# Who is not Getting Tested for HIV/AIDS? Effects of Stigma, Knowledge, and Social Identity

Atreyee Sinha[1], Jasmine Beryl Lydia S[2]*, Gyan Chandra Kashyap[3]

**Abstract**

While there is a large body of research on the uptake of HIV testing, little evidence exists at the national level for India. We bridge this gap by examining the status of HIV testing and therole of knowledge, stigma and social identity using two rounds of the National Family Health Survey 2015-16 and 2019-21 data, who have heard about HIV/AIDS. Bivariate results indicated that 24% of women and 10% of men were tested for HIV, with a slight improvement from the previous round. Region-wise prevalence revealed significant improvements across the country, especially in the Central and Northern parts. Fewer women (24.8%) than men had comprehensive knowledge about HIV/AIDS transmission. Contrary to knowledge, stigma and HIV status disclosure concerns were widely prevalent equally among both genders. Hierarchical regression revealed that wealth, education, mass media exposure and comprehensive knowledge increased the uptake of testing. Conversely, rural places of residence and stigma were significant deterrents ($p<0.01$) for both genders. Findings underscored the need for close policy attention to address the gender gap, stigma, and lack of knowledge to aid national programs' success.

**Key words:** Testing status; Comprehensive knowledge; Stigma; HIV/AIDS; India

## Introduction

HIV pandemic continues to be a public health challenge as recent global statistics show that about 1.3 million people became newly infected with HIV, while about 39 million were living with HIV in 2022 (UNAIDS, 2021; WHO, 2023). In addition to this, about 6,30,000 people died of HIV related issues in 2022 (WHO, 2023). India is home to the third-highest number of people infected with HIV (World Bank, 2019). Although the prevalence has been reduced since 1992 by the National AIDS Control Program (NACP–IV) through the use of better surveillance tools targeting high-risk groups (NACO, 2020), there is still a long road ahead to reach the goal of achieving Sustainable Development Goal 3.3 of ending the HIV pandemic by 2030. National surveillance data for 2020 has shown a decline in new HIV infections by about 37 percent between the ages of 15 and 49 since 2010; the prevalence of HIV among adults in the year 2019 was 0.22 percent (0.17-0.29%) (NACO, 2020). Largely occurring through heterosexual transmission, the distribution is across the country with the highest burden being in the Northeastern states of Mizoram, Nagaland, and Manipur. Other high-burden states include Andhra Pradesh, Meghalaya, Telangana, Karnataka, Delhi, Maharashtra, Goa, Punjab, and Tamil Nadu (NACO, 2020).

The most important step towards curbing

* *Corresponding Author*

[1] *Ph.D. Population Studies, M.Phil. Population Studies, Lead, Monitoring and Evaluation(TB Thematic), Karnataka Health Promotion Trust, Bengaluru, India. Email Id: atreyee_dabloo@yahoo.com*

[2] *MPH, M.Sc. Foods and Nutrition, Consultant, National Health Mission, Tamil Nadu, Chennai - 600006, India. Email: Id beryljonathan17@gmail.com*

[3] *Ph.D. Population Studies, Assistant Professor, Institute of Health Management Research, Bengaluru, India. Email Id: statskashyap@gmail.com*

the deadly disease is to increase the uptake of HIV testing, a critical component in the HIV treatment cascade (Qiao et al., 2018; Nall et al., 2019). Literature has pointed out that HIV testing has been a priority area for prevention globally (Nall et al., 2019). Current advancements suggest that anti-retroviral therapy (ART) makes the individual less likely to transmit the virus to others further (Nall et al., 2019). In India, national HIV testing guidelines recommend HIV testing every six months for key populations, but the coverage remains low (Tanwar et al., 2016). Existing studies suggestthat factors influencing HIV service utilization by the key population such as female sex workers (FSWs), men who have sex with men (MSMs), injecting drug users (IDUs) etc. range from personal, interpersonal (community) to structural i.e., service provider levels (Beattie et al., 2012; Steward et al., 2013; Mayston et al., 2016). India's achievement on the UNAIDS target of 90-90-90 by 2020 (90% of PLHIV knowing their HIV status, people diagnosed and put on ART and all people on treatment to achieve viral suppression) is questionable due to various gaps and challenges (Sidibé, 2016; Ekstrand et al., 2018). Knowledge of HIV among the general population is vital for reaching the targets set towards ending HIV/AIDS. Global studies have found the effects of stigma and discrimination to be the major causes of impeding HIV testing (Teva et al., 2018). Data from India reveal internalized stigma and prevailing discriminatory attitudes as clear themes in participant narratives; concerns regarding the quality of services, and confidentiality were some notable factors emerging from group discussions (Beattie et al., 2012; Steward et al., 2013; Mayston et al., 2016).
Uptake of HIV testing is driven by accurate knowledge and risk perception for HIV, while HIV stigma, especially towards marginalised groups and discrimination in healthcare settings are major pacifiers (Woodland et al., 2016). It was observed that increased HIV testing among injecting drug users in the two highest prevalent states of north-eastern India was associated with exposure to HIV programmes, knowledge and awareness of HIV risk, prevention, and higher educational attainment (Medhi et al., 2012). Several studies from Southern India had shown that stigma was the biggest barrier to adherence to ART and quality of care, especially for female gender, MSMs, FSWs and IDUs. Factors that were linked to delayed enrollment in care include missed diagnosis by the physician, lack of knowledge, poor awareness, fear of stigma at the government facilities and in the community and lack of family support (De et al,.2013; Micheal et al., 2016). Another important dimension of the challenge of HIV testing is the gender gap; the hurdles faced by Indian women were a lack of knowledge and awareness of the disease and testing facilities, partners who were not infected or had equally poor knowledge and a lack of financial support thus restricting travel (Ekstarnd et al., 2018). Women enrolled in Prevention of Mother-to-Child Transmission (PMTCT) programs while on ANC are usually lost to follow-up due to the said reasons (Rahangdale *et al*., 2011). These repeatedly show the need to address gender gaps in testing and family-based education as these provide opportunities to engage the key population in care programs (Allegri et al., 2015; Qiao et al., 2018).

Studies have found significant associations between lower social support and greater stigma (Mahalakshmy et al., 2010), wherein a higher proportion of people in the country express a desire to maintain social distance

from PLHIV and are crippled with the fear of HIV serostatus disclosure (Chan et al.,2020). On the other hand, it is documented that comprehensive knowledge about HIV/AIDS is considerably low and varies significantly by age, sex, education, economic status, and place of residence (Jha et al., 2015; Yadav et al., 2015). With the ambitious plan of targeting zero new transmissions by 2030 in the country, available studies exploring HIV testing and its correlates are overly concentrated on high-risk groups such as FSWs, MSMs, IDUs etc. and localized in coverage. Research at national levels and based on the general population are sparce. It is deemed necessary, hence, to address this gap, especially in the era of ART scale-up, because India has the largest base of youth and adolescent population which is considered the most vulnerable group in terms of risky behaviours and a society that is gripped in a vicious cycle of poverty, illiteracy, and socio-cultural taboos. In this context, the presentstudy aims to bridge the research gap and explore HIV testing in India and its factors using a nationally representative cross-sectional data. The objectives of the present paper were to estimate the prevalence of HIV testing among women and men in the reproductive age group; to understand the extent of knowledge, awareness, and attitude towards PLHIVamong women and men; to determine the factors that propel or repel uptake of HIV testing by women and men.

## Methods

### *Study sample*

Data was obtained from the fourth and fifth round of the National Family Health Survey (NFHS- 4 & 5), 2015–16 & 2019-21, conducted by the International Institute for Population Sciences, Mumbai covering all 29 states and union territories. The NFHS sample is a stratified two-stage sample wherein Census 2011 served as the sampling frame for the selection of Primary Sampling Units (PSU). PSUs were villages in rural areas and Census Enumeration Blocks (CEBs) in urban areas, both selected through the probability proportional to size (PPS) sampling method (IIPS & ICF, 2017). The study sample consists of 91,907 women (15-49 y) & 98,267 men (15-54 y) from NFHS-4 (2015-16) and 95541 women (15-49 y) & 96,602 men (15-54 y) from NFHS-5, who have heard about HIV/AIDS. The sample was further truncated for regression analysis to include those who had awareness about HIV testing centres and the samples were 61,555 women and 72,693 men.

### *Analytical approaches*

*Outcome variable*

The outcome variable was the status of HIV testing. The survey included questions regarding the history of prior HIV testing; men and women who have ever been tested for HIV were coded as '1 and '0' as otherwise.

*Covariates*

*Socio-economic and demographic factors:* A range of socio-economic and demographic factors that were likely to be associated with HIV testing status were controlled. Background characteristics of the respondents included age, place of residence, religion, wealth index, marital status, geographic regions, education, work status and media exposure. We further controlled for educational attainment, categorized as no education, primary, secondary, and higher; working status (non-working/working); exposure to any digital or print media (low/medium//high); and women's freedom to go to the health facility unescorted (no freedom/having freedom).

*Knowledge and awareness of HIV/AIDS and attitude towards negotiating sex with husband:* Respondents were asked five questions to understand their knowledge around HIV/AIDS:Can people reduce their chances of getting HIV/AIDS by having just one uninfected sex partner who has no other sex partners? Can people get HIV/AIDS from mosquito bites? Can people reduce their chances of getting HIV/AIDS by using a condom every time they have sex? Can people get HIV/AIDS by sharing food with a person who has AIDS? Is it possible for a healthy-looking person to have HIV/AIDS? Those who rejected two common misconceptions about transmission or prevention of HIV/AIDS and possessed correct knowledge were classified as having 'comprehensive knowledge' and coded as '1' and '0' otherwise.

Further, respondents who knew that HIV can be transmitted anytime during pregnancy, delivery, and breastfeeding, were grouped as having knowledge of all threemodes of mother-to-child transmission (MTCT) and coded as '1'. Having knowledge of a place where to get tested for HIV, agreeing to the statements viz. a wife can refuse sex if husband has STI, wife can ask husband to use condom if husband has STI were coded as '1' and '0' otherwise.

*Stigma and attitude towards PLHIV:* Respondents were asked about their opinion on seven statements, whether: they would care for a relative with HIV/AIDS in their own home; they would buy fresh vegetables from a shopkeeper or vendor who has HIV/AIDS; a female teacher who has HIV/AIDS but is not sick should be allowed to continue teaching in the school; they would not want to keep it secret that a family member got infected with HIV/AIDS; they would allow an HIV positive student to attend school with students who are HIV negative; they think that people living with HIV should be treated in the same public hospital with patients who are HIV negative; and they think that people living with HIV should be allowed to work in the same office with people who are HIV negative. Respondents expressing acceptance towards PLHIV in all seven items were classified as having 'no stigma' (code '0') and having 'stigma' as otherwise (code '1'). For the regression analysis, an index was computed for stigma, by summing the seven items; the index values range from 0-7 (for women: mean - 2.08, Cronbach's α - 0.799; for men: mean – 1.95. Cronbach's α – 0.789).

*Analysis*

Analyses were done separately for women and men. Univariate analyses were done to assess the coverage of HIV testing, knowledge around HIV/AIDS transmission, prevention, and attitude towards PLHIV. For all socio-demographic, knowledge and attitudinal variables, Pearson chi-squared test was used to identify a significant difference in HIV testing status between groups. To examine independent associations between HIV testing status and knowledge, stigma and social identity, hierarchical logistic regression was applied with three levels, including age, religion, wealth index, marital status, place of residence and geographic regions in step-1, educational attainment, working status, mass media exposure and freedom to visit health facility alone (only for women) in step-2, and comprehensive knowledge of HIV/AIDS, attitude towards PLHIV, knowledge of MTCT and attitude towards negotiating sex with husband in step-3. It was assumed that a hierarchical relationship exists among the factors at each level with no

reverse effect.

## Results

Results presented in Table 1 provide the status of HIV testing by states/UTs at two points in time (NFHS-4, 2015-16; NFHS-5, 2019-21). Improvement in HIV testing between these two successive surveys was estimated. The proportion of individuals who had ever been tested for HIV in India was 24 percent among women and 10 percent among men, registering a marginal increase from NFHS-4 in both groups. There was considerable enhancement in HIV testing in the North, Central, East, and Northeast regions of the country; however, in the West and South, a decline was observed. Mizoram (58.4%), Goa (49.7%), Tamil Nadu (49.7%), Kerala (47.6%), Himachal Pradesh (46.3%) and Manipur (45.6%) were the top six states reporting a higher proportion of women who had ever tested.

**Table 1** HIV testing status of men and women by States/Union Territories, India (2015-16,2019-21)

| State/UT | NFHS-4 (2015-16) Proportion of women tested | NFHS-5 (2019- 21) | Change(%) amongwomen | NFHS-4 (2015-16) Proportion of mentested | NFHS-5 (2019-21) | Change(%) among men |
|---|---|---|---|---|---|---|
| ***India*** | **21.3** | **24.3** | **3.0** | **8.3** | **9.5** | **1.2** |
| **North** | **17.3** | **35.8** | **18.5** | **8.2** | **14.1** | **5.9** |
| Chandigarh | 40.8 | 37.9 | -2.9 | 16.5 | 16.3 | -0.2 |
| Delhi | 28.1 | 43.8 | 15.7 | 8.4 | 18.5 | 10.1 |
| Haryana | 13.4 | 20.3 | 6.9 | 7.0 | 7.3 | 0.3 |
| Himachal Pradesh | 32.3 | 46.3 | 14.0 | 21.9 | 23.0 | 1.1 |
| Jammu & Kashmir | 16.3 | 20.6 | 4.3 | 11 | 17.3 | 6.3 |
| Punjab | 22.7 | 21.8 | -0.9 | 12 | 9.1 | -2.9 |
| Rajasthan | 9.0 | 9.5 | 0.5 | 2.9 | 2.5 | -0.4 |
| Uttarakhand | 12.0 | 23.9 | 11.9 | 5.3 | 5.8 | 0.5 |
| Ladakh | NA | 25.8 | - | NA | 25.0 | - |
| **Central** | **9.0** | **35.3** | **26.3** | **4.1** | **8.6** | **4.5** |
| Chhattisgarh | 12.7 | 14.4 | 1.7 | 6.7 | 5.9 | -0.8 |
| Madhya Pradesh | 12.0 | 18.5 | 6.5 | 3.7 | 3.0 | -0.7 |
| Uttar Pradesh | 6.9 | 8.9 | 2.0 | 3.9 | 3.0 | -0.9 |
| **East** | **10.4** | **28.5** | **18.1** | **4.3** | **14.7** | **10.4** |
| Bihar | 7.4 | 10.2 | 2.8 | 4.2 | 4.9 | 0.7 |
| Jharkhand | 9.2 | 9.0 | -0.2 | 4.9 | 3.9 | -1.0 |
| Odisha | 15.6 | 27.8 | 12.2 | 7.7 | 12.1 | 4.4 |
| West Bengal | 9.8 | 21.0 | 11.2 | 2.7 | 4.0 | 1.3 |
| **Northeast** | **11.0** | **23.9** | **12.9** | **4.6** | **7.0** | **2.4** |
| Arunachal Pradesh | 17.7 | 20.6 | 2.9 | 13.9 | 13.2 | -0.7 |
| Assam | 6.6 | 12.8 | 6.2 | 1.8 | 1.9 | 0.1 |
| Manipur | 41.7 | 45.6 | 3.9 | 17.3 | 20.1 | 2.8 |
| Meghalaya | 12.9 | 28.1 | 15.2 | 2.9 | 5.5 | 2.6 |
| Mizoram | 47.4 | 58.4 | 11.0 | 37.0 | 35.0 | -2.0 |
| Nagaland | 21.9 | 28.4 | 6.5 | 20.6 | 17.0 | -3.6 |
| Sikkim | 22.0 | 25.8 | 3.8 | 14 | 12.5 | -1.5 |
| Tripura | 5.4 | 17.0 | 11.6 | 2.4 | 5.2 | 2.8 |
| **West** | **26.3** | **9.3** | **-17.0** | **10.7** | **3.9** | **-6.8** |
| Dadra & Nagar Haveli | 14.8 | 27.0 | 12.2 | 3.0 | 8.2 | 5.2 |
| Daman and Diu | 10.6 | NA | - | 0.7 | NA | - |
| Goa | 45.0 | 49.7 | 4.7 | 31.6 | 31.7 | 0.1 |
| Gujarat | 15.7 | 15.9 | 0.2 | 5.7 | 4.0 | -1.7 |
| Maharashtra | 31.5 | 39.5 | 8.0 | 13.1 | 16.0 | 2.9 |
| **South** | **35.3** | **34.0** | **-1.3** | **13.3** | **13.4** | **0.1** |
| Andaman & Nicobars | 31.3 | 46.4 | 15.1 | 23.2 | 30.4 | 7.2 |
| Andhra Pradesh | 33.4 | 40.8 | 7.4 | 12.3 | 15.0 | 2.7 |
| Karnataka | 34.4 | 37.1 | 2.7 | 9.8 | 13.9 | 4.1 |
| Kerala | 44.0 | 47.6 | 3.6 | 12.0 | 12.7 | 0.7 |
| Lakshadweep | 31.0 | 25.0 | -6.0 | 15.5 | 0.0 | -15.5 |
| Puducherry | 31.2 | 54.2 | 23.0 | 12.4 | 26.1 | 13.7 |
| Tamil Nadu | 33.4 | 49.7 | 16.3 | 16.3 | 27.4 | 11.1 |
| Telangana | 35.1 | 41.0 | 5.9 | 13.4 | 13.0 | -0.4 |
| N[1] = | 91907 | 95541 | | 98267 | 96022 | |

Note: [1]Based on the unweighted sample; NA –

Table 2 presents the distribution of HIV testing by social and different socio-economic and background characteristics. Results revealed that most men and women who got tested belonged to the 25-44 age group. The proportion of individuals having ever tested was higher among rich, as compared to poor and middle-income groups. A considerably higher proportion of respondents (women and men) getting tested had a secondary and higherlevel of education. Similarly, it was observed that a substantially higher proportion of the respondents who had undergone tests were working when compared to their counterparts. A substantial proportion of women and men who got HIV tests had medium to high mass media exposure.

**Table 2** HIV testing status by social identity, India (2019-21)

| | Proportion Tested | |
|---|---|---|
| | Women (N[1]=95541) | Men (N[1]=96022) |
| **Age group (years)** | | |
| 15-24 | 13.9 | 3.4 |
| 25-34 | 35.9 | 13.3 |
| 35-44 | 26.4 | 14.0 |
| 45 and above | 18.5 | 11.2 |
| **Religion** | | |
| Hindu | 24.6 | 10.6 |
| Muslim | 19.9 | 6.2 |
| Others | 31.8 | 13.8 |
| **Wealth index** | | |
| Poor | 15.9 | 5.5 |
| Middle | 25.9 | 9.6 |
| Rich | 30.3 | 14.0 |
| **Marital status** | | |
| Never married | 3.0 | 4.9 |
| Currently or ever married | 30.9 | 13.0 |
| **Place of Residence** | | |
| Urban | 31.0 | 12.9 |
| Rural | 20.9 | 8.5 |
| **Region** | | |
| North-east | 23.9 | 7.6 |
| North | 35.8 | 14.5 |
| South | 34.0 | 14.2 |
| East | 28.5 | 15.1 |
| West | 9.3 | 4.2 |
| Central | 35.3 | 9.4 |
| **Education** | | |
| No education | 15.9 | 5.2 |
| Primary | 21.7 | 7.6 |
| Secondary | 25.7 | 9.4 |
| Higher | 31.5 | 16.1 |
| **Work status** | | |
| Not working | 22.9 | 4.7 |
| Working | 28.7 | 11.8 |
| **Media-exposure** | | |
| Low | 22.6 | 7.4 |
| Medium | 32.7 | 14.9 |
| High | 33.6 | 19.3 |
| Overall | **24.3** | **9.5** |

**Note:** [1] Based on the unweighted sample

Table 3 presents the extent of knowledge and awareness around HIV/AIDS amongthe respondents in the two rounds of NFHS-4 (2015-16) and NFHS-5 (2019-21). Overall, it was observed that cognizance was higher among men than women. Surprisingly, there was anincrease in the proportion of women and men holding misconceptions about transmission of HIV/AIDS; 38 percent of women and 33 percent of men said that '*people can get HIV/AIDS from mosquito bites*.' Similarly, around half of the women and two-fifths of men said that '*people can get HIV/AIDS by sharing food*' with an affected person. On the other hand, more than three-fourths of both groups (5-6 percentage point increase among women) knew that '*a healthy-looking person can have HIV/AIDS*', transmission of HIV/AIDS can be reduced by using a condom during every sexual intercourse and having just one uninfected partner can reduce the chances of getting HIV. However, in terms of comprehensive knowledge, the results revealed that nearly one-fourth of the women had correct knowledge in all five indicators; although the proportion was slightly higher among men (30 percent) and there was a decline in comprehensive knowledge as compared to NFHS-4. Knowledge about all three modes of mother to child transmission of HIV/AIDS was higher among women (89.2 percent) than men (77.7 percent) and registered a considerable improvement over time.

**Table 3** Percentage of women (15-49 y) and men (15-54 y) by knowledge and awareness around HIV/AIDS, India (2015-16, 2019-21)

| | NFHS-4 | | NFHS-5 | |
|---|---|---|---|---|
| | Proportion of women | Proportion of men | Proportion of women | Proportion of men |
| People can reduce their chances of getting HIV/AIDS by having just one uninfected partner who has no other partners | 76.2 | 83.5 | 81.0 | 82.4 |
| People can reduce their chances of getting HIV/AIDS by using a condom every time theyhave sex | 72.5 | 86.7 | 78.5 | 86.6 |
| It is possible for a healthy-looking person tohave HIV/AIDS | 72.0 | 73.5 | 77.4 | 75.4 |
| ***Misconception:*** | | | | |
| People can get HIV/AIDS from mosquito bites | 32.7 | 28.7 | 38.1 | 32.5 |
| People can get HIV/AIDS by sharing foodwith a person who has AIDS | 36.9 | 30.7 | 48.2 | 37.7 |
| HIV can be transmitted through saliva[1] | NA | NA | 58.1 | NA |
| **Comprehensive knowledge on HIV/AIDS** | | | | |
| Yes | 27.7 | 36.2 | 24.8 | 30.4 |
| No | 72.3 | 63.8 | 75.2 | 69.6 |
| **Knowledge on MTCT** | | | | |
| Yes | 64.8 | 55.6 | 89.2 | 77.7 |
| No | 35.2 | 44.4 | 10.8 | 22.3 |
| **Awareness:** | | | | |
| Knows about a place for HIV testing | 59.5 | 68.2 | 65.2 | 74.7 |
| Agrees that wife can refuse sex if husband hasSTI | 78.4 | 81.2 | 88.6 | 83.3 |
| Agrees that wife can ask husband to use condom if husband has STI | NA | 83.9 | NA | 87.3 |
| **N[2]=** | ***91907*** | ***98267*** | ***95541*** | ***96022*** |

Note: [1] Newly included in women's questionnaire under NFHS-5 (2019-21)
[2] Based on unweighted sample. NA- not available.

The proportion of knowing where to get an HIV test done was higher among menthan women. On the other hand, in terms of attitude towards negotiating sex with the husband, which is another important dimension of awareness about HIV/AIDS transmission,a higher proportion of women (increased from 78% to 89%) agreed that a wife is justified in refusing to have sex with her husband if he has a sexually transmitted disease (STD) while, around three percent more men agreed that a wife is justified in asking her husband to use acondom if he has an STD (increased from 84% to 87%) than men.

Table 4 shows the discriminatory attitudes towards people living with HIV. Results revealed a slight (3-5 percentage points) increase in acceptance towards different statements among both men and women from NFHS-4 (2015-16) to NFHS-5 (2019-20). A considerable proportion of both women and men expressed acceptance towards different statements. The levels of agreement varied for women with 30 percent agreeing that 'a female teacher who has HIV/AIDS but is not sick should not be allowed to continue teaching' and they 'would not be willing to care for a relative if he/she is sick with HIV/AIDS' to 39 percent reporting that they would want to keep it a secret if a family member was infected with HIV/AIDS. Similarly, for men, the agreement ranged from 29 percent saying that 'a female teacher who has HIV/AIDS but is not sick should not be allowed to continue teaching' and 'PLHIV should not be treated in the same hospital with non-HIV patients' to 45 percent professing that they would want it to remain secret that a family member got HIV/AIDS. Overall, the prevalence of stigma was well pronounced among the study population; 77 percent of both men and women expressed stigma in the forms of social rejection of PLHIV and HIV status disclosure concerns.

**Table 4** Percentage of women (15-49 y) and men (15-54 y) by their attitude towards PLHIV, India (2015-16, 2019-21)

| | NFHS-4 | | NFHS-5 | |
|---|---|---|---|---|
| | Proportion of women | Proportionof men | Proportionof women | Proportionof men |
| If a member of your family got infected with HIV/AIDS, you would want it to remain a secret | 44.1 | 41.6 | 38.7 | 44.7 |
| If a relative of yours became sick with HIV/AIDS, you would not be willing to care forhim/her in your own household | 25.4 | 21.4 | 29.1 | 30.4 |
| If a female teacher has HIV/AIDS (but is notsick), she should not be allowed to continue teaching in the school | 23.4 | 22.0 | 29.1 | 28.9 |
| A HIV positive child should not be allowed inschool | 26.7 | 24.4 | 32.0 | 31.4 |
| PLHIV should not be treated in the same public hospital with non-HIV patients | 31.0 | 31.3 | 35.2 | 28.7 |
| PLHIV should not be allowed to work at the sameplace with non-HIV people | 26.2 | 26.8 | 30.9 | 38.6 |
| Would not buy fresh vegetables from a shopkeeper/ vendor if knew that the person hadHIV/AIDS | 31.5 | 27.7 | 35.7 | 35.2 |
| **Attitude towards PLHIV (Stigma)** | | | | |
| Yes | 76.1 | 72.9 | 77.0 | 76.9 |
| No | 23.9 | 27.1 | 23.0 | 23.1 |
| **N[1]=** | ***91907*** | ***98267*** | ***95541*** | ***96022*** |

Note: [1] Based on the unweighted sample

Table 5 underscored the inter-group differences in HIV testing status by various domains viz. knowledge, awareness, and stigma between two time periods. It was found that improved knowledge of HIV/AIDS and acceptance towards PLHIV (i.e., having no stigma) were associated with higher HIV testing among both genders and the associations were significant in the chi-square test. More than one-third (33%) of the women and 13 percent of men having comprehensive knowledge got tested for HIV in NFHS-5, showing a -2 percent improvement from NFHS-4 among women and men respectively. A higher proportion of women and men have the knowledge that HIV can be transmitted at any time during pregnancy/childbirth/ nursing, knowledge of a place for HIV testing, and the wife can ask the husband to use a condom if the husband has STI were tested for HIV, and significant improvement was observed in NFHS-5.

*Results from hierarchical regression*

Table 6 presents the results from stepwise regression analysis which revealed that age, religion, economic status, marital status, and place of residence had statistically significant associations with the probability of getting tested for HIV for both genders (men and women). Overall, a positive correlation was observed between age and testing, i.e., the older the age, the higher the chances of getting tested; the age group of 25-24 years had the strongest association. While Muslims were less likely to get tested for HIV in both groups, respondents belonging to other religious categories, belonging to the middle and rich wealth index were significantly more likely to get tested.

**Table 5** Status of HIV testing by knowledge, awareness, and attitude towards PLHIV, India (2015-16; 2019-21)

| | NFHS-4 | | | | NFHS-5 | | | |
|---|---|---|---|---|---|---|---|---|
| | Proportion of women | | Proportion of men | | Proportion of women | | Proportion of men | |
| | Tested | Not tested | Tested | Not tested | Tested | Not tested | Tested | Not tested |
| **Comprehensive knowledge of HIV/AIDS** | | | | | | | | |
| Yes | 26.7 | 73.3 | 11.1 | 88.9 | 33.0 | 67.0 | 12.9 | 87.1 |
| No | 19.2 | 80.8 | 6.7 | 93.3 | 21.5 | 78.5 | 8.0 | 92.0 |
| **Stigma** | | | | | | | | |
| No | 22.4 | 77.6 | 9.2 | 90.8 | 26.1 | 73.9 | 11.5 | 88.5 |
| Yes | 20.9 | 79.1 | 8.0 | 92.0 | 23.8 | 76.2 | 8.9 | 91.1 |
| **Knowledge that HIV can be transmitted at any time duringpregnancy/childbirth/ nursing** | | | | | | | | |
| Yes | 22.3 | 77.7 | 8.8 | 91.2 | 25.3 | 74.7 | 10.9 | 89.1 |
| No | 19.4 | 80.6 | 7.7 | 92.3 | 16.4 | 83.6 | 4.5 | 95.5 |
| **Knowledge of a place for HIV testing** | | | | | | | | |
| Yes | 35.7 | 64.3 | 12.2 | 87.8 | 37.3 | 62.7 | 13.5 | 86.5 |
| No | 0.0 | 100.0 | 0.0 | 100.0 | 0.0 | 100.0 | 0.0 | 100.0 |
| **Agrees that a wife can refuse sex if husband has STI** | | | | | | | | |
| Yes | 21.7 | 78.3 | 8.5 | 91.5 | 18.7 | 81.3 | 9.8 | 90.2 |
| No | 19.8 | 80.2 | 7.3 | 92.7 | 25.1 | 74.9 | 8.2 | 91.8 |
| **Agrees that a wife can ask husband touse condom if husband has STI** | | | | | | | | |
| Yes | NA | | 8.7 | 91.3 | NA | | 10.0 | 90.0 |
| No | | | 6.3 | 93.7 | | | 6.1 | 93.9 |
| **N[1] =** | ***91907*** | | ***98267*** | | ***95541*** | | ***96022*** | |

Note: [a] Values were significant in the chi-square test (not presented);[1] Based on the unweighted sample. NA – not available.

**Table 6** Hierarchical regression analysis of predictors of HIV testing (2019-21)

| | Odds of getting tested (women) | | | Odds of getting tested (men) | | |
|---|---|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
| ***Step 1*** | | | | | | |
| **Age group (years)** | | | | | | |
| 15-24 (1.00) | | | | | | |
| 25-34 | 3.385*** | 3.519*** | 3.507*** | 2.578*** | 2.323*** | 2.301*** |
| 35-44 | 2.035*** | 2.179*** | 2.170*** | 2.415*** | 2.265*** | 2.242*** |
| 45 and above | 1.308** | 1.443*** | 1.437*** | 1.861*** | 1.818** | 1.804*** |
| **Religion** | | | | | | |
| Hindu (1.00) | | | | | | |
| Muslim | .878*** | .885*** | .890*** | .852*** | .905* | .904* |
| Others | 1.262*** | 1.244*** | 1.245*** | 1.612*** | 1.663*** | 1.653*** |
| **Wealth index** | | | | | | |
| Poor (1.00) | | | | | | |
| Middle | 1.247*** | 1.200*** | 1.196*** | 1.493*** | 1.311*** | 1.301*** |
| Rich | 1.333*** | 1.241*** | 1.234*** | 1.884*** | 1.424*** | 1.394*** |
| **Marital status** | | | | | | |
| Never married (1.00) | | | | | | |
| Currently or ever married | | # | | 2.023*** | 2.162*** | 2.174*** |
| **Place of Residence** | | | | | | |
| Urban (1.00) | | | | | | |
| Rural | .915*** | .925*** | .926** | .869*** | .906*** | .915** |
| **Geographic region** | | | | | | |
| North-east (1.00) | | | | | | |
| North | 1.475*** | 1.476*** | 1.482*** | 1.842*** | 1.777*** | 1.789*** |
| South | 1.526*** | 1.515*** | 1.509*** | 2.026*** | 1.915*** | 1.940*** |
| East | 1.759*** | 1.715*** | 1.698*** | 2.213*** | 2.133*** | 2.077*** |
| West | .468*** | .477*** | .478*** | .535*** | .509*** | .511*** |
| Central | 2.081*** | 2.076*** | 2.076*** | 2.720*** | 2.638*** | 2.830*** |
| ***Step2*** | | | | | | |
| **Education** | | | | | | |
| No education (1.00) | | | | | | |
| Primary | | 1.146*** | 1.146*** | | 1.085 | 1.075 |
| Secondary | | 1.265*** | 1.260*** | | 1.424*** | 1.378*** |
| Higher | | 1.181*** | 1.166*** | | 2.068*** | 1.944*** |
| **Work status** | | | | | | |
| Not working (1.00) | | | | | | |
| Working | | .961 | .960* | | 1.177*** | 1.177*** |
| **Media exposure** | | | | | | |
| Low (1.00) | | | | | | |
| Medium | | 1.145*** | 1.144*** | | 1.371*** | 1.356*** |
| High | | .988 | .994 | | 1.872*** | 1.827*** |
| ***Step 3*** | | | | | | |
| **Comprehensive knowledge about HIV/AIDS** | | | | | | |
| No (1.00) | | | | | | |
| Yes | | | 1.089*** | | | 1.057* |
| **HIV can be transmitted at any time during pregnancy/childbirth/nursing** | | | | | | |
| No (1.00) | | | | | | |
| Yes | | | 1.005 | | | .997 |
| **Attitude towards PLHIV (Stigma)** © | | | 1.007 | | | .922*** |
| **Agrees that wife can refuse sex ifhusband has STI** | | | | | | |
| **Attitude towards PLHIV (Stigma)** © | | | 1.007 | | | .922*** |
| No (1.00) | | | | | | |
| Yes | | | 1.096** | | | .978 |
| **Agrees that wife can ask husband to use condom if husband has STI** | | | | | | |
| No (1.00) | | | | | | |
| Yes | | NA | | | | .772 |
| Constant | 0.220 | 0.182 | 0.162 | 0.021 | 0.013 | 0.020 |
| R2 | 0.148 | 0.151 | 0.151 | 0.140 | 0.156 | 0.161 |
| Model $\chi^2$ | 67.459*** | 78.888*** | 75.358*** | 59.329*** | 13.218*** | 9.332*** |

Note: ***p<0.001; ** p<0.01; * p <0.05,
(1.00) - Reference category.
© - Continuous variable.
# – Variable was excluded because of skewed distribution and distorted ORNA – Variable not available.

Residents of rural areas and people from western India were significantly less likely to have the HIV test done, contrary to respondents from the central and eastern parts of the country, where the likelihood of testing was more than in other geographical regions. Additionally, for men, marital status was an important factor to influence HIV testing significantly; currently, married or ever-married men were more likely to go for the tests. Given the impact of step-1 factors on HIV testing status, the following analysis incorporated them into control variables to further analyse the impact of other factors, and theresults are shown in Model 2 & 5. According to the idea of hierarchical regression, when in step 2, education, work status, and exposure to mass media were put into the regression equation; the model chi-square depicted significant improvement in the ability of the model to predict the probability of HIV testing. At the same time, it can be found that after the addition of step 2 factors, the relationship between step-1 variables and HIV testing status still existed, showing the robustness of the results. The results revealed that a higher level of education increased the probability of testing. Working status depicted an interesting pattern; while working men were more likely than their non-working counterparts to get HIV tests done, working women were less likely to go for the test, although not significant in this model. Mass media exposure for men significantly increased the likelihood of getting tested.

At step 3, a set of more proximate factors was included, viz. comprehensive knowledge about HIV/AIDS, knowledge of three modes of MTCT, stigma and negotiating sex with the husband (Models- 3 & 6). Based on the change from Model-2 & 5 to Model-3 & 6, adding step-3 variables helped to further improve the predictability of the model as also evident from the significant chi-square values, and results still had high robustness.

It was found that comprehensive knowledge about HIV/AIDS transmission and prevention had a significant positive relationship with the testing status for both genders. On the other hand, non-accepting attitudes towards PLHIV, which denotes higher stigma, had a significant negative correlation with testing status for both the sample groups. Those with increasing levels of stigma were 8% less likely to uptake testing (Men; OR=0.922, $p<0.01$). Attitude towards negotiating sex with husband also had significant positive effects; women who agreed that a wife can refuse sex if her husband has STI were 1.1 times more likely to get tested (Women OR=1.096, $p<0.01$). The effect of knowledge on MTCT was not significant for both men and women.

**Discussion**

The present study explored the status of testing and the critical barriers in India. The findings revealed that south, west, north, and northeast regions are more likely to undergo HIV testing as compared to other regions. Existing evidence suggested that awareness programs conducted in the Southern states have increased the proportion of those getting tested over the recent past (Boily et al., 2013; Manjunath et al., 2019); whereas the low uptake of HIV testing could be aresult of poor knowledge on the testing guidelines, lack of testing kits and poor management of the system (Bishnu et al., 2013). However, in terms of percent change with reference to NFHS 4 & 5, marked improvements in testing among women were seen in northern, central, eastern, and north-eastern regions. HIV

self-test kits are gaining acceptance and thereby increase the testing status (Rao, 2020; Jamila et al., 2021; Rao et al., 2021; Ye et al., 2022).

The rates in testing in NFHS – 5 period could also be attributed to the COVID-19 pandemic impacting the uptake of HIV testing and services across the globe. The UNAIDS 2020 analysis showed that progress (81%, 67% and 59%) has been made but not enough to achieve the targets set; additionally, COVID-19 hampering progress to a large extent (UNAIDS 2020). Studies done in India have shown that there was a decline in testing, especially among key populations such as FSW, MSM, TG, Truckers, Migrants and IDUs (Maurya et al., 2022; McFall et al., 2022; Parchure et al., 2023). However, the progress of India on the 95-95-95 as of 2021 is 77-84-85 with a few states above 95% in one of the indicators (NACO, 2022).

Consistent with prior research, it has been found that voluntary uptake of testing is influenced by certain socio-demographic and economic factors such as gender, age, place of residence, education, mass-media exposure, and household economic condition (Teklehaimanot et al., 2016). A unique pattern was observed wherein the utilization of testing was notably higher among women than men. Respondents' age was another significant predictor of testing. Both men and womenat higher ages were more likely to get tested as compared to the younger cohorts; however, the odds of testing decreased with increasing age, the highest odds being for 25-34 years. For women over 45, engagement with the reproductive process reduces to a great extent and thus may result in a reduction in HIV testing (Gazimbi & Magadi, 2017). Lower risk perception with increasing age and association of symptoms with age-related illnesses could also be associated with less uptake of testing (Sousa et al., 2019). Further, the study shows that people living in urban areas and having secondary/higher levels of schooling had a higher tendency to HIV testing and awareness and greater access to testing services could be one possible reason (Ohl & Perencevich, 2011; Singh, 2012; Trepka et al., 2014). It is well documented that education plays a crucial role in developing a positive attitude to HIV testing (Muyunda et al., 2018). Higher education also results in increased awareness about risky sexual behavior. Similarly, exposure to media has a significant positive effect on HIV testing among both genders (Sano et al., 2016; Bago & Lompo, 2019). Female autonomy also has a significance on HIV testing; literature explains that empowerment enables women to make informed choices (Kasoka, 2020).

Economic inequalities are seen as another important predictor of healthcare service utilization, in this case for HIV testing around the globe. Lower uptake of voluntary testing among lower wealth quintiles, as observed in the present study, could be indicative of several facts; first, access to higher wealth make people economically empowered and endow them with the necessary resources to afford healthcare utilization costs more than the poor who are barred from availing the services (Wringe et al., 2008). Secondly, the limited reach of national programmes and interventions to the vulnerable and backward sections of society (Chirawu et al., 2010).

Our study highlights a dearth of comprehensive HIV knowledge among respondents, and both men and women endorse to prejudicial attitude towards

PLHIV. Our results suggest that for both women and men, correct and comprehensive knowledge about HIV/AIDS increased the odds of having been tested whereas, stigma was associated with lower odds of being tested. It is argued that accurate knowledge of HIV transmission and prevention plays an important role in shaping attitudes towards PLHIV, wherein the low level of knowledge fuels an increasingly discriminatory attitude ascribing greater shame, guilt, and social disapproval (Shokoohi et al., 2013; Haroun et al., 2016). Stigmatization in the forms of discrimination by family/friends, fear of disclosure of sexual orientation or sexual activity and resulting recrimination act as serious barriers to uptake of testing (Beattie et al., 2012; Mayston et al., 2016; Woodford et al., 2016).

**Study limitations**

There are a few limitations in the present study, which need to be acknowledged. Firstly, the data is cross-sectional and therefore, building causal inferences was not possible. The data does not allow controlling for availability or knowledge of testing centres/services. Further, information on knowledge and stigma was self-reported and hence, under-reporting of socially unacceptable attitudes and over-reporting of socially desirable behaviour is possible. However, in spite of the caveats, the major strength lies in the fact that the study is based on nationally representative data and findings may be generalized for its overall population.

**Conclusion and recommendations**

With regard to India's long stride towards achieving the sixth Millennium Development Goal of halting and reversing the HIV epidemic, this study highlights the need to scale up HIV testing in the country. Although women being more prone to have been tested is a welcome change, the prevailing sex differentials warrant closer policy attention, especially towards encouraging men to get themselves tested and declare their HIV status. A couple-centric approach, as part of MNCH programmes, may serve a great deal to increase testing among men. While wider gaps existing across socio-economic and cultural realms are key roadblocks, policymakers must not ignore the geographical spread and cultural diversity of the country while formulating any strategy. More research on various facets of HIV-related stigma, and individual risk perception is required in the Indian context to provide critical information to national policymakers. Strategies must invest in family life/sex education (FLE) and awareness of the trajectories of HIV disease progression which will, in turn, serve the objectives of addressing HIV/AIDS-related stigma. Considering the cultural challenge Indian societies posit for younger cohorts viz. risky sexual behaviour, unprejudiced discussion on sex-related topics, the long-standing tradition of early marriage among girls and the disproportionate burden of HIV/AIDS in the country that is contributed by the age groups of 15-24 years, the introduction of FLE may reap multiple benefits in terms of reproductive decision making, negotiations and identifying sources of help. Lastly, healthcare professionals and social leaders need to set forth a model of compassion and care towards PLHIV, so as to influence the larger communities to break the barriers of stigma, develop positive attitudes, uptake timely tests and ensure utilization of appropriate treatment facilities.

**Data Availability**

NFHS-4 (2015-16) and NFHS-5 (2019-21) data associated with this study is available in the public domain at the URL: https://www.dhsprogram.com/Data/

**References**


Allegri, M, D., Agier, I., Tiendrebeogo, J., Louis, V. R., Yé, M., Mueller, O., & Sarker, M. (2015) Factors Affecting the Uptake of HIV Testing among Men: A Mixed Methods

Study in Rural Burkina Faso. PLoS ONE, 10(7): e0130216. doi: 10.1371/journal.pone.0130216.

Bago, J. L., & Lompo, M. L. (2019). Exploring the linkage between exposure to mass media and HIV awareness among adolescents in Uganda. Sexual & reproductive healthcare: official journal of the Swedish Association of Midwives, 21, 1–8. https://doi.org/10.1016/j.srhc.2019.04.004.

Beattie, T. S., Bhattacharjee, P., Suresh, M., Isac, S., Ramesh, B. M., & Moses, S. (2012). Personal, interpersonal and structural challenges to accessing HIV testing, treatment and care services among female sex workers, men who have sex with men and transgenders in Karnataka state, South India. Journal of Epidemiology and Community Health, 66 (Suppl 2), ii42-ii48.

Bishnu, B., Bhaduri, S., Kumar, A. M., Click, E. S., Chadha, V. K., Satyanarayana, S., Nair, S. A., Gupta, D., Ahmed, Q. T., Sarkar, S., Paul, D., & Dewan, P. (2013). What are the reasons for poor uptake of HIV testing among patients with TB in an Eastern India District?. PloS one, 8(3), e55229. https://doi.org/10.1371/journal.pone.0055229.

Boily, M. C., Pickles, M., Lowndes, C. M., Ramesh, B. M., Washington, R., Moses, S., Deering, K. N., Mitchell, K. M., Reza-Paul, S., Blanchard, J., Vassall, A., Alary, M., & Vickerman, P. (2013). Positive impact of a large-scale HIV prevention programme among female sex workers and clients in South India. AIDS (London, England), 27(9), 1449–1460. https://doi.org/10.1097/QAD.0b013e32835fba81.

Chan, B. T., Chakrapani, V., & Tsai, A. C. (2020). HIV-related stigma trends in the general population of India during an era of antiretroviral treatment expansion, 2005-16. Journal of global health, 10(2), 1-9.

Chirawu, P., Langhaug, L., Mavhu, W., Pascoe, S., Dirawo, J., & Cowan, F. (2010). Acceptability and challenges of implementing voluntary counselling and testing (VCT) in rural Zimbabwe: Evidence from the Regai Dzive Shiri Project. AIDS Care, 22(1), 81-88. doi: 10.1080/09540120903012577

De, R., Bhandari, S., Roy, S., Bhowmik, A., Rewari, B. B., & Guha, S. K. (2013). Factors Responsible for Delayed Enrolment for Anti-Retroviral Treatment. J Nepal Health Res Counc, 11(24):194-7.

Ekstrand, M. L., Heylen, E., Mazur, A., Steward, W. T., Carpenter, C., Yadav, K., Sinha, S., & Nyamathi, A. (2018). The Role of HIV Stigma in ART Adherence and Quality of Life Among Rural Women Living with HIV in India. AIDS and behavior, 22(12), 3859–3868. https://doi.org/10.1007/s10461-018-2157-7

Gazimbi, M. M., & Magadi, M. A. (2017). A multilevel analysis of the determinants of HIV testing in Zimbabwe: Evidence from the demographic and health surveys. HIV/AIDS Research and Treatment Open Journal, 4(1), 14-31. doi: 10.17140/HARTOJ-4-124.

Haroun, D., El Saleh, O., Wood, L., Mechli, R., Al Marzouqi, N. & Anouti, S. (2016). Assessing Knowledge of, and Attitudes to, HIV/AIDS among University Students in the United Arab Emirates. Eugenin EA, ed. PLoS One. 11(2), e0149920. doi: 10.1371/journal.pone.0149920.

International Institute for Population Sciences (IIPS) and ICF. (2017). National Family Health Survey (NFHS-4), 2015-16: India. Mumbai: IIPS.

Jamila, M. S., Eshun-Wilsonb, I., Witzelc, T. C., Siegfriedd, N., Figueroaa, C., Chitemboe, L., Msimanga-Radebef, B., Pashag, S. M., Hatzoldh, K., Corbetti, E., Barr-DiChiaraa, M, Rodgerk, A. J., Weatherburnc, P., Gengb, E. Baggaleya, R., Johnsona, C. (2021). Examining the effects of HIV self-testing compared to standard HIV testing services in the general population: A systematic review and meta-analysis. EClinicalMedicine, 38 (100991). https://doi.org/10.1016/j.eclinm.2021.100991.

Jha, P. K., Narayan, P., Nair, S., Ganju, D., Sahu, D. & Pandey, A. (2015). An assessment of comprehensive knowledge of HIV/AIDS among slum and non-slum populations in

Delhi, India. Open Journal of Preventive Medicine, 5(06), 259-268.

Joint United Nations Program on HIV/AIDS (2022). UNAIDS special analysis 2020. 90-90-90: Treatment for all. https://www.unaids.org/en/resources/presscentre/featurestories/2020/september/20200 921_90-90-90.

Kasoka K. (2020). Autonomy in HIV testing: a call for a rethink of personal autonomy in the HIV response in sub-Saharan Africa. Medicine, health care, and philosophy, 23(3), 519–536. https://doi.org/10.1007/s11019-020-09959-y.

Mahalakshmy, T., Premarajan, K. C., & Hamide, A. (2010). HIV Related Stigma and Perceived Social Support of People Living with HIV: In South India. National Journal of Integrated Research in Medicine, 1(4), 36-39.

Manjunath, K., Cherian, A. G., Abraham, V., Minz, S., George, K., & Helan, J. (2019). Trends of HIV prevalence in rural South India. Journal of family medicine and primary care, 8(2), 669–672. https://doi.org/10.4103/jfmpc.jfmpc_326_18.

Maurya, S. P., Sharma, A., Singh, R., Gautam, H., & Das, B. K. (2022). HIV testing & diagnosis in 2020 at the apex tertiary referral hospital of India: impact of COVID-19 pandemic. AIDS care, 34(7), 828–831. https://doi.org/10.1080/09540121.2021.1975631.

Mayston, R., Lazarus, A., Patel, V., Abas, M., Korgaonkar, P., Paranjape, R., Rodrigues, S., & Prince, M. (2016). Pathways to HIV testing and care in Goa, India: exploring psychosocial barriers and facilitators using mixed methods. BMC Public Health, 16(1), 1-10.

McFall, A. M., Menezes, N. P., Srikrishnan, A. K., Solomon, S. S., Anand, S., Baishya, J. J., Lucas, G. M., Celentano, D. D., & Mehta, S. H. (2022). Impact of the COVID-19 pandemic on HIV prevention and care services among key populations across 15 cities in India: a longitudinal assessment of clinic-based data. Journal of the International AIDS Society, 25(7), e25960. https://doi.org/10.1002/jia2.25960.

Medhi, G. K., Mahanta, J., Paranjape, R. S., Adhikary, R., Singh, S. G., Akoijam, S. B. & Goswami, P. (2012). Factors associated with ever HIV testing among injecting drug users (IDUs) in two HIV high prevalent States of India. Indian Journal of Medical Research, 136(7), 64-71.

Muyunda, B., Musonda, P., Mee, P., Todd, J., & Michelo, C. (2018). Educational attainment as a predictor of HIV testing uptake among women of child-bearing age: analysis of 2014 demographic and health survey in Zambia. Front. Public Health, 6:192. doi: https://doi.org/10.3389/fpubh.2018.00192

Nall, A., Chenneville, T., Rodriguez, L. M., & O'Brien, J. L. (2019). Factors affecting HIV testing among youth in Kenya. International journal of environmental research and public health, 16(8), 1450. doi:10.3390/ijerph16081450.

National AIDS Control Organization. (2020). National AIDS Control Programme. http://naco.gov.in/.

Ohl, M.E., & Perencevich, E. (2011). 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, 11(1), 1-7. https://doi.org/10.1186/1471-2458-11-681.

Parchure, R., Darak, T., More, P., Jori, V., Darak, S., Gabane, L., Deoraj, P., Kapoor, N., Verma, V., Singh, B., Das, C., Rajan, S., & Kulkarni, V. (2023). Impact of COVID- 19 Pandemic on HIV Testing Uptake Among Key Populations Enrolled in Targeted Intervention Program in Maharashtra, India. AIDS and behavior, 1–8. Advance online publication. https://doi.org/10.1007/s10461-023-04011-5

Rahangdale, L., Banandur, P., Sreenivas, A., Turan, J. M., Washington, R., & Cohen, C. R. (2010). Stigma as experienced by women accessing prevention of parent-to-child transmission of HIV services in Karnataka, India. AIDS care, 22(7), 836–842. https://doi.org/10.1080/09540120903499212.

Rao A. (2020). HIV self-test during the time of COVID-19, India. The Indian journal of medical research, 152(1 & 2), 164–167. https://doi.org/10.4103/ijmr.IJMR_2521_20

Rao, A., Patil, S., Kulkarni, P. P., Devi, A. S., Borade, S. S., Ujagare, D. D., Adhikary, R., & Panda, S. (2021). Acceptability of HIV oral self-test among truck drivers and youths: a qualitative investigation from Pune, Maharashtra. BMC public health, 21(1), 1931. https://doi.org/10.1186/s12889-021-11963-7.

Sano, Y., Sedziafa, A. P., Amoyaw, J. A., Boateng, G. O., Kuuire, V. Z., Boamah, S., & Kwon, E. (2016). Exploring the linkage between exposure to mass media and HIV testing among married women and men in Ghana. AIDS care, 28(6), 684–688. https://doi.org/10.1080/09540121.2015.1131970.

Sidibé, M., Loures, L., & Samb, B. (2016). The UNAIDS 90-90-90 target: a clear choice for ending AIDS and for sustainable health and development. Journal of the International AIDS Society, 19(1), 21133. https://doi.org/10.7448/IAS.19.1.21133.

Singh, M. K. (2012). Understanding the gender disparity in HIV testing in India. (Paper presentation). Annual Meeting of Population Association of America, San Francisco,

CA.Shokoohi, M., Karamouzian, M., Mirzazadeh, A., Haghdoost, A., Rafierad, A. A., Sedaghat, A., & Sharifi, H. (2016). HIV knowledge, attitudes, and practices of young people in Iran: findings of a national population-based survey in 2013. PloS one, 11(9), e0161849.

Sousa, A., Queiroz, A., Fronteira, I., Lapão, L., Mendes, I., & Brignol, S. (2019). HIV Testing Among Middle-Aged and Older Men Who Have Sex With Men (MSM): A Blind Spot?. American journal of men's health, 13(4), 1557988319863542. https://doi.org/10.1177/1557988319863542.

Steward, W. T., Bharat, S., Ramakrishna, J., Heylen, E., & Ekstrand, M. L. (2013). Stigma is associated with delays in seeking care among HIV-infected people in India. Journal of the International Association of Providers of AIDS Care, 12(2), 103–109. https://doi.org/10.1177/1545109711432315.

Tanwar, S., Rewari, B. B., Rao, C. D., & Seguy, N. (2016). India's HIV programme: successes and challenges. Journal of virus eradication, 2, 15-19.

Teklehaimanot, H.D., 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(1), 1-13.https://doi.org/10.1186/s12889-016-2918-z.

Teva, I., Fernandes de Araújo, L., & Bermúdez, M. (2018): Knowledge and Concern about STIs/HIV and Sociodemographic Variables Associated with Getting Tested for HIV Among the General Population in Spain, J Psychol, 290-303. https://doi.org/10.1080/00223980.2018.1451815.

The World Bank. (2019). Data: India. https://data.worldbank.org/country/IN.

Trepka, M. J., Fennie, K. P., Sheehan, D. M., Lutfi, K., Maddox, L., & Lieb, S. (2014). Late HIV diagnosis: Differences by rural/urban residence, Florida, 2007-2011. AIDS patient care and STDs, 28(4), 188–197. https://doi.org/10.1089/apc.2013.0362.

UNAIDS. (2023). AIDS by the numbers. https://www.unaids.org/en

Woodford, M. R., Chakrapani, V., Newman, P. A., & Shunmugam, M. (2016). Barriers and facilitators to voluntary HIV testing uptake among communities at high risk of HIV exposure in Chennai, India. Global Public Health, 11(3), 363-379.

World Health Organization. (2023). HIV and AIDS: Key https://www.who.int/news-room/fact-sheets/detail/hiv-aids

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

Yadav, J., Gautam, S., & Singh, K. J. (2015). Differential in awareness and comprehensive knowledge of HIV/AIDS and its determinants among youth in India: A population based cross-sectional study. American International Journal of Research in Humanities, Arts and Social Sciences, 13(3), 222-230.

Ye, Z., Virginia, W., Tanya A. L., Abreu, L.R.D., Deborah S. J., Kirsty, S., Muhammad, J. S., Fern,T.P., Christopher, F. K., Anna, M., Adam, H., Karl, J., Eric, C. P. F., Benjamin,B. R., Andrew, G., Mark, S., Martin, H., John, K., Rebecca, G., Jason, O. J. (2022).Preferences for HIV Testing Services and HIV Self-Testing Distribution Among Migrant Gay, Bisexual, and Other Men Who Have Sex With Men in Australia. Frontiers in Medicine, 9. DOI=10.3389/fmed.2022.839479. ISSN=2296-858X. https://www.frontiersin.org/articles/10.3389/fmed.2022.839479.