www.dhsprogram.com/pubs/pdf/fr179/fr179%5B23june2011%5D.pdf. Accessed on: 21 June 2018.
10. Brima N, Burns F, Fakoya I, Kargbo B, Conte S, Copas A. Factors Associated with HIV Prevalence and HIV Testing in Sierra Leone: Findings from the 2008 Demographic Health Survey. PLoS one. 2015;10(10):0137055.
11. Mahande MJ, Phimemon RN, Ramadhani HO. Factors associated with changes in uptake of HIV testing among young women (aged 15–24) in Tanzania from 2003 to 2012. Infect Dis Poverty. 2016;5(1):92.
12. Ethiopian Federal Ministry of Health, Demographic and Health Survey; 2011. Available at: https://dhsprogram.com/pubs/pdf/SR191/SR191.pdf. Accessed on: 16 February 2017.
13. Finlayson T, Le B, Smith A, Bowles K, Cribbin M, Miles I, DiNenno E. HIV risk, prevention, and testing behaviors among men who have sex with men: National HIV Behavioral Surveillance System, 21 U.S. Cities, United States, 2008. Surveillance Summaries. 2011;60(14):1-34.
14. Pham MD. Factors associated with HIV testing among young men who have sex with men in Myanmar: a cross-sectional study. J Int AIDS Soc. 2017;20:25026.
15. Aung T, McFarland W, Paw E, Hetherington J. Reaching men who have sex with men in Myanmar: population characteristics, risk and preventive behavior, exposure to health programs. AIDS Behav. 2013;17(4):1386-94.
16. Reilly KH, Neaigus A, Jenness SM, Wendel T, Marshall DM, Hagan H. Factors associated with recent HIV testing among men who have sex with men in New York City. AIDS Behav. 2014;18:297-304.
17. Gwadz M, Cleland CM, Kutnick A, Leonard NR, Ritchie AS, Lynch L, Banfield A, McCright-Gill T, del Olmo M, Martinez B. Factors Associated with Recent HIV Testing among Heterosexuals at High Risk for HIV Infection in New York City. Front Public Health. 2016;4:76.
18. National AIDS/STI Control Programme (NASCOP), Kenya. 2007 Kenya AIDS Indicator Survey: Final Report 2007. Nairobi, NASCOP. September 2009. Available at: www.nascop.or.ke. Accessed on: 21 June 2018.
19. Staveteig S, Wang S, Head SK, Bradley SEK, Nybro E. Demographic patterns of HIV testing uptake in sub-Saharan Africa. DHS Comparative Reports No. 30. Calverton, Maryland, USA. ICF Int. 2013.
20. Bekele YA, Fekadu GA. Factors associated with HIV testing among young females; further analysis of the 2016 Ethiopian demographic and health survey data. PLoS one. 2020;15(2):0228783.
21. Molla G. Factors associated with HIV counseling and testing among males and females in Ethiopia: evidence from Ethiopian Demographic and Health Survey data. J AIDS Clin Res. 2015;6(3).
22. Ibrahim M, Ipadeola O, Adebayo S, Fatusi A. Socio-demographic determinants of HIV counseling and testing uptake among young people in Nigeria. Int J Prev Treatment. 2013;2(3):23-31.

23. Oginni A, Obianwu O, Adebajo S. Socio-demographic Factors Associated with Uptake of HIV Counseling and Testing (HCT) among Nigerian Youth. AIDS research and human retroviruses. 2014. Available at: https://www.researchgate.net/publication/267727859. Accessed on: 18 June 2018.

24. Hibbett K. Addressing the Barriers to Proper Health Care in Ethiopia. 2018. Available at: https://borgenproject.org/addressing-the-barriers-to-proper-health-care-in-ethiopia/. Accessed on: 18 June 2018.

25. Gazimbi MM, Magadi MA. A multilevel analysis of the determinants of HIV testing in Zimbabwe: Evidence from the demographic and health surveys. HIV/AIDS Res Treat Open J. 2017;4(1):1431.

26. Mainous AG, Neill RA, Matheny SC. Frequency of human immunodeficiency virus testing among rural US residents and why it is done. Arch Fam Med. 1995;4:41-5.

27. Weis KE, Liese AD, Hussey J, Gibson JJ, Duffus WA. Associations of rural residence with timing of HIV diagnosis and stage of disease at diagnosis, South Carolina 2001-2005. J Rural Health. 2010;26:105-12.

28. Venkatesh KK, Madiba P, De Bruyn G, Lurie MN, Coates TJ, Gray GE. Who gets tested for HIV in a South African urban township? Implications for test and treat and gender-based prevention interventions. J Acquir Immune Defic Syndr. 2011;56(2):151-65.

29. Kimani JK, Ettahr R. Determinants of pathways to HIV Testing in rural and urban Kenya: Evidence from the 2008 Kenya Demographic and Health Survey. J Rural Trop Public Health. 2012;11:1-7.

30. Peltzer K, Mateke G. Determinants of HIV testing among young people aged 18–24 years in South Africa. Afr Health Sci. 2013;13(4):1012-20.

31. Isingo R, Wringle A, Todd J, Urassa M, Mbata D, Maiseli G, et al. Trends in the uptake of voluntary counselling and testing for HIV in rural Tanzania in the context of the scale up of antiretroviral therapy. Trop Med Int Health. 2012;17(8):15-25.

32. Baisley K, Doyle AM, Changalucha J, Maganja K, Watson-Jones D, Hayes R, Ross D. Uptake of voluntary counselling and testing among young people participating in an HIV prevention trial: comparison of opt-out and opt-in strategies. PLoS One. 2012;7(7):42108.

33. Weiser SD, Heisler M, Leiter K. Routine HIV testing in Botswana: A population-based study on attitude, practices, and human rights concerns. PLoS Med. 2006;3(7):261.

34. Nakanjako D, Kamya M, Daniel K, Mayanja-Kizza H, Freers J, Whalen C, et al. Acceptance of routine testing for HIV among adult patients at the medical emergency unit at a national referral hospital in Kampala. AIDS Behav. 2006;11(5):753-8.

35. Mugavero MJ, Castellano C, Edelman D, Hicks C, et al. Late diagnosis of HIV infection: the role of age and gender. Am J Med. 2007;120:370-3.

36. Zingmond DS, Wenger NS, Crystal S, Joyce GF, Liu H, Sambamoorthi U, et al. Circumstances at HIV diagnosis and progression of disease in older HIV-infected Americans. Am J Public Health. 2001;91:1117-20.