January 2022

Solidarity Fund
Unity in action

SOLIDARITY FUND SUPPORT FOR RESEARCH INTO COVID-19 SURVEILLANCE AND PREVALENCE

Interim Report

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DESCRIPTION	BENEFICIARY	FUNDING ALLOCATED	*FUNDING DISBURSED
COVID-19 antibody prevalence survey	Human Sciences Research Council (HSRC)	R45,8m	R30,9m
Wastewater surveillance and research programme (WSARP)	South African Medical Research Council (SAMRC)	R1,3m	R1,3m
HDIHL COVID-19 related research	University of Venda, Walter Sisulu University (through SAMRC)	R2m	R1,6m
Total amount		**R50,4m**	**R33,8m**

**As of August 2021*

01

SOLIDARITY FUND'S HEALTH CARE MANDATE

The Solidarity Fund's Health Pillar works to augment and strengthen the South African government's COVID-19 response. It operates as a rapid response mechanism, assisting the country in addressing the key areas that will have the most significant impact on reducing the devastating effects of the pandemic on the health and wellbeing of its citizens.

A critical tool in the fight against the pandemic is the availability of current, accurate information about the prevalence of the COVID-19 virus and how it is spreading throughout communities. Testing and tracing is one method being employed to gather this data. However, since this is mostly done on patients already showing symptoms, and there is a delay in when symptoms arise after infection, this method puts us behind the curve of the infection. Current testing also doesn't capture the vast numbers of asymptomatic cases in the general population who would not go for testing due to lack of symptoms and not knowing their exposure status.

Therefore, the Solidarity Fund is supporting the South African Human Sciences Research Council (HSRC) and the South African Medical Research Council (SAMRC) to conduct innovative research that is providing invaluable information on the spread and evolution of the pandemic in the country. This is helping to refine and focus the pandemic response and vaccination efforts.

The Fund is supporting the following key COVID-19 research projects:

- **A national COVID-19 antibody seroprevalence (NCAS) survey**, led by the HSRC, to determine the actual prevalence of COVID-19 virus infection in the general population, including the proportion of asymptomatic infections, using antibody tests.

- **A wastewater COVID-19 surveillance and research early warning system** - that monitors wastewater for the presence of COVID-19 as an early warning system of the spread of the virus in communities. This research is being conducted through the SAMRC in conjunction with three historically disadvantaged universities, thereby enabling the training and capacitation of the next generation of researchers.

- **Wastewater surveillance and molecular epidemiology of COVID-19 in northern South Africa.** Through the University of Venda, this research project aims to build capacity within the university to conduct disease surveillance through support for the wastewater study and genome sequencing and variant detection of COVID-19 in northern South Africa.

- **The impact of obesity on COVID-19 severity and mortality.** This research will help identify those most at risk for severe illness and death from COVID-19 due to obesity while building capacity for surveillance. Walter Sisulu University is conducting this research in the Eastern Cape with support from the SAMRC.

The details and achievements of these projects are discussed below.

02

IMPACT OF THE FUND'S RESEARCH SUPPORT

The research projects have produced much-needed and highly beneficial data and information that is helping the country to better understand the spread of the SARS-Cov-2 virus through the population.

- The seroprevalence study was the **first to provide national estimates of the prevalence of SARS-CoV-2 antibodies in South Africa** based on a representative sample of the population. Other similar studies were limited to specific regions only.

- The **seroprevalence study provided decision-makers with critical information on the burden of COVID-19 infection in the country, the high person-to-person transmissibility of COVID-19, and the proportion of asymptomatic infections**, providing valuable information for prevention, testing, and vaccination strategies.

- The **wastewater study has implemented an early warning public health surveillance system** for COVID-19. It is a valuable source of real-time data to guide the best deployment of public health interventions and resources in the fight against the pandemic.

- The **wastewater surveillance is being conducted at 72 wastewater treatment plants across four provinces** (Western Cape, Eastern Cape, Gauteng and Limpopo), monitoring 7,6 million people.

- The **wastewater surveillance dashboard was upgraded** to better provide the public and health stakeholders a centralised, online location to obtain up-to-date information on levels of COVID-19 in wastewater, thereby allowing them to make informed decisions on how to focus their response (https://www.samrc.ac.za/wbe/).

- **Capacity for surveillance research was strengthened in three historically disadvantaged universities.**

03

THE FUND'S RESEARCH PROJECTS

NATIONAL COVID-19 ANTIBODY SEROPREVALENCE SURVEY

The HSRC entered a contract with the Solidarity Fund to conduct a national household-based population seroprevalence survey of SARS CoV-2 antibodies in South Africa in 2020-2021. The contract ran from September 2020 to 31 July 2021.

Purpose of the study

Seroprevalence surveys of SARS COV-2 antibodies provide valuable information about the true extent of the COVID-19 pandemic. It counts infected people who have not been tested, including those that are asymptomatic. The project aimed to undertake a nationally representative household survey to determine the actual prevalence of COVID-19 in the South African population. This will help better characterize the pandemic in the country, including which communities are more susceptible to infection, and determine the proportion of COVID-19 cases that are asymptomatic. This data is helping to inform the pandemic response, including vaccination strategies.

The specific primary objectives were:

- To determine the extent of the COVID-19 virus infection in the general population with age-specific infection prevalence
- To determine the proportion of asymptomatic COVID-19 infections

The secondary objectives of the study were:

- To determine risk factors for COVID-19 virus infection
- To estimate the prevalence of COVID-19 antibodies by age and sex
- To assess antibody levels to assist with estimating future herd immunity

Methodology

The survey used a cross-sectional multi-stage stratified cluster survey design undertaken over two separate periods (November 2020 - February 2021 and April - June 2021). It targeted individuals aged 12 years and older. It used an interviewer-administered individual questionnaire to collect socio-demographic data and information about comorbidities and SARS CoV-2 symptoms. Blood samples were also collected to test for SARS CoV-2 antibodies.

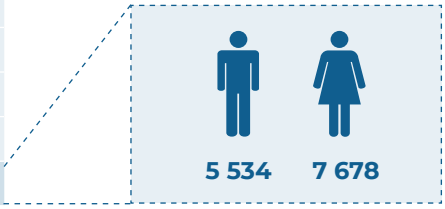
Data were collected electronically and was weighted against 2020 mid-year population estimates by age, race, sex, and province. Weighted summary statistics were used to describe SARS-CoV-2 seroprevalence and characteristics of the study population. Bivariate and multivariate logistics regression analysis were used to identify factors associated with SARS-CoV-2 seropositivity.

Results

A total of 15 115 people were interviewed, and of these, 13 640 (90.2%) gave a blood sample to test for SARS-CoV-2 antibodies. Table 1 summarises samples collected and tested per province and across gender between September 2020 and July 2021.

Table 1: Summary of samples collected and tested between September 2020 and July 2021

Province	Number of samples collected	Number of samples tested
WC	3 367	3 314
EC	2 717	2 610
NC	909	834
FS	1 076	1 034
KZN	2 319	2 258
NW	548	530
GP	1 501	1 459
MP	630	609
LP	5 73	567
Total	**13 640**	**13 215**



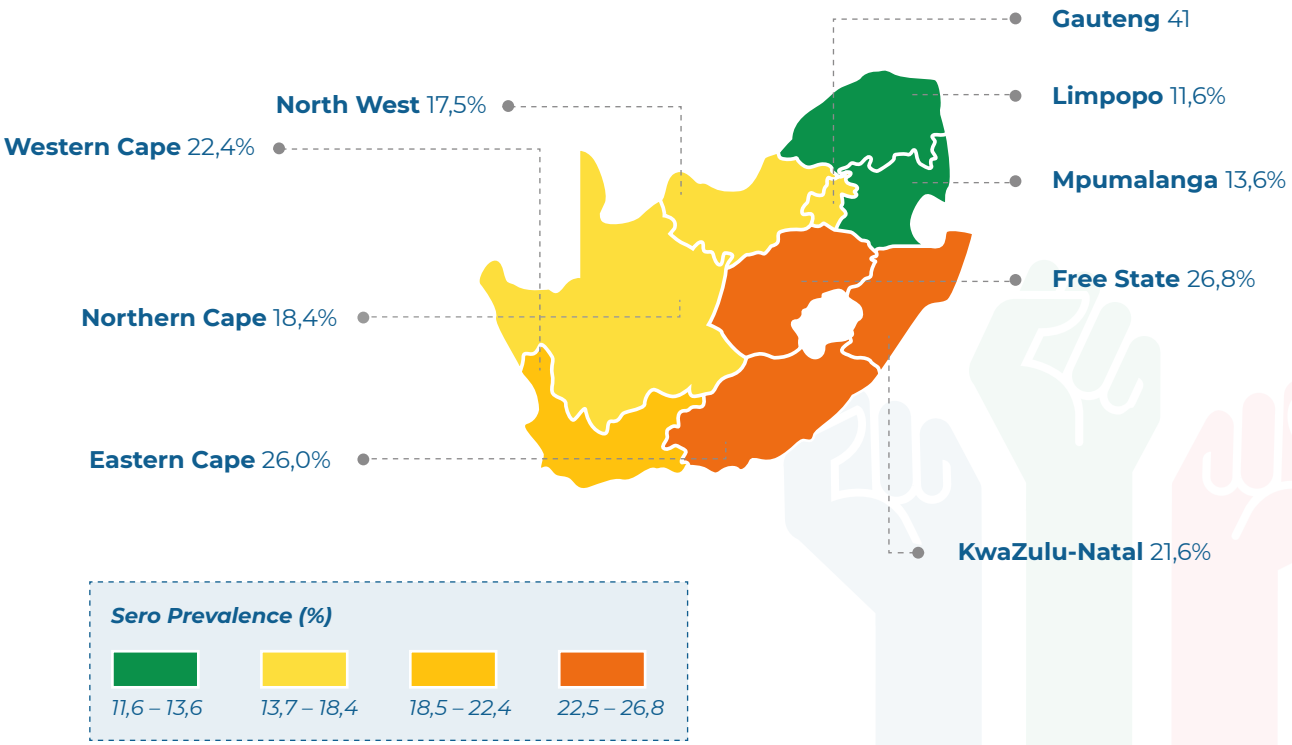
The seroprevalence study showed the following results:

- The overall estimated number of COVID-19 infections was 6,5 times higher than the recorded number of cases based on PCR testing when the study ended. The SARS-CoV-2 seroprevalence was 19.6% showing an estimated 8 675 265 infections among people aged 12 years and older across South Africa by June 2021 compared to the just over two million cases reported through PCR tests by NICD in the same period.

- Seroprevalence estimates were highest in the Free State (26.8%), Eastern Cape (26%), and KwaZulu-Natal (21.6%) provinces. Within the metros - Mangaung (29.0%), Nelson Mandela Bay (26.0%), and the City of Cape Town (25.4%) showed the highest seroprevalence estimates.

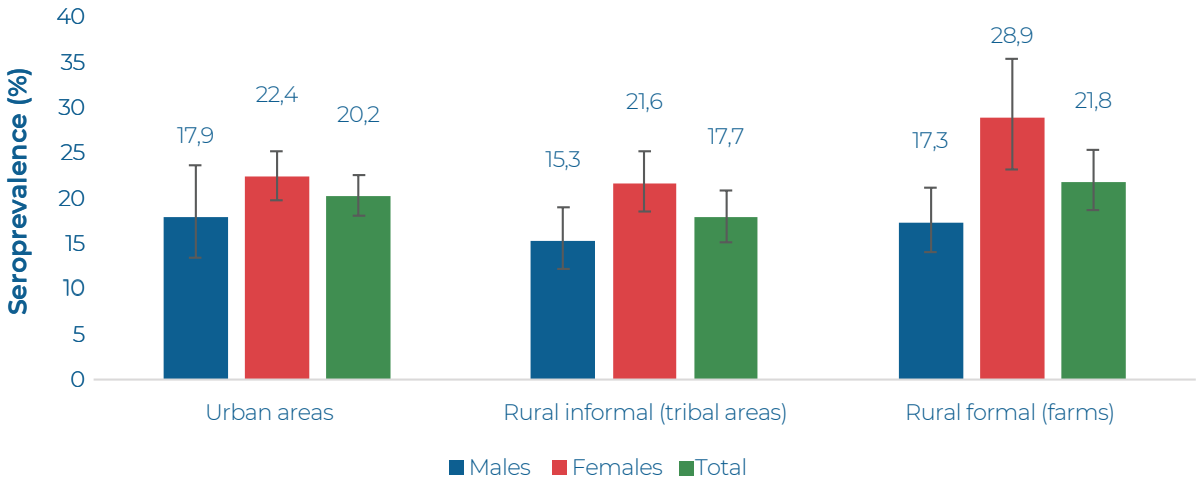
A summary of seroprevalence findings per province is shown in figure 1 below.

Figure 1: Estimated SARS-CoV-2 seroprevalence per province



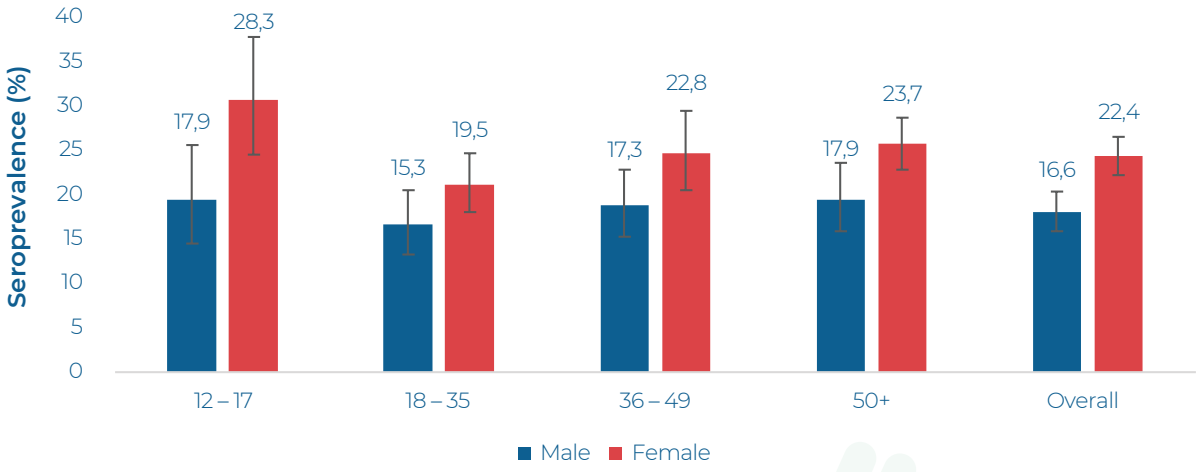
- Seroprevalence was highest in rural formal areas (21,8%), followed by urban areas (20,2%), being lowest in rural informal areas (farms) (17,8%).

Figure 2: SARS COV-2 seroprevalence by sex in each locality type among population 12 years and older, South Africa, 2021



- Women are more likely to be infected than men across all age groups. 18 to 35-year-olds were less likely to be infected compared to those aged 12 to 17 years.

Figure 3: SARS COV-2 seroprevalence by age and sex among population 12 years and older, South Africa, 2021



- In terms of co-morbidities, those with hypertension were more likely to be infected. However, there was no statistically significant difference in the likelihood of infection among those who reported being on treatment for tuberculosis, those who reported living with HIV, and those reporting diagnoses of diabetes, compared to those without any of these conditions.

- A large majority of those that were seropositive (93.1%) had not experienced any of the common symptoms of COVID-19 in the preceding three months.

Impact of the study

The results were shared with the government (national, provincial and local), policymakers, modelling groups, researchers and academics.

This study is the first of its kind to provide national estimates of the prevalence of SARS-CoV-2 antibodies in South Africa based on a representative sample of the population. Other similar studies focused on specific regions. **It, therefore, provides a holistic picture of the extent of the pandemic in the country, its impact across age and sex and across localities.**

The survey showed that all population groups, in all locality types, were equally at risk of contracting COVID-19. It further showed that adolescents may be more likely than adults to contract and spread the virus. This has implications for infection prevention controls within households, schools, and other educational institutions to minimize the risk of transmission.

The findings also identified hypertension as a medical condition that put individuals at risk of infection. As the COVID-19 pandemic unfolds in the country, assessing the role and risk of such chronic illness across populations can help guide public health responses.

Most notably, the study confirmed that many people with COVID-19 infection may not experience or report symptoms. This underpins the importance of non-pharmaceutical strategies to prevent infection transmission.

Lastly, but just as importantly, **the survey also showed that less than two-thirds of the sample tested presented natural immunity to both the original and the more transmissible Beta strain** of the SARS-CoV-2 virus. It was also completed before widespread vaccinations began and indicated susceptibility in the community before vaccination. **This highlights the critical importance of a strong vaccination response.**

Challenges and mitigation

Conducting a household survey amid a severe pandemic is challenging as people were wary to engage with fieldworkers who were seen as strangers, and fears of infection heightened their anxiety towards outsiders. To mitigate this, more effective communication strategies were employed to ensure that people were less fearful and more accepting of the study, and more likely to participate.

The wearing of masks reduced fieldworkers' ability to communicate and encourage participation. Fieldworkers were therefore given additional training in more effective communication skills while wearing a mask, including speaking at a slower pace, articulating words more clearly, and using hand gestures.

The real risk of fieldworkers becoming infected with COVID-19 and infecting their fellow team members and participants was most concerning. To mitigate this, fieldworkers wore effective masks to ensure that they had some protection and were tested regularly to prevent the spread of the virus.

WASTEWATER SURVEILLANCE & RESEARCH PROGRAMME (WSARP)

Historically, wastewater monitoring has been used as a public health tool to track polio, measles, and hepatitis A, among other diseases. In March 2020, it was found that the RNA (the genetic material) of SARS-CoV-2 can be detected in wastewater one to two weeks before COVID-19 detection in communities through human testing. Since then, more than 50 countries across seven continents are monitoring wastewater as an early warning system for COVID-19.

The SAMRC began planning to conduct wastewater surveillance in May 2020, collaborating with a range of academic and government partners. In April 2021, the Solidarity Fund entered into a contract to support the SAMRC Wastewater Surveillance & Research Programme (WSARP). This contract ran from April to December 2021.

Purpose of the study

- To use the identification of SARS-CoV-2 RNA in wastewater as a tool to study trends of the COVID-19 virus circulation in the population across time and locations.
- To use the data from the wastewater study as an early warning system for COVID-19 to guide the best deployment of public health interventions and resources.
- To build capacity in early-career scientists, including from previously disadvantaged universities, through training and promoting interdisciplinary research networks with researchers from various academic backgrounds and institutions.
- To develop a dashboard that provides stakeholders with current data on the weekly average of COVID-19 in wastewater so they can make decisions in real-time. (https://www.samrc.ac.za/wbe/)

Methodology

Viral RNA from a person (with or without COVID-19 symptoms) can enter the sewage system through their faeces. Each wastewater treatment works (WWTW) has a catchment population (those connected to the sewage works). A specially trained sampler takes a sample of sewage at a sewage treatment plant and delivers them to the SAMRC and partner university analytical laboratories on the same day.

The virus particles are extracted, concentrated, and the amount measured in the laboratory. Within two days the results showing the levels of coronavirus RNA at each wastewater treatment plant are reported to local, provincial and national health departments, and posted on the SAMRC Wastewater Surveillance and Research Programme dashboard.

Impact of the WSARP

- As of the end of October 2021, the **wastewater surveillance is being conducted at 72 wastewater treatment plants, across four provinces** (Western Cape, Eastern Cape, Gauteng and Limpopo), in nine metros/ districts, monitoring 7,6 million people.

Figure 4 shows the provinces where wastewater surveillance is being implemented and the university partners for each province. Table 2 below shows the municipalities per province it is being implemented in, and the number of treatment works sites for each.

Figure 4: Map showing where the wastewater surveillance is taking place

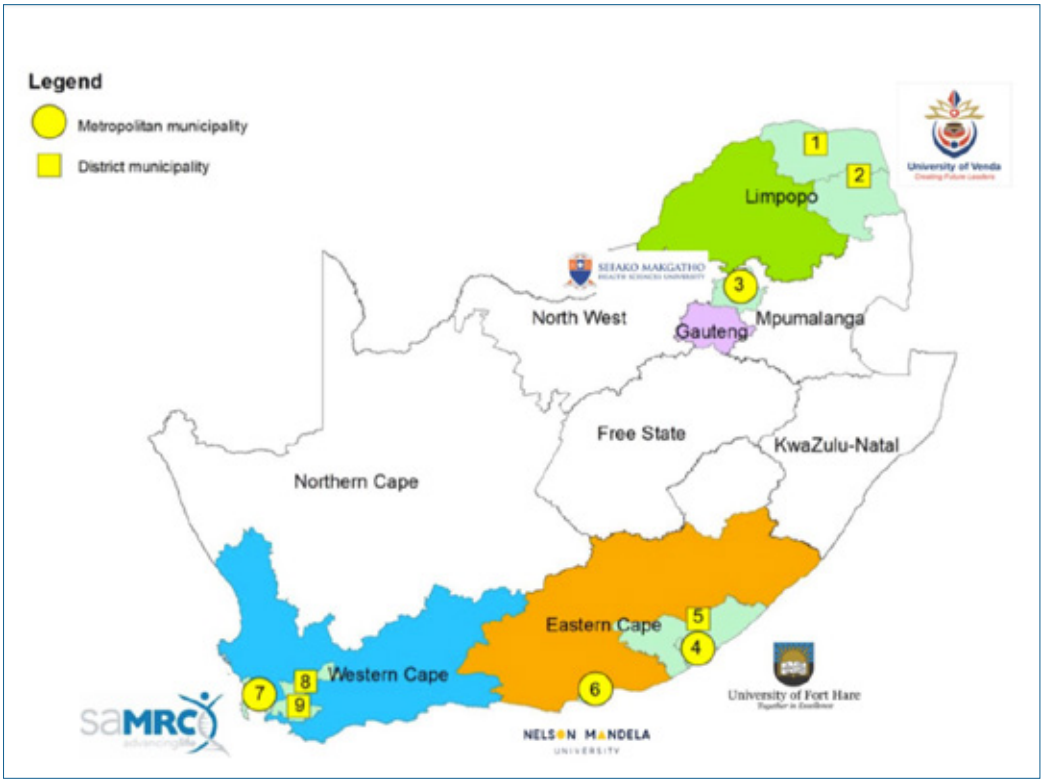


Table 2: Municipality and number of treatment works sites per province participating in the wastewater surveillance project

Province	Site no.	Municipality	No. of WWTW
Limpopo	1	Mopani District	4
	2	Vhembe District	4
Gauteng	3	Tshwane Metropolitan	10
Eastern Cape	4	Buffalo City Metropolitan	4
	5	Amathole District	9
	6	Nelson Mandela Bay Metropolitan	9
Western Cape	7	City of Cape Town Metropolitan	24
	8	Breede Valley Local	4
	9	Theewaterskloof Local	4

- The SAMRC wastewater surveillance project is **generating an increasingly rich dataset that provides a deeper understanding of the patterns of COVID-19** in urban and rural communities, as well as unique locations such as public beaches, around the country.

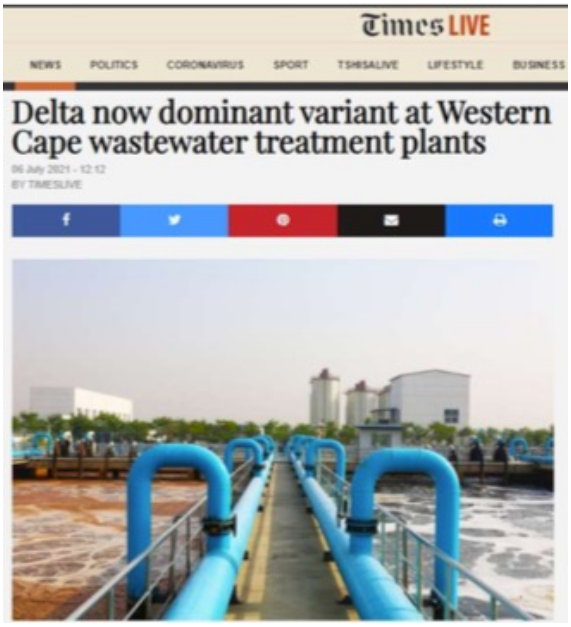
- **This data provides local health authorities with valuable information sooner,** enabling them to plan and implement appropriate public health campaigns to help prevent the spread of the virus, such as more stringent mask-wearing, physical distancing, and optimal hand hygiene, etc., as well as preparing facilities for a possible increase in COVID-19 cases.

- **Testing sewage uses a single test to indicate the presence of COVID-19 in an entire community, town, or city** (covering many thousands of people). In contrast, human testing gives a result for only one person.

- **The project is building capacity in research with three historically disadvantaged institutions as key partners** (University of Venda, University of Fort Hare and Sefako Makgatho Health Sciences University). 30+ field and laboratory staff have been trained to support the project.

- **The wastewater surveillance system was the first to detect the highly infectious Delta variant in several towns in the Western Cape.** This information was made public through the media and to various stakeholders to inform the public.

Figure 5: Media article on finding the delta variant through the WSARP programme


Times LIVE

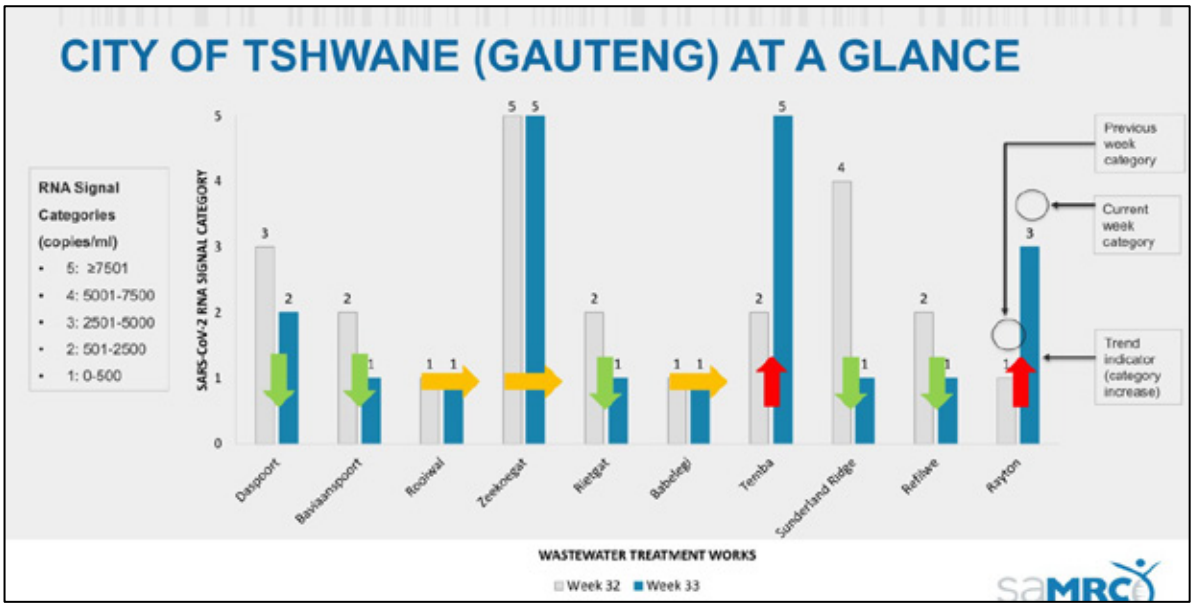
NEWS POLITICS CORONAVIRUS SPORT TSHISALIVE LIFESTYLE BUSINESS

Delta now dominant variant at Western Cape wastewater treatment plants

- **Results from the surveillance is widely shared with critical stakeholders to inform decision-making on the pandemic response.** An integrated weekly report that summarise key findings across all sites is shared with relevant health authorities and community services departments who are part of various ministerial advisory committees. The results are also used as part of the Western Cape Premier's weekly digital conference.

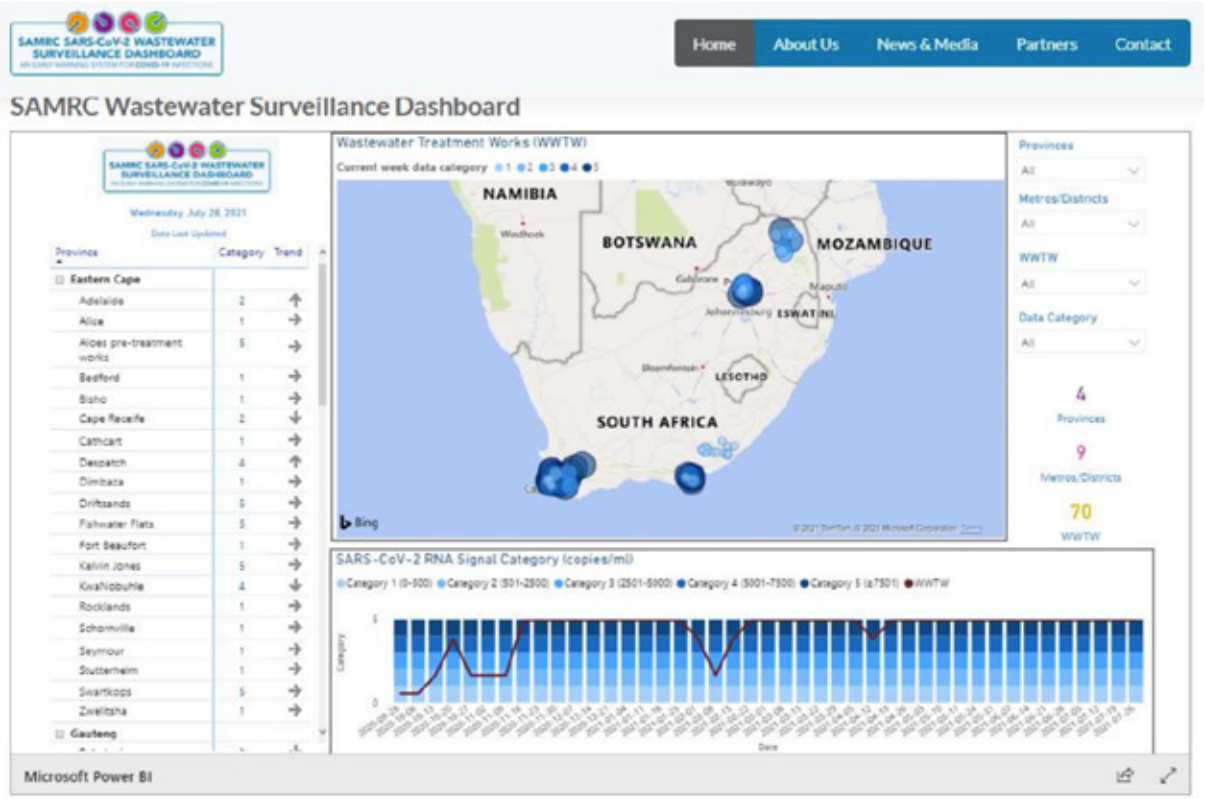
  The weekly report presents results in categories from extremely high presence to very low presence per province and treatment works site catchment area. The reports also indicate whether the current SARS-CoV-2 RNA signal has increased, decreased or remained unchanged relative to the previous week.

Figure 6: Graph from weekly report showing the COVID-19 presence and evolution in Tshwane



- **The SAMRC Wastewater Surveillance and Research Programme dashboard provides valuable information for COVID-19 decision-making, allowing stakeholders to make real-time decisions on the pandemic response.** It provides the public and health stakeholders with up-to-date information on levels of COVID-19 in wastewater in participating communities in the form of graphs and maps. With support from the Solidarity Fund, the dashboard was upgraded and newly launched on 3 June 2021 (https://www.samrc.ac.za/wbe/).

Figure 7: The wastewater surveillance online dashboard



Challenges

Quality control issues with samples analysed at SMU were reported, but this has been resolved through Inter Laboratory Quality Control programmes.

The project experienced delays due to the initial contracting and disbursement of funds that caused subsequent delays in project activities. There were also delays in purchasing equipment, such as the minus 80°C freezer for the University of Venda, and a turbidity meter for the Sefako Makgatho Health Sciences University. The delays resulted from limited stock availability in the country and the NHLS laboratories being given priority. The orders for both pieces of equipment have been placed with the respective suppliers.

The recruitment of a laboratory coordinator to assist with the extraction of wastewater samples has been delayed. A suitable candidate was not identified when the post was initially advertised. The post has since been re-advertised, and recruitment is being finalised. Houses in unsewered areas are not connected to a waterborne sewage system, and are therefore not captured in the surveillance. The SAMRC is researching ways to conduct community-based coronavirus testing in such communities.

RESEARCH PROJECTS AT HISTORICALLY DISADVANTAGED UNIVERSITIES

The SAMRC is supporting two historically disadvantaged universities to strengthen their capacity in surveillance research – the University of Venda and Walter Sisulu University. As part of this capacity building, it supports the universities in conducting specific research projects related to COVID-19. These research projects commenced in January 2021, however, contracts were fully executed in June 2021. They are ongoing until April 2022. Details of the projects and the progress to date are provided below.

University of Venda

Research: Wastewater-based surveillance and molecular epidemiology of SARS-CoV-2 in northern South Africa

Purpose of the study

- To develop capacity to use the wastewater surveillance to monitor SARS-CoV-2 infection in selected communities in the Limpopo Province, northern South Africa
- To build capacity and support for national surveillance of SARS-CoV-2 and other future diseases in South Africa
- To use molecular epidemiology to describe introductory trends of SARS-CoV-2 variants in Limpopo Province through complete genome sequencing of SARS-CoV-2
- To initiate community engagement, involvement and mobilization in the prevention and control of epidemics

Progress to date

Ethics approval for the study was received in April 2021, with districts and provincial approval completed in July 2021. The University of Venda team carries out surveillance for two municipalities: Vhembe and Mopani districts, covering eight treatment sites: four in Vhembe and four in Mopani.

As of the end of August 2021, the university team has been trained and has demonstrated proficiency in detecting and quantifying of SARS-CoV-2 RNA from wastewater samples.

Laboratory protocols for quality RNA isolation and quantitative reverse transcriptase-polymerase chain reaction were set up, and quality was assured. A protocol to interpret and classify SARS-CoV-2 RNA signals has also been established.

Sampling is carried out weekly. Ninety-five (95) high-quality RNA, of sufficient concentration, have been prospectively collected from the two districts and are entering the viral sequencing workflow.

The team participates in the technical meetings to discuss data reliability and approve results for release to stakeholders. Updates on RNA signals for the eight sites within Vhembe and Mopani districts are then provided through weekly virtual meetings with local authorities to explain and discuss the sampling, testing, and interpretation approaches, and possible targeted community interventions to mitigate SARS-CoV-2 transmission. The data is also fed into the wastewater surveillance project dashboard to add to the national picture.

So far, results for 31 weeks of surveillance (January to 2 August 2021; 248 samplings) have been shared with local municipal stakeholders.

Capacity in conducting surveillance research is ongoing with proficiency in the detection of SARS-CoV-2 from wastewater has been established. The network's weekly technical meetings provide a platform for continuous education, training and for exchanging experiences with other investigators.

The SARS-CoV-2 whole-genome sequencing has been delayed due to the delayed execution of the funding agreement and disbursement of funds. This impacted on their ability to procure supplies for the genetic characterisation of SARS-CoV-2 identified in the wastewater samples.

This part of the project describes the introductory trends of SARS-CoV-2 variants in Limpopo province. It follows two approaches: Single nucleotide polymorphism (SNP) variant testing to screen for SARS-CoV-2 variants and next-generation sequencing to reveal diversity in whole genomes.

To date, the pilot SNP variant testing has been completed on eight samples collected during the third wave. Workflow and outcome data were then reviewed and found to be satisfactory. The pilot data detected alpha, beta, delta, and kappa variants of SARS-CoV-2.

Challenges

Several factors caused delays to the project. Initial contracting was delayed as all surge testing equipment purchases were included in this agreement causing delays in the disbursement of funds. However, to the extent possible preparation work commenced earlier using supplementary funds from the University of Venda.

COVID-19 restrictions have delayed the organisation of a seminar with community leaders on the control of epidemics. However, with relaxation in restrictions, this activity will now move forward.

Walter Sisulu University

Research: The distribution of obesity phenotypes and its impact on COVID-19 severity and mortality: A community and hospital-based prospective study in a rural Eastern Cape population

People that are overweight and obese are more likely to have other diseases such as hypertension, heart disease and diabetes, making them more susceptible to more severe COVID-19 infection and death. Immunity also weakens in people with obesity.

Understanding the impact of the obesity metabolic phenotypes on COVID-19 severity and mortality will provide baseline data for assessing and managing the risk of severe COVID-19 cases.

Objectives

- To determine the distribution of obesity phenotypes among the study participants and its impact on COVID-19 severity and mortality.
- To provide insights into COVID-19 severity and mortality to inform health care policy and future therapeutic interventional studies. This will, in turn, enable improved care pathways and long-term patient outcomes and improve severe COVID-19 clinical management.
- To build capacity in research in early-career scientists.

Progress to date

Project start-up activities commenced in April 2021, although ethics approval was only received in July 2021 and funds were only received in July 2021 due to a delay in contracting. Two research assistants and one phlebotomist have been recruited and are undergoing training on the use of the research tool. Data collection commenced in October 2021, with project completion expected in February 2022.

Challenges

The project has been severely delayed because initial contracting was delayed due to all surge testing equipment purchases being included in this agreement, which caused delays in the disbursement of funds.

The major challenge encountered was the delay in obtaining the research ethics approval certificate, which affected the application to obtain permission from the provincial and district health departments to conduct the study. In addition, the approved fund was only received by Walter Sisulu University in July 2021, delaying the recruitment and training of research assistants.

04

KEY LESSONS LEARNT

- Rapid response programmes are essential during a pandemic that requires fast-tracking processes for contracting, procurement, payments, reporting etc.
- Rapid response requires adequate resourcing to prevent bottlenecks
- Planning for pandemic response is difficult due to the rapidly changing statistics, demand and context. This requires agility and flexibility on the part of funders and implementers.
- Strong partnerships with stakeholders (e.g. NHLS) ensure buy-in, uptake, cooperation and joint planning.
- Clear and effective communication with stakeholders is needed to clarify expectations and requirements.
- Lockdown restrictions impact travel and survey participation. Planning for data collection and analysis and interpretation should accommodate this.
- DOH is a critical partner, and the community look to DOH to validate the legitimacy of the large national survey studies. Such surveys should work more closely and communicate directly with provincial health departments to ensure that communication about such surveys reaches all levels of the health department.
- Surveys should work more closely with the health department and use their communication channels to get out information on national surveys. The health department has been very effective during the COVID-19 pandemic to reach communities.
- Survey field teams need highly visible vehicle branding and a high media profile on multiple media platforms to raise awareness of surveys and mitigate mistrust that limits participation. Before starting fieldwork, an extensive targeted communication strategy should be undertaken.