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REVIEW ARTICLE HIV TESTING

Effectiveness of Human Immunodeficiency Virus Index Testing: A Global Scoping Review

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ABSTRACT

Background and Objective: Over 2.5 million people are living with human immunodeficiency virus (HIV) in India. The World Health Organization recommends HIV self-screening and partner notification services. Index testing is a case-finding approach that focuses on eliciting the sexual or needle-sharing partners and biological children of HIV-positive individuals. This review aims to understand the effectiveness of index case testing in the uptake of HIV diagnosis and care.

Methods: A scoping review was conducted to examine the effectiveness of HIV index case testing. Studies published between 2010 and 2024 in English were included. A total of 10 final studies were included in this scoping review. No such studies were found in the Indian context.

Results: The studies were from Zimbabwe, Malawi, Nigeria, South Africa, Lesotho, Kenya, Zambia, Mozambique, and Ukraine. Sample sizes ranged from under 1,000 individuals to large-scale community-based programs enrolling over 38,000 participants. The studies demonstrated the effectiveness of index case testing in identifying previously undiagnosed HIV infections among sexual partners (up to 51%) and children (4.0–5.8%) of people living with HIV. The studies also indicated high acceptance rates and feasibility of the approach.

Conclusion and Global Health Implications: HIV index case testing presents a valuable strategy for reaching diverse populations at risk for HIV infection and improving care linkages. Further research is needed to explore cost-effectiveness and optimize implementation strategies for various contexts.

Keywords: Contact Tracing, Human Immunodeficiency Virus, HIV Testing, Index Case Testing, Linkage to Care

INTRODUCTION

New human immunodeficiency virus (HIV) infections and acquired immunodeficiency syndrome (AIDS)-related deaths in India dropped by 44% (1.2 lakhs to 68,450) and 80% (1.6 lakhs to 35,870), respectively, between 2010 and 2023,[1] both outclassed the global average; however, 185 Indians were infected each day in 2023.[2] HIV prevention efforts need to be accelerated if India is to meet the sustainable development goal (SDG) 3.3 target of ending AIDS as a public health threat by 2030. To achieve SDG 3.3, early diagnosis of HIV and prompt linkage of the diagnosed case to anti-retroviral treatment (ART), along with prevention of new HIV infections, is the key.

In India, 81% of the people living with HIV (PLHIV) know their status, and 70% of PLHIV are on ART, implying that many with HIV were unaware of their status.[1] There is an increasing focus

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on HIV testing in high-risk or key groups such as people who inject drugs, men who have sex with men (MSM), and female sex workers. However, sexual partners of index-positive clients are an important population that has largely been ignored due to the reluctance to disclose information about their sexual partners, stigma, and social barriers. This high-risk group establishes a "pivotal point" that must be reached to achieve HIV control, thereby attaining the 1st 95% of the 95-95-95 initiative.[3]

The Government of India introduced newer strategies that reinforce these targets under the National AIDS Control Program (NACP-V). One of these strategies is HIV index testing, which the National AIDS Control Organization introduced in a campaign mode. The campaign was from April 15th, 2024, to October 15th, 2024, with pan-India implementation. The first phase was from April 15th, 2024, to July 15th, 2024, in all districts having ART centers; whereas the second phase, from July 15th, 2024, to October 15th, 2024, included the remaining districts.[4]

Index testing is an evidence-based, World Health Organization (WHO)-endorsed form of contact tracing. It involves identifying and testing partners as well as biological children who are at risk of vertical transmission of HIV. It is a targeted approach to identify undiagnosed infections and improve diagnosis rates.[5] Index testing focuses on individuals diagnosed with HIV, referred to as the "index case."[6] These individuals are offered counseling to disclose their status to their sexual partners, children, and other close contacts.[7] Healthcare providers then work with the index case to encourage these contacts to undergo HIV testing. This strategy leverages existing connections and overcomes the stigma associated with routine testing.[8]

Early diagnosis allows PLHIV to initiate ART, which suppresses the virus and reduces the risk of transmission.[9] Late diagnosis of HIV is an important factor associated with HIV-related morbidity and mortality. Early HIV diagnosis has benefits on individual and population levels.[10] At an individual level, it significantly enhances quality of life by enabling timely access to ART, which prevents opportunistic infections, reduces transmission risk, and prolongs life expectancy. Knowing HIV status empowers individuals to make informed decisions about their health. At a population level, it significantly reduces new infections, strengthens healthcare systems, and stimulates economic growth.

This scoping review was carried out with the research question "*How effective is Index case testing in the uptake of HIV testing and counselling services (HFS), diagnosing partners, and linking them to care?*"

METHODS

This scoping review adhered to PRISMA-ScR and Arksey and O'Malley's guidelines.[11] A search for relevant studies was carried out in the database PubMed, and an additional search was done in Google Scholar. The search was first performed using MeSH terms. The terms "HIV," "AIDS," "index cases," "HIV Care," "linkage to care," "HIV partner testing," "HIV contact," "global," "HIV care continuum," and "Index testing" were among those used [Table 1]. The WHO and US Centers for Disease Control and Prevention websites were also checked for information about the HIV and AIDS program and operating procedures. The Mendeley software was then used to import relevant records and eliminate duplicate documents. Following that, full-text papers were filtered per the eligibility criteria listed in Table 1. To acquire more data, cross-references were gathered from the appropriate papers.

Search Results

A total of 396 records were initially identified through database searching. The 343 unique records were screened after removing 53 duplicates. The articles were assessed for inclusion criteria, and ultimately, 7 records were found relevant, and 3 articles were selected from back-referencing the included articles, resulting in 10 final studies [Figure 1].

Characteristics of Reviewed Studies

The studies included participants from Zimbabwe, Malawi, Nigeria, South Africa, Lesotho, Kenya, Zambia, Mozambique, and Ukraine. Sample sizes ranged from under 1,000 individuals to large-scale community-based programs enrolling over 38,000 participants [Table 2]. A total of 10 studies were included, of which 50% of the studies were community-based, two studies were retrospective cross-sectional, and one study each had with retrospective cohort, mixed method, and intervention design.

Table 1: Inclusion and exclusion criteria for study selection.

Items	Criteria
Database	PubMed Central, Google Scholar
Time	From the year 2010 to 2024
Spatial filter	Worldwide
Language filter	English
Inclusion criteria	1. Peer-reviewed published paper 2. Performed using policy analysis or original data 3. Study conducted for HIV index testing services or partner notification services.

HIV: Human immunodeficiency virus.

Table 2: Characteristics of included studies (*n*=10).

S. No.	Author	Year	Study design	Country	Sample size	Study population	Result	Key findings
1.	Kranzer et al.	2014	Mixed Method	Zimbabwe	2,831 children	Children 6–15 years	19.8% of the 940 guardians who tested with the youngster had HIV.	PITC was offered to 76% of the 2,831 eligible children, and 54.2% of them agreed to be tested for HIV. Of those screened, 95% of children with HIV were connected to care.
2.	Ahmed et al.	2017	Community-based	Malawi	1567 patients	HIV-infected children (1–15 years) and young persons (>15–24 years)	After testing 711 children and youth, CHWs identified 28 new HIV-positive individuals.	The index case-finding strategy is acceptable and workable and promotes prompt linkage to care when paired with home-based testing and monitored follow-up.
3.	Katbi et al.	2018	Non-controlled interventional	Nigeria	1277 index clients	PLHIV and their partners	51% of partners HIV positive	Identified the need to reach sexual partners of PLHIV for testing and treatment.
4.	Joseph Davey et al.	2019	Community-based	South Africa	16,033 partners and children	PLHIV partners and children	38% HIV positive	Index partner/child testing is feasible and effective for case finding.
5.	Jubilee et al.	2019	Community-based	Lesotho	7916 index clients	PLHIV, their biological children and partners	Higher HIV positivity rates and linkage rates were observed with HIV index testing compared to other models.	Linkage to care and treatment was higher among those identified through HIV index testing.
6.	Mugo et al.	2020	Prospective cohort	Kenya	493 caregivers with children	Children of PLHIV	5.8% HIV prevalence	Home-based testing is feasible, but uptake was moderate.
7.	Kariuki et al.	2020	Retrospective cross-sectional	Kenya	183 index clients	PLHIV and their partners	216 sexual partners were evoked for tracing by 89% of the indexed clients who accepted the services.	In low-resource nations, assisted partner notification programs are both acceptable and successful in boosting the identification of HIV cases among sexual partners who have been exposed.

(Contd...)

Table 2: *(Continued).*

S. No.	Author	Year	Study design	Country	Sample size	Study population	Result	Key findings
8.	Mwango et al.	2020	Community-based	Zambia	38,255 persons	Men living with HIV	Among those tested, 29% were newly identified as people living with HIV.	Among men, 24% tested positive, with index testing yielding higher positivity but lower linkage compared to targeted community testing.
9.	Songane et al.	2023	Community-based	Mozambique	91,411 individuals	Parents of PLHIV, sexual partners, and biological children under the age of 14	7,011 people received a new HIV diagnosis because of community index testing.	Extending the community index case technique could be an economical and successful way to find people who have never been diagnosed with HIV, especially men.
10.	Secor et al.	2024	Retrospective cross-sectional	Ukraine	14,554 adults	PLHIV adults	Within 7 days of testing, named couples had a considerably higher chance of starting ART.	By reducing the time between HIV testing and starting ART and bringing PLHIV into treatment earlier during their HIV disease, index testing services may help to improve patient outcomes and retention.

HIV: Human immunodeficiency virus, PLHIV: People living with human immunodeficiency virus, ART: Anti-retroviral treatment, PITC: Provider-initiated HIV testing and counseling.

RESULTS

Increased Case Identification

A finding across the studies was the effectiveness of index testing in identifying previously undiagnosed HIV infections. The studies documented a 51%[12] HIV positivity among partners of PLHIV, highlighting a risk for transmission within these close relationships. The studies found a prevalence of 4.0[13]–5.8%[14] among children of PLHIV, raising concerns about potential mother-to-child transmission during pregnancy, childbirth, or breastfeeding.

Feasibility, Acceptability, and Linkage to Care

The studies indicated that index testing is feasible and well-accepted by both the index client and their contacts. Studies observed good acceptance of index testing services by PLHIV clients, with a willingness to disclose their status and encourage partner testing.[15-17] Community-based approaches utilizing home-based testing and trained community health workers (CHWs) demonstrated successful outreach to geographically dispersed populations and those facing barriers to facility-based testing.[13,15,18] Studies reported higher rates of linkage to care and treatment initiation among those diagnosed through index testing compared to traditional methods.[14,15,19]

Effectiveness across Populations

The studies included diverse populations, demonstrating the potential of index testing to reach various groups at risk for HIV infection. Studies focusing on children of PLHIV

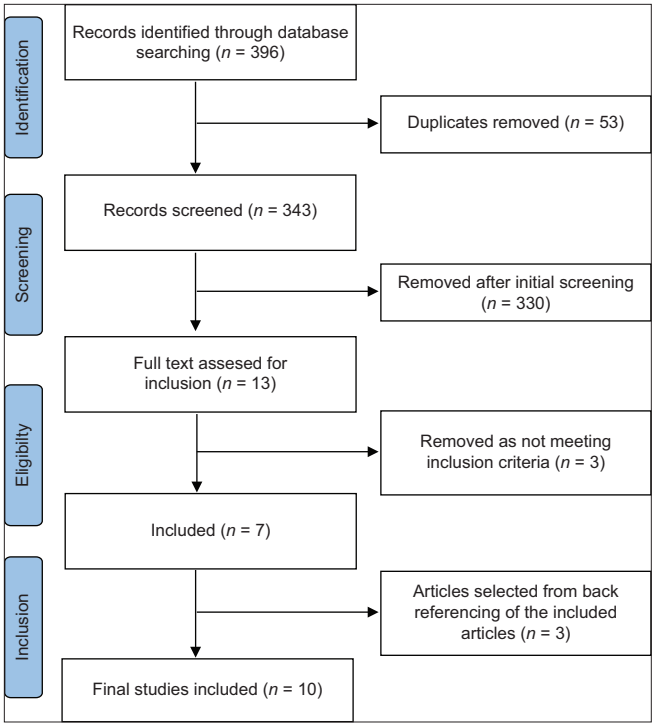

Figure 1: Preferred reporting items for systematic reviews and meta-analyses (PRISMA) flowchart for inclusion of study articles.

identified a significant burden of undiagnosed infections, highlighting the importance of including children in index testing strategies.[13,14,20,21] One study involving adolescents and young people showed promise in reaching this age group with a high-yield case identification rate.[13] Studies targeting MSMs, often underdiagnosed due to social stigma, yielded positive results for case identification.[17]

Cost-effectiveness

Index testing emerged as a cost-effective approach for identifying new HIV cases in Mozambique.[18] While the initial cost of $65.32 per new HIV diagnosis, this figure decreased to $362 per infection averted within 5 years. This method proved more efficient than traditional facility-based testing, detecting a higher percentage of new HIV cases (7.7% compared to 4.1%). Community index testing was more successful in diagnosing HIV among males.[18]

While the studies provide strong evidence for the effectiveness of index testing, some challenges identified were:

- The 5 Cs (consent, confidentiality, counseling, correct results, connection, or linkages) of HIV testing must be maintained in the context of index testing
- Individual factors – self-stigma, i.e., key populations are usually reluctant to divulge their contacts and details about their family due to stigma
- Interpersonal factors such as fear of divorce and separation
- Health system factors such as gaps in training healthcare workers on effective communication and counseling skills, and a lack of confidential space for counseling
- HIV-related stigma in the community.[22]

DISCUSSION

This review aligns with previous studies by the WHO and the Joint United Nations Programme on HIV/AIDS (UNAIDS), which emphasize the usefulness of index testing in recognizing hidden reservoirs of HIV within social networks.[23,24] The prevalence rates observed among partners and children in this review (51% for partners and 4.0–5.8% for children) are comparable to those reported in other studies (35–62% for partners and 4–18% for children).[25] This consistency strengthens the evidence base for the strategy's ability to detect undiagnosed infections and contribute to achieving targets.

The studies found high acceptance rates for index testing among PLHIV clients, like Edosa et al.[6] and Kumar et al.[26] This suggests a willingness among PLHIV to participate in efforts to prevent onward transmission within their social circles. This review aligns with Mushamiri et al., demonstrating the effectiveness of community-based outreach strategies using CHWs to reach geographically dispersed populations.[27] The observed improvement in linkage to care among those diagnosed through index testing is also consistent with Oljira et al., who reported a higher rate of ART initiation among partners identified through this approach.[28] These findings suggest that index testing is not only feasible and acceptable but also holds promise for improving care cascades by facilitating earlier access to treatment.

The present review highlights the potential of index testing to reach diverse populations at risk for HIV infection, including children, adolescents, and MSM.[13,20] The inclusion of MSM populations in this review adds to the growing body of evidence suggesting the strategy's utility in reaching groups often facing social stigma and barriers to healthcare access. This review identified challenges like those reported in previous studies, including the need for specialized training for healthcare workers on communication and counseling skills, particularly for addressing disclosure concerns.

Limitations

Since this is a scoping review, it provides a moderate level of evidence, and there always remains a risk of bias due to the heterogeneity of the studies.

CONCLUSION AND GLOBAL HEALTH IMPLICATIONS

Through the evidence presented by this scoping review, there is no doubt that index testing is a high-yielding

strategy to fast-track the identification of new cases of HIV and to sustain the high levels of linkages to ART. It is specifically effective in increasing the detection and testing of biological children. This is a welcome and much-needed strategy to cater to the high-risk/key population where HIV remains focused, but to include it in NACP-V, the various limitations cited above need to be taken care of. Without targeted intervention offering HIV index testing services to key population clusters, including sexual partners, it will be a challenge to end HIV/AIDS by 2030.

Key Message

For the goal of ending HIV/AIDS by 2030, targeted HIV testing for key populations, including sexual partners of index PLHIV, is essential.

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COMPLIANCE WITH ETHICAL STANDARDS

Conflicts of Interest: The authors declare no competing interests. **Financial Disclosure:** Nothing to declare**. Funding/Support:** There was no funding for this study. **Ethics Approval:** Not applicable. **Declaration of Patient Consent:** Patient's consent is not required, as there are no patients in this study. **Use of Artificial Intelligence (AI)-Assisted Technology for Manuscript Preparation:** The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript, and no images were manipulated using AI. **Disclaimer:** None.

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