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Monitoring of SARS-CoV-2 in wastewater using Wastewater-Based Epidemiology (WBE)

The effect of super spreader events on WBE for COVID-19

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Detection and quantification of the N2 gene within the SARS-CoV-2 genome has been ongoing at the head of works at the Central Wastewater Treatment Plant (CWWTP) since July 2020 and the eThekweni Metro continues to be a good representation of KwaZulu-Natal (KZN) – following the trajectory of the pandemic.

- *The number of active clinical cases in KZN has been increasing steadily since 20 April 2021, however a drastic increase was noted from 9 June onwards, signalling the start of the 3rd wave*
- *Previous WBE data was able to predict the surge in clinical cases that occurred on 20 April 2021, 2 weeks prior to it happening (30 March 2021). The second surge in clinical cases (9 June 2021) could also be predicted 3 weeks prior (18 May 2021) using WBE data – further emphasizing the predictive nature of WBE*
- *WBE data collected during and after the civil unrest (detailed below) which occurred on the 9th of July 2021 allowed us to get a good reflection of the number of infected individuals in the community. It was then predicted that a further spike in clinical cases would emerge.*
- *In summary an almost 6-fold increase in copy numbers was observed approximately 2 weeks after the July protests in KZN. Further, WBE data should be considered a more accurate representation of COVID-19 infections at a community level than clinical data as clinical testing came to a halt during the unrest while WBE testing did not.*

The effect of super spreader events on WBE for COVID-19

On 9 July 2021, civil unrest broke out in the provinces of KZN and Gauteng in which thousands of people took to the streets to protest. These protests lasted 9 days and impacted significantly on the provinces' response to the COVID-19 pandemic – and placed strain on an already stressed healthcare system. In addition to hindering the provinces' vaccination rollout strategies, most private and state-run diagnostic laboratories were closed due to safety concerns. From the onset, it was anticipated that this would be a COVID-19 super spreader event as thousands of people were in confined spaces for long periods of time without masks or any form of social distancing during the protest action.

What did this mean for COVID-19 surveillance in KZN?

- The closure of diagnostic laboratories meant that there was significant underreporting of the number of COVID-19 infected individuals in KZN from 9 July – 17 July 2021.
- Any backlog in clinical data would have been reported from 19 July onwards – when laboratory personnel returned to work.
- The effect of the civil unrest (if any) on COVID-19 infections would only manifest itself in clinical data 7-14 days later.

Prior to the civil unrest, the average number of new cases per day in a 7-day period was 1366 for KZN, and 449 for

the eThekweni Municipality. However, clinical data from 31 July reports that the number of new infections in a 24-hour period in KZN reached 2239, with 1007 of this stemming from the eThekweni Municipality. As of 5 August 2021, 2667, and 1280 new cases per day were reported for KZN and eThekweni Municipality respectively, clearly indicating that the protests were indeed a COVID-19 super spreader event and contributed to the spike in COVID-19 infections. The average copy number of SARS-CoV-2 (N2) gene per 100ml remained constant for 3 weeks prior to the civil unrest (average of 2.7 million copies/100ml) (Table 1).

Key findings of the civil unrest using WBE:

- An almost 6-fold increase in copy numbers was observed approximately 2 weeks after the protests (average of 12.7 million copies/100ml), in line with reported spike in clinical data confirming the occurrence of a super spreader event – However, the percentage change over 7 days in clinical data is lower than that of WBE data (Table 1 and Figure 4).
- WBE data should be considered a more accurate representation of COVID-19 infections at a community level than clinical data as clinical testing came to a halt during the unrest while WBE testing did not.
- Data from 27 July 2021 suggested that there was a greater number of infected individuals in the system than what is clinically reported, and a further increase in clinical case numbers were anticipated for KZN (Figure 2).

Table 1: Average number of copies of N2 gene detected per 100 ml of wastewater from May – August 2021

Sample Date	Copies per 100ml of wastewater
18 May	2 710 000
25 May	414 000
28 May	763 000
2 June	1 120 000
9 June	824 000
10 June	1 110 000
17 June	400 000
22 June	1 800 000
24 June	1 245 000
1 July	2 750 000
6 July	2 705 000
20 July	2 652 159
27 July	12 700 000
3 August	11 600 000
17 August	13 800 000
24 August	8 705 000

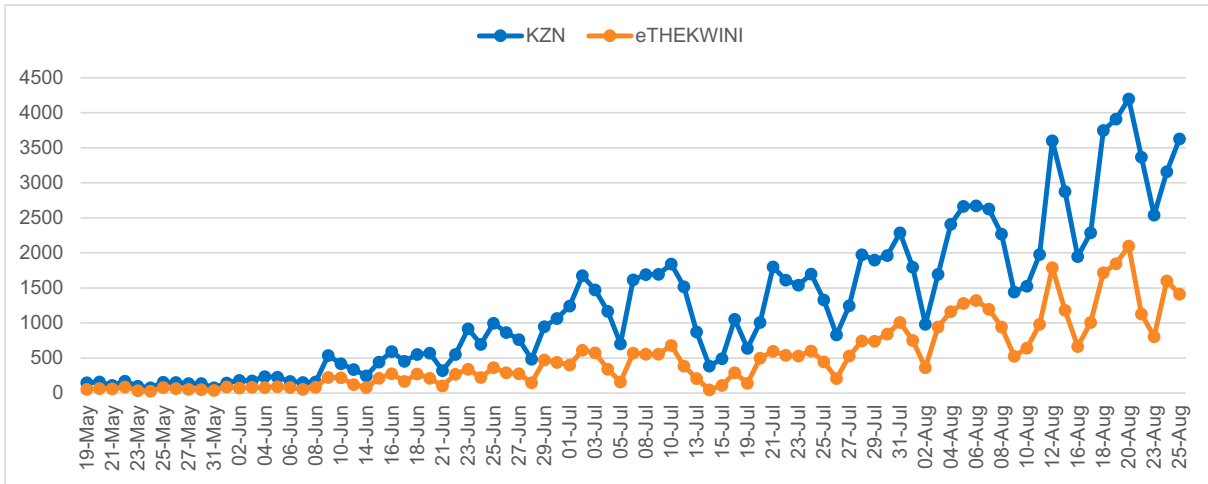


Figure 1: Number of new cases per day in KZN and eThekweni Municipality (19 May – 25 Aug 2021)

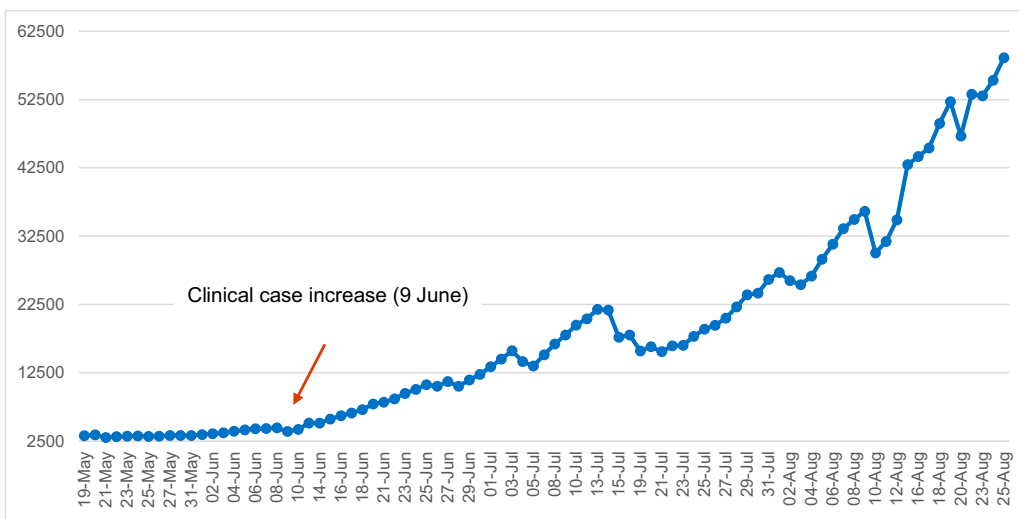


Figure 2: Number of active clinical cases per day in KZN (19 May – 25 August 2021)

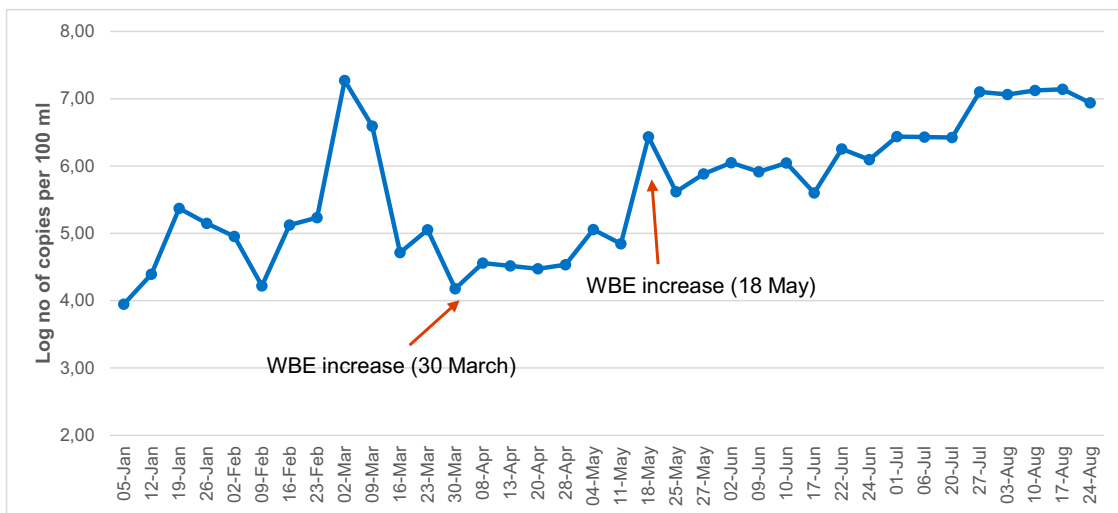


Figure 3: WBE surveillance data for CWWTTP (5 January – 24 August 2021)

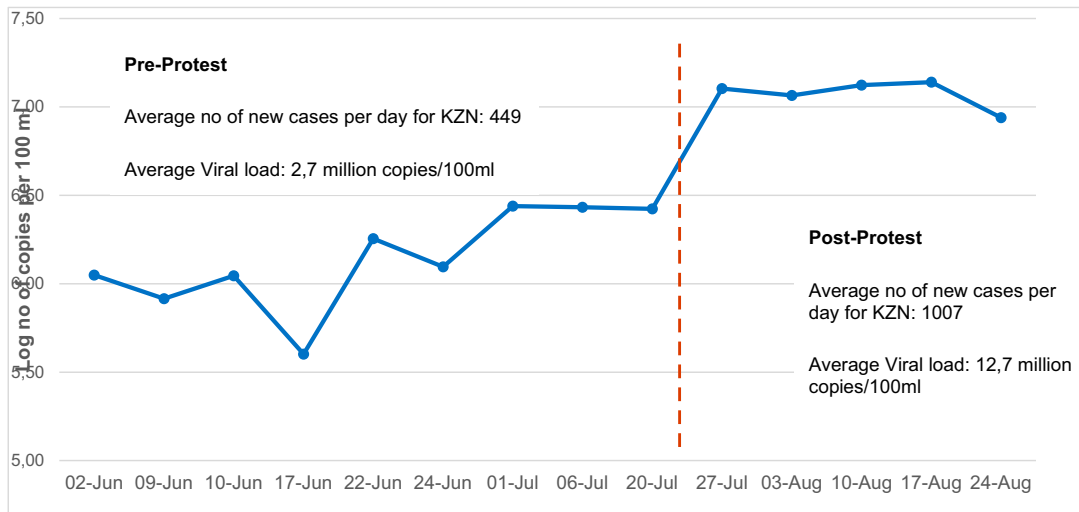


Figure 4: The effect of civil unrest on SARS-CoV-2 viral loads in wastewater