Preliminary report of SARS-CoV-2 antibody prevalence among blood donors in Kenya

key messages

- The ideal way of estimating exposure to COVID-19 in the Kenyan population would be visiting randomly selected homesteads to collect and then test blood samples. This has not been practical under current restrictions.
- Blood donors are a convenient sample of the community.
- Antibody testing suggests many more Kenyans have already been exposed to COVID-19 than have been identified by surveillance activities.
- The estimated prevalence of antibodies to SARS-CoV-2 among blood donors in Kenya ranged from 1.1% in Uasin Gishu county to 12.4% in Nairobi county.
- The numbers exposed would suggest that we should be seeing significant severe disease based on modelling approaches currently in use, but this has not yet happened.
- The analysis is based on only 2,535 samples with limitations previously discussed. e.g. if blood donors are more mobile and more exposed than the general population then we would over-estimate the exposed population.
- Many more samples including sources outside blood donors are required to make confident conclusions. These include asymptomatic and symptomatic PCR-positive cases, frontline workers in the health and non-health care sectors, ANC clients and ultimately, from the general population.

What antibody testing can tell us about COVID-19

- Active virus infection can be detected by running PCR tests on nose/throat swab samples. The test stays positive for about two weeks.
- Whether a person has been infected before can be detected by testing the blood for antibodies. Antibodies are thought to stay positive for several months
- Testing a sample of the population for antibodies tells us how many people have already been exposed to the virus at some time in the past.

Antibody test development and validation

- KEMRI-Wellcome has developed an enzyme-linked immunosorbent assay (ELISA) that targets the spike protein of SARS-CoV-2.
- We successfully generated and purified recombinant SARS-CoV-2 spike protein using protocols provided by collaborators in the USA
- We optimized the assay using blood samples obtained before the COVID-19 pandemic (negative controls), and blood samples obtained from PCR confirmed SARS-CoV-2 positive cases (positive controls).
- External validation of the seropositivity thresholds was performed with a panel from the WHO (Figure 1).

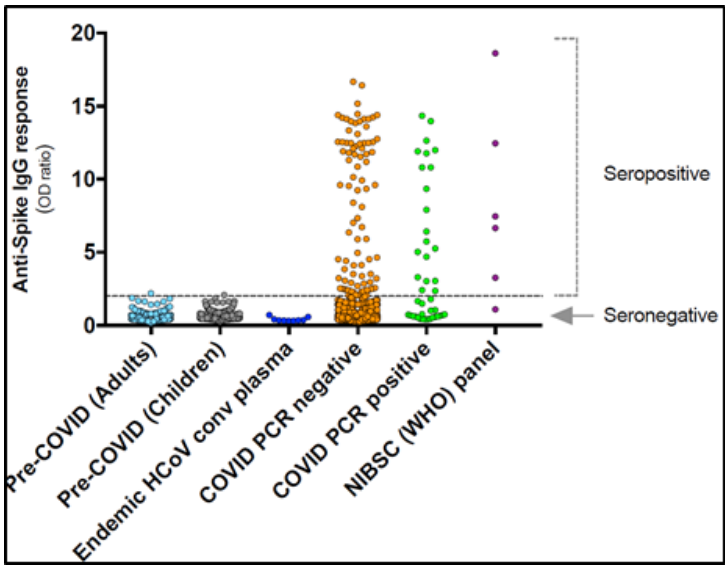


Figure 1: Findings from ELISA validation

Blood donor samples

- The ideal way of estimating exposure to COVID in the Kenyan population would be visiting randomly selected homesteads to collect and then test blood samples. This has not been practical under current restrictions.
- Blood donors are a convenient sample of the community.
- Blood donors may differ from the general population (such as age, sex and health status). So we may not be representatively sampling the Kenyan population.
- The blood samples used in this analysis were donated between 30/04/2020 and 16/06/2020 (median 27/05/2020).

Findings

Table 1: Antibody prevalence from blood donor samples by region

County/ region*	No. of samples collected	% antibody positive (95%CI)	Total population (Census 2019)	Predicted exposed population
Kilifi	336	1.5 (0.6, 3.5)	1,453,787	20,000
Kwale	210	4.3 (2.2, 8.0)	866,820	40,000
Mombasa	385	8.6 (6.1, 11.8)	1,208,333	100,000
Other Coastal counties	124	4.8 (2.1, 10.3)	800,534	40,000
N. Eastern	41		2,490,073	0
Machakos	145	6.2 (3.2, 11.5)	1,421,932	90,000
Other Eastern counties	46	4.3 (1.1, 15.8)	5,399,117	230,000
Central	105	6.7 (3.2, 13.3)	5,482,239	370,000
Nairobi	137	12.4 (7.8, 19.0)	4,397,073	550,000
Kisumu	200	7.5 (4.5, 12.1)	1,155,574	90,000
Other Nyanza counties	269	7.8 (5.1, 11.6)	5,114,005	400,000
Western	47	4.3 (1.1, 15.5)	5,021,843	220,000
Uasin Gishu	375	1.1 (0.4, 2.8)	1,163,186	10,000
Other R' Valley counties	115	4.3 (1.8, 10.0)	11,589,780	500,000
Total	**2,535**		47,564,296	

**Counties with <150 samples are grouped into former provinces*

Table 2: Comparison between predicited COVID-exposed popualtion and PCR-confirmed cases by region

County/ region	Predicted exposed population from antibody data[1]	Total PCR-confirmed Cases by RRTs in County Health Teams[2]
Kilifi	20,000	54
Kwale	40,000	51
Mombasa	100,000	1368
Other Coastal counties	40,000	30
N. Eastern	0	
Machakos	90,000	52
Other Eastern counties	230,000	40
Central	370,000	208
Nairobi	550,000	2732
Kisumu	90,000	20
Other Nyanza counties	400,000	142
Western	220,000	400
Uasin Gishu	10,000	72
Other R' Valley counties	500,000	302

[1] Mid May 2020
[2] 26 June 2020

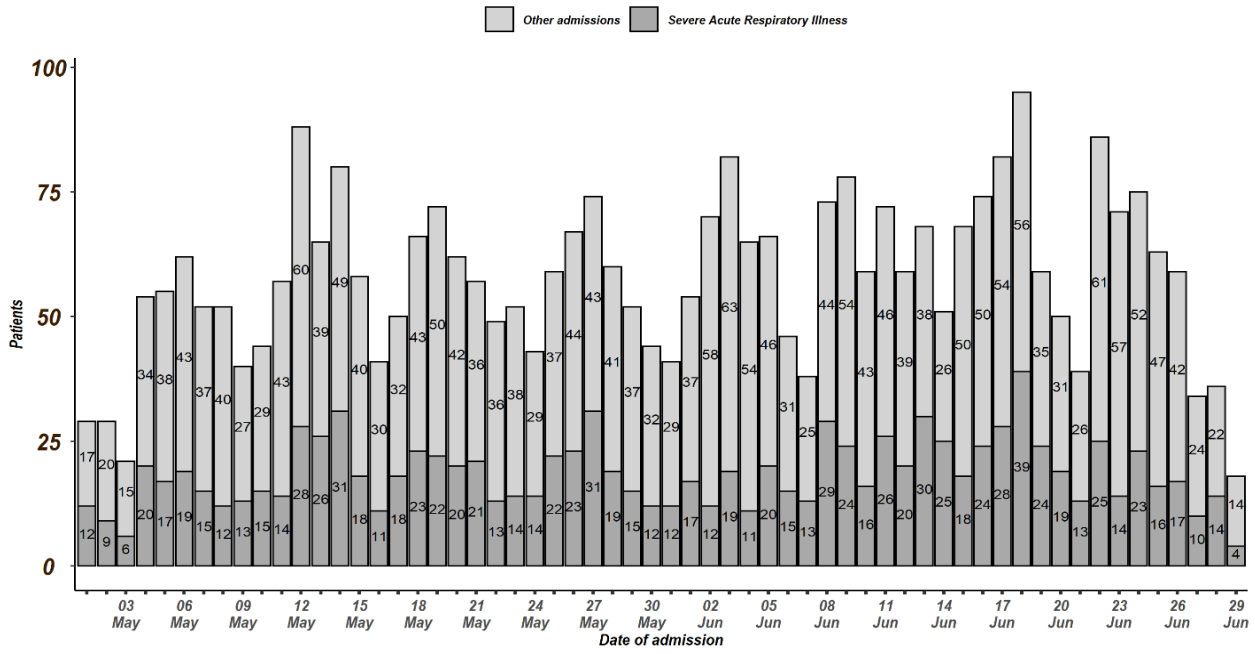
There is a large gap between the confirmed cases identified by RRTs in testing and tracing, and the numbers of individuals in the population that we believe have been exposed based on antibody data.

Table 3: Severe cases and deaths predicted from current models by region based on antibody data

County/ region	Predicted exposed population from antibody data	Numbers of Severe Cases Predicted from Models Based on Antibody Data	Numbers of Deaths Predicted from Models Based on Antibody Data
Kilifi	20,000	207	52
Kwale	40,000	344	87
Mombasa	100,000	750	165
Other Coastal counties	40,000	421	108
N. Eastern	0	0	0
Machakos	90,000	1250	323
Other Eastern counties	230,000	3077	808
Central	370,000	5219	1351
Nairobi	550,000	3489	718
Kisumu	90,000	840	210
Other Nyanza counties	400,000	4361	1126
Western	220,000	2370	616
Uasin Gishu	10,000	112	27
Other R' Valley counties	500,000	4398	1093

The large numbers of the population that have been exposed would lead models to predict significant numbers of severe cases and deaths.
However, the county hospitals in which monitoring for pneumonia admissions is established are not seeing high numbers of admissions (Figure 2).

*Figure 2: Adult inpatient hospital adminssions in clinical information network county hospitals**



County hospitals included: Homa Bay, Naivasha, Kiambu, Machakos, Mama Lucy, Kisumu, Kakamega, Busia, Kitale, Embu, Bungoma, Migori

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