

Supplementary material:

Estimated SARS-CoV-2 infection rate and fatality risk in Gauteng Province, South Africa: a population based sero-epidemiological survey.

1.1 Epidemiology of COVID-19 in Gauteng and Government responses

The first confirmed COVID-19 case in Gauteng was identified on March 7, 2020. South Africa's Government embarked on a highly restrictive lockdown from March 23, 2020, with almost complete shutdown of all economic and public activities until May 31, 2020, following which restrictions were gradually relaxed paradoxically as the first COVID-19 wave gained momentum (Supplementary Fig. S1). The effective reproductive rate for COVID-19 was estimated at 1.5 during the initial highly restrictive lockdown, indicating ongoing community transmission of SARS-CoV-2¹. Despite availability of medical laboratory infrastructure in South Africa, testing for SARS-CoV-2 using NAAT was constrained by challenges in accessing testing reagents, resulting in testing for SARS-CoV-2 infection being mainly selective of symptomatic or highly suspicious cases of COVID-19². The selective testing was partly manifest by high average test positivity rates of 29.7% and 34.7% during the peak periods, defined as when the rolling 7-day average for NAAT positivity rates was >10%. The timing of the peak of the first wave was from mid-June to early-September, 2020 and the second peak was from mid-November, 2020 to end-January, 2021³.

Supplementary Table S1: Literature review of sero-surveys conducted in Africa through to April 30, 2021.

Author and publication status	Country & setting	Study population	Design	Sample size	Participant age (years) Median (IQR)	Specimen collection dates	Survey in relation to waves	Antibodies tested	Assay used	Sensitivity / specificity	Seroprevalence (%)
Sykes et al., (2021)· Preprint	South Africa· 4 provinces	Blood donors – blood transfusion centres	Cross-sectional	4 858	15-69	January 7-25, 2021	2nd wave peak and soon after	IgG	Elecsys Anti-SARS-CoV-2 immunoassay	99/100	31·8 to 62·5
Uyoga et al., (2021)· Published	Kenya· National	Blood donors – 4 regional blood transfusion centres	Cross-sectional	3 174	15-66	April 30-June 16, 2020	1st wave surge	IgG	ELISA - spike IgG	93/99	5·6
Alemu et al., (2020)· Published	Ethiopia· Addis Ababa	Random sample of adult community members	Cross-sectional	301	30 (19-41)	April 23-28, 2020	Pre-1st wave surge	IgG, IgM	Lateral flow immunoassay	88/100	7·6
Quashie et al., (2021)· Preprint	Ghana· Selected regions	Convenience sample of adults at markets, lorry stations, malls, Covid testing centres, hospitals	Repeated cross-sectional	2 729	Mode: 21-40	*August 2020; October 2020; December 2020; February 2021	Start: post-1 st wave End: peak 2 nd wave	IgG IgM	Lateral flow immunoassay	98/64	Round 1: IgG 13·0; IgM 1·6 Round 2: IgG 15·2; IgM 1·3 Round 3: IgG 9·7; IgM 2·3 Round 4: IgG 22·8, IgM 2·2
Kempen et al., (2020)· Published	Ethiopia· Addis Ababa	Convenience sample of laboratory users	Cross-sectional	99	>14	May 18-21, 2020	Pre-1st wave surge	IgG	Abbott IgG	100/100	3·0
Majiya et al., (2020)· Preprint	Nigeria· Niger State	Random sample of adult community members	Cross-sectional	185	>30	June 26-30, 2020	1st wave peak	IgG, IgM	Lateral flow immunoassay	99/98	IgG: 25·4 IgM: 2·2

Mulenga et al., (2021)- Published	Zambia- Six districts	Population-based representative sample of 6 districts	Cross-sectional	3 742	18 (8–32)	July 4-27, 2020	1 st wave surge and peak	IgG	ELISA (spike)	90/N/A	Pooled: 10-6 ELISA only: 2-1
Wiens et al., (2021)- Preprint	South Sudan- Juba	Population-based representative sample of Juba	Cross-sectional	2 214	1-84	August 10-Sep 11, 2020	Post-1 st wave	IgG	ELISA - spike RBD	100/64	22-3
Hsiao et al., (2021)- Unpublished report	South Africa- Cape Town	Residual blood of patients at primary care clinics	Cross-sectional	2 791	<20->50	July 15-August 7, 2020	1st wave peak and soon after	IgG, IgM	Roche Elecsys anti-SARS-CoV-2 assay	91/100	40-0
Halatoko et al., (2020)- Published	Togo- Lome	Convenience sample of high-risk adults	Cross-sectional	955	36 (32-43)	April 23, 2020, to May 8, 2020	Months before 1 st wave	IgG, IgM	Rapid Test	73/85	Pooled 1-6 IgG or IgM: 0-9
Mukwege et al., (2021)- Published	Democratic Republic of Congo- Bukavu	Health workers at 1 hospital	Cross-sectional	359	mean 43,1 (SD 11,3)	July 2-August 19, 2020	Post-1 st wave peak	IgG, IgM	Lateral flow immunoassay- ELISA to confirm	62/99	41-2
Mostafa et al., (2021)- Published	Egypt- Cairo	Health workers at 12 health facilities	Prospective cohort	4 040	32 (27-42)	April 22-June 10, 2020	1 st wave surge and peak	IgG, IgM	Lateral flow immunochromatographic assay	83/100	IgG: 0-4, IgM: 1-0
Kassem et al., (2020)- Published	Egypt- Cairo	Health workers at 1 hospital	Cross-sectional	74	32 (x-x)	June 1-14, 2020	1 st wave peak	IgG, IgM	Rapid Serology Test	93/98	IgG + IgM: 4-0 IgG or IgM: 12-2
Rusakaniko et al., (2021)- Published	Zimbabwe- Bulawayo	Health workers at 24 health facilities	Cross-sectional	635	40 (32–52)	June 9-22, 2020	Pre-1 st wave surge	IgG, IgM	Chromatographic immunoassay (spike & nucleocapsid)	98/88	IgG or IgM: 8-9
Etyang et al., (2021)- Preprint	Kenya- 3 counties	Health workers at 5 hospitals	Cross-sectional	684	35 (24-46)	July 3- December 4, 2020	1st wave peak to post-2nd wave peak	IgG	ELISA	93/99	19-7
Chibwana et al., (2020)- Preprint	Malawi- Blantyre	Health workers at 1 hospital	Cross-sectional	500	31 (20-64)	May 22-June 19, 2020	Pre-1st wave surge	IgG	ELISA (spike & nucleo)	88/93	16-8

Abdelmoniem et al., (2021)- Published	Egypt- Cairo	Health workers at 1 hospital	Cross-sectional	203	31-9 (25,3-38,5)	June 1-14, 2020	1 st wave peak	IgG, IgM	Rapid test, qualitative lateral flow immunochromatographic assay	93/98	IgG + IgM: 16-7 IgG or IgM: 18-2
Olayanju et al., (2021)- Published	Nigeria- Ibadan	Health workers at 1 hospital	Cross-sectional	133	20-60	N/A	Pre-1st wave surge	IgG	ELISA	N/A	45-1
Kammon et al., (2020)- Preprint	Libya- Alzintan	Adult patients and health workers at 2 hospitals and 1 clinic	Cross-sectional	219	Adults	April 2-May 18, 2020	Pre-1 st wave (survey ended before 20 cases)	Combined IgG+ IgM	Lateral flow immunochromatographic assay	86/99	2-7
Asuquo et al., (2020)- Preprint	Nigeria- Calabar	Adult patients and health workers at 1 hospital	Cross-sectional	66	> 18	June 17-25, 2020	1 st wave peak	IgG, IgM	COVID-19 IgG/IgM Rapid Test + another test kit (not well described)	N/A	IgG: 25-8 IgG + IgM: 7-6
Shaw et al., (2021)- Published	South Africa- Cape Town	Convenience sample of workers at 1 shopping & tourist complex	Cross-sectional	405	38 (18-69)	August 17-September 4, 2020	Post-1st wave peak	IgG	Abbott SARS-CoV-2 IgG assay	87/99	23-7
Kagucia	Kenya- 3 counties	Convenience sample of truck drivers and assistants	Cross-sectional	830	40 (34-48)	Sep 30-October 23, 2020	2nd wave surge	IgG	ELISA (spike)	93/99	39-6,

*The four rounds were not done in all sites or in the same sites.

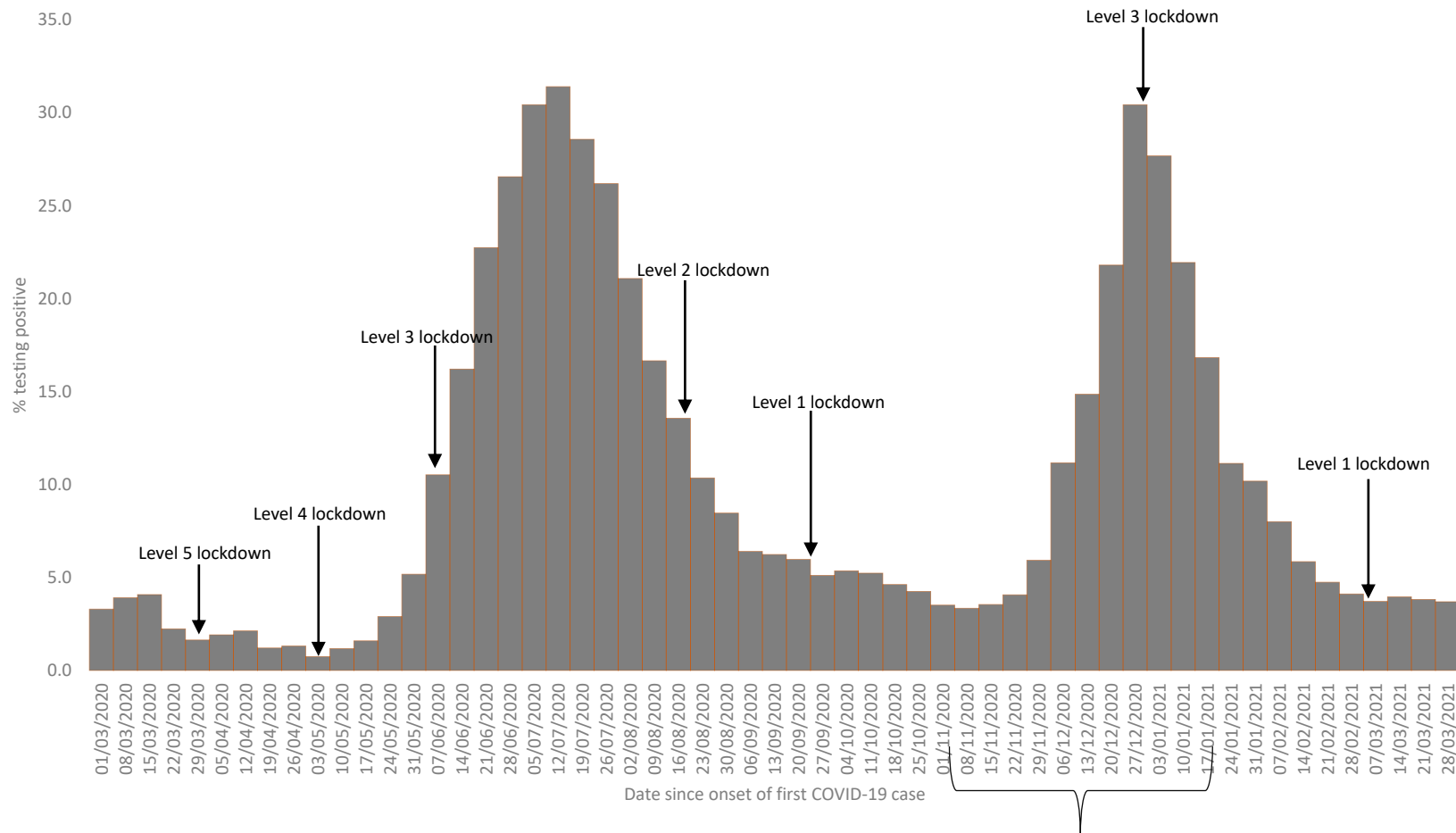
We identified 22 African seroprevalence surveys through a literature search. We searched PubMed for African seroprevalence studies published during 1 January 2020 to 25 April 2021, using the key words “COVID-19”, “SARS-COV-2”, “seroprevalence”, “antibody survey”, “sero-epidemiolog*”, and “Africa”. We also searched the pre-print server MedRxiv. We identified 17 studies. We further used the Google search engine to identify other pre-prints and unpublished reports and reviewed the bibliographies of our identified studies and recent systematic reviews. This increased the identified studies to 22.

Supplementary Table S2: survey sample size per sub-district and the accompanying seroprevalence estimates

District	Sub-district	Total population size	% of informal dwellings sampled	Target sample size	Sampled size	Achieved as % of target	Survey start date	Survey end date
Johannesburg	Johannesburg A	779 519	5.8%	287	285	99.2%	07-Dec-20	22-Jan-21
	Johannesburg B	435 241	0.0%	142	96	67.6%	08-Dec-20	21-Jan-21
	Johannesburg C	799 980	7.3%	301	274	91.1%	16-Nov-20	14-Jan-21
	Johannesburg D	1 396 243	12.4%	508	550	108.3%	04-Nov-20	21-Jan-21
	Johannesburg E	601 433	15.8%	174	162	93.2%	16-Nov-20	21-Jan-21
	Johannesburg F	751 484	9.7%	217	310	142.8%	17-Dec-20	20-Jan-21
	Johannesburg G	842 339	16.4%	319	239	74.8%	05-Nov-20	18-Jan-21
	Johannesburg District	5 606 238	10.4%	1 948	1 916	98.4%	04-Nov-20	21-Jan-21
Ekurhuleni	Ekurhuleni E1	626 517	15.8%	283	439	155.4%	09-Nov-20	18-Jan-21
	Ekurhuleni E2	455 262	25.5%	201	287	142.4%	10-Nov-20	18-Jan-21
	Ekurhuleni N1	708 290	17.8%	276	182	66.0%	09-Nov-20	21-Jan-21
	Ekurhuleni N2	697 175	21.4%	268	221	82.5%	12-Nov-20	21-Dec-20
	Ekurhuleni S1	673 758	29.9%	257	193	75.1%	07-Dec-20	22-Jan-21
	Ekurhuleni S2	664 648	16.3%	299	415	138.6%	25-Nov-20	22-Jan-21
	Ekurhuleni District	3 825 650	20.0%	1 584	1 737	109.7%	09-Nov-20	22-Jan-21
Sedibeng	Emfuleni	830 798	18.4%	369	271	73.4%	12-Nov-20	21-Jan-21
	Lesedi	127 419	33.3%	56	49	87.0%	23-Nov-20	16-Jan-21

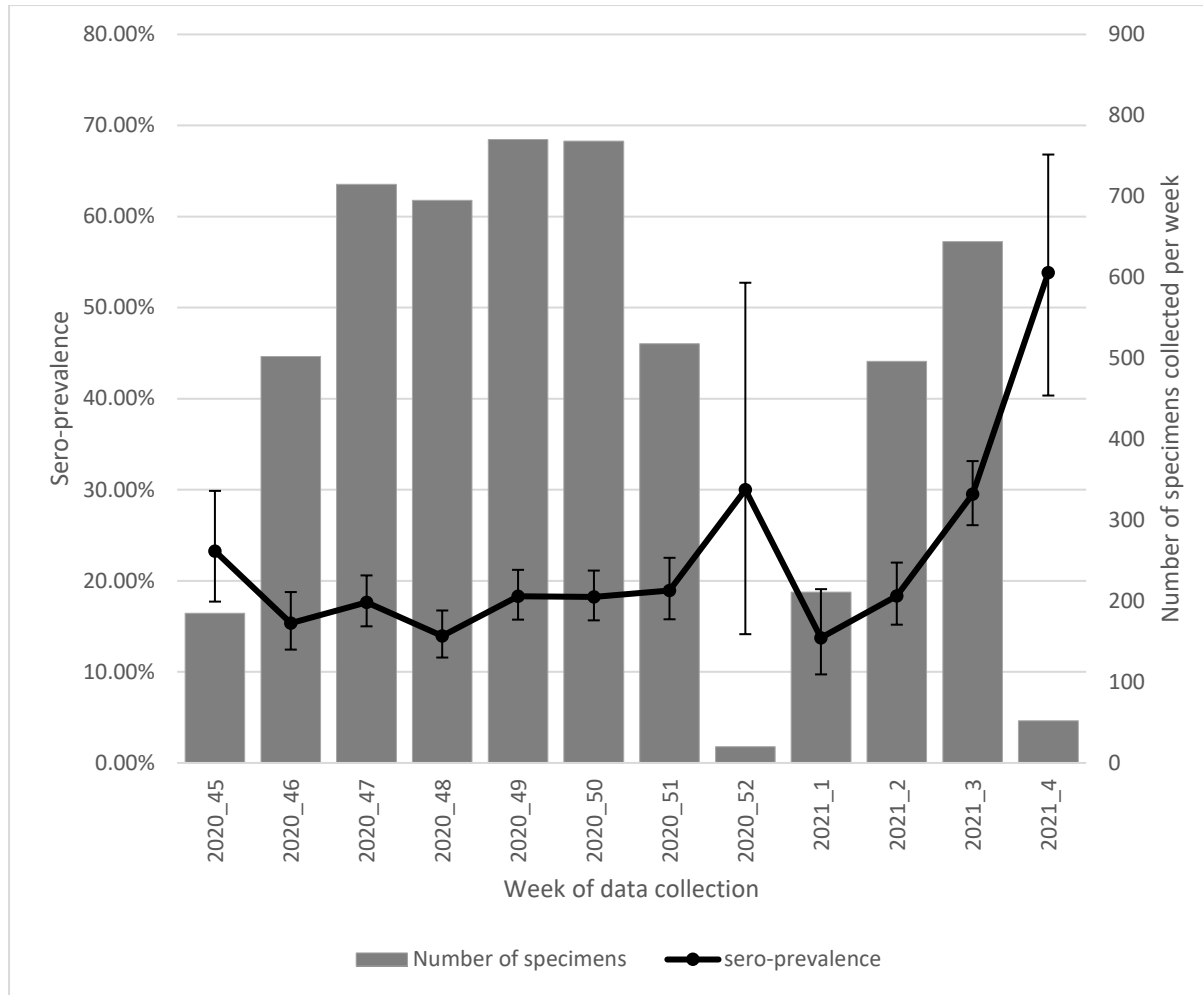
	Midvaal	126 285	27.1%	51	58	113.4%	10-Dec-20	19-Jan-21
	Sedibeng District	1 084 503	21.8%	477	378	79.3%	12-Nov-20	21-Jan-21
Tshwane	Region 1	1 032 885	25.5%	468	260	55.6%	10-Nov-20	14-Jan-21
	Region 2	436 950	24.5%	176	221	125.3%	06-Nov-20	17-Jan-21
	Region 3	730 788	20.4%	262	170	65.0%	20-Nov-20	13-Jan-21
	Region 4	482 448	16.3%	238	55	23.1%	27-Nov-20	18-Jan-21
	Region 5	119 190	36.6%	166	46	27.8%	16-Nov-20	20-Jan-21
	Region 6	768 446	20.7%	240	154	64.3%	26-Nov-20	21-Jan-21
	Region 7	138 928	17.1%	56	40	71.0%	17-Nov-20	15-Dec-20
	Tswane District	3 709 635	23.3%	1 606	946	58.9%	06-Nov-20	21-Jan-21
West Rand	Merafong City	213 874	23.0%	114	176	154.4%	10-Nov-20	18-Dec-20
	Mogale City	435 254	19.7%	164	255	155.3%	09-Nov-20	17-Dec-20
	Rand West City	300 960	17.6%	133	176	132.7%	22-Nov-20	21-Dec-20
	West Rand District	950 088	20.0%	411	607	147.8%	09-Nov-20	21-Dec-20
Unallocated					748			
GAUTENG PROVINCE	TOTAL	15 176 113		6025	6 332	108.4%		
			17.3%				5 584	92.7%

Figure presents the target sample size and the achieved number of individuals. Across all sub-districts, the sample size was inflated by 25% to account for non-participation with 10% oversampling of households. The survey data collection was from November 4, 2020 to January 22, 2021.



Supplementary Figure S1: Sero-survey period by epidemic week showing weekly NAAT positivity rates.

This figure depicts SARS-CoV-2 nucleic acid amplification test (NAAT) positivity trajectory since the first NAAT test in Gauteng, in relation to national outbreak control measures. NAAT testing positivity of >10% was used as a proxy for onset of a resurgence in Gauteng. The survey started November 4, 2020, 8 weeks after the end of the first wave (SARS-CoV-2 NAAT positivity had declined to <10% for the first wave) and coincided with the peak of the second wave. The last sampling was done on January 22, 2021, which was nine weeks after SARS-CoV-2 resurgence.



Supplementary Figure S2: Number of specimens collected per week of survey data collection and the corresponding seroprevalence for specimens collected that week.

We present the number of specimens collected per survey week and the corresponding seroprevalence for specimens collected that week. There was a significant increase in seroprevalence for specimens collected after the first week of January 2021.

References

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