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Impact of COVID-19 on the Management of People Living with HIV: A Systematic Review

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ABSTRACT

Introduction: The COVID-19 pandemic and associated containment measures have raised concerns about their impact on healthcare systems beyond direct virus-related issues. Among these concerns is the potential disruption of HIV services. The objective of this study was to systematically assess the effect of the COVID-19 pandemic on service delivery and treatment outcomes in people living with HIV (PLHIV).
Methods: A systematic search was conducted across online databases, including Scopus, PubMed, Web of Science, and Cochrane, using relevant keywords. The search strategy adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist to ensure comprehensiveness and transparency and the Joanna Briggs Institute (JBI) critical appraisal tools to assess the methodological quality of a study and to determine the extent to which a study has addressed the possibility of bias in the design, conduct and analysis.
Results: Our investigation revealed that studies primarily concentrated on HIV-positive patients, HIV clinics, and healthcare providers. These studies explored various facets of HIV care during the pandemic, including medication adherence and clinical appointment attendance. While most studies highlighted declines in adherence to treatment and attendance at clinical appointments, other aspects of HIV care received less attention.
Conclusion: The COVID-19 pandemic resulted in interruptions in in-person visits, reduced treatment adherence, and increased mortality among PLHIV due to pandemic-related complications. Additionally, challenges such as psychological disorders, substance abuse, and stigma were exacerbated.

Keywords: COVID-19, SARS-CoV-2, Treatment outcomes, PLHIV, HIV/AIDS

INTRODUCTION

The emergence of the novel coronavirus disease 2019 (COVID-19), caused by the SARS-CoV-2 virus, has had a profound impact on global healthcare systems and individual health outcomes, disrupting essential medical services and presenting unique challenges for various patient populations (Zhu *et al.,* 2020). People living with HIV (PLHIV) constitute a vulnerable group with an increased potential

for severe illness and complications from COVID-19 due to their compromised immune function associated with HIV infection (World Health Organisation, 2020).

Non-communicable diseases, also known as chronic diseases, are a major global health concern, accounting for approximately 71% of all deaths worldwide (World Health Organisation, 2020). HIV/AIDS remains a significant public health issue, with an estimated 690,000 deaths annually (UNAIDS, 2021). The COVID-19 pandemic has impacted global health efforts, including HIV services, due to disruptions and resource challenges.

Social distancing measures, closures of social services, and job losses associated with the COVID-19 pandemic have further exacerbated the challenges faced by PLHIV (World Health Organisation, 2020). These factors contribute to social isolation, financial strain, and potential discontinuation of antiretroviral therapy (ART) medications, a critical component of HIV management that suppresses viral replication (UNAIDS, 2021).

As of 2020, an estimated 37.6 million people worldwide were living with HIV, with 1.3 million new adult infections and 160,000 new infections in children identified that year alone (World Health Organisation, 2020). Despite progress in HIV treatment, significant gaps remain. In 2020, approximately 16% of PLHIV were unaware of their status, 27% lacked access to ART, and 34% on ART did not achieve viral suppression, indicating continued viral replication (UNAIDS, 2021).

Modelling studies have highlighted the potential for disruptions in ART programs due to COVID-19 to have a dramatic impact on HIV mortality (Theunissen *et al.,* 2020). Given these concerning trends, this systematic review aims to comprehensively evaluate the impact of the COVID-19 pandemic on service delivery and treatment outcomes in PLHIV.

MATERIALS & METHODS

The authors tried to investigate the impacts of the COVID-19 pandemic on service delivery and treatment outcomes in people living with HIV. This study adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) to ensure the reliability and validity of the study results. Additionally, we utilised the Joanna Briggs Institute (JBI) critical appraisal tools to assess the trustworthiness, relevance, and results of the included studies.

Eligibility Criteria

Empirical studies, including any study design (i.e., case report, case series, cross-sectional, case-control, cohort, and clinical trial) that reported individual- or aggregate-level data on COVID-19 among PLHIV were considered for this review. Studies that included a mixed sample of HIV-positive and HIV-negative COVID-19 patients were only considered if subgroup analyses for PLHIV were reported or could be extracted.

Search Strategy

A systematic literature search was conducted across Scopus, PubMed, Web of Science, and Cochrane databases. The aim was to identify studies focusing on HIV-positive patients and the clinical implications of HIV infection in the context of COVID-19. This search adhered to the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines for transparent reporting and utilised the Joanna Briggs Institute (JBI) critical appraisal tools to assess the methodological quality of the included articles. Our search strategy employed multiple combinations of keywords, as follows:

A: (services) (Title/Abstract) OR (outcomes) (Title/Abstract) OR (follow-up) (Title/Abstract).

B: (HIV) (Title/Abstract) OR (AIDS) (Title/Abstract) OR (Human Immunodeficiency Virus) (Title/Abstract),

(Acquired Immuno Deficiency Syndrome) (Title/Abstract).
C: (Covid-19) (Title/Abstract) OR (SARS-COV-2) (Title/Abstract) OR (Coronavirus) (Title/Abstract).

Study Selection
The selection of the studies was performed by assessing relevance based on the titles and abstracts by three independent investigators. The full texts were reviewed and assessed against the eligibility criteria. The English-written peer-reviewed original papers published were included.

The exclusion criteria:
- Non-human study papers including animal experiments, in vitro observations, and papers with no reference to the keywords of this review.
- Papers with unavailable full texts.
- Any duplicated and suspicious outcomes in databases.
- Review articles, editorials, commentaries, opinions, or any studies with no original data
- Ongoing projects (e.g., articles discussing the protocol of a future study)
- Non-English articles
- Papers with a lack of experimental data

Data Extraction
We employed data extraction forms to condense pertinent details, such contained the following sections, to capture relevant information from the studies on how COVID-19 impacted people living with HIV (PLHIV):

Basic Information
- **Authorship:** List of the study's authors
- **Publication Year:** Year the study was published
- **Country of Origin:** Where the study was conducted

Study Population Characteristics
Age: Age range or average age of participants
Gender: Breakdown of participants by gender (male, female, non-binary, etc., if specified)

Focus of the Study on PLHIV Challenges
- HIV-related Healthcare Services: Issues related to access to antiretroviral therapy (ART), clinic visits, or other HIV-specific care during the pandemic.
- General Healthcare Services: Difficulties in accessing general healthcare services due to COVID-19.
- Additional Challenges: This section captures specific reasons outlined in the studies, such as mental health issues, social stigma, substance use, or any other challenges faced by PLHIV due to the pandemic.

This approach facilitated a comprehensive understanding of challenges faced by PLHIV during the pandemic, encompassing both HIV-related and general healthcare services crucial for PLHIV. Two separate investigators independently conducted the data extraction process. The extracted information was then utilised in constructing the results section of our study.

Quality assessment
To ensure the quality and reliability of the selected articles, we adhered to the PRISMA checklist throughout the review process. Additionally, we utilised the Joanna Briggs Institute (JBI) critical appraisal tools to assess the trustworthiness, relevance, and results of the included studies. These tools provided a structured approach to evaluate methodological quality and potential biases.
Two independent researchers conducted a detailed quality assessment of each article, including evaluating the risk of bias using the JBI criteria. In cases of disagreement, a third independent researcher was consulted to resolve discrepancies through discussion and consensus. The full texts of the selected

articles were thoroughly reviewed, and the main findings were systematically extracted to ensure accuracy and reliability.

Data Synthesis

The studies identified did not provide sufficient data to support a quantitative synthesis (meta-analysis). Instead, a qualitative synthesis was carried out to summarise the findings. Key themes and patterns emerging from the included studies were systematically analysed and grouped based on their relevance to the impact of COVID-19 on the management of people living with HIV.

This approach allowed for a detailed narrative review, highlighting variations in healthcare access, disruptions to antiretroviral therapy (ART) services, and the psychosocial challenges experienced during the COVID-19 pandemic. The synthesis also incorporated factors influencing the continuity of care and identified gaps in service delivery. Findings were presented in a structured manner to ensure clarity and coherence, facilitating meaningful interpretations.

RESULTS

Our initial search of online databases retrieved 526 records and 3 additional records from other sources. There were 203 duplicate records, resulting in the remainder of 326 records for the subsequent steps. A total of 114 articles entered the full-text screening step, and 14 eligible records were ultimately selected for data extraction. The PRISMA Flow Diagram (Fig. 1) illustrates the details of our selection process (SeyedAhmad *et al.*, 2023).

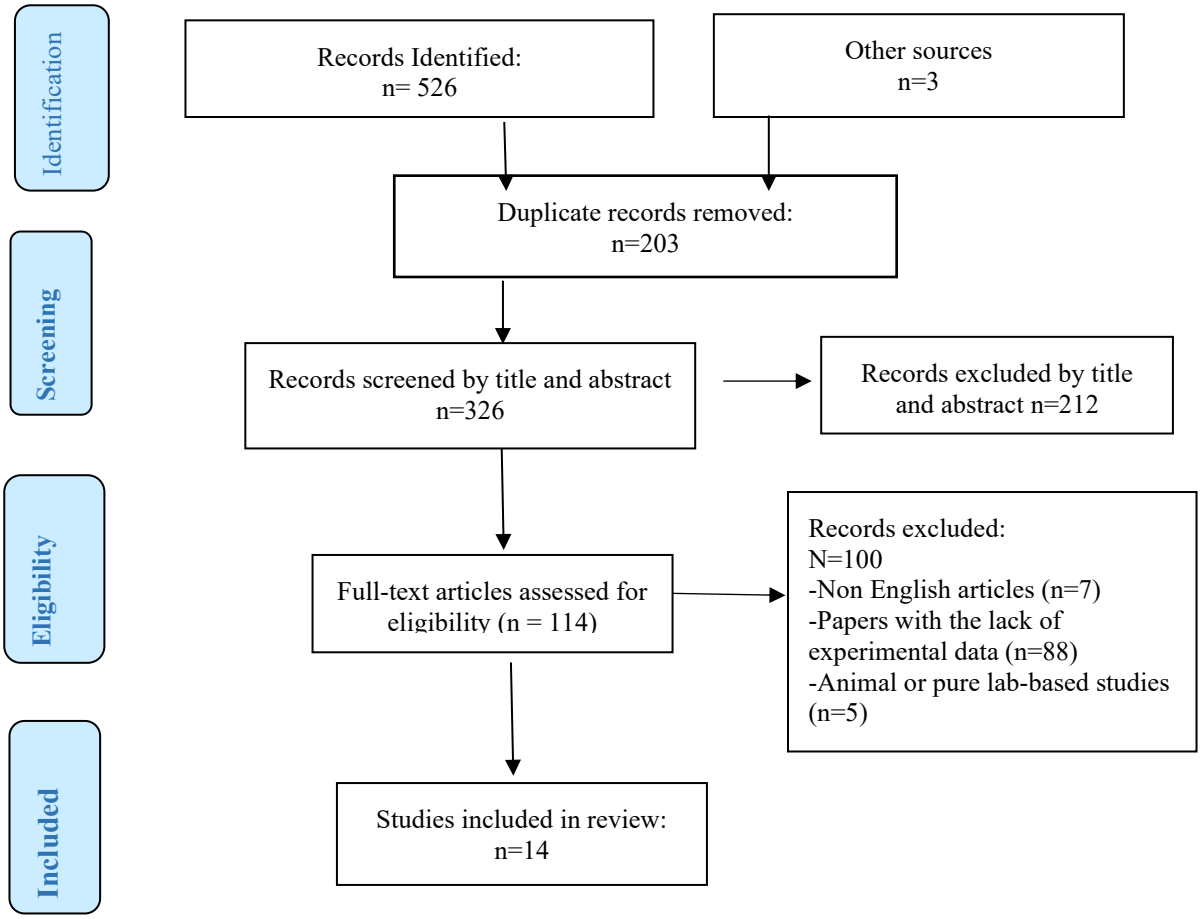

Figure 1: PRISMA Flow diagram

The research was categorised according to the demographics of the study participants. Specifically, two investigations centered on healthcare providers, involving 1029 HIV healthcare providers in China, while another focused on HIV clinics, encompassing 27 clinics in the USA. The remaining 13 studies focused on more than 21,000 HIV-positive individuals across 10 countries, with the USA being the most prominent (n = 4), followed by Italy (n = 2), and single studies conducted in Argentina, Uganda, Pakistan, South Africa, Ethiopia, Indonesia, Belgium, and Brazil. Notably, Fodjo *et al.* (2021) conducted a cross-sectional online survey that drew respondents from 26 countries, with a significant proportion originating from Belgium and Brazil. Across the majority of these studies, researchers assessed variables of interest, such as adherence to antiretroviral medications, heightened levels of anxiety, depression, and other mental health issues, by examining the frequency of healthcare service utilisation and the incidence of missed medication doses or medical appointments through the use of questionnaires and patients' medical records.

HIV-directed care challenges

In this analysis, 11 out of 13 studies focusing on PLHIV, along with one of the two studies involving healthcare providers, documented a decline (whether statistically significant or not) in the receipt or adherence to ART medications, primarily attributed to pandemic-related circumstances (Adugna *et al.* (2021), Ballivian *et al.* (2020), Campbell *et al.* (2022), Chilot *et al.* (2021), Fodjo *et al.* (2021), Guo *et al.* (2020), Medina *et al.* (2021), Mehraeen *et al.* (2022), Moitra *et al.* (2022) and Mukwenha *et al.* (2020)).

Medication Adherence

Among studies involving PLHIV, notable alterations in ART uptake were observed: a 33.7% rate of less-than-excellent and 1.7% under-average adherence to antiretroviral medications (Fodjo *et al.,* 2021); a 7% increase (from 5 to 12%) in the rate of non-adherence to HIV medications (Mehraeen *et al.,* 2022); a 23.1% decrease in obtaining antiretroviral medication (Quiros *et al.,* 2020); an 8.2% rate of missing one dose of ART medication and 13.2% avoidance of ART uptake (Tamargo *et al.,* 2021); a 5% to 26% increase in the chance of ART supply failure (Wagner *et al.,* 2021); a 36% temporary non-adherence due to inadequate ART supply (Ahmed *et al.,* 2022); a 13.25% rate of running out of ART medication during the pandemic (Nyashanu *et al.,* 2021); a 27.4% rate of missing visits for antiretroviral stock refill (Karjadi *et al.,* 2021); a 3% decrease in ART uptake (Musuka *et al.,* 2022); a 24.0% rate of missing at least one dose of HIV medications (Rhodes *et al.,* 2021); and a 3.6% rate of ART refill failure (Fodjo *et al.,* 2021). Additionally, one study conducted among providers reported a 67.25% rate of ART-application-service suspension or postponement due to the COVID-19 pandemic (Shi *et al.,* 2021).

In our systematic review, nearly all studies documented a decline in ART supply and uptake during the pandemic (Ahmed *et al.,* 2022; Fodjo *et al.,* 2021; Karjadi *et al.,* 2021; Mehraeen *et al.,* 2022; Musuka *et al.,* 2022; Nyashanu *et al.,* 2021; Quiros Roldan *et al.,* 2020; Rhodes *et al.,* 2021; Shi *et al.,* 2021; Tamargo *et al.,* 2021; Wagner *et al.,* 2021); however, in some instances, these changes significantly affected ART adherence. Notably, age ≥ 55, fear of COVID-19, transport disruption, reduced income, unaffordable travel to healthcare facilities, limited access to face masks, and lack of non-medical support were identified as predictive factors for missing ART stock refill (Karjadi *et al.,* 2021). Another study identified healthcare accessibility disruption, missed clinical appointments, post-traumatic stress disorder (PTSD), and younger age as associated factors for missed ART medication doses (Rhodes *et al.,* 2021). These factors were largely

consistent with the main reasons cited by the WHO, including inadequate ART supply, diverted healthcare workers to COVID-19 management, transportation lockdowns, and pharmaceutical company shutdowns (World Health Organization, 2020). Similarly, studies among healthcare providers highlighted ART application service suspension or postponement due to COVID-19 restrictions or short supplies (Shi *et al.,* 2021). In Northwest Ethiopia, a substantial decline in ART services between 2019 and 2020 was noted due to a national lockdown (Adugna *et al.,* 2021). Furthermore, studies in China reported difficulties with refilling ART stocks due to lockdowns (Guo *et al.,* 2020; Mukwenha *et al.,* 2020), with some PLHIV reporting ART interruptions or shortages (Guo *et al.,* 2020). Challenges faced by ART-producing pharmaceuticals during the pandemic, such as international shipping problems, transportation delays, increased lead times, and rising costs, also contributed to global ART disruptions (Rewari *et al.,* 2020). Predictive factors for low ART adherence among PLHIV included social stigma or discrimination, missed clinical visits, tuberculosis therapy, CD4 cell count < 500 cells/mm3, and being in WHO-HIV clinical stage III at ART initiation (Adugna *et al.,* 2021). In Zimbabwe, women on ART encountered difficulties accessing medication during the COVID-19 lockdown, attributed to transportation challenges, COVID-19 restrictions, police abuse, medication supply shortages, clinical check-up disruptions, involuntary ART non-adherence, and personal protective equipment (PPE) shortages (Nyashanu *et al.,* 2021). In China, a survey reported that a significant proportion of PLHIV did not have enough ART to meet their needs (Guo *et al.,* 2020). Additionally, a study assessing the impacts of the pandemic reported a considerable rate of major depressive and anxiety disorders among PLHIV (SeyedAlinaghi *et al.,* 2023).

Clinical Appointments

The overwhelming consensus across studies highlighted significant challenges with clinical appointments and HIV follow-up sessions during the pandemic. Out of the studies reviewed, twelve consistently reported adverse impacts on clinical appointments among PLHIV (Ahmed *et al.* (2022), Fodjo *et al.* (2021), Guo *et al.* (2020), Karjadi *et al.* (2021), Mehraeen *et al.* (2022), , Mukwenha *et al.* (2020), Musuka *et al.* (2022), Nyashanu *et al.* (2021), Rhodes *et al.* (2021), Tamargo *et al.* (2021) and Wagner *et al.* (2021), however, two studies observed an increase in visit percentages (Oyelade *et al.,* 2022; Quiros *et al.,* 2020). Many patients encountered difficulties attending their HIV clinical visits, recovery support meetings, follow-up tests, and counselling sessions. The primary causes contributing to this decline in clinical appointments included inadequate transportation, instances of police abuse, limited transportation funds to mitigate COVID-19 exposure (Ahmed *et al.,* 2022), lockdown measures (Nyashanu *et al.,* 2021), restricted access to healthcare services, decreased income, challenges affording transportation to health facilities, unavailability of face masks, fear of contracting COVID-19 (Karjadi *et al.,* 2021), and apprehension about visiting hospitals (Rhodes *et al.,* 2021).

Similarly, two studies among healthcare providers underscored disruptions in HIV services during the pandemic. Shi *et al.* (2021) reported a 22.0% complete disruption, 15.4% moderate disruption, and 21.9% minor disruption in HIV services, while Oyelade *et al.* (2022) documented interruptions in 11.1% minimal, 56% partial, and 26% complete interruptions among HIV clinics

Healthcare Provision

Ensuring access to healthcare services for PLHIV is paramount for maintaining viral suppression, reducing HIV transmission,

enhancing clinical outcomes, and extending lifespan (Mehraeen *et al.,* 2022). However, the COVID-19 pandemic has imposed significant restrictions, placing many PLHIV at risk of missing crucial clinical follow-ups and healthcare provisions, potentially leading to interruptions in ART (Fodjo *et al.*, 2021). Several studies included in this review underscored disruptions in both HIV-specific and general healthcare services, including missed HIV clinical visits (Ahmed *et al.,* 2022; Fodjo *et al.,* 2021; Karjadi *et al.,* 2021; Nyashanu *et al.,* 2021; Oyelade *et al.,* 2022, Rhodes *et al.,* 2021; Shi *et al.,* 2021; Tamargo *et al.,* 2021; Wagner *et al.,* 2021; fear of hospital visits (Rhodes *et al.,* 2021), and interruptions in HIV clinics due to nationwide restrictions and healthcare diversion (Oyelade *et al.,* 2022; Shi *et al.,* 2021). For instance, a study conducted in Northwest Ethiopia revealed a significant decrease in HIV services, including voluntary counselling and testing (VCT) and Provider-Initiated HIV Testing & Counselling (PITC) in 2020 compared to 2019 (Mehraeen *et al.,* 2022). Similarly, in Tigray, Northern Ethiopia, another study reported a substantial decline in HIV early diagnosis and detection, ART enrollment care, and general HIV care (Ahmed *et al.,* 2022). Furthermore, a study from China highlighted a significant reduction in HIV testing rates and new HIV diagnoses during the initial months of COVID-19 restrictions, underscoring the adverse impact on HIV diagnosis and treatment (Tamargo *et al.,* 2021). Lower access to HIV clinical services, as reported in these studies, could result in increased HIV transmission, higher rates of opportunistic infections, lower CD4 cell counts, and decreased viral suppression (Wagner *et al.,* 2021). Therefore, engagement between healthcare providers and PLHIV is critical to maintaining their clinical status and mitigating HIV transmission, aligning with the UNAIDS 90–90-90 policy (Fodjo *et al.,* 2021). While some studies reported an increase in telehealth utilisation as a means of avoiding COVID-19 exposure (Fodjo *et al.,* 2021; Tamargo *et al.,* 2021), others noted challenges with telemedicine adoption (Mehraeen *et al.,* 2022). Additionally, several studies highlighted decreases or avoidance of general healthcare services during the pandemic (Ahmed *et al.,* 2022; Oyelade *et al.,* 2022; Wagner *et al.,* 2021). Two studies among healthcare providers further emphasised the suspension or postponement of services at HIV clinics, including voluntary counselling, testing services, follow-up services, home visits, support groups, and walk-in services, underscoring the broader impact on healthcare delivery systems (Oyelade *et al.,* 2022; Shi *et al.,* 2021).

Viral Suppression

Interestingly, only two studies included in our review reported alterations in viral suppression during the pandemic, and both studies observed an increase rather than a decrease (Alqahtani *et al.*, 2022). However, it is important to note that the available data may not be sufficient to conclusively determine that there was no negative impact on viral suppression among people living with HIV during the pandemic. For a comprehensive overview of the findings from all included studies and demographic information, please refer to Table 1.

Table 1: Included studies' summary of findings

Study info						**Demographics**					
ID	**Author**	**Year**	**Country**	**Study type**	**Study population (N)**	**Age**	**%Male**	**Ethnicity**	**Education**	**Employment**	**COVID-19 infection**
1	Ballivian *et al.*	2020	Argentina	Quantitative Survey	1336 HIV +	45.83 ± 10.34	66.8	NA	NA	NA	NA
2	Giacomelli *et al.*	2021	Italy	Retrospective study (before and after quasi experimental design)	NA	NA	NA	NA	NA	NA	NA
3	Hochstatter *et al.*	2021	USA	Quasi-experimental (time-series design)	60 HIV +	49 (Mean age)	75	White, Black/African American, Mixed, Hispanic/Latino	NA	Employed (39%)	NA
4	Quiros-Roldan *et al.*	2020	Italy	Retrospective Observational Study	3875 HIV +	51.4 ± 13	72	Non-Italian	NA	NA	Hospitalized (48%)
5	Ridgway *et al.*	2020	USA	NA	98 HIV +	NA	NA	African American	NA	NA	COVID + (14.5 %), Hospitalized (75%)
6	Tamargo *et al.*	2021	USA	Quantitative Survey	183 HIV +	56.5 ± 6.5	50.3	Non-Hispanic Black	NA	Unemployed (86.9%), Employed but on leave/had reduced hours (6.6%), Employed with no change (6.6%)	COVID + (7.6%), Hospitalized (0.6%)

7	Wagner *et al.*	2021	Uganda	Observational Cohort Study	14,632 HIV +	38.7 ± 0.11	34	NA	NA	NA	NA
8	Ahmed *et al.*	2022	Pakistan	Semi-structured interviews	25 HIV +	41	68	NA	No education (56%)	Unemployed (72%)	NA
9	Campbell *et al.*	2021	South Africa	Cluster randomised control trial	83 HIV +	31	29	NA	Secondary (38.55%), Diploma (2.41%)	NA	NA
10	Chilot *et al.*	2021	Ethiopia	Cross-Sectional Study	212 HIV +	48.6% in the age group 35–54 years	37.3	NA	No education (21.7%), Can read and write (14.2%), Primary education (27.8%), Secondary education (20.8%), Diploma and above (15.6%)	NA	NA
11	Karjadi *et al.*	2021	Indonesia	Cross-Sectional Study	545 HIV +	66.5% in age group 36–55 years	72.8	NA	High-school graduate (49.5%)	NA	NA
12	Nguyen *et al.*	2021	USA	Cross-sectional surveys	100 HIV +	64.2	96	NA	College education or higher (93.9%)	NA	NA
13	Rhodes *et al.*	2020	South of USA	Qualitative study	15 HIV + cisgender men	28	100	Black/African American (50%), Latina (33%), White (27%)	NA	NA	NA
14	Fodjo *et al.*	2021	26 countries,	Cross-sectional	247 HIV +	44.5 ± 13.2	73.7	NA	Primary (7.7%),	NA	COVID + (15.3 %)

			with a majority of respondents residing in Brazil (n = 83) and Belgium (n = 82)	online survey					Secondary (29.6%), Undergraduate (30.4%), post-graduate (32.4%)		

Non-HIV Directed Care Challenges

Among the studies included in our review, three studies highlighted an increase in depression, anxiety, and other mental health disorders among PLHIV (Hickey *et al.,* 2021; Izzo *et al.,* 2021; Fodjo *et al.,* 2021), while two studies reported interruptions in therapeutic services provided to HIV-positive patients during the pandemic (Melamed *et al.,* 2020; Yuvaraj *et al.,* 2020). Additionally, one study identified alcohol and substance abuse as a disruption in substance abuse care services (Fodjo *et al.,* 2021), while two studies documented an increased use of recreational drugs among PLHIV. However, it's worth noting that one study reported the opposite trend. Moreover, people living with HIV encountered various challenges related to COVID-19 care and treatment, including stigma and discrimination associated with HIV (Ridgway *et al.,* 2020), as well as difficulties in accessing other medications (Pry *et al.,* 2022). Detailed information from these studies is presented in Table 2.

Table 2: HIV and Non-HIV Directed Care Challenges

HIV directed care challenges						**Non-HIV directed care challenges**		
ID	**Medication**	**Appointments**	**Health care**	**Viral Suppression**	**Other**	**Mental health care**	**Alcohol and substance abuse care**	**Other**
1	Difficulty obtaining HIV medication (3.9%), Under average adherence to antiretrovirals (1.7%)	NA	Inability to access telehealth technology (34.7%)	NA	NA	Disruption in mental health services (11%)	Disruption in substance abuse care services (1.3%)	Difficulty obtaining other medication (9.1%)
2	No change in adherence to antiretrovirals	Increased interruption of virological follow-up in 2020 (12.9%)	NA	Progressive increase of virological suppression rate, a Decreasing trend of virological	NA	NA	NA	NA

		(half of them continued obtaining medication) / Decreased routine in-person appointments		determinations ≥ 50 copies/mL during the pandemic				
3	Decreased adherence to medication (from 5 to 12%)	Decreased attendance to recovery support meetings, decrease in confidence to keep next HIV appointment	NA	NA	NA	NA	No difference in the proportion of people using alcohol (41%) or marijuana (32%), Increase utilization of illicit substances (including heroin, cocaine, sedatives, prescription opioids, or methamphetamine) (8%)	NA
4	23.1% decrease in obtaining medication during the pandemic. (higher in females and non-Italians)	Increased missing HIV clinic visits (higher in females)	Started using telemedicine (67.3%)	NA	Increase in the number of hospitalizations in HIV + patients	NA	NA	NA
5	Increased mail delivery for prescriptions and extended refills	Visits during the pandemic: 2.0% attended in-person, 21.4% attended virtual visits, and 30.6% rescheduled for a later date. (Rescheduled or cancelled visits were associated	NA	NA	The difficulty of laboratory testing	Increased therapy sessions	NA	NA

		with lower viral loads)						
6	No changes in antiretroviral adherence or health care utilization. (8% missed at least one dose and 13% avoided picking up ART due to the pandemic)	Missed an appointment in the past month (6.0%) (54.6% due to cancellations)	Avoided health care in the past month (20.2%)	NA	NA	NA	Reduced cocaine use and cigarette smoking	NA
7	No change (uncertain) in adherence to medication, decreased obtaining medication and less refill during and post lockdown, No change in consistency of daily pill-taking timing, Missing a dose of ART (12.1%) (due to food insecurity during the lockdown)	Decreased clinic visits during lockdown (46% decreased compared to last year)	NA	No reduction with a slight increase in viral suppression (90%)	NA	NA	NA	NA
8	Temporarily non-adherent due to finishing off ART stock (36%) (presence of family	Difficulty visiting clinics (due to inadequate transport, police abuse, and insufficient	NA	NA	Declined courier home delivery due to stigma	NA	NA	Covid care concerns regarding stigma and discrimination associated with HIV

	improved the condition)	transportation funds to avoid exposure to COVID-19)						
9	No change in adherence, Run out of medication (13.25%)	Missed an appointment (15.66%)	Missed the community health worker's support (69.88%)	NA	NA	Depression (29%)	NA	Decrease in reporting violence (emotional, physical, sexual)
10	Missed visits for a refill (27.4%) (predicting factors: age ≥ 55, fear of COVID-19, transport disruption, reduced income for travelling to the health facility, and limited access to masks, sanitiser, and non-medical support)	Missed follow-up tests (26.4%), missed counselling services (25.9%)	NA	NA	NA	NA	NA	NA
11	Stopped taking ART (3%)	Fear of visiting the hospital (48%)	NA	NA	NA	NA	NA	NA
12	Missed a dose of HIV medications (24.0%). (associated with disruption of access to health care, missed	Missed appointment (46.0%)	NA	NA	NA	Changes in sleep patterns (54.0%), Feeling anxious (56.0%), Frustrated (50.0%), Depressed (41%), Bored (43.0%)	NA	NA

	appointments, and PTSD) (Younger respondents were more likely to report missed HIV medication doses)							
13	No change in obtaining HIV medications, Difficulty adhering to medication regimens	Challenges with virtual appointments	Difficulty accessing medical care in the context of COVID-19	NA	NA	NA	NA	NA
14	Unable to refill their ART (3.6%)	Unable to meet their HIV physician face-to-face (55.8%)	NA	NA	NA	Anxiety and depression (27.9%), Anxiety and depression (19.8%), Need for psychosocial support (40.1%)	Increased recreational drug use (8.6)	NA

DISCUSSION

The COVID-19 pandemic has disrupted healthcare systems globally, particularly affecting the management of chronic infections like HIV, with low and middle-income countries being particularly vulnerable. This disruption has led to challenges in HIV care, including decreased adherence to antiretroviral therapy (ART) and exacerbated mental health issues among people living with HIV (PLHIV). Despite these challenges, viral suppression rates have remained unaffected. In-person visits and clinical follow-up services have been impacted, but telemedicine has emerged as a valuable tool for maintaining continuity of care. It is crucial to leverage innovative strategies like telemedicine to ensure PLHIV receive necessary care and support during this pandemic.

HIV-directed care challenges

Research on the impact of COVID-19 on people with underlying health conditions shows they experience worse outcomes (Melamed *et al.*, 2020; Volkow, 2020; Wang *et al.*, 2021). However, the effect of HIV on COVID-19 severity is unclear. Some studies suggest no increased risk for severe illness in people living with HIV (PLHIV) compared to the general population (Shi *et al.*, 2020; Yuvaraj *et al.*, 2020; SeyedAlinaghi *et al.*, 2021). With some even reporting milder symptoms in those with advanced HIV (So-Armah *et al.*, 2020). However, other studies find that PLHIV may be more susceptible to complications (Gatechompol *et al.*, 2021).

Antiretroviral therapy (ART) disruption

The COVID-19 pandemic significantly disrupted HIV services and ART distribution globally (World Health Organisation, 2021, 2020). A WHO model predicted a major increase in HIV-related deaths if disruptions continued (World Health Organisation, 2020, 2021). Our review confirmed a widespread decline in ART access during the pandemic (Ridgway *et al.*, 2020; Fodjo *et al.*, 2021; Oyelade *et al.*, 2022).

Factors included supply chain issues, healthcare workers' focus on COVID-19, and lockdowns (Fodjo *et al.*, 2021; World Health Organisation, 2021). Studies from Ethiopia, China, and Zimbabwe documented additional challenges like stigma, missed appointments, and lack of protective equipment (Ridgway *et al.*, 2020; Fodjo *et al.,* 2021; Oyelade *et al.*, 2022).

Countries responded with measures like mail delivery of medications, longer refills, telemedicine, and wider multi-month dispensing, which helped mitigate disruptions and restore adherence (World Health Organization, 2021; Fodjo *et al.*, 2021; Oyelade *et al.*, 2022).

By November 2020, disruptions were significantly reduced due to these efforts (World Health Organization, 2021).

HIV and general healthcare disruption

The COVID-19 pandemic significantly disrupted healthcare services for PLHIV, raising the risk of missed ART treatment (Fodjo *et al.*, 2021). Studies documented disruptions like missed clinic visits, patient fear of hospitals, and clinic closures due to lockdowns and diverted healthcare resources (Fodjo *et al.*, 2021; Oyelade *et al.*, 2022). These resulted in declines in HIV testing, diagnoses, and CD4 count monitoring (Fodjo *et al.*, 2021; Oyelade *et al.*, 2022), potentially worsening individual health outcomes and impacting HIV transmission rates (UNAIDS, 2014). Telemedicine emerged as a helpful tool for remote consultations and patient education during the pandemic (Fodjo *et al.*, 2021; Oyelade *et al.*, 2022). However, limited accessibility in low-income settings remains a challenge (Fodjo *et al.*, 2021; Oyelade *et al.*, 2022). Efforts to improve telemedicine infrastructure are crucial to ensure equitable healthcare access for all PLHIV (World Health Organisation, 2020).

Viral suppression

Despite limited research, some studies suggest viral suppression rates among PLHIV may not have been negatively affected by the COVID-19 pandemic (Del

Amo *et al.*, 2020; Kowalska *et al.*, 2020; Spinelli *et al.*, 2020). However, more studies are needed to definitively understand the long-term impacts of the pandemic on viral suppression and other health outcomes in PLHIV.

Non-HIV directed care challenges

The COVID-19 pandemic brought on a wave of non-medical challenges for PLHIV beyond just medication access. Stigma and discrimination persisted, with reports of job loss, denied healthcare services, and forced provider changes (Dubey *et al.*, 2020; Melamed *et al.*, 2020; Fodjo *et al.*, 2021). Mental health concerns worsened due to disruptions in services, leading to increased depression, anxiety, and substance abuse (Chambers *et al.*, 2015; Dubey *et al.*, 2020; Khalsa *et al.*, 2021; Murthy *et al.*, 2021; Fodjo *et al.*, 2021). Financial difficulties, food insecurity, and increased alcohol consumption added to the burden (Melamed *et al.,* 2020; Fodjo *et al.,* 2021). These findings highlight the need for a holistic approach to caring for PLHIV, addressing not just medical needs but also social, psychological, and economic challenges, especially during crises.

LIMITATIONS AND RECOMMENDATIONS

This study highlights the challenges faced by people living with HIV (PLHIV) during the COVID-19 pandemic and suggests several interventions to address them. Limitations include variations in study methodology and reliance on self-reported data. To improve services for PLHIV, targeted interventions are needed, including remote medical visits to overcome barriers to in-person consultations. Ensuring uninterrupted access to antiretroviral therapy (ART) is crucial, necessitating efforts to maintain drug supply and implement strategies for ongoing clinical follow-up. Addressing the psychological well-being of PLHIV is also vital, requiring the integration of evidence-based interventions into routine HIV care. Leveraging technology for the delivery of psychological interventions is suggested, with consideration for limited access in low- and middle-income countries. Overall, a multifaceted approach combining innovative healthcare delivery, strengthened ART supply chains, and tailored psychological interventions is essential for meeting the evolving needs of PLHIV during the pandemic.

CONCLUSION

The COVID-19 pandemic has presented significant challenges for people living with HIV (PLHIV), including disruptions in healthcare services and treatment adherence, leading to increased mortality. The pandemic has also worsened psychological disorders, substance use, and experiences of stigma among PLHIV, emphasising the need for comprehensive support systems in future epidemics. Telemedicine has emerged as a crucial tool for HIV care, particularly in low- and middle-income countries with limited healthcare infrastructure. Sharing successful telemedicine practices can improve service delivery globally. Addressing these challenges requires a coordinated approach focusing on healthcare access, treatment adherence, mental health, and social support for PLHIV, facilitated by innovative strategies like telemedicine and global knowledge exchange.

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