SARS-CoV-2 Seroprevalence Trend among Pregnant Women in Zambia, 2021-2022

CENTER FOR GLOBAL HEALTH

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BACKGROUND

- First COVID-19 cases confirmed in Zambia on 18 March 2020 [1]
- As of 1 February 2023, the Zambia National Public Health Institute reported 340,944 cumulative confirmed cases
- Confirmed COVID-19 case counts underestimate SARS-CoV-2 infections, particularly in countries with limited testing capacity
- A seroprevalence study in July 2020 estimated 92 SARS-CoV-2 infections occur in Zambia per laboratory-confirmed case [2]
- Pregnant antenatal care (ANC) attendees have served as healthy population surrogates for disease surveillance of HIV, malaria, and syphilis

We measured monthly SARS-CoV-2 seroprevalence among women attending ANC clinics to assess infection trends over time in Zambia.

METHODS

Study design, setting, and participants

- Repeated monthly cross-sectional surveys of pregnant women aged 15-49 years attending first antenatal care visits in 3 districts of Zambia from September 2021 to September 2022
  - Data collection began after wave 3 (Delta variant) and encompassed wave 4 (Omicron variant)
- Selected 10 facilities per district and enrolled up to 20 women per facility per month

Sample collection and testing

- Dried blood spots collected on filter paper using blood from finger prick or venipuncture
- HIV testing according to national guidelines (i.e., all women tested at first ANC visit unless known to be HIV positive)
- Serologic testing using Tetracore® FlexImmArray™ SARS-CoV-2 Human IgG Antibody Test
  - 3 targets: spike protein, nucleocapsid protein, hybrid
  - Results based on signal ratios according to manufacturer specifications (Table 1) [3]

$$Signal\ ratio = \frac{Median\ fluorescent\ intensity\ for\ each\ protein}{Average\ calibrator\ median\ fluorescent\ intensity}$$

Table 1. SARS-CoV-2 Human IgG assay results determination

Signal ratio	Result
≥1.2 for all 3 targets	SARS-CoV-2 IgG Positive
≤0.9 for any target	SARS-CoV-2 IgG Negative
>0.9 and <1.2 for 1 or 2 targets AND ≥1.2 for other 1 or 2 targets	Indeterminate

Survey analysis

- Compared SARS-CoV-2 seroprevalence trend among participants with national confirmed COVID-19 cases
- Excluded participants with indeterminate antibody results
- Calculated odds ratios (ORs) for aggregated SARS-CoV-2 seroprevalence by selected participant characteristics, adjusting for enrollment month

Most women had evidence of SARS-CoV-2 exposure after the Omicron variant spread throughout Zambia

RESULTS

- 6,680 pregnant women were enrolled between September 2021 and September 2022 (Table 2)
- 260 (4%) participants were excluded due to indeterminate antibody test results (N=6,420)
- Overall SARS-CoV-2 seroprevalence was 70% (Table 3)
  - Seroprevalence rose from 50% in September 2021 to 89% in September 2022 (Fig. 1)
  - Greatest increase in seroprevalence was from 47% in December 2021 to 64% in January 2022 during the Omicron wave
- SARS-CoV-2 seroprevalence trends differed by district (Fig. 2), with higher odds of SARS-CoV-2 seropositivity in urban districts (Lusaka and Chipata) compared to rural Chongwe District (Table 3)
- Odds of seropositivity were greater among older women and women who had received a COVID-19 vaccine (Table 3)

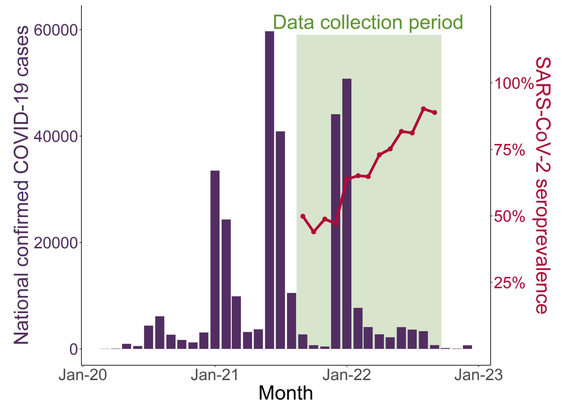

Figure 1. SARS-CoV-2 seroprevalence among ANC attendees in Zambia between September 2021 and September 2022 superimposed over national confirmed COVID-19 cases.

Table 2. Participant characteristics

	Participants N=6,420 n (col %)
District	
Chongwe	2,334 (36.4)
Chipata	2,006 (31.2)
Lusaka	2,080 (32.4)
Age group	
15-24 years	3,026 (47.1)
25-49 years	3,368 (52.5)
missing	26 (0.4)
HIV status	
Negative	5,573 (86.8)
Positive	628 (9.8)
missing	219 (3.4)
Vaccination status	
Unvaccinated	5,270 (82.1)
Vaccinated	1,138 (17.7)
missing	12 (0.2)
Prior COVID-19	
No or unknown	6,288 (97.9)
Yes	132 (2.1)

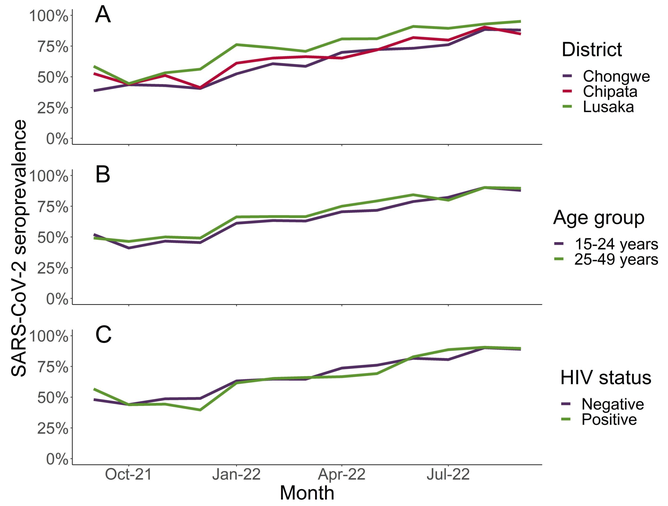

Figure 2. SARS-CoV-2 seroprevalence trends among women attending first antenatal care visits in 3 districts of Zambia between September 2021 and September 2022 by (A) district, (B) age group, and (C) HIV status.

RESULTS, continued

Table 3. SARS-CoV-2 seroprevalence by participant characteristics

	SARS-CoV-2 Seronegative n (row %)	SARS-CoV-2 Seropositive n (row %)	aOR§ (95% CI)
Total	1,927 (30.0)	4,493 (70.0)	--
District			
Chongwe	794 (34.0)	1,540 (66.0)	Ref
Chipata	631 (31.5)	1,375 (68.5)	1.2 (1.0, 1.3)*
Lusaka	502 (24.1)	1,578 (75.9)	1.9 (1.6, 2.2)*
Age group			
15-24 years	948 (31.3)	2,078 (68.7)	Ref
25-49 years	966 (28.7)	2,402 (71.3)	1.2 (1.1, 1.4)*
HIV status			
Negative	1,642 (29.5)	3,931 (70.5)	Ref
Positive	220 (35.0)	408 (65.0)	1.0 (0.8, 1.2)
Vaccination status			
Unvaccinated	1,714 (32.5)	3,556 (67.5)	Ref
Vaccinated	211 (18.5)	927 (81.5)	1.4 (1.2, 1.6)*
Prior COVID-19			
No or unknown	1,895 (30.1)	4,393 (69.9)	Ref
Yes	32 (24.2)	100 (75.8)	1.3 (0.9, 2.0)

§Odds ratios adjusted for enrollment month; CI: confidence interval; *p-value<0.05

DISCUSSION

- Most participants had evidence of SARS-CoV-2 exposure; low COVID-19 vaccine coverage and nucleocapsid protein target suggest seroprevalence was mostly due to natural infection
- COVID-19 vaccine coverage among participants was low, but associated with higher odds of SARS-CoV-2 seropositivity, which could suggest stronger or more sustained immune response in vaccinated individuals exposed to SARS-CoV-2
- High SARS-CoV-2 seroprevalence compared to reported prior COVID-19 indicates a surveillance gap in which many women with mild or asymptomatic infections may not have been tested
- This study demonstrates that ANC clinics have a potential role in providing an easy-access population for ongoing SARS-CoV-2 serosurveillance
- ANC clinics provide a platform for focused SARS-CoV-2 prevention messaging and COVID-19 vaccination and management in pregnant women at risk of severe disease

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