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"Impact Of COVID-19 On HIV Testing, ART Initiation, And Viral Suppression: A Systematic Review"

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ABSTRACT

This systematic review examines the impact of the COVID-19 pandemic on HIV testing, antiretroviral therapy (ART) initiation, and viral suppression. The pandemic disrupted healthcare systems globally, leading to reduced access to HIV prevention and treatment services, particularly among vulnerable populations such as people living with HIV (PLWH). Lockdowns and resource shifts affected HIV testing, treatment adherence, and care continuity. In Jiangsu province, for example, HIV testing among men who have sex with men (MSM) fell by 59%, and ART initiation dropped by 34%.Using data from the AIDS Healthcare Foundation (AHF) Global Quality Program across 44 countries, researchers compared HIV service indicators from January to August 2020 with the same period in 2019. Despite challenges, many PLWH maintained viral suppression, possibly due to strong treatment adherence, telehealth, and strategies like ART home delivery. However, overall global HIV efforts slowed, and testing declined sharply, with a 37.8% drop in voluntary counseling and testing (VCT) services from 2019 to 2021.While most PLWH who contracted COVID-19 experienced mild to moderate symptoms, the pandemic exposed and deepened health disparities. Key HIV care indicators—such as linkage to care and ART continuity—were preserved in many cases, but ongoing support, targeted strategies, and behavioral research are essential to mitigate long-term impacts and maintain progress in HIV control.

KEY WORDS : HIV,COVID-19,Antiretroviral Therapy (ART),Viral Suppression,HIV Testing, Healthcare Disruption,People Living with HIV (PLWH), Telehealth.

INTRODUCTION

systems both nationally and locally and has highlighted existing inequalities in medicine and public health. When lockdowns were enforced to stop the virus from spreading, many people lost jobs or had fewer working hours. This led to economic hardship and mental health problems, such as increased stress and loneliness. These challenges placed even more pressure on the healthcare system and caused delays in regular preventive health services. COVID-19 especially affected African American, Hispanic, and low-income communities, revealing major health inequalities.For people living with HIV (PWH), staying in regular care is very important because it helps keep the virus under control and leads to better health outcomes. Although the use of telehealth (online medical services) was promoted during the pandemic by programs like the HRSA Ryan White Program, not everyone could benefit—mainly because many people with HIV don't have good access to technology.As a result, COVID-19 made it harder for some people to get their HIV medicine (antiretroviral therapy), and also reduced access to HIV prevention services like testing and pre-exposure prophylaxis (PrEP). Since it first appeared in December 2019, COVID-19 has been a serious global health issue. The pandemic has impacted healthcare, and these setbacks could have long-term effects on the U.S. efforts to end the HIV epidemic. In 2003, the Chinese government introduced the "Four Free, One Care" policy to help reduce HIV stigma and increase awareness.

. This strategy provided:

- Free ART (HIV treatment) for everyone living with HIV
- Free HIV testing and counseling services
- Free help to prevent HIV from being passed from mother to child.
- Free education for children impacted by HIV.
- Financial support for families of people living with HIV

This policy helped reduce the health and financial burden of HIV, increased HIV testing, and improved care for patients. However, new challenges appeared. The number of people diagnosed with HIV was lower than the estimated number of people who were actually infected.Also transmission became the main way HIV , sexspread, especially among high-risk groups like men with who have sex men (MSM), where risky sexual bual was behavior increased. In 2010, the Chinese government introduced the "Five Expands and Six Strengthens" program to tackle ongoing HIV challenges.. This aimed to improve HIV healthcare by expanding education, testing, mother-to-child prevention, treatment coverage, and intervention strategies. It also strengthened systems like blood safety, healthcare services, support for people with HIV, reducing discrimination, leadership, and healthcare workforce development.Local governments expanded HIV testing to all secondary-level hospitals and promoted community-based and self-testing. However, the COVID-19 pandemic disrupted these efforts One study found that HIV testing dropped by 36.7% during the COVID-19 pandemic compared to early 2019.. In Jiangsu province, testing among men who have sex with men (MSM) fell by **59%**, and ART initiation decreased by **34%**.Due to hospital closures and resources being shifted to COVID-19, many people living with HIV (PLWH) faced interruptions in treatment and care for other health issues. Additionally, many suffered from mental health issues like anxiety and

depression.This study looked at how COVID-19 restrictions affected HIV care by comparing the predicted and actual levels of HIV services in Jiangsu province during the first three months of 2020, when strict control measures were in place. To control the spread of COVID-19, governments put strict measures in place, including mass testing, contact tracing, quarantine, handwashing, travel restrictions, school closures, social distancing, and full lockdowns.. While these actions were essential to fight the pandemic, they unintentionally disrupted other public health programs. Many outpatient services were paused or moved online, drug supplies were affected, and labs focused mostly on COVID-19 testing. Healthcare staff were reassigned to COVID duties, and restrictions on travel reduced access to care.

Chronic diseases, including HIV, which causes around 690,000 deaths each year, were heavily impacted. Global HIV efforts slowed down, and funding was reduced. Preventive COVID measures like distancing, closing services, postponing appointments, and job losses led to social isolation, financial stress, and missed HIV treatments.

By 2020, about 37.6 million people worldwide were living with HIV, including 1.3 million adults and 160,000 children who got infected that year. However,:

- 16% didn't know their HIV status,
- 27% couldn't get HIV treatment (ART),
- 34% on treatment didn't achieve viral suppression, and
- Around 19% of patients couldn't get medication refills during the pandemic.

This study aimed to explore how the COVID-19 pandemic affected HIV services and treatment results.

METHODS

In this study, researchers used data from the AHF Global Quality Program to look at the impact of COVID-19. They compared data from January 1 to August 31, 2020, with the same period in 2019. The AIDS Healthcare Foundation (AHF) works in 44 countries with high HIV rates across Africa, Latin America, the Caribbean, Asia, and Europe. AHF primarily supports government-run HIV care and treatment centers (664 total) and also operates 33 of its own facilities. Out of these, 522 offer HIV testing, and AHF supports an additional 437 testing sites, including partner programs, community testing, walk-in sites, hotspot testing (421 sites), and 26 stand-alone rapid testing programs. Data from all 949 testing sites are reported monthly to the AHF Global Quality Program.In this study, researchers looked at several key indicators:

- The number of HIV tests
- The percentage of positive tests (overall and by vulnerable groups)
- The number of in-person clinic visits
- The number of new people enrolled in HIV care

Although the data was first collected by country, the researchers grouped the results by continent to better show the overall impact of COVID-19.They used basic statistics (like totals and percentages) to compare the data from 2019 and 2020. The change (increase or decrease) was calculated by taking the difference

between the two years and dividing it by the 2019 value. A 95% confidence interval (CI) was also calculated using Stata software (version 15.1).

To understand whether COVID-19 affected certain high-risk groups more, separate analyses were done for:

- Men who have sex with men (MSM)
- Transgender people
- Migrants
- Sex workers
- People who inject drugs (PWID)
- Prison inmates

DATA EXTRACTION

Data for the review was collected independently by four researchers, working in pairs (DM, OO, BD, or SES). They used a survey form created in Google Forms, which had been tested earlier by the research team to ensure it worked well. If there were any disagreements between the reviewers while collecting the data, they discussed them together until they reached an agreement.The information collected included details such as the type of study, the main outcomes, where the study took place, a description of the participants, the measures used, and the time period of data collection. It also included data related to HIV care, like how well people stayed connected to services, how regularly they took their medication, and whether their viral load was suppressed. In addition, the team gathered information about how HIV healthcare systems adapted during the COVID-19 pandemic to manage new challenges.After gathering the data, the studies were grouped based on the CDC's HIV surveillance regions and by specific characteristics of the study populations (such as people with low incomes, older adults, etc.) to help compare how COVID-19 affected different groups.

COVID-19 and HIV: Pathophysiology and Immune Response

COVID-19 (caused by SARS-CoV-2) is a type of beta coronavirus made up of four main structural proteins: Spike (S), Membrane (M), Envelope (E), and Nucleocapsid (N). Its life cycle includes five stages: attachment, entry, replication, assembly, and release. The virus enters human cells by attaching to the ACE2 receptor, which is found in organs like the lungs, heart, intestines, kidneys, and bladder.

Interestingly, although many COVID-19 patients experience loss of smell (anosmia), ACE2 receptors are not present in the neurons responsible for smell. This suggests that non-neuronal cells might be responsible for this symptom.

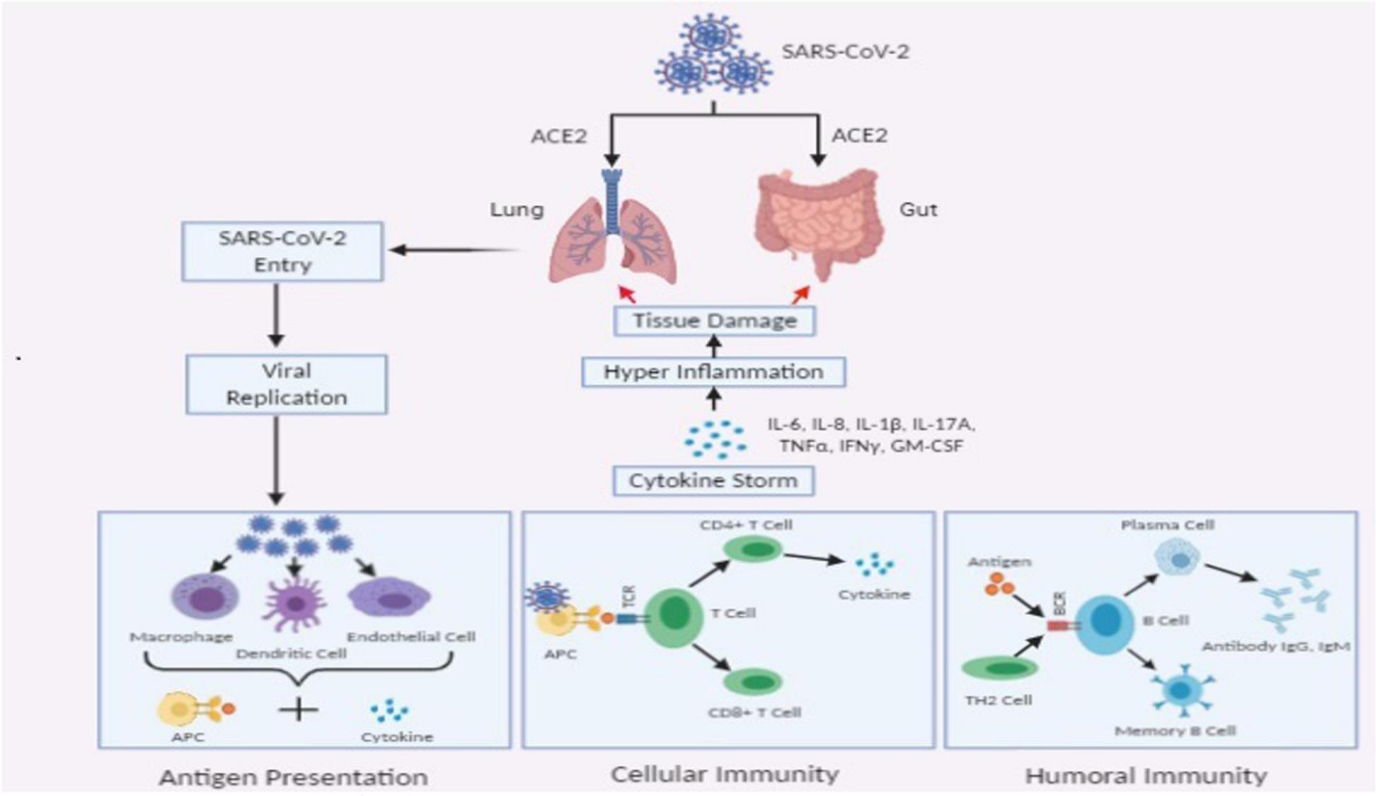
Once inside the body, the virus infects the upper respiratory tract and then spreads to the lower airways, affecting bronchial and lung cells and immune cells like alveolar macrophages. The body's natural immune system reacts, and infected cells are eliminated.Antigen-presenting cells like dendritic cells carry viral pieces to lymph nodes, where T cells are activated.

In severe COVID-19 cases, lung damage such as inflammation, fluid buildup, and acute respiratory distress syndrome (ARDS) may occur.

How HIV Works (Compared to COVID-19)

HIV targets the CD4 receptor on immune cells, and also uses CCR5 or CXCR4 co-receptors to enter. HIV causes damage in two main ways:

1. Directly, by killing infected cells.
2. Indirectly, by triggering an overactive immune response and causing damage to the gut, leading to chronic inflammation, immune dysfunction, and CD4 cell loss.



Effect of Antiretroviral HIV Medication in Patients with Both HIV and COVID-19

The spike (S) protein of the coronavirus (SARS-CoV-2) helps the virus enter human cells by attaching to the ACE2 receptor. However, before it can fuse with the cell membrane, the S protein must be activated by enzymes in the host, like

TMPRSS2 or cathepsin B/L**.** Because of this**,** protease inhibitors (a class of HIV drugs) have been explored as possible treatments for COVID-19.

One such drug combination, lopinavir/ritonavir (LPV/r)—commonly used in HIV treatment—showed some benefit in animal studies for MERS (a related coronavirus). Lab studies also suggested LPV/r has some effect against SARS-CoV-2, though only at high doses.

However, clinical studies in humans did not show clear benefit**:**

- Observational studies and reports had mixed or inconclusive results.
- A large randomized trial found no significant difference in recovery or death rates between patients treated with LPV/r and those who received standard care.
- Some patients even had to stop LPV/r early due to side effects.

Major global studies like RECOVERY and SOLIDARITY also confirmed that LPV/r did not help treat COVID-19.

Another HIV drug, darunavir**,** was also tested. Lab studies showed it had no activity against the virus, and people living with HIV who were taking darunavir still got COVID-19, so it didn't offer protection.

On the other hand, tenofovir, another HIV medication, showed potential antiviral activity against SARS-CoV-2 in lab and computer-based studies. This has led scientists to **s**peculate that HIV treatments containing tenofovir disoproxil fumarate (TDF) or tenofovir alafenamide (TAF) might offer some protection, but more research is needed to confirm this.

COVID-19 in People Living with HIV (PLWH): Symptoms and Effects

While there are many large studies on how COVID-19 affects the general population, there are fewer studies focused specifically on people who have both HIV and COVID-19. This section summarizes data from different reports, case studies, and research on PLWH who also got COVID-19.

- Most PLWH with COVID-19 were men aged 40–61, which is similar to the general population.
- The majority of these individuals were already receiving antiretroviral therapy (ART) and had their HIV well controlled**.**
- COVID-19 infection rates among PLWH vary by country. For example:
  - USA: 0.8%
  - Spain: 1.8%
  - China: 0.68%

Note: These numbers may be higher than in the general population because PLWH are tested more often due to being considered high-risk.

- Many of these patients also had other health problems like:
  - High blood pressure (hypertension)
  - Diabetes
  - Kidney disease

These symptoms are similar to those in people without HIV**.**

Mortality and Severity

- Generally, people with weakened immune systems (such as cancer or organ transplant patients) are at a higher risk of severe outcomes or death from COVID-19.There was concern that PLWH might also have more severe COVID-19, but most were already on ART, had low viral loads, and CD4 counts above 350**.**
- Studies found no strong link between low CD4 counts and higher death rates from COVID-19.
- People with CD4 counts below or above 200 had similar outcomes.

Final Summary

- Most people living with HIV (PLWH) who contracted COVID-19 experienced mild to moderate symptoms.
- A few studies did report more severe disease and higher death rates, but this was mainly among people with other health issues or older age.
- Risk factors for severe COVID-19 in PLWH are similar to the general population**:** age and other chronic conditions**.**

DISCUSSION

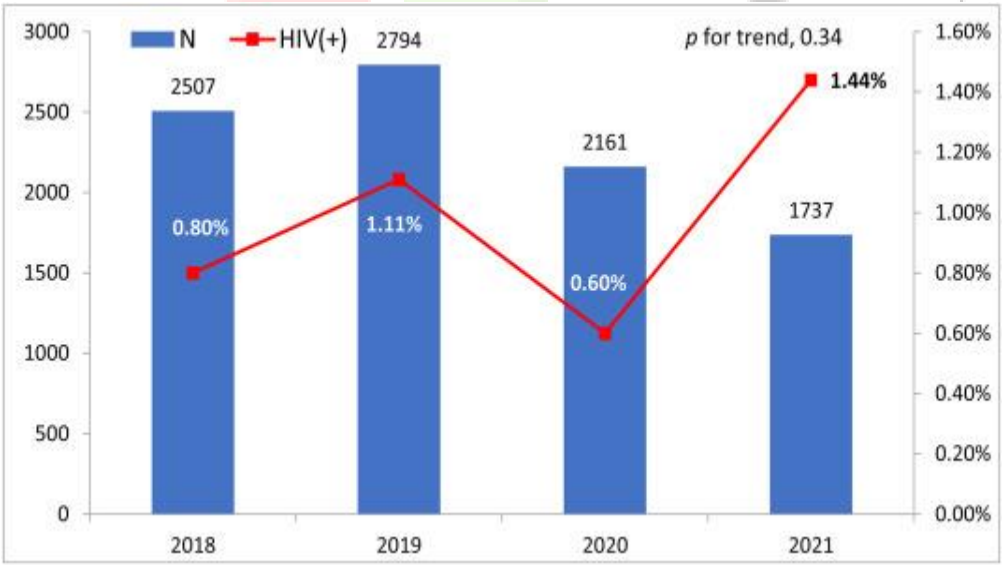
Our study looked at how COVID-19 restrictions affected the quality of HIV care at our hospital. We found that even though the number of viral load tests dropped during the strictest lockdown periods, the percentage of patients with undetectable viral loads stayed consistent. This suggests that many people living with HIV (PLWH) maintained good treatment outcomes, possibly due to their strong commitment to medication and care, even though we didn't directly measure behavior changes.We also observed that the number of patients taking their medications, the number of hospital admissions, and deaths among PLWH were not negatively impacted by the lockdowns or other COVID-19 control measures. These results are in line with similar findings from other countries like Spain, the U.S., Peru, and Uganda.This indicates that the strategies used during the pandemic helped protect people with chronic illnesses like HIV. It highlights how specific healthcare practices, such as those used at our hospital, may have helped ensure patients continued receiving care despite disruptions in the broader health system.To guide HIV care during the pandemic, we relied on the HIV Care Continuum (HCC), a model outlining the five key stages of care: diagnosis, linkage to care, retention in care, adherence to antiretroviral therapy (ART), and viral suppression. Due to restrictions and fewer in-person visits, some steps—like HIV testing, linking newly diagnosed patients to care, and keeping patients engaged in care—were more difficult.Although our hospital's "first visit" clinic stayed open for new patients, many community organizations had to scale back their outreach activities due to lockdowns. In some areas, such as Ottawa, Canada, self-testing kits were made available in pharmacies to keep testing accessible.For people already diagnosed with HIV, lockdowns may have made it harder to stay on treatment. To address this, we launched an ART home delivery program managed by the hospital pharmacy. This helped reduce concerns about hospital visits and allowed patients to avoid crowded spaces while still getting their medications. As a result, there were no major differences in ART access before and during the pandemic.Other hospitals also adopted similar methods to care for PLWH, including expanded use of telemedicine and outpatient medication pickup. However, few studies have actually compared viral suppression rates before and during the pandemic. Our research contributes to this gap by showing that viral suppression remained strong, thanks to consistent treatment delivery and patient support.Overall, our results suggest that HIV patients continued achieving good treatment outcomes during the pandemic. Factors like more effective ART options, increased awareness of medication adherence, and implementation of the HCC model likely helped. Ongoing support for ART access and adherence will be crucial for maintaining these results.\Home delivery of ART also reduced hospital crowding and supported continuous care. Looking ahead, future research should explore how PLWH adjusted their behaviors during the pandemic and how those changes affected treatment outcomes. This

includes studying medication adherence, healthcare usage, and preventive behaviors.Understanding these behavioral and emotional factors can help health professionals and policymakers develop more effective, patient-centered strategies that support long-term viral suppression.Finally, we did not observe an increase in hospitalizations or deaths due to COVID-19 among PLWH, in line with other studies. However, overall deaths among PLWH have risen in the pandemic and post-pandemic periods, mostly due to other illnesses unrelated to AIDS. This may reflect the fact that the rate of people with undetectable viral loads has stayed the same over time.In conclusion, people with chronic diseases like HIV rely on regular medical follow-ups to manage their health. The pandemic disrupted this care for many, but the strategies we adopted—such as continuing new patient visits, delivering ART to homes, and starting treatment quickly—helped us maintain strong care outcomes. These practices supported adherence and reduced COVID-19 risks. While our findings are encouraging, it remains important to monitor patients closely in the coming years and continue adapting care to respond to changing public health needs.

Results

Trends in HIV Testing at VCT Services

The number of HIV tests conducted at Voluntary Counseling and Testing (VCT) services dropped noticeably over the four-year period. In 2018 and 2019, there were 2,507 and 2,794 tests done, respectively. But this number fell to 2,161 in 2020 and further to 1,737 in 2021 — a 37.8% decrease from 2019 to 2021.Despite this drop in testing, the percentage of people who tested positive for HIV stayed relatively steady. It was 0.8% (20 people) in 2018, 1.1% (31 people) in 2019, 0.6% (13 people) in 2020, and 1.4% (25 people) in 2021. The trend was not statistically significant (P = 0.34).The percentage of people who tested positive and were successfully linked to HIV care was high throughout the years: 85.0% in 2018 (17 out of 20), 93.5% in 2019 (29 out of 31), 100% in 2020 (13 out of 13), and 96.0% in 2021 (24 out of 25).



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