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# Seroprevalence of SARS-CoV-2 Infection Among People Living with HIV in Libreville, Gabon

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**Abstract:** (1) Objectives: The burden of SARS-CoV-2 infection in people living with HIV (PLHIV) in Gabon is unknown. (2) Methods: We conducted a cross-sectional seroprevalence study of SARS-CoV-2 immunoglobulin (Ig) G/M antibodies in PLHIV in Libreville from April 2022 to April 2023 after the fourth wave of the pandemic. We used the WANTAI SARS-CoV-2 Ab ELISA targeting the SARS-CoV-2 spike, receptor-binding domain. (3) Results: Among 480 samples tested, the seroprevalence of IgG antibodies to SARS-CoV-2 spike protein was 87.5% (95% confidence interval (CI) 77.7–97.3%). History of SARS-CoV-2 diagnosis, ART treatment, and TCD4 lymphocyte count were not found to be associated with the presence of antibodies against SARS-CoV-2 among the study participants. However, having a detectable viral load ($p$ = 0.0001), being vaccinated (COVID-19 vaccine, $p$ = 0.04), and a history of COVID-19 ($p < 0.0001$) symptoms were associated with a higher risk of having anti-SARS-CoV-2 antibodies. (4) Conclusions: By early 2023, PLHIV in Gabon had high rates of SARS-CoV-2 seropositivity. To our knowledge, this is the first study to determine the seroprevalence of SARS-CoV-2 antibodies in PLHIV in Gabon. This study provides further evidence of anti-SARS-CoV-2 seroconversion in the absence of any vaccination in a particular target population. The surveillance of diseases of global health concern in PLHIV is crucial to estimate population-level exposure and inform public health responses.

**Keywords:** seroprevalence; SARS-CoV-2 antibodies; PLHIV; Libreville



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## 1. Introduction

Since the first cases reported in December 2019 in Wuhan (Hubei, China) [1], coronavirus disease 2019 (COVID-19) spread all over the world until reaching a state of pandemic, as recognized by the World Health Organisation (WHO) [2]. The first case of coronavirus disease 2019 (COVID-19) in Gabon was registered on 12 March 2020 [3]. At the time of writing (16 March 2023), 1,621,947 (89.6% of a total population of 1,811,079 million) had been tested by PCR, and the total number of confirmed cases was 48,980, with 48,674 recoveries and a staggering 306 deaths officially reported in the country [4].

SARS-CoV-2 (the etiologic agent of COVID-19) impacted everyone across the globe, Moreover, its spread continues inexorably, making it one of the most significant global health threats of the 21st century. However, the true scale of the epidemic is still unclear, especially as the PCR- and antigen-confirmed case counts that are commonly relied upon

may understate the burden of this viral infection [5–8]. Thus, seroprevalence studies have been more widely conducted to provide information on the extent of population or community exposure to SARS-CoV-2 infection and identify groups disproportionately affected in low- and middle-income countries [9,10].

SARS-CoV-2 infection can be asymptomatic or symptomatic and manifests, among other ways, as headaches, loss of smell, loss of taste, and respiratory distress that can cause death, especially in individuals with comorbid conditions (Fadaka et al., 2020; Kumar and Al Khodor, 2020), such HIV infection [11,12].

Human immunodeficiency virus (HIV) infection has been associated with an increased risk of severe illness and in-hospital mortality associated with SARS-CoV-2 [13].

Early in the SARS-CoV-2 pandemic, reports and meta-analyses of more severe symptoms and higher mortality rates in PLHIV appeared, justifying the higher initial vaccine prioritization [14,15]. Moreover, in some studies, lower titers of antibodies against SARS-CoV-2 were measured in patients with HIV compared with HIV-negative controls after infection or vaccination [16,17]. There are also scarce and inconsistent data on the dynamics of the pandemic in PLWH compared with the general population. In some populations, the incidence of SARS-CoV-2 in PLHIV was higher [18].

In Gabon, vaccination started on 2 April 2021, prioritizing at-risk groups like people living with HIV (PLHIV), using the Sinopharm vaccine. However, the national rate of vaccination remains very low.

Sub-Saharan Africa (SSA) remains the region most affected by the HIV epidemic. Almost three-quarters (69%) of the 23.5 million people infected worldwide are found in this region [19]. In Gabon, HIV is a public health problem, with 4.1% of the population affected [20]. To date, no data on SARS-CoV-2 infection in this category of the population are available in the country.

The objective of this study was to determine the prevalence of anti-SRAS-CoV-2 antibodies in persons living with HIV in Libreville, Gabon, and identify the epidemiologic characteristics associated with seropositivity.

## 2. Materials and Methods

### *2.1. Study Design and Setting*

This was a cross-sectional study conducted from April 2022 to April 2023 after the fourth wave of the pandemic in the National Reference Laboratory of IST/Sida of Libreville (Gabon).

This laboratory performs almost 90% of the immuno-virological monitoring of persons living with HIV in Gabon.

### *2.2. Study Population and Data Collection*

All PLWH who came to the laboratory for their routine analyses were eligible for inclusion following informed consent. A standardized questionnaire was administered face-to-face to participants. The questionnaire was developed on the basis of a literature review to identify the most representative variables. It included sociodemographic characteristics, the patient's immuno-virological status (last CD4 value, last viral load value, and CD4/CD8 ratio), history of SARS-CoV-2 contamination or notion of contact with SARS-CoV-2, lifestyle, COVID-19–related symptoms (fever, cough/sore throat, muscle/joint pain, loss of taste/smell, and difficulty breathing), and SARS-CoV-2 vaccination status. Then, a sample of 4 mL of venous blood was taken.

### *2.3. Laboratory Procedures*

The WANTAI SARS-CoV-2 Ab ELISA was used to screen for SARS-CoV-2 antibodies in the serum of participants, according to the manufacturer's instructions. This is an

enzyme-linked immunosorbent assay (ELISA) intended for the qualitative detection of total antibodies (including IgG and IgM) to SARS-CoV-2.

The test has a manufacturer-estimated sensitivity and specificity of 94.36% and 100%, respectively. However, since test specificity varies across populations, externally assessed specificity values may be misleading. Thus, the test specificity was validated on a panel of 125 pre-pandemic (2018) samples from individuals living in Libreville. The test correctly diagnosed all of these negative samples.

### 2.4. Statistical Analysis

The data were analyzed using OpenEpi statistical software (available at http://openepi.com/Menu/OE_Menu.htm, accessed on 10 October 2024. We performed descriptive statistics, and the results were presented using frequency tabulations and percentages for categorical variables. The chi-square test ($\chi^2$) was used to assess the significance of differences among study variables. The odds ratio (OR) was calculated using binary logistic regression. *p*-values less than 0.05 were considered to indicate statistical significance.

### 2.5. Ethical Considerations

The study protocol obtained ethical clearance (PROT N° 006/20222/CNER/P/SG). Every adult participant (21 years or above) signed an informed consent form and, for minors, a person with parental authority was asked to sign the consent form. Minors who were able to sign were also asked to sign a special assent form.

## 3. Results

### 3.1. Sociodemographic Characteristics of Patients

In total, 500 PLHIV were invited to participate in this study. Of these, 20 declined, and 480 were enrolled in the study. Among them, 373 (77.7%) were females. The mean age was 44.5 years (SD: 6.6), and more than half of the participants were aged more than 40 years (252, 62.2%). The TCD4 lymphocyte count was above 500 cells/mm$^3$ in 90 (18.7%) people, and the viral load was undetectable in 185 (38.6%) people at the time of study enrollment. All the participants were on antiretroviral treatment, and 370 (77.1%) were on a first-line regimen (TDF + 3TC + DTG) (Table 1).

**Table 1.** Patient demographics and clinical characteristics.

| | Number | % |
|---|---|---|
| **Age mean (SD)** | 44.5 (6.6) | |
| Sex | | |
| M | 107 | 22.3 |
| F | 373 | 77.7 |
| **HIV serotype** | | |
| HIV-1 | 480 | 100 |
| **Current viral load** | | |
| Undetectable (<20 copies/mL) | 185 | 38.6 |
| Detectable (>20 copies/mL) | 295 | 61.4 |
| **WHO clinical stage at treatment initiation** | | |
| Early | 307 | 64.0 |
| Late | 173 | 36.0 |
| **Latest TCD4 lymphocyte count** | | |
| <500/mm$^3$ | 390 | 81.3 |
| ≥500/mm$^3$ | 90 | 18.7 |
| **Treatment** | | |
| Yes | 443 | 92.3 |
| No | 37 | 7.7 |

**Table 1.** *Cont.*

| | Number | % |
|---|---|---|
| **Treatment regimen** | | |
| 2 NRTI + 1 NNRTI | 90 | 18.7 |
| 2 NRTI + 1 INSTI | 370 | 77.1 |
| 2 NRTI + 1 PI | 20 | 4.2 |
| **History of COVID-19 symptoms from start of pandemic up to inclusion** | | |
| Yes | 39 | 8.1 |
| No | 441 | 91.9 |
| **History of SARS-CoV-2-positive diagnosis** | | |
| Yes | 16 | 3.3 |
| No | 464 | 96.7 |
| **SARS-CoV-2 vaccination status** | | |
| Unvaccinated | 431 | 89.8 |
| Vaccinated | 49 | 10.2 |
| **SARS-CoV-2 vaccine** | | |
| Sinopharm | 28 | 57.1 |
| Johnson & Johnson | 17 | 34.7 |
| Pfizer | 4 | 8.2 |

SD: Standard deviation; NRTI: nucleoside reverse transcriptase inhibitor; NNRTI: non-nucleoside reverse transcriptase inhibitor; INSTI: integrase strand transfer inhibitor; PI: protease inhibitor.

Regarding past COVID-19 diagnosis, participants were asked if they had ever had a COVID-19-positive result. A total of 16 out of 480 respondents answered yes, representing 3.3%. Moreover, 39 participants (8.1%) reported a history of COVID-19 symptoms (having influenza-like illness symptoms) since the beginning of the epidemic.

All the participants were eligible for vaccination (aged over 21 years); among them, 49 were vaccinated against COVID-19, accounting for 10.2%. The most frequent vaccines were as follows: Sinopharm (57.1%), Johnson & Johnson (34.7%), and Pfizer (8.2%).

### *3.2. Prevalence of Anti–SARS-CoV-2 Antibodies*

On testing of anti-SARS-CoV-2 IgG antibodies by commercial ELISA, we found that more than half of the participants were positive, giving an overall seroprevalence of 87.5% (77.7–97.3%).

Among the vaccinated persons tested, 48 were positive, for a seroprevalence of 98%. Among the 431 unvaccinated persons, 372 were positive, for a seroprevalence of 86.3%. The difference between the proportion of positive tests in vaccinated and unvaccinated participants was statistically significant ($p = 0.04$).

A history of SARS-CoV-2 diagnosis and ART treatment were not found to be associated with the presence of antibodies against SARS-CoV-2 among the study participants (Table 2). Our study also revealed that TCD4 lymphocyte count was not significantly associated with the study outcome.

**Table 2.** Factors associated with the presence of anti-SARS-CoV-2 antibodies in PLHIV.

| | **Anti-SARS-CoV-2 Positive (n = 420, 87.5%; 95% CI: 77.7–97.3%)** | **Anti-SARS-CoV-2 Negative (n = 60, 12.5%; 95% CI: 2.7–22.3%)** | **OR (95% CI)** | ***p*** |
|---|---|---|---|---|
| **Current viral load** | | | | |
| Undetectable (<20 copies/mL) | 177 (95.7%) | 8 (4.3%) | **1** | **0.0001** |
| Detectable (>20 copies/mL) | 243 (82.4%) | 52 (7.6%) | **4.7 (2.2–10.2)** | |
| **Sex** | | | | |
| M | 104 | 3 | **1** | **0.002** |
| F | 316 | 57 | **0.2 (0.05–0.5)** | |

**Table 2.** *Cont.*

| | Anti-SARS-CoV-2 Positive (n = 420, 87.5%; 95% CI: 77.7–97.3%) | Anti-SARS-CoV-2 Negative (n = 60, 12.5%; 95% CI: 2.7–22.3%) | OR (95% CI) | *p* |
|---|---|---|---|---|
| **Treatment** | | | | |
| Yes | 384 (86.7%) | 59 (13.3%) | 1 | 0.09 |
| No | 36 (97.3%) | 1 (2.7%) | 0.2 (0.02–1.3) | |
| **Latest TCD4 lymphocyte count** | | | | |
| <500/mm$^3$ | 336 (86.2%) | 54 (13.8%) | 2.3 (0.9–5.4) | 0.07 |
| ≥500/mm$^3$ | 84 (97.5%) | 6 (2.5%) | 1 | |
| **History of COVID-19 symptoms** | | | | |
| Yes | 16 (41.0%) | 23 (59.0%) | **15.7 (7.6–32.3)** | **<0.0001** |
| No | 404 (91.6%) | 37 (8.4%) | **1** | |
| **History of SARS-CoV-2 positive diagnosis** | | | | |
| Yes | 14 (87.5%) | 2 (12.5%) | **1.0 (0.2–4.5)** | 1.0 |
| No | 406 (87.5%) | 58 (12.5%) | **1** | |
| **Vaccination status** | | | | |
| Unvaccinated | 372 (86.3%) | 59 (13.7%) | **7.6 (1.0–56.2)** | **0.04** |
| Vaccinated | 48 (98.0%) | 1 (2.0%) | **1** | |

Having a detectable viral load ($p = 0.0001$) and a history of COVID-19 ($p < 0.0001$) symptoms were associated with a higher risk of having anti-SARS-CoV-2 antibodies.

## 4. Discussion

The present study was conducted among PLHIV after the fourth wave of COVID-19 in Gabon, a Central African country. In this study, 87.5% of people tested positive for SARS-CoV-2 antibodies. This result is not surprising in our country. Indeed, a nationwide household study on SARS-CoV-2 seroprevalence antibodies conducted between November and December 2021 reported approximately the same seroprevalence (86%) [21]. This result reflects the rapid progression of SARS-CoV-2 antibody seroprevalence, as described in many African countries [22,23].

It is widely believed that men are more susceptible to SARS-CoV-2 infection and severe COVID-19 disease than women [24]. According to this observation, we found that men with HIV infection were more likely than women to be seropositive for SARS-CoV-2 antibodies. The reasons for this are elusive.

However, a difference in the immune response to SARS-CoV-2 infection has been reported between male and female patients [25].

The analysis of factors associated with SARS-CoV-2 antibodies showed a significant association with a history of COVID-19 symptoms, viral load, and vaccination status.

A significant correlation between SARS-CoV-2 seropositivity and uncontrolled HIV viral load was found in a study conducted in South Africa [26]. These results suggest either higher SARS-CoV-2 infection susceptibility among viremic PLHIV or long-term effects of previous SARS-CoV-2 infection on patients with HIV infection and viremia.

HIV viral load assessment is recommended by WHO and the national HIV program as the preferred method to monitor HIV treatment progress [27,28]. In our study, 38.6% of the participants were virally suppressed. This finding highlights the need for more sensibilization among ART treatments to avoid virological failures or even virological blips (rebound). It is generally accepted that PLWH receiving effective ART are able to achieve complete or nearly

complete suppression of viral replication and maintain immune function comparable to that of people in the general population who can fight against pathogens [29].

In this study, most of the persons with HIV infection did not experience any COVID-19 symptoms (91.9%), similar to studies conducted in North India [30] and Pune [31].

According to the World Health Organization, people with HIV are at higher risk of severe or critical illness at the time of admission and higher risk of dying after being admitted to the hospital with COVID-19. In this context, the WHO has recommended prioritizing PLHIV for early COVID-19 vaccines.

In this study, we found that only 10.2% of the studied population was vaccinated. Among them, SARS-CoV-2 antibodies were found in 98.0%, compared with 86.3% among those unvaccinated. The Gabonese Government rolled out COVID-19 vaccination in July 2021, with priority given to people at risk of severe forms, including PLHIV. By the end of 2022, only 10% of the Gabonese population had been vaccinated.

These data suggest that vaccination status was unlikely to affect the SARS-CoV-2 seroprevalence status, although COVID-19 vaccination started before the period of this study.

The high SARS-CoV-2 seroprevalence among vaccinated people may be attributed to hybrid immunity from natural infection and vaccination. Moreover, the high seroprevalence in unvaccinated PLHIV reflects the circulation of SARS-CoV-2 in this vulnerable population.

We acknowledge there are some limitations to our study. We only conducted a qualitative study using the WANTAI SARS-CoV-2 Ab ELISA kit. The use of a qualitative rather than quantitative test for IgG and/or IgM antibodies against SARS-CoV-2 in the participants surveyed did not enable us to assess the degree of immunization. Future studies with larger samples, including multiple study sites and subgroup analyses based on the immunological status of patients who are HIV-positive, will provide further evidence. However, our study has strengths that deserve to be highlighted. To our knowledge, this is the first study to determine the seroprevalence of SARS-CoV-2 antibodies in PLHIV in Gabon. This study provides further evidence of anti-SARS-CoV2 seroconversion in the absence of any vaccination in a particular target population.

These data show that people living with HIV have not been spared during this pandemic and that the virus has circulated actively within this category of the population, like the general population. These findings reveal significant challenges posed to the continuity of care for patients living with HIV during a pandemic. Healthcare system adaptations, including the reorganization of facilities, play a crucial role in maintaining HIV/AIDS care during the pandemic. Efforts to address interruptions to ART follow-up services, such as extended ARV refilling periods and providing psychosocial support, are key activities that can be implemented to mitigate the impact of infectious agents on PLHIV during the pandemic period.

## 5. Conclusions

Our study reports, for the first time, the seroprevalence of SARS-CoV-2 in PLHIV in Gabon. We observed a high seroprevalence in this category of the population. The data also provide evidence that vaccination status, HIV viral load, and a history of COVID-19 symptoms can alter the risk of SARS-CoV-2 seropositivity. This study is an important first step in highlighting the importance of PLHIV being retained in care and achieving viral suppression in reducing hospitalizations due to COVID-19.

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**Institutional Review Board Statement:** This study complies with the Declaration of Helsinki and was approved by the Gabonese National Ethics and Research Committee (CNER) under project number PROT N° 006/2023/CNER/P/SG.

**Informed Consent Statement:** All the participants gave their consent for the use of their data.

**Data Availability Statement:** A subset of the key-anonymized individual data collected during the study, along with a data dictionary, is available upon request from the corresponding author at samirazoaassoumou@yahoo.fr after approval of a proposal with a signed data access agreement.

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