REVIEW PAPER

Investigating the status of HIV self-testing before and during the COVID-19 pandemic: a systematic review study

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Abstract

In order to effectively address the goals of human immunodeficiency virus (HIV) prevention and control on both regional and global scales, there is a pressing need for an innovative approach to providing testing-related services. The objective of this study was to scrutinize and compare the utilization of HIV self-testing before and during the COVID-19 pandemic.

To identify appropriate studies, a comprehensive search was conducted across various databases, including PubMed, Scopus, Ovid, and ISI between December 2019 and May 2023. Strengthening the reporting of observational studies in epidemiology checklist (STROBE) was employed to evaluate the quality of each study. Of the numerous articles reviewed, 24 were included in the study. It was ascertained that before the emergence of the COVID-19 pandemic, individuals living with HIV employed HIV self-testing together with routine HIV tests. The advent of the COVID-19 pandemic disrupted service delivery of healthcare centers, resulting in a decline in facility-based tests. However, the utilization of HIV self-tests significantly surged, proving to be a prevalent method for HIV testing during the COVID-19 pandemic.

It seems that the use of HIV self-testing increased during the COVID-19 pandemic, because it allowed people to test themselves at home, reducing the need to visit clinics, and minimizing the risk of contracting COVID-19. It is recommended that countries with limited access to HIV diagnostic services comprise the usage of HIV self-testing in their national guidelines.

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Introduction

Over the past three decades, human immunodeficiency virus (HIV) has emerged as one of the most perilous and lethal infectious diseases across the globe [1]. By the end of 2022, the worldwide tally of new HIV cases had reached 39 million, with nearly 650,000 fatalities recorded. Moreover, in 2021, there were 680,000 deaths due to HIV-associated causes, with majority of males (340,000 individuals) compared with females (240,000 individuals). Consequently, the highest HIV prevalence rate (3.6%) was

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documented in the African region, while the lowest (less than 0.1%) was reported in the Eastern Mediterranean region [2].

Presently, numerous tools are available for HIV prevention, including abstinence (abstaining from sexual intercourses), refraining from needle sharing, and thoughtful use of condoms during sexual activities. Furthermore, drugs for HIV prevention, such as pre-exposure prophylaxis (PrEP) and post-exposure prophylaxis (PEP), have demonstrated their efficacy in managing this viral infection [3].

To effectively govern HIV, the identification of infected individuals is paramount. Many high-risk groups remain under-tested, owing to diverse factors, such as inadequate HIV testing coverage in various regions, apprehension of discrimination, and social stigma. Consequently, a novel approach is necessary to facilitate the provision of testing-related services to fulfill the objectives of HIV prevention and control at both regional and global scales. In 2016, the World Health Organization (WHO) instigated the implementation of HIV self-testing (HIVST) strategy [4].

HIVST entails collection of a biological sample (blood or oral fluids), and subsequent interpretation of results by individuals in a private setting. Research has demonstrated that this approach saves time, diminishes high-risk behaviors, and upholds confidentiality [5, 6]. HIV self-tests are new ways for people to test themselves for HIV, as they can do the test at home and check the results themselves. If the test shows positive result, the person should proceed to a medical center to confirm the result by performing more tests. HIV self-testing is a simple and convenient way for people to examine themselves without the need of help from specialists [7]. It has been shown by different studies that HIV self-testing is satisfactory, efficient, and WHO-approved [8].

Research has shown that the COVID-19 pandemic prompted health systems to prioritize care of HIV-infected individuals, reducing the availability of routine healthcare services [9]. Between March and June 2020, facilities where individuals traditionally sought HIV testing were temporarily closed. Upon re-opening, patients were obliged to schedule appointments in advance, which resulted in a decline in the number of people getting tested for HIV [7].

Inadequate HIV testing leads to transmitting the virus to sexual partners of HIV-positive individuals unaware of their condition, causing detrimental health consequences for these partners. Consequently, an approach that enhances accessibility is imperative for both HIV-positives and their sexual partners.

The primary objective of this study was to assess and compare the utilization of HIV self-testing before and during the COVID-19 pandemic.

Material and methods

This research adhered to the preferred reporting of items for systematic reviews and meta-analyses (PRISMA) guidelines, with methodology for conducting systematic reviews and meta-analyses (Figure 1).

Data source and search strategy

To identify relevant studies, a thorough search was conducted across multiple databases, including PubMed, Scopus, Ovid, and ISI during the review period. Subsequently,

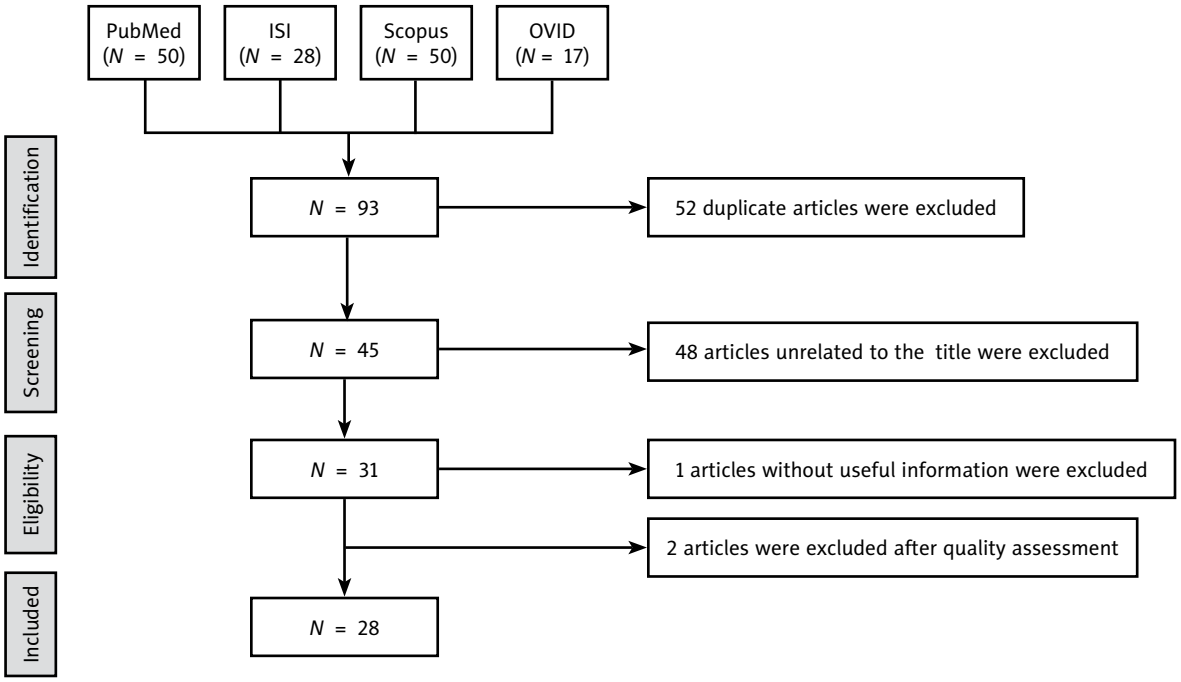

Figure 1. The PRISMA flow diagram

a well-defined search strategy was employed to identify appropriate papers (Table 1).

Inclusion and exclusion criteria

Inclusion criteria encompassed all epidemiological studies, namely cross-sectional and case-control studies, retrospective and prospective cohorts, clinical trials, structured reviews, meta-analyses, and molecular epidemiology studies, conducted worldwide between December 2019 and May 2023. Exclusion criteria were studies with insufficient or absent data, and letters to the editor or conference presentations.

Study quality

Two reviewers performed independent searches in the databases. Quality of each study was assessed using strengthening the reporting of observational studies in epidemiology checklist (STROBE). This checklist comprises six main sections, categorized as follows: title and abstract, introduction, methods, results, discussion, and additional details. Out of 22 paragraphs, 18 apply to all types of research, while 4 refer particularly to study design.

Analysis of the study

Data were analyzed using SALSA method, with four phases: 1) search (defining the searching string and types of databases); 2) appraisal (pre-determined inclusion and exclusion criteria as well as quality assessment criteria for literature); 3) synthesis (extracting and categorizing the data); and 4) analysis (narrating the results and ultimately reaching a conclusion, SALSA).

Results

Search results

In the initial database search, a total of 145 articles were retrieved, out of which 52 articles were duplicates (excluded) and 48 articles were deemed irrelevant to the study's subject (excluded). Upon reviewing the abstracts, 14 papers that lacked sufficient information for inclusion in the study were identified. Ultimately, 28 articles were selected for the analysis. The PRISMA flow diagram in Figure 1 illustrates the search process.

Overview of included studies

Among the chosen studies, six were conducted in China [9-14], two in Canada [15, 16], two in Brazil [17, 18], two in the Philippines [19, 20], two in Malawi [21, 22], Japan [23], Poland [7], two in the United States [24, 25], Columbia [26], Senegal, Côte d'Ivoire, Mali [6], Oregon [27], two in Kenya [28, 29], Lebanon [30], two in Uganda [31, 32], North Carolina [33], and Myanmar [34]. In terms of study design, there were 17 cross-sectional studies, two qualitative studies, three cohort studies, four randomized controlled trials (RCTs), one secondary study, and one hybrid type 2 implementation science study. Table 2 presents the details of the selected studies.

Table 1. Search strategy

(HIV OR "Human Immunodeficiency Virus" OR "AIDS" OR "Acquired Immunodeficiency Syndrome") AND (Self-test*) AND ("Covid*" OR "Covid-19" OR "SARS-COV-2" OR "Coronavirus" OR "SARS" OR "2019-ncov2")

Findings from systematic review

Upon reviewing the research until 2023, it was observed that prior to the COVID-19 outbreak, individuals living with HIV primarily used routine HIV tests administered by professionals in healthcare facilities, along with HIV self-testing. However, with the onset of COVID-19, there was a notable increase in the preference for HIV self-testing over routine tests conducted by healthcare workers. During the pandemic, HIV self-testing became the predominant method for detecting the virus, effectively mitigating challenges in HIV diagnosis during COVID-19. The disruption caused by the COVID-19 pandemic in healthcare service delivery resulted in a decline in service-based HIV tests. At the same time, the utilization of HIV self-tests significantly surged, establishing itself as a prevalent method for HIV testing during the COVID-19 pandemic.

Discussion

In late 2000, health workers in African regions with particularly high rates of HIV have been facilitating the practice of HIV self-testing via private pharmacies and online platforms [28, 35, 36]. Before the COVID-19 pandemic, several studies have observed that various groups of individuals were willing to embrace HIV self-testing, including critical populations [37-39], healthcare professionals [28, 40], men [22, 41], pregnant women [42], and their sexual partners [28, 43]. Furthermore, according to a recent study conducted in 2021, more than 90% of participants found HIV self-testing acceptable [15]. Implementing HIV self-testing enhances the efficiency of patient care within healthcare system, leading to improved service delivery [44]. For individuals who are constantly at risk of HIV, HIV self-testing can offer a superior and convenient alternative; it saves time and money compared with visiting a healthcare facility. However, it is essential to note that HIV self-tests may have limitations, as they may not yield accurate results if performed too soon or if the person has different types of HIV antibodies [45].

Between 2005 and 2015, data from the World Health Organization indicated that in Africa, the proportion of people

Table 2. Characteristics of studies included in the systematic review and meta-analysis

First author, year [Ref.]	Location	Sample size	Study design	Population	Results
Before the COVID-19 pandemic					
Katz *et al.*, 2018 [24]	United States	230	RCT	MSM	MSM getting tested for HIV increased by providing them free access to HIV self-testing
Kinney *et al.*, 2015 [33]	North Carolina, USA	178	Cross-sectional	Migrant and seasonal farmworkers	Willingness to use HIV self-testing increased due to knowledge of HIV treatment and condom use
Kalibala *et al.*, 2014 [28]	Kenya	765	RCT	Healthcare workers	Favorable acceptance of HIV self-testing among HCWs (89%)
Qin *et al.*, 2015 [10]	China	1,610	Cross-sectional	MSM	HIV self-testers are more likely to have HIV (7%) than service-based test users (4.9%)
Maheswaran *et al.*, 2018 [21]	Malawi	–	Cohort	HIV-positive individuals	HIV self-testing is cost-effective ($270/ QALY) in populations with high HIV prevalence
Ortblad *et al.*, 2018 [31]	Uganda	104	Cross-sectional	Female sex workers	About 73% of positive HIV self-tests match with guidelines, while about 68% of negative HIV self-tests match with guidelines
Wei *et al.*, 2018 [11]	China	400	Cross-sectional	MSM	People who have taken HIV tests more than 4 times before are more likely to use HIV self-testing before having sex
After the COVID-19 pandemic					
Choko *et al.*, 2019 [22]	Malawi	200	RCT	Pregnant woman	High mean number of HIV self-testing in pregnant women (RR = 1.71, $p < 0.0001$, mean = 73%). Average number of new HIV-positive sexual partners of 1.91 (SD = 1.87) in self-testing group
Carnevale *et al.*, 2020 [12]	China	421	Cross-sectional	HIV-infected patients	Favorable acceptance of HIV self-testing among patients (10-30%). High willingness of young individuals to utilize HIV self-testing (25%)
Ankiersztejn-Bartczak *et al.*, 2020 [7]	Poland	48	Cross-sectional	HIV-infected patients	HIV self-testing is a simple and accessible way for inexperienced clients. Experts are not required for HIV self-testing use
Ejima *et al.*, 2021 [23]	Japan	–	Cross-sectional	Men who have sex with men (MSM) and non-Japanese	It is essential to employ HIV self-tests as a means to gain a deeper understanding of HIV epidemiology
Fistonich *et al.*, 2020 [26]	Columbia	1,245	Cross-sectional	General population	HIV self-tests are favored (60%) due to their ease of use and lower risk of contracting COVID-19. Half of participants experienced their first HIV test through self-testing (45%)
Hecht *et al.*, 2020 [25]	United States	4,904	Cross-sectional	Gay, bisexual, and MSM	The utilization of an HIVST would result in a 10% increase in the population's capacity to receive AIDS screening. The main reasons for choosing HIVST included free distribution (64%), ease of use (63%), and privacy protection (46%)

Table 2. Cont.

First author, year	Location	Sample size	Study design	Population	Results
Hoagland *et al.*, 2020 [17]	Brazil	5,490	Cross-sectional	Gay, bisexual, MSM and transgender/ non-binary (TGNB)	Many people (about 79%) are open to using HIVST. Most patients are willing to receive HIVST kits at home (86%)
Kra *et al.*, 2020 [6]	Senegal, Côte d'Ivoire, Mali	151,067	Secondary	High-risk populations	Using HIVST instead of other types of HIV-tests. HIVST method exhibits a high degree of flexibility. Highest HIVST use in the age group of 25 to 49 years (75%)
Menza *et al.*, 2020 [27]	Oregon	37,081	Cohort	MSM	The utilization of HIVST is simple. HIVST relieves anxiety related to healthcare visits. Protection of individuals' privacy through the implementation of HIVST
O'Byrne *et al.*, 2020 [15]	Canada	637	Cross-sectional	HIV-negative persons	HIVST is helpful for first-time individuals. 75% of those at risk for HIV are interested in HIVST. HIVST is widely accepted by HIV-negative persons (90%)
Kariithi *et al.*, 2020 [29]	Kenya	8,000	Hybrid type 2 implementation science	Males and their female sexual partners	HIVST can help people avoid problems caused by COVID-19
Maatouk *et al.*, 2021 [30]	Lebanon	280	Cross-sectional	MSM	HIVST can eliminate stigma linked with conventional HIV testing. About 64% of HIVST use due to COVID-19's spread, quarantine, and limitations
Muwanguzi *et al.*, 2020 [32]	Uganda	44	Qualitative	Men employed in private security companies	HIVST is helpful in crises and where medical care is scarce
Jiang *et al.*, 2020 [9]	China	683	Cross-sectional	MSM	HIVST has increased by 52.1% during COVID-19. Using HIVST kits has become common during the COVID-19 pandemic
Nyunt *et al.*, 2020 [34]	Myanmar	21,000	Cross-sectional	People living with HIV and key population	HIVST kits are proposed to increase access during the COVID-19 pandemic
Rick *et al.*, 2020 [18]	Brazil	847	Cross-sectional	Male clients	More people are using HIVST because it is faster, they do not need to go to a health center during COVID-19, and it keeps their test results private
Galli *et al.*, 2021 [16]	Canada	900	Cross-sectional	Individuals with unknown HIV status	The self-testing acceptance rate for HIVST is 95%
Rosadiño *et al.*, 2023 [19]	Philippines	20	Qualitative	MSM	The reasons people are more likely to try HIVST include simple use, feeling more comfortable about it, and HIV services becoming more accepted
Luo *et al.*, 2021 [13]	China	2,320,000	Cross-sectional	HIV-infected patients	HIVST kits are proposed to increase access during the COVID-19 pandemic
Shi *et al.*, 2021 [14]	China	436	Cohort	MSM	One problem with HIVST is that people may have their personal information shared when they bring their test results to the clinic for treatment
Eustaquio *et al.*, 2022 [20]	Philippines	768	Retrospective cohort	MSM	Lack of side effects in HIVST. HIVST is a simple and accessible way for inexperienced clients (50%)

HIVST – HIV self-testing, MSM – men who have sex with men, RCT – randomized controlled trial.

diagnosed with HIV who became aware of their condition increased from 10% to 55%. This improvement is attributed to the availability of tests with rapid results as well as more effective methods for managing HIV [46, 47].

Until 2018, many countries were open to adopting HIV self-testing, and some, i.e., Iran, considered the use of oral HIV self-testing. However, the advent of COVID-19 and quarantine measures caused certain high-risk groups, such as men who have sex with men, avoiding facility-based HIV testing due to concerns of contracting COVID-19. They opted for self-testing as a safer alternative [48].

Furthermore, during the COVID-19 pandemic, an increased number of people were able to undergo HIV testing due to the rising popularity of self-tests, with testing rates growing by 10%. HIV self-testing is cost-effective, user-friendly, and ensures privacy, thus valued by people [25]. Nevertheless, insufficient availability of HIV diagnosis services in various geographical regions have been reported. A global scientific study conducted in 2014 across continents, such as Africa, Asia, Europe, and North America, demonstrated positive outcomes from HIV self-testing practices. This approach gained significant recognition among homosexual males, healthcare professionals, and young individuals. Notably, this testing method showed a substantially elevated level of sensitivity (97.1%) and specificity (97.9%) [49, 50]. A 2020 report from Canada revealed that almost every person (95%) agreed with the concept of HIV self-testing [16], and a substantial percentage (86%) preferred to conduct the test in privacy of their homes [17]. The study corroborates these findings, confirming that HIV self-testing has no adverse effects, aligning with a 2013 study conducted by Pai *et al.* [50]. One critical concern of both health authorities and users, is the cost associated with acquiring and implementing HIV self-testing. Estimates suggest that during the COVID-19 pandemic, HIV self-tests for female sex workers, gay men, and drug users costed approximately $13, $15, and $16, respectively. These expenses constitute a significant portion of the cost of HIV self-test program [51, 52].

A study conducted by Jiang *et al.* [9] found that among Chinese gay men who used WeChat, concerns related to COVID-19 and limited access to facility-based testing resulted in a 59.4% decrease in routine HIV testing. However, the overall HIV testing rates did not decline, owing to a 52.1% increase in utilization of HIV self-tests, which became the predominant testing method during the COVID-19 pandemic. Moreover, between 2015 and 2016, findings from four clinical trials conducted across diverse global regions, such as Kenya, China, Australia, and the United States, indicated a growing tendency in the adoption of HIV self-testing among gay men, their sexual partners, pregnant women, and post-delivery women [53-56].

Challenges, which hinder the utilization of facility-based testing include limited awareness about testing facilities, fear of receiving negative feedback from medical practitioners, embarrassment associated with testing, and anxiety about the results, all of which discourage individuals from seeking testing. HIV self-testing is preferred because it offers rapid access to test results, eliminates the need for physical visits to healthcare facilities, especially during the COVID-19 pandemic, and ensures one's privacy throughout the testing process [18].

As of now, the HIV self-testing program has gathered support from 88 nations and is being implemented in 40 different countries, including Australia, Brazil, China, France, Italy, the United States, etc. Additionally, 48 countries have expressed their intentions to launch programs for HIV self-testing, including Iran, Albania, Algeria, Angola, Armenia, Bahamas, Bahrain, Benin, Bolivia, Bulgaria, Cambodia, Cook Islands, Cuba, Dominica, Ethiopia, Fiji, Gabon, Germany, Haiti, Indonesia, Afghanistan, Ireland, Kosovo, Kuwait, Kyrgyzstan, Lithuania, Mali, Mauritius, Mongolia, Myanmar, Namibia, Nepal, Nigeria, Niue, Paraguay, Peru, Philippines, Saudi Arabia, Singapore, Somalia, South Sudan, Sudan, Suriname, Swaziland, Switzerland, Uganda, Uruguay, and Venezuela [57].

Our study have limitations similar to other studies. We conducted a thorough search for articles published in English language. Although this is a limitation of our study, it appears that most of the articles related to HIV self-testing were indeed published in the English language. Therefore, our search coverage was relatively high to some extent. Another limitation of the study is that we only searched four databases, such as OVID, PubMed, ISI, and Scopus. However, it appears that majority of articles related to HIV self-testing have been published in these four databases, hence the study search was fairly comprehensive.

Conclusions

The HIV self-testing program represents a crucial means for individuals to test themselves conveniently and safely for HIV without the need to visit a clinic, particularly during the COVID-19 pandemic. To expand the availability of the HIV self-testing program to more countries, the support of the WHO, Global Fund, and the Unitaid health organizations is essential. It is recommended that all countries should incorporate HIV self-testing as a vital component of their national guidelines. This is especially beneficial for groups with limited access to HIV testing and regions with a higher prevalence of HIV.

Disclosures

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4. Conflicts of interest: None.

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