Epidemiology of SARS-CoV-2 in South Africa including Omicron

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Number and cumulative number of laboratory-confirmed cases of COVID-19 by province and date of specimen collection, South Africa, 3 March 2020 – 22 May 2021 (n=1 635 465)
PHIRST-C Study design and recruitment

- Prospective household-level community cohort
- 2 sites: Agincourt Demographic Surveillance Site (rural) and Jouberton in Klerksdorp (urban)
- Random selection of ~100 households at each site >500 individuals per site (>1000 total) – from previous PHIRST cohort (new households if needed)
- Verify eligibility and baseline data, baseline blood (serology), HIV status and viral load, underlying illness

**Intense 14 months follow up** - July 2020 to end August 2021

- **Twice weekly** household visit (Monday to Wednesday and Thursday to Saturday), mid-turbinate **nasal swab** (Seegene real-time reverse transcriptase PCR – SARS-CoV-2, Flu, RSV), data on **symptoms** and healthcare seeking
- **Two monthly blood draw** (serology – ELISA Roche Elecsys and neutralising antibodies)

Cohen et al Lancet Global Health, 2021;
Cohen et al Infl Other Resp Virus 2021
High attack rate, mostly asymptomatic, some severe

- Of 125,088 potential follow-up visits July 2020 - 28 August 2021
  - 115,759 (93%) nasal swabs tested,
  - 62% (749/1200) individuals at least one infection
    - 12% reinfection rate
  - 90% (200/222) households at least one infection
  - 15% (96/662) of infection episodes had symptoms
    - 6 (6%) attended outpatient clinic
    - 9 (9%) hospitalised
    - 2 (2%) died (IFR 0.3% (95% CI 0.03%-1%)
- 25% (213/856) of susceptible household contacts acquired infection
  - Beta variant 4 times and Delta 15 times more infectious than wild type virus
High proportion of individuals with previous natural infection after third wave

4-6% of infections diagnosed in South Africa
Age standardised infection fatality ratios 0.1-0.4% in 1st wave

Rural site, Mpumalanga
Seroprevalence end of September – 60%

Urban Site, Northwest
Seroprevalence at end of September – 70%


Kleynhans et al EID 2021 and unpublished data
Risk factors associated with Transmission

Kaiyuan Sun

Sun et al, In preparation
COVID-19 vaccination in SA, 01 Dec 2021

NDoH, December 2021
https://sacoronavirus.co.za/latest-vaccine-statistics/
S gene target failure – proxy for 69-70del
Thermo Fisher TaqPath assay

- S gene target failure was a proxy marker for Alpha variant, which was introduced in SA before Delta but never took over
- New increase in SGTF noted very recently - from mid-November
- ~20% of tests in public sector are TaqPath assay

Figure 9: S-gene dropout (%) of cases with high VL (Ct value<30 for ORF or N gene). The red bars are the number of tests reporting the presence of SARS-CoV-2 (daily) on the TaqPath assay. The solid blue line is the moving median of S-gene dropout (%).

*Current (end of Nov ’21) dramatically increasing trend in the proportion of SGTF (Ct value<30 for ORF or N gene)
S gene target failure by province

- Rapid increase in proportion with SGTF noted across multiple provinces (caution low number of tests in most provinces)

- Many samples with SGTF sequenced from Gauteng (samples collected 14-16 Nov) - majority were B.1.1.529

- Hundreds of recently collected samples being sequenced currently by NGS-SA labs – results available by end of week

Courtesy of Lesley Scott and NHLS team
Delta dominated South Africa’s third wave with >80% frequency in October, with C.1.2 detection remaining <4%. Omicron appears to dominate November sequencing data but sequencing is ongoing to determine its true prevalence.

Testing – PCR and Antigen

In week 48 the percentage testing positive was 24.9%, which was 16.4% higher than the previous week.

<table>
<thead>
<tr>
<th>Week number</th>
<th>Week beginning</th>
<th>Percentage testing positive (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>16-May-21</td>
<td>9.7</td>
</tr>
<tr>
<td>21</td>
<td>23-May-21</td>
<td>11.3</td>
</tr>
<tr>
<td>22</td>
<td>30-May-21</td>
<td>13.4</td>
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<tr>
<td>23</td>
<td>06-Jun-21</td>
<td>17.6</td>
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<tr>
<td>24</td>
<td>13-Jun-21</td>
<td>23.7</td>
</tr>
<tr>
<td>25</td>
<td>20-Jun-21</td>
<td>27.4</td>
</tr>
<tr>
<td>26</td>
<td>27-Jun-21</td>
<td>29.9</td>
</tr>
<tr>
<td>27</td>
<td>04-Jul-21</td>
<td>31.9</td>
</tr>
<tr>
<td>28</td>
<td>11-Jul-21</td>
<td>31.5</td>
</tr>
<tr>
<td>29</td>
<td>18-Jul-21</td>
<td>28.2</td>
</tr>
<tr>
<td>30</td>
<td>25-Jul-21</td>
<td>25.2</td>
</tr>
<tr>
<td>31</td>
<td>01-Aug-21</td>
<td>23.7</td>
</tr>
<tr>
<td>32</td>
<td>08-Aug-21</td>
<td>23.3</td>
</tr>
<tr>
<td>33</td>
<td>15-Aug-21</td>
<td>22.7</td>
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<tr>
<td>34</td>
<td>22-Aug-21</td>
<td>20.0</td>
</tr>
<tr>
<td>35</td>
<td>29-Aug-21</td>
<td>16.0</td>
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<tr>
<td>36</td>
<td>05-Sep-21</td>
<td>13.0</td>
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<tr>
<td>37</td>
<td>12-Sep-21</td>
<td>9.3</td>
</tr>
<tr>
<td>38</td>
<td>19-Sep-21</td>
<td>6.7</td>
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<tr>
<td>39</td>
<td>26-Sep-21</td>
<td>4.6</td>
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<tr>
<td>40</td>
<td>03-Oct-21</td>
<td>3.3</td>
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<tr>
<td>41</td>
<td>10-Oct-21</td>
<td>2.6</td>
</tr>
<tr>
<td>42</td>
<td>17-Oct-21</td>
<td>1.8</td>
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<td>43</td>
<td>24-Oct-21</td>
<td>1.5</td>
</tr>
<tr>
<td>44</td>
<td>31-Oct-21</td>
<td>1.1</td>
</tr>
<tr>
<td>45</td>
<td>07-Nov-21</td>
<td>1.2</td>
</tr>
<tr>
<td>46</td>
<td>14-Nov-21</td>
<td>2.5</td>
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<tr>
<td>47</td>
<td>21-Nov-21</td>
<td>8.5</td>
</tr>
<tr>
<td>48</td>
<td>28-Nov-21</td>
<td>24.9</td>
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</tbody>
</table>

Number of new daily tests for SARS-CoV-2 and proportion positive by date of reporting and health sector, and 7-day moving average proportion positive, 6 April 2020 to date, South Africa.
The 7-day moving average daily number of cases has increased.
Proportion testing positive by health sub-district in South Africa for the week of 28 November – 3 December 2021 (Week 48)
Upper panel: Estimated daily reproduction number (R), with 95% confidence intervals Gauteng (last date included in the estimation: 29 November 2021). Lower panel: estimated number of laboratory-confirmed COVID-19 cases and hospital admissions by onset date with missing data imputed.


Trade off between:
- Transmission per unit contact
- Contact patterns
- Population immunity (immune escape)
Weekly proportion testing positive by age group, South Africa, 31 October – 20 November 2021

Proportion of positive tests

Age group (years)

10-14 year and 20-24 year age groups
Weekly incidence of laboratory-confirmed cases by age
Number of COVID-19 admissions in first two weeks of third and fourth wave, by age group in years, City of Tshwane Metro, 9-29 May 2021 and 14 November-4 December 2021
### Percentage of COVID-19 admissions with severe disease, by age group, Tshwane Metro, 5 March 2020 – 4 December 2021

<table>
<thead>
<tr>
<th>Age group</th>
<th>Total percentage severe n/N (%)</th>
<th>November 2021 percentage severe n/N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20 years</td>
<td>291/1,039 (28.0%)</td>
<td>24/139 (17.3%)</td>
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<tr>
<td>20-34 years</td>
<td>750/2,108 (35.6%)</td>
<td>15/8114 (13.2%)</td>
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<tr>
<td>35-59 years</td>
<td>6,347/9,704 (65.4%)</td>
<td>35/154 (22.7%)</td>
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<tr>
<td>≥60 years</td>
<td>5,889/7,563 (77.9%)</td>
<td>45/88 (51.1%)</td>
</tr>
<tr>
<td>All ages</td>
<td>13,277/20,414 (65.0%)</td>
<td>119/495 (24.0%)</td>
</tr>
</tbody>
</table>

**Severe = ARDS, Oxygen, Ventilation, ECMO, ICU, High care, Died**

Intrinsic bias around phase of wave
Early and late wave less severity
Incidental testing positive when admitted for surgery etc
More likely to admit mild patient early when beds available
Time to accumulate admissions and outcomes

**Limitations of the data**
Proxy indicator for severity
Data quality and delays, note private sector more reliable
daily update
No data on vaccination or previous infection

Clinician impressions milder illness
More in-depth analyses underway
Acknowledgement

Staff at CRDM, NICD

NICD COVID-19 response team

NICD DATCOV team

Many volunteers supporting NICD COVID-19 response
SARS-CoV-2 Sequencing Update
26 November 2021

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Msmoi N. Milisana K. et al. Lancet Microbe 2020

Prepared by the National Institute for Communicable Diseases (NICD) of the National Health Laboratory (NHLS) on behalf of the Network for Genomics Surveillance in South Africa (NGS-SA)
A Prospective Household study of SARS-CoV-2, Influenza, and Respiratory Syncytial virus community burden, Transmission dynamics and viral interaction in South Africa (PHIRST-C Study)

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In memory of Solly Hlatshwayo

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Rebiditshe Leketi
Kgaugelo Agasa
Tumele Molontoa
Naluwege Kato-kalule

Data Management
Pattamukkil Abraham
Mbusseni Ngema
Excess deaths 3 May 2020-27 Nov 2021 N=273,239
Age-standardise rate - 459 per 100,000 population

https://www.samrc.ac.za/reports/report-weekly-deaths-south-africa
Omicron spike mutations compared to other VOC/VOIs

- Multiple changes within the two immunogenic regions in S1 (NTD and RBD)
  - including a three amino acid insertion

- Accumulation of mutations surrounding the furin cleavage site
  - Including combination of N679K and P681H

- Effect of most spike S2 subunit changes have not been defined