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Prevalence of SARS-CoV-2 antibodies in the Republic of Congo in mid-2021

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ABSTRACT

Objectives: To estimate the seroprevalence of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) antibodies in the general population in the Republic of Congo.

Methods: In this cross-sectional study, conducted from June to July 2021, participants were recruited from the general population in three districts in the Republic of Congo. Eligible participants were tested for anti-SARS-CoV-2 antibodies using a rapid diagnostic assay.

Results: Overall, 31.8% [95% confidence interval (CI) 29.5–34.0] of the 1669 participants tested positive for anti-SARS-CoV-2 antibodies. Higher prevalence was observed in the rural region (37.3%, 95% CI 31.0–44.1%) than the urban region (30.9%, 95% CI 28.5–33.3); however, the difference was not significant. The risk of testing positive for anti-SARS-CoV-2 antibodies increased significantly with age, ranging from 22.5% (95% CI 18.1–27.5) in 15–24 year olds to 47.9% (95% CI 39.3–56.5) in 55–64 year olds.

Conclusions: The antibody levels observed in this survey correlate with a moderate rate of virus circulation, which correlates with the low number of confirmed cases of coronavirus disease 2019 in the Republic of Congo.

Introduction

The first cases of coronavirus disease 2019 (COVID-19) in the Republic of Congo were reported in early 2020, with possible introduction of the virus into the country in December 2019 (Bonguili et al., 2022). By July 2022, 24,421 confirmed cases and 386 deaths had been reported to the World Health Organization (WHO, 2022). The present study aimed to estimate the seroprevalence of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) antibodies in three districts (urban and rural) of the Republic of Congo in June 2021, in order to better understand the trends of SARS-CoV-2 spread in the country.

Methods

A cross-sectional survey was implemented in June–July 2021 to estimate the seroprevalence of SARS-CoV-2 antibodies in the Republic of Congo. The sample size was estimated assuming reference seroprevalence of 10% and an estimated error scale of 1% with 95% confidence intervals (CI). Study participants were recruited from three regions: Brazzaville (capital of Republic of Congo), Pointe-Noire (economic capital) in the south; and Ouesso (rural location) in the north. The study participants were recruited from the general population. The inclusion criteria were: age ≥15 years; and gave written informed consent. Subjects who had been vaccinated against COVID-19 were excluded from the study. Eligible participants were recruited consecutively until the required sample size was achieved. A questionnaire was implemented to collect sociodemographic data, including age; gender; living conditions; recent travel from/to the Republic of Congo; knowledge about SARS-CoV-2, COVID-19 and associated preventive measures; and COVID-19 status. A clinical assessment was conducted to identify potential signs of SARS-CoV-2 infection, including temperature records.

Participants were tested for antibodies against SARS-CoV-2 using a field-friendly lateral flow immunoassay, the Biosynex COVID-19 BSS IgG/IgM (BIOSYNEX, Illkirch-Graffenstaden, France). This assay has been reported to have good sensitivity (>95%) and specificity (>98%) (Pere et al., 2021). All participants with either body temperature >38.5°C or who tested positive for IgM underwent nasopharyngeal swab collection for SARS-CoV-2 antigen (Ag) testing using the Panbio COVID-19 Ag test (Abbott, Lake Country, IL, USA). Data analysis was

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Table 1
Participants' characteristics

Characteristics	Urban region (%)	Rural region (%)	Missing data (%)	Overall (%)
Total recruited	1444 (86.5%)	226 (13.5)		1670
Female	566 (39.4%)	101 (44.7%)	7 (0.4%)	667 (40.1)
Median age, years (IQR)	36 (26–46.25)	36 (30.25–44)	0 (0%)	36 (27 - 46)
Educational level			2 (0.1%)	
None	51 (3.5%)	2 (0.9%)		53 (3.2%)
Primary school	71 (4.9%)	16 (7.1%)		87 (5.2%)
Secondary school	562 (38.9%)	134 (59.8%)		696 (41.7%)
University	760 (52.6%)	72 (32.1%)		832 (49.9%)
Marital status				
Married	603 (41.9%)	161 (71.9%)	7 (0.4%)	764 (45.9%)
Travel since Jan 2020			5 (0.3%)	
Inside Africa	82 (6.1%)	14 (6.2%)		96 (5.8%)
Outside Africa	64 (4.8%)	5 (2.2%)		69 (4.1%)
Suspicious clinical signs				
Fever (>38.5°C)	1 (0.07%)	0	0	3 (0.2%)
Cough	95 (6.6%)	16 (7.1%)	1 (0.06%)	111 (6.7%)
Headache	109 (7.6%)	24 (10.7%)	7 (0.4%)	133 (8.0%)
Difficulty breathing	46 (3.2%)	8 (3.5%)	2 (0.12%)	54 (3.2%)
Sore throat	41 (2.8%)	0	2 (0.12%)	41 (2.5%)
Ageusia or anosmia	28 (1.9%)	8 (3.5%)	3 (0.18%)	36 (2.2%)
Knowledge about COVID-19				
Heard of COVID-19	1442 (99.9%)	223 (99.1%)	1 (0.06%)	1665 (99.8%)
Knows SARS-CoV-2 is a virus	1201 (83.3%)	124 (55.1%)	3 (0.18%)	1325 (79.5%)
Declared wearing a face mask	1333 (92.4%)	119 (52.7%)	1 (0.06%)	1452 (87.0%)

IQR, interquartile range; COVID-19, coronavirus disease 2019; SARS-CoV-2, severe acute respiratory syndrome coronavirus-2.

Table 2
Seroprevalence of severe acute respiratory virus coronavirus-2 (SARS-CoV-2)

(A) Overall seroprevalence Parameters	Urban region	Rural region	Overall
Tested for SARS-CoV-2 antibodies	1444	225	1669
Positive for IgM	4.4% (3.4–5.6)	1.3% (0.3–3.8)	4.0% (3.1–5.1)
Positive for IgM + IgG	2.8% (2.0–3.8)	0.9% (0.1–3.2)	2.6% (1.9–3.5)
Positive for IgG	29.3% (27.0–31.7)	36.9% (30.6–43.6)	30.3% (28.1–32.6)
Positive for IgM or IgG	30.9% (28.5–33.3)	37.3 % (31.0–44.1)	31.8 % (29.5–34.0)
Tested for SARS-CoV-2 antigen	63 (4.4%)	3 (1.3%)	66 (4.0%)
Antigen positive	2 (3.2%)	1 (33.3%)	3 (4.5%)
(B) Seroprevalence by age group **Parameters**	**Urban region**	**Rural region**	**Overall**
15–24 years	311	13	324
Positive for IgM	3.9% (2.0–6.6)	0.0% (0.0–24.7)	3.7% (1.9–6.4)
Positive for IgM + IgG	2.9% (1.3–5.4)	0.0% (0.0–24.7)	2.8% (1.3–5.2)
Positive for IgG	22.2% (17.7–27.2)	7.7% (0.2–36.0)	21.6% (17.2–26.5)
Positive IgM or IgG	23.1 % (18.6–28.2)	7.7 % (0.2–36.0)	22.5 % (18.1–27.5)
25–54 years	957	200	1158
Positive for IgM	4.3% (3.1–5.8)	1.5% (0.3–4.3)	3.8% (2.8–5.1)
Positive for IgM + IgG	2.5% (1.6–3.7)	1.0% (0.1–3.6)	2.3% (1.5–3.3)
Positive for IgG	29.0% (26.2–32.0)	38.0% (31.2–45.1)	30.6% (27.9–33.3)
Positive IgM or IgG	30.8 % (27.9–33.9)	38.5 % (31.7–45.6)	32.1 % (29.4–34.9)
55–64 years	128	12	140
Positive for IgM	6.3% (2.7–11.9)	0.0% (0.0–26.5)	5.7% (2.5–10.9)
Positive for IgM + IgG	3.9% (1.3–8.9)	0.0% (0.0 -26.5)	3.6% (1.2–8.1)
Positive for IgG	45.3% (36.5–54.3)	50.0% (21.1–78.9)	45.7% (37.3–54.3)
Positive IgM or IgG	47.7% (38.8–56.7)	50.0% (21.1–78.9)	47.9% (39.3–56.5)
≥65 years	48	0	48
Positive for IgM	6.3% (1.3–17.2)		6.3% (1.3–17.2)
Positive for IgM + IgG	6.3% (1.3–17.2)		6.3% (1.3–17.2)
Positive for IgG	37.5% (24.0–52.6)		37.5% (24.0–52.6)
Positive IgM or IgG	37.5% (24.0–52.6)		37.5% (24.0–52.6)

IgM, immunoglobulin M; IgG, immunoglobulin G; CI, confidence interval.
Numbers in parentheses are 95% confidence intervals.

conducted using R software (R Core Team, 2020). The 95% CI associated with the seroprevalence values in diverse subsamples were exact binomial CI. Associations between seroprevalence and a number of covariates – age, gender and living environment (urban vs rural) – were assessed through binomial generalized linear models, and likelihood ratio tests provided the corresponding *P*-values.

Results and discussion

In total, 1670 participants were recruited into the study (e 1). The overall proportion of patients testing positive for SARS-CoV-2 antibodies was 31.8% (95% CI 29.5–34.0%) (Table 2A). Only 4.0% (95% CI 3.1–5.1%) of patients tested positive for IgM, indicating a recent or on-

going infection, and 30.3% (95% CI 28.1–32.6%) of patients tested positive for IgG alone. The proportion of patients who tested positive for IgM and/or IgG was higher in the rural region (37.3%, 95% CI 31.0–44.1%) compared with the urban region (30.9%, 95% CI 28.5–33.3%), although the difference was not significant (P=0.062). The proportion of participants who tested positive for IgM and/or IgG increased with age, ranging from 22.5% (95% CI 18.1–27.5%) in patients aged 15–24 years to 47.9% (95% CI 39.3–56.5%) in patients aged 55–64 years. Similar trends were observed in both rural and urban populations (Table 2B). On multi-variate analysis, the risk of testing positive for IgM and/or IgG increased significantly with age (odds ratio 1.21, 95% CI 1.08–1.36; P<0.0001).

This cross-sectional survey found seroprevalance of SARS-CoV-2 antibodies at a similar level to that reported from other countries and regions. A cross-sectional study conducted in six districts in Zambia reported overall prevalence of 10.6%, ranging from 6.0% to 14.4% depending on the district (Mulenga et al., 2021). A survey conducted in Nairobi, Kenya in November 2020 reported seroprevalence of 34.7% (Ngere et al., 2021), which was higher than that found in a population of 9000 blood donors (22.7%) (Adetifa et al., 2021) and a population of refugees (5.8%) (Gignoux et al., 2021) in the same country. This illustrates the high heterogenicity of SARS-CoV-2 seroprevalence depending on region and survey period. Similar variations have been observed outside of Africa, depending on the population assessed and the implementation period. A large cross-sectional survey of 9181 individuals from 18 cities in Iran in late 2020 reported overall prevalence of 17.1%, ranging from 1.7% to 72.6% depending on the city (Poustchi et al., 2021). A large study conducted in the USA from April to May 2020, involving five states (California, Florida, Georgia, Indiana and New York), reported estimated SARS-CoV-2 seroprevalence of 14.3% (interquartile range 11.6–18.5%) overall (Angulo et al., 2021), which was lower than that found in this study in the Republic of Congo 1 year later.

As observed in other studies, the present study found a higher risk of infection in older populations, with the highest risk found in participants aged ≥55 years (Gignoux et al., 2021; Poustchi et al., 2021). This finding stresses the need for robust public health action for this population group, which is at higher risk of developing severe COVID-19 and at higher risk of death (Huang et al., 2020). Contrary to other reports of SARS-CoV-2 seroprevalence from rural areas of Africa (Mulenga et al., 2021), the present study found higher prevalence in the rural region compared with the urban region; this correlates with the authors' recent findings in a similar study conducted in Gabon (in press). This is not a common finding, and can be explained by local living conditions, less follow-up of preventive public health measures, and other unidentified factors that should be investigated.

Potential limitations of this study include the fact that population-based random sampling was not used, and the results cannot be truly extrapolated to the general population. Also, a simple rapid assay was used, and this may be less sensitive than enzyme-linked immunosorbent assays to detect SARS-CoV-2 antibodies. Finally, antibodies decay over time, which can lead to underestimation of seroprevalence.

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Conflict of interest statement

None declared.

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Ethical approval

The study protocol was approved by the National Ethics Committee (Authorization 343/MRSIT/IRSSA/CERSSA).

References

Adetifa IMO, Uyoga S, Gitonga JN, Mugo D, Otiende M, Nyagwange J, et al. Temporal trends of SARS-CoV-2 seroprevalence during the first wave of the COVID-19 epidemic in Kenya. Nat Commun 2021;12:3966.

Angulo FJ, Finelli L, Swerdlow DL. Estimation of US SARS-CoV-2 infections, symptomatic infections, hospitalizations, and deaths using seroprevalence surveys. JAMA Netw Open 2021;4.

Bonguili NCB, Fritz M, Lenguiya LH, Mayengue PI, Koukouikila-Koussounda F, Dossou-Yovo LR, et al. Early circulation of SARS-CoV-2, Congo, 2020. Emerg Infect Dis 2022;28:878–80.

Gignoux E, Athanassiadis F, Garat Yarrow A, Jimale A, Mubuto N, Deglise C, et al. Seroprevalence of SARS-CoV-2 antibodies and retrospective mortality in a refugee camp, Dagahaley, Kenya. PLoS One 2021;16.

Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020;395:497–506.

Mulenga LB, Hines JZ, Fwoloshi S, Chirwa L, Siwingwa M, Yingst S, et al. Prevalence of SARS-CoV-2 in six districts in Zambia in July, 2020: a cross-sectional cluster sample survey. Lancet Glob Health 2021;9:e773–81.

Ngere I, Dawa J, Hunsperger E, Otieno N, Masika M, Amoth P, et al. High seroprevalence of SARS-CoV-2 but low infection fatality ratio eight months after introduction in Nairobi, Kenya. Int J Infect Dis 2021;112:25–34.

Pere H, Mboumba Bouassa RS, Tonen-Wolyec S, Podglajen I, Veyer D, Belec L. Analytical performances of five SARS-CoV-2 whole-blood finger-stick IgG-IgM combined antibody rapid tests. J Virol Meth 2021;290.

Poustchi H, Darvishian M, Mohammadi Z, Shayanrad A, Delavari A, Bahadorimonfared A, et al. SARS-CoV-2 antibody seroprevalence in the general population and high-risk occupational groups across 18 cities in Iran: a population-based cross-sectional study. Lancet Infect Dis 2021;21:473–81.

R Core Team. R: a language and environment for statistical computing. Vienna: R Foundation for Statistical Computing; 2020.

WHO. WHO coronavirus (COVID-19) dashboard. Situation by region, country, territory & area. Geneva: World Health Organization; 2022 Available at https://covid19.who.int/table last accessed July 2022.