The spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), responsible for the coronavirus disease 2019 (COVID-19) pandemic, has had a significant impact on access to health facilities in developed countries. However, some emergency healthcare pathways have managed to remain intact. Furthermore, studies have shown that the COVID-19 pandemic also affected access to HIV services in African countries, including South Africa. However, the impact on HIV services in developing countries with less robust healthcare systems has not been thoroughly investigated. Currently, there is a lack of available data in Chad, where we previously observed that stock-outs of antiretroviral treatment (ART) were associated with an increase in loss to follow-up (LTFU) among people living with HIV (PLWH). In this study, we retrospectively examined the impact of the COVID-19 pandemic on LTFU and mortality rates in a cohort of PLWH receiving ART despite the absence of ART stock-outs in "Le Bon Samaritanit" Hospital, which is located in a particularly poor area of N'Djama, Chad.

All 1,645 PLWH (1,107 females [63.7%]; median age, 33 [1–75] years) receiving ART and actively followed up in Le Bon Samaritanit Hospital (N'Djama, Chad) on December 31, 2019 were included. The study gathered data on the endpoints, including LTFU, transfer to another facility, or death, from the hospital register on a quarterly basis between December 31, 2019 and December 31, 2022.

Loss to follow-up was defined as cases in which PLWH were no longer actively being monitored but were not reported to have transferred to another facility or to have died. The PLWH who returned to care after being initially LTFU were excluded from the study cohort when they resumed care. The term “death” encompassed all-cause mortality and was not limited to mortality induced by COVID-19 specifically. No active investigation was performed to confirm that PLWH who were LTFU were in fact transferred or dead. During the study period, peaks of SARS-CoV-2 genome detection in upper respiratory samples were evidenced in Chad during the first wave of the COVID-19 pandemic in May 2020, followed by a second larger wave from December 2020 to March 2021 with a peak in early January 2021 and a third wave peaking in January 2022, according to the Chadian national SARS-CoV-2 molecular survey. No ART stock-outs were reported during the study period according to Le Bon Samaritanit Hospital data.

Cumulative incidence graphs were built, and statistical analyses were performed using GraphPad Prism 7 (Boston, MA) and SAS version 9.4 (SAS Institute Inc., Cary, NC). Comparison of cumulative incidence was performed using a log rank (Mantel-Cox) test. A P value < 0.05 was considered significant.

An annual stratified analysis was conducted on PLWH receiving ART, revealing a 20% decrease in the number of PLWH accessing ART in the outpatient setting during the first year of the COVID-19 pandemic (N = 1,645 compared with N = 1,249). This decline was attributed to LTFU, with 409 individuals classified as LTFU compared with 22 deaths and 8 transfers (Figure 1A). Notably, 14 patients who were previously LTFU returned to care during the study period and were subsequently excluded (data not shown). To understand the dynamics of LTFU throughout the study period, cumulative incidence plots were generated for the endpoints of LTFU, transfer, or death (Figure 1B). The incidence of LTFU started to increase in the first trimester of 2020, preceding the peak detection of SARS-CoV-2 genomes in Chad (Figure 1B). Furthermore, the incidence of LTFU was higher in 2020 than in 2021 or 2022 (P < 0.0001) (Figure 1C). The overall all-cause mortality rate remained relatively low, with 36 of 1,645 PLWH experiencing mortality (2.4%; Figure 1A). The increase in mortality incidence was less pronounced than LTFU and did not appear to be influenced by the peaks of SARS-CoV-2 genome detection in Chad (Figure 1B). In addition, the incidence of referral to another center as an endpoint appeared to remain consistent throughout the study period (Figure 1A and B).

In the present report, we aimed to shed light on the effects of the COVID-19 pandemic on Chadian outpatients receiving ART, enabling us to develop strategies to mitigate any negative consequences and improve patient outcomes in case of...
further pandemics or a sanitary crisis. Within a well–clinically monitored monocentric cohort of PLWH, we compared the dynamics of our study cohort, focusing specifically on the incidence of attrition/LTFU and mortality rates between the years of the study’s COVID-19 pandemic period (Figure 1). Notably, we observed that the onset of the COVID-19 epidemic resulted in a 20% reduction in the cohort of PLWH receiving ART and being clinically monitored at Le Bon Samaritan Hospital in N’Djamena, Chad (Figure 1A). This decrease occurred during the first trimester of 2020, prior to the detection of SARS-CoV-2 genomes in Chadian patients, and was attributed to LTFU of significant numbers of clinically monitored HIV-infected patients (PLWH).

To try exploring the potential reasons of LTFU among PLWH, we compared LTFU subgroup patients with available data concerning WHO stage and CD4 cell counts with those actively followed up with available data concerning WHO stage and CD4 cell counts (Table 1). We did not identify significant differences between these two patient subgroups, but it seems to be a trend toward a higher WHO stage and a lower T-CD4 count in LTFU patients, suggesting that identified LTFU patients might be dead. However, this observed

TABLE 1
Comparison of demographic, biological, and clinical characteristics between LTFU and actively followed patient subgroups with available data concerning WHO stage and CD4 cell counts

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>LTFU (N = 45)</th>
<th>Actively followed (N = 1,110)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females (%)</td>
<td>26 (57.7)</td>
<td>651 (58.6)</td>
<td>0.9*</td>
</tr>
<tr>
<td>Age in years, median (min-max)</td>
<td>30 (5–67)</td>
<td>31 (1–80)</td>
<td>0.62†</td>
</tr>
<tr>
<td>CD4 median (min-max)</td>
<td>217 (25–615)</td>
<td>253 (1–2,443)</td>
<td>0.08†</td>
</tr>
<tr>
<td>WHO stage median (min-max)</td>
<td>3 (1–4)</td>
<td>2 (1–4)</td>
<td>0.053†</td>
</tr>
</tbody>
</table>

* Statistical comparative analysis was performed using Pearson \( \chi^2 \) test.
† Statistical comparative analysis was performed using Mann-Whitney U test.
decline in PLWH accessing ART could be explained mainly by the disruption of healthcare systems caused by COVID-19 or the fear of infection at healthcare facilities, which posed a threat to accessing HIV treatment services.5,6 Our observed consistent incidence of the “referral to another center” endpoint throughout the study period indicated that healthcare facilities were not overcrowded, and the coordination between them was not significantly affected by the COVID-19 pandemic. It is worth noting that there were no care discontinuations, such as healthcare provider withdrawal or transportation system shutdowns, during the study period, except for a curfew in place during nighttime from April 2, 2020 to March 11, 2021.6,9 Thus, these findings suggest that the fear of SARS-CoV-2 infection could result in the significant and early LTFU observed. Indeed, in Africa, PLWH have been reported to avoid hospitals because of concerns about exposure to the coronavirus, and misinformation about the virus has exacerbated this fear.10,11

Although SARS-CoV-2 infection could be associated with an increased risk of mortality among PLWH, the confirmed all-cause mortality in our study cohort remained low (2.4%) during the COVID-19 pandemic period. This could be partly explained by the young median age of study PLWH (median age of 33 years), which may have significantly contributed to a lower COVID-19–induced mortality. However, recently published studies in similar young HIV-infected populations described an increased risk of mortality by chronic cardiovascular pathologies, diabetes, malaria, or tuberculosis.12,13 Moreover, by contrast to these published reports concerning PLWH surveys in Africa during the COVID-19 pandemic, we did not observe any significant interruption of ART availability related to ART drug stock-outs promoting therapeutic and clinical failures and subsequently increasing mortality rates in such HIV-infected patients. However, our retrospective investigation is not fully representative because we investigated data from only one well-clinically monitored monocentric cohort of PLWH in N’Djamena, Chad. Another key limitation of our retrospective investigation is the lack of active investigation to confirm whether PLWH who were LTFU had indeed transferred or died. To this end, it would have been helpful to collect phone numbers at the time of cohort inclusion for each study patient, therefore allowing monitoring of LTFU patients by calling them or sending them phone messages. Whatever, it is known that LTFU is associated with poorer outcomes, and only a small proportion of patients who were LTFU returned to care.14 Efforts should be intensified to locate and reengage PLWH who have been LTFU, not only in our monocentric cohort but also in other cohorts in Chad and across sub-Saharan African countries.15

In conclusion, our retrospective epidemiological findings reveal a concerning trend of significantly increased LTFU among Chadian individuals living with HIV (PLWH) who were receiving ART during the COVID-19 pandemic. This unexpected observation can be attributed to the heightened fear of SARS-CoV-2 infection within African hospital settings. It is crucial to address these concerns and provide accurate information to ensure continuity of care for PLWH during times of sanitary crisis in Sahelian Africa countries.

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