Journal of Public Health: From Theory to Practice (2019) 27:63–76
https://doi.org/10.1007/s10389-018-0928-2

ORIGINAL ARTICLE

Tracking the efficacy of the test and treat model of HIV prevention in India using National Family Health Surveys (2005–16)

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Received: 15 February 2018 / Accepted: 10 May 2018 / Published online: 8 June 2018

Abstract

Aim This paper aims to track the efficacy of the Test and Treat model of human immunodeficiency virus (HIV) prevention adopted by the government of India, 2015–16, using the last two rounds of National Family Health Survey, providing community-based insights in the testing of HIV prevalence in 2005–06 and 2015–16.

Methods The survey collected information from a nationally representative sample of 69,751 men and 124,385 women in 2005–06 and 103,411 men and 121,118 women age 15–49 in 2015–16 respectively. Both descriptive and multivariate techniques have been used.

Results The 'test and treat' model of HIV in India portrays a women-centric effort to ensure HIV testing as part of their ANC, resulting in a substantial increase in ever being tested for HIV. Women who are educated, living in urban areas, and in economically better households are more prone to have ever undergone HIV testing, it is a welcome change given the existing HIV scenario, with a continuously narrowing gender gap in new HIV infections (NFHS-4). Women and men having positive attitude towards stigma and discrimination to people living with HIV (PLHIV) are in better agreement to ever being tested. Further, women and men having knowledge about antiretroviral therapy (ART) are 1.6 times ($p < 0.001$) and 1.8 times ($p < 0.001$) more likely to have ever been tested for HIV.

Conclusions Despite an improvement in coverage of HIV testing, the existing disparities in HIV testing and treatment require policy instruments with an integrated approach. Government should work in close collaboration with communities/key stakeholders, and efficiently use their resources to provide evidence-based HIV prevention and treatment interventions.

Keywords HIV testing · Treatment · Test and treat model · HIV prevention · Gender · India

Abbreviations

NFHS	National Family Health Survey
PLHIV	People living with HIV
ANC	Antenatal care visit
HIV	Human immunodeficiency virus
ART	Antiretroviral therapy

Introduction

The human immunodeficiency virus (HIV) continues to take a tremendous toll on human health, with 37 million people living with infection and 1.2 million deaths occurring worldwide due to it in 2014. A remarkable scale-up of antiretroviral therapy has put the world on track to reach the target for prevention of AIDS-related deaths. Intensive efforts to eliminate mother-to-child transmission of HIV have led a steep decline in the annual number of new HIV infections among children, from 290,000 [250,000–350,000] in 2010 to 150,000 [110,000–190,000] in 2015. However, problems remain with HIV prevention; decline in new HIV infections among adults have been sluggish, which is a threat to further progress towards the end of the AIDS epidemic. Since 2010, the annual

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number of new infections among adults (15+) has remained static at an estimated 1.9 million (2015 range of 1.7 million–2.2 million) (UNAIDS 2016a).

In late 2015, based on new scientific findings, the World Health Organization (WHO) recommended that all those vulnerable to HIV should be tested, and those found to be infected should be offered antiretroviral therapy (ART) immediately on diagnosis. This strategy known as "treat all" or "test and treat" (Rosen 2016) is now considered essential to reduce viral load, thus preventing further transmission of HIV. Treating HIV-infected people has both a therapeutic and a preventive effect because treatment reduces viral load. Reducing viral load increases survival, and also decreases the infectivity of the individual. Consequently, by treating HIV-infected people, HIV infections are being prevented and transmission level also decreases. A universal test & treat strategy is based on treating all HIV-infected individuals whether they have been living with HIV infection for a long time or are at the initial level of infection. In resource-constrained countries, individuals are not considered to be in need of treatment until their CD4 count falls to 350 cells/ml; this generally occurs approximately 5–7 years after infection. Unfortunately, universal access to treatment for those in need is yet to be achieved in many countries (Wagner and Blower 2012). The World Health Organization (WHO) and the Joint United Nations Programme on HIV/AIDS (UNAIDS) endorse and encourage universal access to knowledge of HIV status. Increased access to and uptake of HIV testing is central to achieving the 90–90–90 targets endorsed in the 2016 United Nations Political Declaration on Ending AIDS. One main challenge in administration of the test and treat approach is to increase access to and uptake of HIV testing among priority populations.

In 2016, the world has adopted fast-track commitment to end AIDS by 2030. The Fast-Track Commitments were drawn from the 2016 United Nations Political Declaration on Ending AIDS, which were adopted by United Nations Member States at the 2016 United Nations General Assembly High-Level Meeting on Ending AIDS and the UNAIDS 2016–2021 Strategy (UNAIDS 2016b). The UNAIDS targets specify that, by 2020, 90% of people living with HIV (PLHIV) will be aware of their HIV status, 90% of diagnosed PLHIV will receive ART, and 90% of that treatment will be virologically suppressed (with 95–95–95 coverage by 2030) (UNAIDS 2014).

India has the third largest HIV epidemic infected population in the world. In 2015, HIV prevalence in India was around an estimated 0.26% (NACO 2016a). This figure is small when compared to most other middle-income countries, but because of India's huge population (1.2 billion), this equates to 2.1 million people living with HIV. In the same year, an estimated 68,000 people died from AIDS-related illnesses (UNAIDS 2016a). Overall, India's HIV epidemic is slowing down, with a 32% decline in new HIV infections (86,000 in 2015), and a 54% decline in AIDS-related deaths between 2007 and 2015 (NACO 2016a). The HIV epidemic in India is driven by heterosexual sex, which accounted for 87% of new infections in 2015. The epidemic is concentrated among key affected populations such as sex workers. The vulnerabilities that drive the epidemic are different in different parts of the country (UNGASS 2015). The five states with the highest HIV prevalence (Manipur, Mizoram, Nagaland, Andhra Pradesh, and Karnataka) are in the south of India, while several states in the northern and northeastern part of the country have also reported rising HIV prevalence (NACO 2016a). This variation in HIV epidemiology warrants different innovative strategic approaches suitable for implementation across different states and union territories of India.

In India, HIV Counselling and Testing Services started in the year 1997 and since then have been scaled up in different healthcare settings. Currently, there are more than 19,800 centres, including 5385 Stand-Alone Integrated Counselling and Testing Centres (ICTCs), 11,780 Facility Counselling and Testing Centres (CTCs) and 2581 Public-Private Partnership (PPP) CTCs across the country. This scale up was guided by the "Operational Guidelines for Integrated Counselling and Testing Centres 2007", and was able to detect about 67% of the estimated 2.12 million PLHIVs in the country by 2015 (NACO 2016b). Despite these efforts, at the end of 2016, approximately 30% of people living with HIV in India had not been tested and were still unaware of their HIV status (WHO/UNAIDS 2017). India is committed to achieving the global 90–90–90 strategies that will help to identify 90% of those infected, place 90% of these on treatment, and ensure 90% have their virus under control (Joy 2017).

Gender plays a central role in HIV vulnerability. Gender refers to the *socially constructed* roles, attitudes, behaviours, norms, values and influences that "a given society considers appropriate" for men, Trans men, Trans women and women. Gender roles may place a woman in a position in which she is less able to protect herself from HIV by making it difficult for her to practice safer sex and safer drug use, by limiting her ability to access HIV prevention services, or both. Gender roles have an effect on the course of the HIV/AIDS epidemic and drive the pattern of vulnerability among men, women, boys, girls, as well as the kinds of responses observed in different communities and societies (Anthony et al. 2016 and United Nations 2001).

The study carried out by Ompad et al. (2002) on ethnic and gender differences in HIV testing among urban, economically disadvantaged adolescents in Baltimore, Maryland revealed that most of the adolescents were first-time tested for HIV. Further, compared to males, females were 1.7 times more likely to be tested for HIV. Another study conducted by Snow et al. (2010) in Mpumalar South Africa showed that

chances of HIV testing increased twice with the increase in facility provided in the area during 2004–2006. Further, the extent of HIV testing was high among women compared to men. Several studies have reported health-related disparities between women and men in India (Kishor and Gupta 2009 and Malavé et al. 2014). A community-based survey in India reported that the majority of men were tested usually after having HIV-related symptoms, and after engaging in sexual risk behaviour, while women were tested after their husband's diagnosis or AIDS-related death (Joseph et al. 2010). Malavé et al. (2014) suggested in his study that men are often granted more independence and agency to act on their own, whereas women have less independence, forcing them to rely on others to a greater degree.

In the present context, the study has tried to track the efficacy of the test and treat model of HIV prevention using data from national family health surveys during the last decade. The primary objective of the study is to understand the changes in ever HIV testing and treatment with regard to their socioeconomic and demographic characteristics among women and men in India and across the states.

Data and methods

The present study uses data from the two rounds of the National Family Health Survey (NFHS) conducted during 2005–2006 (NFHS-3) and 2015–2016 (NFHS-4). NFHS is a nationally representative, large-scale, repeated cross-sectional survey in representative samples of households throughout India. The principal objective of NFHS is to provide updates and evidence of trends in key population, health, and nutrition indicators, including HIV prevalence. Moreover, the survey covers a range of health-related issues, including fertility, infant and child mortality, maternal and child health, perinatal mortality, adolescent reproductive health, high-risk sexual behaviour, safe injections, tuberculosis, and malaria, non-communicable diseases, domestic violence, HIV knowledge, and attitudes toward people living with HIV. Both the NFHS-3 and NFHS-4 surveys were conducted under the stewardship of the Ministry of Health and Family Welfare (MoHFW), Government of India coordinated by the International Institute for Population Sciences (IIPS), Mumbai, as the nodal agency, and technical assistance provided by as ICF International. Both the surveys were funded by the United States Agency for International Development (USAID), DFID, the Bill and Melinda Gates Foundation (BMGF), UNICEF, UNFPA, the MacArthur Foundation, and the Ministry of Health and Family Welfare (MoHFW), Government of India. NACO and the National AIDS Research Institute (NARI) provided technical assistance for the HIV component.

Both surveys adopted uniform sample design in all states. In each state, the rural sample was selected in two stages, with the selection of Primary Sampling Units (PSUs), which are villages, with probability proportional to population size (PPS) at the first stage, followed by the random selection of households within each PSU in the second stage. In urban areas, a three-stage procedure was followed. In the first stage, wards were selected with PPS sampling. In the next stage, one census enumeration block (CEB) was randomly selected from each sample ward. In the final stage, households were randomly selected within each selected CEB.

The survey collected information from a nationally representative sample of 69,751 men and 124,385 women in 2005–06 and 103,411 men and 121,118 women aged 15–49 during the period 2015–16 respectively. Both surveys collected information about HIV, including the primary variables utilized in this paper: ever had HIV test, knowledge of place for obtaining HIV test, and knowledge about anti-retroviral therapy (ART) as dependent variables, age of the respondents, place of residence, educational status, regular media exposure, marital status, religion, caste, wealth quantile, and regions of the respondents as independent variables.

Bivariate and multivariate analysis has been applied to understand the test and treat model of HIV prevention. To determine the factor associated with ever HIV testing among men and women aged 15–49 in India, binary logistics regression has been used. We have also used kappa statistics to understand the agreement on ever HIV testing with attitude towards stigma and discrimination among men and women. Kappa (Cohen's Kappa) statistics was used as a measure of agreement between the two individuals (Viera and Garrett 2005).

Results

HIV testing and counselling is a key entry point for the prevention of HIV, the management of HIV-related illnesses, PMTCT, ART, and psychosocial and legal support. Gender and socio-economic and cultural factors affect uptake of HIV testing and ultimately early treatment. Table 1 shows the gender differences in the knowledge about a place of HIV testing according to some selected background characteristics of the respondents in India. Results show that as compared to women, knowledge about a place of HIV testing is higher among men in both the surveys. It is also evident that knowledge about a place of HIV testing has substantially increased over the last decade (2005–16), among women (from 27 to 45%) as well as men (from 51 to 61%). It is clear from the table that younger women (15–29 years), residing in urban areas, having 10 or more years of education, having regular exposure to media, and those who are never married, have relatively more knowledge about place of HIV testing in the consecutive surveys. At the same time, there is a considerable

Table 1 Percentage of women and men age 15–49 having knowledge of place of HIV testing by some selected background characteristics in India, 2005–06 & 2015–16

Background characteristics	Women		Men	
	2005–06	2015–16	2005–06	2015–16
Age (years)				
15–19	27.0	37.0	46.1	50.8
20–24	31.3	50.6	53.6	63.0
25–29	30.3	51.9	54.6	65.4
30–34	27.0	47.7	53.6	65.1
35–39	25.0	45.2	50.1	62.2
40 and above	23.1	39.9	47.1	59.7
Years of schooling				
No education	8.3	23.1	17.7	37.5
< 5	18.2	32.3	30.4	42.8
5–9	31.8	42.4	49.3	53.5
10 and above	59.5	64.9	74.8	74.0
Marital status				
Never married included gauna not performed	35.1	43.4	53.0	59.3
Married	25.6	45.7	49.4	61.6
Widowed/divorced/separated	21.3	41.5	33.9	51.3
Residence				
Urban	43.3	57.8	64.9	68.8
Rural	19.6	37.8	42.2	55.5
Religion				
Hindu	27.6	44.6	51.2	60.5
Muslim	20.6	39.6	42.7	56.9
Others	40.5	64.7	58.1	71.4
Caste/tribe				
Scheduled caste	22.6	43.1	45.5	59.5
Scheduled tribe	14.3	33.1	31.7	46.4
Other backward class	26.5	44.8	52.8	61.6
Others	35.9	52.0	57.5	65.8
Regular exposure to media				
No	8.0	20.1	18.8	35.3
Yes	37.9	53.0	58.2	65.2
Wealth index				
Poorest	6.8	17.9	20.6	36.0
Poorer	12.5	30.5	34.6	49.6
Middle	22.5	44.6	47.9	61.7
Richer	34.1	56.2	61.1	69.7
Richest	54.0	66.0	75.3	75.5
Region				
North	29.8	50.9	57.3	71.4
Central	18.0	30.1	45.9	51.8
East	16.8	28.7	34.8	49.3
Northeast	21.6	31.3	32.2	41.3
Western	38.3	49.3	60.0	60.6
South	40.0	67.2	62.5	73.9
Total	27.4	45.0	50.5	60.6

increase in knowledge about places offering HIV testing among women as well as men according to different background characteristics during the last decade. It is observed that knowledge about place of HIV testing rapidly increased among those who have no education, were residing in rural areas, belonged to other religions (Sikhs, Christian, Buddhism etc.) as compared to Hindu and Muslim, having no regular exposure to media and from poorest quintile over the last decade among women as well as men in India. The result also shows that as wealth quantile increases, knowledge about a place of HIV testing also increases in both the surveys among both the sexes, the only difference being in its magnitude. Regional variation in the knowledge about place of HIV testing has also been reported among women and men. Knowledge about place of HIV testing is higher among women in the southern region than the other geographical regions of India, and has also increased over the last decade, to 67% from 40%. This pattern of variation in the knowledge about place of HIV testing for men is also similar to women. Moreover, it can be observed that the knowledge about place of HIV testing has rapidly increased among men and women in the northern region of India from 2005–06 to 2015–16.

Table 2 depicts the changes in ever testing of HIV in relation to the respondent's background characteristics. It is clearly observed that ever testing of HIV has rapidly increased among women in the last 10 years. Overall, ever testing of HIV has increased by 13 percentage points among women and 4 percentage points among men over the last decade. The variation in the change can also be seen among women as well as men according to their socio-demographic and socioeconomic characteristics. Although HIV testing has increased among each age group of both the sexes, the maximum increase is reported among women in the age group 25–29 (from 6% to 28%), and among men in the age groups 30–34 (6 to 12%) and 35–39 (5 to 11%). In contrast, analysing by the level of education, an ascending pattern can be observed in the HIV testing among women as well as men in both the surveys. In analysing women with no education and 10 or more years, 6.2 and 25% respectively were tested for HIV in 2015–16, whereas these percentages were 0.8 and 8.2% respectively in 2005–06. In the case of men with no education and 10 or more years, prevalence of HIV testing has increased from 0.8 and 7.1% to 3.0 and 10.4% respectively over the last decade. In the case of place of residence, urban residents are tested for HIV more among women as well as men in both the surveys; however, HIV testing has increased more rapidly among women residing both in urban (6 to 23%) and in rural (2 to 12%) areas from 2005–06 to 2015–16. Results reveal that 21% of married women and 10% of men were tested for HIV in 2015–16, whereas these percentages were 4% and 5% respectively in 2005–06. It was also found that among widowed/divorced/separated women, HIV testing considerably increased, from 2% in 2005–06 to 15% in 2015–16. Comparing the religions, the rate of increase in HIV testing among women is significantly higher than the men. It is observed that women and men belonging to other religions (including Christians, Sikhs, and Buddhists, etc.) were tested for HIV more as compared to Hindus and Muslims in both the surveys, and also that this has increased from 6 to 26% among women and 8 to 13% among men during the last decade. Caste-wise comparison shows that respondents belonging to the general caste are tested for HIV more than the rest of the population, among women as well as men, in both the surveys. Findings from the table reveal that the prevalence of HIV testing among the general caste of women and men was 18 and 9% respectively in 2015–16, whereas this percentage was 4 and 5% in 2005–06. At the same time, the rate of increase among women is much higher than men in each caste group. Results also reveal that women who are regularly exposed to mass media reported more HIV testing (20%) in 2015–16 than in 2005–06 when this percentage was only 5%. In the case of men having regular exposure to mass media, the percentage has increased from 5 to 9% over the last decade.

Findings reveal that affluent people from both genders are tested for HIV more than the poor group in both the consecutive surveys. Over the last decade, the prevalence of HIV testing has considerably seen an upsurge among women as well as men. A positive association is confirmed between wealth and HIV testing. Results reflect that among both women and men as wealth increases, the prevalence of HIV testing increases significantly. Women belonging to the richest wealth quintile are tested for HIV more in 2015–16 such as 26%, whereas this percentage was 7% in 2005–06. When we move from poorest to higher wealth quintiles, an astronomical increase in HIV testing can be observed among men. Regional variation in the HIV testing is also observed among women and men. Results show that women and men from the North, Western and South regions are reporting more HIV testing over the last decade; nonetheless, the rate of increase is significantly higher among women than the men from 2005–06 to 2015–16.

Figure 1(a) and (b) shows the percentage distribution of women age 15–49 by ever testing of HIV in the Indian States during the period 2005–06 and 2015–16. HIV testing has increased rapidly in every state of India among women aged 15–49 during the last decade. Mizoram (46%), Goa (44%), Kerala (43%) and Manipur (41%) reported a high proportion of women aged 15–49 who have ever undergone HIV testing in 2015–16. Bihar (3.4%), Uttar Pradesh (4.2%), Tripura (4.6%) and Assam (5.1%) have the lowest prevalence of HIV testing among women, though the percentage has increased from 2005–06 to 2015–16. Similarly, in the case of men aged 15–49, the percentages are high among those who reported ever HIV testing in Mizoram (36%), Goa (30%), Himachal Pradesh (21%) and Nagaland (20%) in 2015–16, while they were low in 2005–06. The lowest

Table 2 Percentage of women and men age 15–49 by ever testing of HIV according to some selected background characteristics in India, 2005–06 & 2015–16

Background characteristics	Women		Men	
	2005–06	2015–16	2005–06	2015–16
Age (years)				
15–19	1.0	2.8	0.7	1.3
20–24	4.8	19.5	2.6	4.7
25–29	6.1	27.8	5.5	9.7
30–34	4.3	23.0	6.2	11.7
35–39	2.0	16.2	5.1	11.0
40 and above	1.3	10.7	3.6	8.1
Years of schooling				
No education	0.8	6.2	0.8	3.0
<5	1.6	10.1	1.3	3.8
5–9	3.1	15.0	2.7	5.7
10 and above	8.2	25.0	7.1	10.4
Marital status				
Never married included gauna not performed	0.5	1.7	2.4	3.7
Married	4.0	20.7	4.6	9.9
Widowed/divorced/separated	2.0	14.6	2.4	6.3
Residence				
Urban	5.7	22.7	5.3	9.7
Rural	1.9	12.4	2.6	6.1
Religion				
Hindu	3.1	15.8	3.6	7.4
Muslim	2.7	14.1	3.3	5.8
Others	5.5	25.5	7.5	13.4
Caste/tribe				
Scheduled caste	2.4	14.8	2.8	7.4
Scheduled tribe	1.5	11.3	1.5	4.8
Other backward class	3.5	16.6	3.6	7.3
Others	3.8	18.3	5.2	8.9
Regular exposure tomedia				
No	0.6	5.0	0.6	1.9
Yes	4.6	19.6	4.5	8.5
Wealth index				
Poorest	0.5	3.9	0.5	1.8
Poorer	1.0	8.9	1.3	3.9
Middle	2.3	16.2	2.4	7.4
Richer	4.0	21.4	4.3	9.8
Richest	7.1	25.5	8.4	11.8
Region				
North	1.5	14.0	3.7	7.4
Central	0.5	5.7	1.6	3.5
East	0.5	6.8	1.8	3.9
Northeast	1.2	8.9	2.1	4.2
Western	5.2	19.6	5.8	9.4
South	8.8	32.6	6.9	13.0
Total	3.2	16.1	3.7	7.5

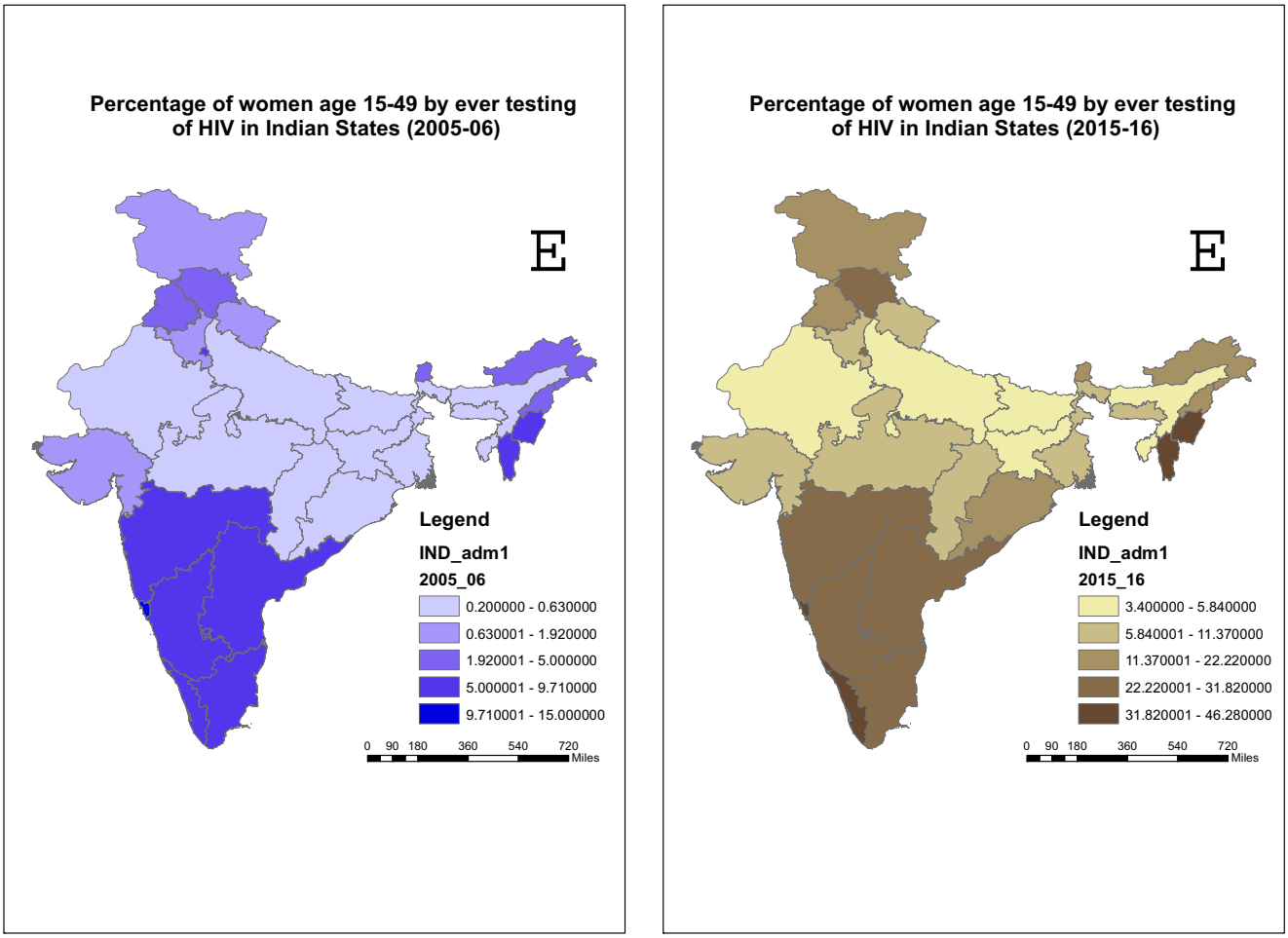

Fig. 1 **a** Percentage of women aged 15–49 by ever testing of HIV in Indian States, 2005–06. **b** Percentage of women aged 15–49 by ever testing of HIV in Indian States, 2015–16

prevalence of HIV testing is observed among men from Assam (1.7%), Tripura (2.1%), Meghalaya (2.5%), and Rajasthan (2.5%) in 2015–16 which is still low as it was in 2005–06 (Fig. 2).

Table 3 shows the result of a binary logistic regression model for ever testing of HIV among women and men according to some selected background characteristics in India. It is observed that the older age group (40 and above) of women, residing in rural areas, and belonging to the Muslim religion are less likely to have ever been tested for HIV. The chance of ever testing of HIV among women age group 15–29 increased over the last decade. Women aged 25–29 are 3 times more likely to have ever tested for HIV in 2015–16, whereas this likelihood of testing of HIV was 1.6 ($p < 0.001$) in 2005–06. In the case of men, the chances of HIV testing has remained the same over the last 10 years. Women and men having 5–10 or more years of education are significantly more likely to have ever tested for HIV in both the surveys. It is noticeable that women and men who are married and widowed/divorced/separated are significantly more likely to report HIV testing in 2015–16. Married women are 16 times more likely to report HIV testing in 2015–16, while in 2005–06 it was 12 times. However, the likelihood of ever testing of HIV is much higher among women than the men; men are significantly 2 times ($p < 0.001$) more likely to have ever tested for HIV. Findings reveal that women and men belonging to other religion are more likely to have tested for HIV in both the surveys. Those who have regular exposure to mass media are more likely to report ever testing of HIV among women as well as men in both the consecutive surveys. It is also interesting to note that likelihood of women and men ever got to test for HIV increases with the increase in wealth index in 2015–16. Men and women belonging to richest quintile are 1.7 times ($p < 0.001$) and 2.7 times ($p < 0.001$) more likely to report ever HIV testing. It is evident that women and men in the Central India and East India regions were less likely to report ever HIV testing in both the consecutive surveys. Northeast, Western and South region people are more likely to report testing for HIV; nonetheless, the magnitude of the odds ratio has changed over the last decade among women as well as men.

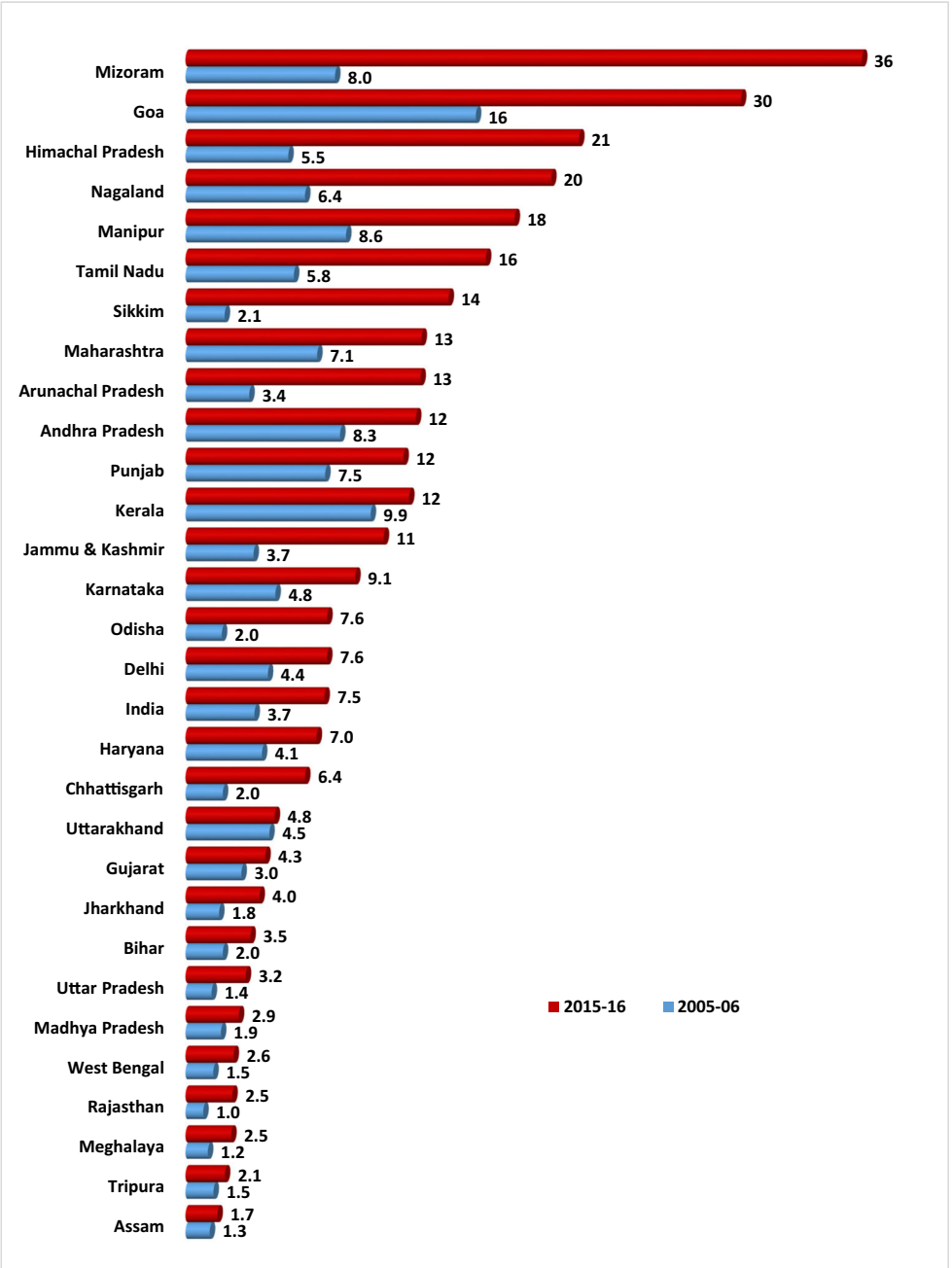

Fig. 2 Percentage of men aged 15–49 by ever testing of HIV in Indian States, 2005–06 & 2015–16

Table 4 represents the agreement between ever HIV testing and attitude towards stigma and discrimination by using Kappa statistics. Results reveal that women and men both slightly agree on ever HIV testing when they are accepting all the four attitudes of stigma and discrimination. It means those who accepted the attitude towards stigma and discrimination have to a small extent agreed to have ever undergone HIV testing. However, ever testing of HIV increased among those women and men who agreed in accepting the attitude of stigma and discriminations from 2005–06 to 2015–16.

Table 5 represents the changes in knowledge about ART that can help people live longer among men and women aged 15–49 by some selected background characteristics in India. It can be observed from the table that knowledge about ART among men is higher as compared to women in both the consecutive surveys. About one-fourth of men and 23% of women are aware about ART where people could go for treatment in 2015–16, whereas this percentage in 2005–06 was 14 and 8% respectively. However, the rate of increase in knowledge about ART among women is high than the men during the last decade. Results reveal that knowledge about ART among women has rapidly increased in each age group from 2005–06 to 2015–16. Knowledge about ART through their education depicts an ascending pattern among women as well as

Table 3 Logistic regression odds ratios for ever HIV testing among women and men age 15–49 by some selected background characteristics in India, 2005–06 & 2015–16

Background characteristics	Ever HIV testing			
	Women (odds ratio, 95% CI)		Men (odds ratio, 95% CI)	
Age (years)	2005–06	2015–16	2005–06	2015–16
15–19 ®				
20–24	1.6***(1.40–1.93)	2.7***(2.35–2.98)	3.0***(2.47–3.71)	2.6***(2.27–3.06)
25–29	1.6***(1.36–1.89)	2.9***(2.65–3.36)	5.1***(4.15–6.24)	4.3***(3.70–4.98)
30–34	1.1(0.90–1.27)	2.1***(1.88–2.39)	5.4***(4.37–6.74)	5.3***(4.53–6.18)
35–39	0.6***(0.47–0.67)	1.3***(1.15–1.48)	4.6***(3.65–5.73)	4.5***(3.80–5.84)
40 and above	0.3***(0.26–0.38)	0.8***(0.71–0.99)	3.3***(2.64–4.13)	3.5***(2.96–4.06)
Years of schooling				
No education ®				
< 5	0.9(0.77–1.17)	1.04(0.92–1.117)	1.2(0.90–1.58)	0.9(0.81–1.19)
5–9	1.3***(1.15–1.53)	1.5***(1.37–1.58)	1.8***(1.40–2.18)	1.5***(1.30–1.69)
10 and above	2.6***(2.23–2.97)	2.2***(2.03–2.35)	2.8***(2.22–3.46)	2.1***(1.87–2.44)
Marital status				
Never married included gauna not performed ®				
Married	12.5***(10.77–14.45)	15.7***(14.26–17.26)	1.6***(1.41–1.77)	1.8***(1.69–2.00)
Widowed/divorced/separated	10.5***(8.33)	12.8***(11.18–14.75)	1.8**(1.27–2.65)	1.6***(1.34–2.03)
Residence				
Urban ®				
Rural	0.7***(0.67–0.78)	0.8***(0.81–0.88)	1.1(0.96–1.15)	0.9***(0.86–0.97)
Religion				
Hindu ®				
Muslim	0.9(0.84–1.12)	1.01(0.94–1.08)	0.9(0.83–1.07)	0.9**(0.82–0.99)
Others	1.6***(1.40–1.72)	1.7***(1.59–1.81)	1.6***(1.42–1.79)	1.8***(1.67–1.97)
Caste/tribe				
Scheduled caste ®				
Scheduled tribe	1.1(0.96–1.33)	1.2***(1.09–1.27)	0.8**(0.64–0.92)	1.1**(1.01–1.23)
Other backward class	1.2**(1.05–1.32)	0.9***(0.84–0.95)	0.9(0.79–1.01)	0.8***(0.73–0.85)
Others	1.3***(1.15–1.45)	1.05(0.98–1.12)	1.1(0.98–1.24)	0.9**(0.84–0.99)
Regular exposure to media				
No ®				
Yes	1.5***(1.28–1.73)	1.3***(1.22–1.41)	1.5***(1.21–1.88)	1.5***(1.31–1.67)
Wealth index				
Poorest ®				
Poorer	1.03(0.75–1.40)	1.1**(1.03–1.26)	1.2(0.85–1.66)	1.3***(1.15–1.56)
Middle	1.2(0.86–1.54)	1.3***(1.21–1.49)	1.6** (1.18–2.21)	1.9***(1.63–2.17)
Richer	1.3(0.95–1.68)	1.5***(1.34–1.65)	2.1***(1.52–2.82)	2.2***(1.94–2.59)
Richest	1.5*(1.08–1.94)	1.7***(1.49–1.86)	3.0***(2.21–4.15)	2.7***(2.31–3.12)
Region				
North ®				
Central	0.5****(0.41–0.59)	0.6***(0.58–0.66)	0.7***(0.59–0.82)	0.7***(0.63–0.76)
East	0.5***(0.38–0.58)	0.8***(0.75–0.88)	0.8*(0.61–0.95)	1.1*(0.99–1.22)
Northeast	2.1***(1.79–2.38)	1.7***(1.53–1.79)	1.6***(1.39–1.90)	1.5***(1.38–1.70)
Western	4.1***(3.60–4.57)	1.7***(1.63–1.88)	1.8***(1.56–2.07)	1.4***(1.24–1.49)
South	5.4***(4.81–6.11)	3.3***(3.1–3.57)	2.1***(1.83–2.42)	2.2***(2.02–2.38)
Constant	0.0008	0.0030	0.0011	0.0028

® Reference; * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; CI = confidence intervals

men in both the surveys. In case of the place of residence, urban residents are more aware about ART among women and men in both the surveys. Nonetheless, the percentage of men and women having knowledge about ART increased from 13% & 18% to 29% & 29% respectively during last decade. This finding reveals that women and men belonging to general caste have more knowledge about ART than the other caste groups among women as well as men. The percentages of women and men having knowledge about ART were 27% and 29% in 2015–16, while these percentages in 2005–06 were 11% and 16% respectively. It is observed that as the wealth index increases, knowledge about ART also increases among women and men in both surveys. About one-third of men and women belonging to the richest quintile are aware about ART that can help people live longer in the 2015–16 survey, whereas these percentages in 2005–06 were 16% and 22%. Regional variations can also be observed from the table; women and men in the South and Western regions

Table 4 Agreement between ever HIV testing and attitude towards stigma and discrimination among women and men age 15–49, India, 2005–06 & 2015–16

Kappa statistics				
	Women		Men	
	2005–06 (coeff.)	2015–16 (coeff.)	2005–06 (coeff.)	2015–16 (coeff.)
Are willing to care for a relative with HIV/AIDS in own home	0.01	0.03	0.01	0.01
Would buy fresh vegetables from a shopkeeper or vendor who has HIV/AIDS	0.02	0.06	0.03	0.03
Say that a female teacher who has HIV/AIDS but is not sick should be allowed to continue teaching	0.02	0.03	0.02	0.03
Would not want to keep secret that a family member got infected with HIV/AIDS	0.03	0.05	0.00	0.01
Accepting atitude on all four indicators	0.01	0.04	0.03	0.04

Kappa agreement:

< 0 less than chance agreement

0.01–0.20 slight agreement

0.21–0.40 fair agreement

0.41–0.60 moderate agreement

0.61–0.80 substantial agreement

0.81–0.99 almost perfect agreement

Coeff = Kappa coefficient

are more aware about ART in both the surveys. Moreover, the rate of increase in knowledge about ART among women belonging to the North, Central and East region was higher than in the other parts of India during the last decade.

Figure 3 shows the annual AIDS-related deaths and ART scale-up in India during 2000–2014. It is observed that as access to ART by PLHIV increased since 2007, AIDS-related deaths (ARD) started to show a declining trend. The annual number of AIDS-related deaths have declined by 54%. In 2015, an estimated 68,000 people died of AIDS-related causes nationally.

This decline is consistent with the rapid expansion of access to ART across the country. It is estimated that the scale-up of free ART since 2004 saved cumulatively around 450,000 lives in India up to 2014 (NACO, 2015–16).

Discussion and conclusions

The Ministry of Health and Family Welfare/Government of India launched the 'Test and Treat policy' to achieve the global targets. The Health Minister of India stated that this will help to improve longevity, improve quality of life of those infected, and will save them from many opportunistic infections, especially TB. The key provisions of the Act are prohibition of discrimination, informed consent, non-disclosure of HIV status, antiretroviral therapy and opportunistic infection management, protection of property of affected children, a safe working environment, and the appointment of an ombudsman in every state. Out of 2.1 million people estimated to have HIV, only about 1.4 million have been identified yet. To detect those remaining, the government has revised national HIV testing guidelines and is aiming to reach out to people in communities and test them where they are — of course, with proper counselling and consent. There are about 1600 ART and Link ART sites across the country where treatment is provided. Recently, these sites crossed the 1 million people treated mark, making India the second country in the world to have such large numbers on free lifelong treatment. (MoHFW 2017). As India has a large number of PLHIV, any change in policy has major financial implications. The global vision and sustainable development goal to end AIDS by 2030 requires initiating all PLHIV on ART irrespective of CD4 cell count, as per the 2015 WHO antiretroviral therapy guidelines (Tanwar et al. 2016 and WHO 2015).

Using the data from NFHS-3 (2005–06) and NFHS-4 (2015–16), this study has made an attempt for the first time in India to track the efficacy of the test and treat model of HIV prevention among females and males, and also highlights the significant predictors of HIV testing among both women and men at national level. The findings of the study clearly indicate that the extent of HIV testing has improved remarkably over the last decade among both women and men. There is a huge gender difference in HIV testing and knowledge about places offering HIV testing, as the rate of increase either in

Table 5 Percentage of women and men aged 15–49 who are aware of ART that can help people infected with HIV to live longer according to some selected background characteristics in India, 2005–06 & 2015–16

Background characteristics	Women		Men	
	2005–06	2015–16	2005–06	2015–16
Age (years)				
15–19	8.3	21.3	11.5	19.7
20–24	9.0	24.1	14.7	25.9
25–29	9.2	23.9	14.5	27.5
30–34	8.6	24.1	15.5	26.3
35–39	7.7	23.0	14.0	24.2
40 and above	7.5	20.3	13.3	23.9
Years of schooling				
No education	2.3	10.6	4.3	14.3
< 5	6.3	17.8	8.1	18.9
5–9	8.9	20.4	11.1	18.9
10 and above	19.7	33.7	23.4	31.8
Marital status				
Never married included gauna not performed	11.6	24.7	14.9	24.6
Married	7.7	22.1	13.3	24.4
Widowed/divorced/separated	6.3	19.7	8.0	19.8
Residence				
Urban	12.9	28.9	17.5	29.4
Rural	6.2	19.0	11.7	21.3
Religion				
Hindu	8.4	22.5	14.0	24.3
Muslim	6.2	20.6	11.7	23.7
Others	14.1	29.1	16.3	27.4
Caste/tribe				
Scheduled caste	6.7	22.2	12.2	22.3
Scheduled tribe	3.9	18.4	7.9	19.9
Other backward class	8.2	20.7	14.0	23.8
Others	11.0	27.0	15.9	28.5
Regular exposure to media				
No	1.8	10.1	3.7	12.8
Yes	12.0	26.6	16.3	26.5
Wealth index				
Poorest	1.6	10.4	4.7	14.8
Poorer	3.7	16.4	9.1	18.5
Middle	7.2	21.0	12.6	23.8
Richer	11.0	26.9	16.8	27.8
Richest	16.4	33.8	21.8	32.7
Region				
North	6.9	19.3	9.1	25.5
Central	3.6	11.3	6.9	12.4
East	6.3	25.1	12.7	26.1
Northeast	10.1	19.9	12.8	28.2
Western	5.4	27.1	12.3	25.4
South	18.2	29.6	27.1	32.1
Total	8.4	22.6	13.8	24.4

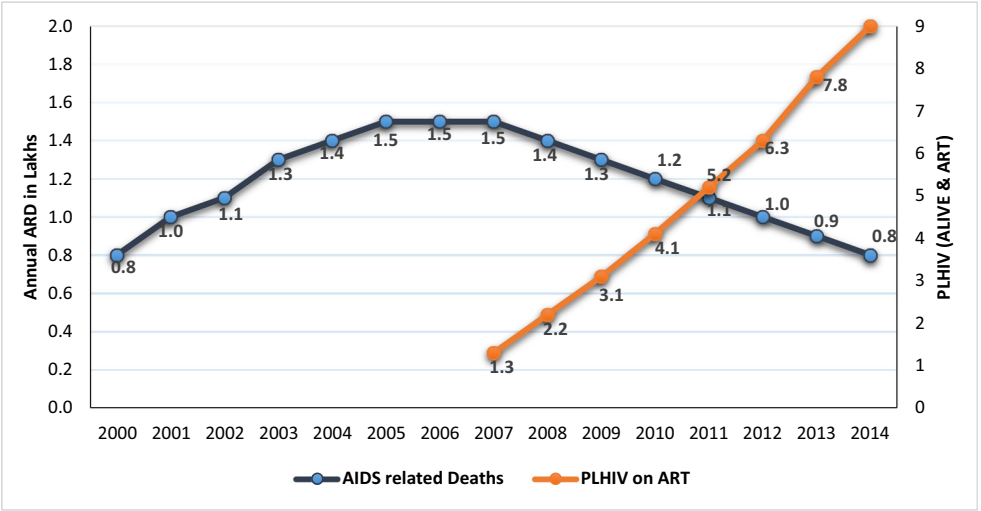

Fig. 3 Annual AIDS-related deaths and ART scale-up, India, 2000–14. Source: NACO annual report 2015–16

Source: NACO annual report 2015-16

HIV testing or in the knowledge about the places offering HIV testing among women was substantially higher than among men. One of the important findings of the study is that men are more aware about places of HIV testing as compared to women in both the surveys; nevertheless, HIV testing among them is lower than women in 2015–16. However, the extent of HIV testing was lower among women in 2005–06. This could be due to more frequent interaction due to visiting the health services during antenatal care and prevention of mother to child transmission programs (Hendriksen et al. 2009 and MacPhail et al. 2009).

It is extensively believed that the voluntary counselling and testing are influenced by socio-demographic characteristics such as age, gender, marital status, educational attainment, socio-economic status, and area of residence, behavioural and psychosocial factors such as high-risk sexual partner, HIV/AIDS-related knowledge, confidentiality, self-perceived risk, stigma and discrimination (EDHS 2005; Leta et al. 2012; Wringe et al. 2008 and Teklehaimanot et al. 2016). The findings of this study have shown that several socio-demographic and socioeconomic factors were associated with HIV testing among men and women. It is evident from the findings that the extent of HIV testing among women and men differs widely as per their age, place of residence, mass media exposure, and the household's economic status. The results show that better educated individuals are more likely to be tested for HIV, but the rate of increase is much higher among women than men over the last decade. Similar findings were also observed in a study conducted in Ethiopia (Teklehaimanot et al. 2016). The findings of the study reveal that even widowed/divorced/separated women were tested for HIV more than the men in the last 10 years; however, married individuals were tested more than the widowed.

While HIV testing improved considerably as compared to 2005–06 levels among both women and men, probably due to the increasing number of health facilities and increased accessibility to free anti-retroviral drugs, the extent of HIV testing in rural areas was low in comparison to urban areas. This finding of the study is also consistent with the study conducted in Ethiopia (EDHS 2011). Other factors such as individuals belonging to other religions (Christians, Sikhs, Buddhists, etc.), general caste, having exposure to mass media, and belonging to affluent classes having been significantly more tested for HIV over the last decade. These findings suggest that in the recent course of HIV testing, women are performing better than men.

The results depict significant differences in the extent of HIV testing by state and geographical region, which partly reflects the multifactorial characteristics of the country and differences in the pace of implementation of the HIV prevention programme. The percentage that has ever been tested for HIV ranged from 4% in Bihar to 46% in Mizoram among women, and 2% in Assam to 36% in Mizoram among men. Although every state and geographical region is performing better in terms of ever HIV testing as compared to 2005–06 levels among both men and women, the extent of HIV testing has substantially increased among women in each of the states more than the men over the last decade. The findings of the study also noted that the Northeast, Western, and South regions are more likely to accept HIV testing more openly than other regions of India.

Provision of free anti-retroviral therapy (ART) for eligible persons living with HIV/AIDS was launched on 1 April, 2004 in eight government hospitals located in six high prevalence states in India. Since then, the programme has been scaled up significantly both in terms of facilities for treatment and the number of beneficiaries. The ART centres are established in the medical department of medical colleges and district hospitals, mostly in the government sectors. However, some ART centres are functioning in the sub-district and area hospitals also, mainly in high prevalence states. The ART centres are set

up based on prevalence of HIV in the district/region, a volume of PLHIV detected, and capacity of the institution to deliver ART-related services. Till September 2015, there are 519 functional ART centres across the country (NACO 2016b). The findings of the study clearly reveals that those respondents who are unmarried, residing in urban areas, belonging to other religions, belonging to the general caste, having regular exposure to mass media, and belonging to the affluent class are more aware about ART, which can help people to live longer. However, knowledge about ART has considerably increased among both men and women during the last decade. It has been found that among even those individuals who are not educated or have less than 5 years of schooling, are married or widowed/divorced/separated, reside in rural areas, are Hindu or Muslim, or are from scheduled castes or scheduled tribes (SC/ST), awareness about ART has increased rapidly among women as well as men over the last decade. The NACO Annual Report 2015–16 stated that the scale of ART centres since 2004 has improved and saved 450,000 lives in India up to 2014 (NACO 2016a).

Conclusion

India has successfully achieved the sixth Millennium Development Goal of halting and reversing the HIV epidemic [Millenium Development Goals (MDG India report 2015].This study concluded that HIV testing and treatment have improved considerably over the last decade among women and men, which cuts across various socio-economic groups. The findings highlight that women with a higher level of educational attainment, living in urban areas, having regular exposure to mass media and belonging to economically better-off households are more prone to accept HIV testing than their men counterparts, which is a welcome change in the existing HIV scenario with a continuously narrowing gender gap in new infections (NFHS-4). Findings from the study highlight a need to develop policy instruments which may work as a catalyst in enhancing HIV testing, targeting those living in rural areas, who are less educated, and coming from households in the lowest wealth quintile. This is particularly important in the context of the recent findings of community-based HIV testing in India under NFHS-4, where only one-third of HIV-positive people reported to have ever had HIV testing and received the test results. This indicates that two-thirds of HIV-positive people who were included in the community-based HIV testing in the country had never been tested for their HIV status prior to NFHS-4. Of course, the pattern of HIV testing and getting test results is not uniform across the country. A wider disparity across region, religion, education, caste, gender, poverty, and other forms of social exclusions are the key challenges for the efficacy of the test and treat model in India. The existing disparities in HIV testing and treatment demand an integrated approach where governments should work in close collaboration with communities and key stakeholders, and efficiently use their scarce resources to provide evidence-based HIV prevention and treatment interventions for population groups that need them most.

Acknowledgements The authors of this papers are thankful to the participants. The paper did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Compliance with ethical standards

Conflict of interest statement The authors of this paper declare that they have no conflict of interest.

References

Anthony OK, Adetayo T, Folajinmi O, Onu Eugene A, Uchendu O, Ikenna N, Ogbang D (2016) Gender and HIV testing service uptake: trend in northern Nigeria. J AIDS Clin Res 7:638. https://doi.org/10.4172/2155-6113.1000638

EDHS (Ethiopia Demographic and Health Survey) (2011) Central Statistical Agency [Ethiopia] and ICF International 2012. Addis Ababa, Ethiopia and Calverton, Maryland, USA: Central Statistical Agency and ICF International. Retrieved from https://www.dhsprogram.com/pubs/pdf/fr255/fr255.pdf. Accessed 15 Feb 2018

EDHS (Ethiopia Demographic and Health Survey) (2005) Central Statistical Agency [Ethiopia] and ORC Macro 2006. Addis Ababa, Ethiopia and Calverton, Maryland, USA: Central Statistical Agency and ORC Macro. https://www.dhsprogram.com/pubs/pdf/FR179/FR179[23June2011].pdf. Accessed 15 Feb 2018

Gahagan J (2012) Gender matters in HIV prevention. http://www.catie.ca/en/pif/spring-2012/gender-matters-hiv-prevention. Accessed 15 Feb 2018

Hendriksen E, Hlubinka D, Chariyalertsak S, Chingono A, Gray G, Mbwambo J, Richter L, Kulich M, Coates TJ (2009) Keep talking about it: HIV/AIDS-related communication and prior HIV testing in Tanzania, Zimbabwe, South Africa, and Thailand. AIDS Behav 13(6):1213–1221. https://doi.org/10.1007/s10461-009-9608-0

Joseph S, Kielmann K, Kudale A, Sheikh K, Shinde S, Porter J, Rangan S (2010) Examining sex differentials in the uptake and process of HIV testing in three high prevalence districts of India. AIDS Care 22(3): 286–295

Joy H (2017) New Therapy for All HIV Infected People: Nadda. Medindia AIDS/HIV News. 29 April. Retrieved from https://www.medindia.net/news/new-therapy-provided-for-all-hiv-infected-people-nadda-169699-1.htm. Accessed 15 Feb 2018

Kishor S, Gupta K (2009) Gender equality and women's empowerment in India. National Family Health Survey (NFHS-3), India, 2005–2006. International Institute for Population Sciences and ICF Macro, Mumbai and Calverton, Maryland, USA.https://dhsprogram.com/pubs/pdf/od57/od57.pdf. Accessed 15 Feb 2018

Leta TH, Sandøy IF, Fylkesnes K (2012) Factors affecting voluntary HIV counselling and testing among men in Ethiopia: a cross-sectional survey. BMC Public Health 12:438. https://doi.org/10.1186/1471-2458-12-438

MacPhail C, Pettifor A, Moyo W, Rees H (2009) Factors associated with HIV testing among sexually active South African youth aged 15–24

years. AIDS Care 21(4):456–467. https://doi.org/10.1080/09540120802282586

Malavé S, Ramakrishna J, Heylen E, Bharat S, Ekstrand ML (2014) Differences in testing, stigma, and perceived consequences of stigmatization among heterosexual men and women living with HIV in Bengaluru, India. AIDS Care 26(3):396–403. https://doi.org/10.1080/09540121.2013.819409

Millennium Developments Goals (MDGs), India Country Report (2015) Government of India, Ministry of Statistics and Programme implementation Central Statistics Office (Social Statistics division). http://mospi.nic.in/sites/default/files/p.ublication_reports/mdg_2july15_1.pdf. Accessed 15 Feb 2018

Ministry of Health and Family Welfare (MoHFW) (2017) Health Ministry launches 'Test and Treat Policy for HIV'. Press Information Bureau. Government of India. April, 28, 2017 http://pib.nic.in/newsite/PrintRelease.aspx?relid=161389. Accessed 15 Feb 2018

National AIDS Control Organization (NACO) (2016a) Annual Report 2015–16 Pg. 366 http://naco.gov.in/sites/default/files/Annual%20Report%202015-16.pdf. Accessed 15 Feb 2018

National AIDS Control Organization (NACO) (2016b) National HIV Counselling and Testing Services (HCTS) Guidelines December http://www.indiahivinfo.naco.gov.in/naco/resource/national-hiv-counselling-and-testing-services-hcts-guidelines-2016. Accessed 15 Feb 2018

Ompad DC, Strathdee SA, Kellam C, Latin DD, Celentano JP, Ialongo N (2002) Ethnic and gender differences in HIV testing among urban, economically disadvantaged adolescent in Baltimore, Maryland. International AIDS Conference held at Johns Hopkins University of Public Health, Baltimore, United States during July 7-12; 2002

Rosen S (2016) HIV 'test and treat' strategy can save lives—but it needs to be easier for patients to start treatment.https://theconversation.com/hiv-test-and-treat-strategy-can-save-lives-but-it-needs-to-be-easier-for-patients-to-start-treatment-59372. Accessed 15 Feb 2018

Snow R, Madaleni M, Poulsen M (2010) Are men testing? Sex differentials in HIV testing in Mpumalanga province, South Africa. AIDS Care 22(9):1060–1065. https://doi.org/10.1080/09540120903193641

Tanwar S, Rewari BB, Rao CD, Seguy N (2016) India's HIV programme: successes and challenges. J Virus Erad 2(Suppl 4):15–19

Teklehaimanot HD, Teklehaimanot A, Yohannes M, Biratu D (2016) Factors influencing the uptake of voluntary HIV counselling and testing in rural Ethiopia: a cross sectional study. BMC Public Health 16:239. https://doi.org/10.1186/s12889-016-2918-z

UNAIDS (2014) Ambitious treatment targets: writing the final chapter of the AIDS epidemic. United Nations Joint Programme on HIV/AIDS, Geneva http://www.unaids.org/sites/default/files/media_asset/JC2670_UNAIDS_Treatment_Targets_en.pdf. Accessed 15 Feb 2018

UNAIDS (2016a) Fast-track: ending the AIDS epidemic by 2030. Joint United Nations Programme on HIV/AIDS, Geneva, Switzerland http://www.unaids.org/en/resources/documents/2016/fast-track-commitments. Accessed 15 Feb 2018

UNAIDS (2016b) Prevention Gap Report. http://www.unaids.org/sites/default/files/media_asset/2016-prevention-gap-report_en.pdf. Accessed 15 Feb 2018

UNGASS (2015) Narrative country progress report of India: Global AIDS Response Progress Reporting 2015. http://www.unaids.org/en/regionscountries/countries/india. Accessed 15 Feb 2018

United Nations Special Session on HIV/AIDS Fact Sheet (2001) Gender and HIV. http://www.un.org/ga/aids/ungassfactsheets/pdf/fsgender_en.pdf. Accessed 15 Feb 2018

Viera AJ, Garrett JM (2005) Understanding inter observer agreement: the kappa statistic. Fam Med 37(5):360–363

Wagner BG, Blower S (2012) Universal access to HIV treatment versus universal 'test and treat': transmission, drug resistance & treatment costs. PLoS One 7(9):e41212. https://doi.org/10.1371/journal.pone.0041212

WHO (2015) Guideline on when to start antiretroviral therapy and on pre-exposure prophylaxis for HIV. http://apps.who.int/iris/bitstream/handle/10665/186275/9789241509565_eng.pdf;jsessionid=EEC828A171B8E39AAC190F718CDD695B?sequence=1. Accessed 15 Feb 2018

WHO/UNAIDS (2017) WHO, UNAIDS statement on HIV testing services: new opportunities and ongoing challenges. http://www.unaids.org/en/resources/presscentre/featurestories/2017/august/20170829_HIV-testing-services. Accessed 15 Feb 2018

Wringe A, Isingo R, Urassa M, Maiseli G, Manyalla R, Changalucha J, Mngara J, Kalluvya S, Zaba B (2008) Uptake of HIV voluntary counselling and testing services in rural Tanzania: implications for effective HIV prevention and equitable access to treatment. Trop Med Int Health 13(3):319–327. https://doi.org/10.1111/j.1365-3156.2008.02005.x