

EXCESS DEATHS: ADDITIONAL MEASURES AND APPROACHES TO UNDERSTANDING COVID-19 RELATED MORTALITY IN SOUTH AFRICA

Tom Moultrie, Rob Dorrington, Ria Laubscher,
Pam Groenewald, Debbie Bradshaw

Burden of Disease Research Unit
South African Medical Research Council
11 August 2020



UCT Centre
for Actuarial
Research

Introduction

In addition to the weekly mortality surveillance reports released by the SAMRC Burden of Disease Research Unit and UCT Centre for Actuarial Research,¹ the same collaborators have undertaken to release periodic additional measures of mortality in South Africa that might aid both public understanding, as well as response efforts aimed at mitigating the impact of COVID-19 on the South African population. This supplementary report presents additional measures and approaches to understanding excess deaths and COVID-19 related mortality in South Africa. Readers interested in the data source and the underlying methodology and approach adopted to calculating excess deaths are referred to the weekly mortality surveillance report.

We focus on two measures/approaches. The first is the use of p-scores that expresses the excess mortality relative to the underlying expected baseline of mortality. The second presents the excess mortality estimated by the SAMRC and UCT team relative to the numbers of COVID-19 deaths in the country as reported by the National Department of Health. While the material presented here contains little new information relative to that contained in the weekly surveillance report, the manner of presentation may nevertheless be of interest.

Proportionate excess mortality – p-scores

The p-score is one of the measures for comparing mortality changes across space and time.² The measure is defined as the proportionate excess mortality, relative to the baseline. In algebraic terms,

$$p\text{-score} = \frac{\text{Observed mortality} - \text{Expected mortality}}{\text{Expected mortality}},$$

where the observed mortality is the weekly observed count of deaths, and the expected mortality is the weekly 'baseline' of 'normal' mortality. Both of these elements, as well as details of their derivation, are included in the weekly surveillance reports.¹

A p-score of 0 (or 0%) would indicate that the observed mortality is the same as the expected mortality, the numerator being zero. By contrast, a p-score of 1 (or 100%) would indicate that the observed mortality is twice that expected.

The data available to the SAMRC-UCT team allow p-scores to be calculated for the country as a whole, as well as for individual provinces.

Furthermore, while Aron and Muellbauer note that p-scores are robust for comparison across countries of similar demographic profiles, as the baseline mortality already accounts for differences in underlying levels and patterns of mortality, as the age distribution of the population is not taken into account in the construction of p-scores, comparisons with countries with a different age distribution are difficult to interpret. As the disease affects the elderly disproportionately relative to younger people, populations with a greater proportion of young people will therefore show lower p-

¹ Bradshaw D, Laubscher R, Dorrington RE, Groenewald P, Moultrie TA. Weekly deaths in South Africa 1 January - 28 July 2020. Cape Town South African Medical Research Council 2020. <https://www.samrc.ac.za/sites/default/files/files/2020-08-05/weekly28July2020.pdf> Accessed 11 August 2020.

² Aron, Janine and John Muellbauer. 2020. 'A pandemic primer on excess mortality statistics and their comparability across countries'. Our World in Data: University of Oxford. <https://ourworldindata.org/covid-excess-mortality> Accessed 11 August 2020.

scores relative to populations with a greater concentration of the elderly. Comparisons, therefore, of the national p-scores between countries should not be drawn uncritically.

Finally, significant spatial differences in the timing of the spread of SARS-CoV-2 within countries, including South Africa, have been observed. This leads to two further caveats: First, the national p-score will reflect an average of the timing and scale of these separate sub-epidemics. Second, comparisons of sub-regional p-scores with those of other countries as a whole is largely fallacious. The p-score for Italy, for example, reflects a national average of regions (largely in the North) heavily affected by the outbreak in March-April 2020; and other regions far less affected.

p-scores for South Africa since 1 April 2020

The figure on the next page shows the derived p-scores for South Africa and the nine provinces for every week since 1 April. Positive excess mortality was identified, nationally and in the Western Cape, in the week beginning 6 May 2020.

Given the significant impact of lockdown in reducing unnatural deaths, we focus here on the p-scores for natural deaths. At a national level, this measure of excess mortality shows that excess deaths reached a high of 76.4% above normal (176 natural deaths observed for every 100 'normal' natural deaths) in the week beginning 15 July 2020. The measure has fallen over the two most recent weeks and is currently 58.4% above the normal level.

At a provincial level, 'negative' excess mortality is visible in the figure in all provinces other than the Western Cape for some weeks after 6 May, reflecting the delayed emergence of excess mortality in those provinces. However, while excess mortality in the Western Cape was identified earliest (a reflection of the much earlier scale and scope of the outbreak in that province), the Western Cape has shown relatively mild excess mortality, barely exceeding 60% in the most severe weeks. The duration of the period of excess mortality in the province is 13 weeks to date, and the level of mortality is still some 27% above 'normal', and just under half of the level at the peak of excess mortality.

By contrast, excess mortality in the Eastern Cape, Free State, and Gauteng have each exceeded 100% (double 'normal' mortality) for at least two weeks each. The shape of the estimated excess mortality would appear to be far more peaked than that observed in the Western Cape, although it is clearly too early to speculate yet as to the future evolution of excess mortality in these, and other, provinces.

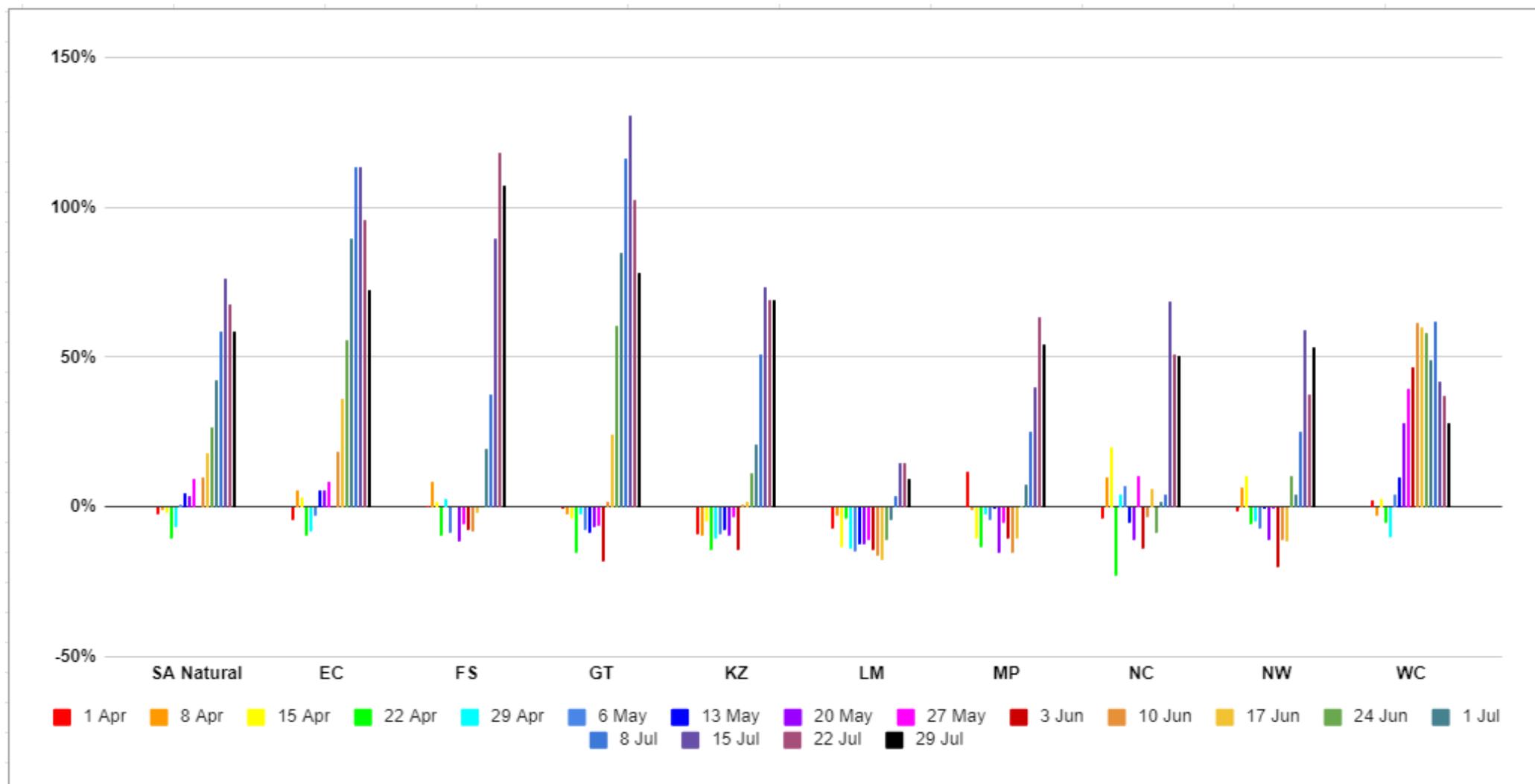


Figure 1: p-scores based on the number of natural deaths 1+ years from 1 April 2020 for South Africa and the provinces

Excess deaths relative to reported COVID-19 deaths

The second approach to aid understanding of the emerging COVID-19 mortality is to compare the estimated weekly excess deaths with the number of COVID-19 deaths reported by the Minister of Health in the ministry's nightly releases. This comparison is hampered to some degree by the fact that the excess deaths are classified by week in which the death occurred; **the reported COVID-19 deaths are classified by date the numbers are reported to the Department**. When large numbers of COVID-19 deaths are reported retrospectively, this can cause distortions in the series, as occurred in the Eastern Cape on 22 July 2020 (400 deaths reported on a single day, when the average of COVID-19 deaths in the province over the preceding 7 days was barely over 30); and in the Western Cape on 4 August 2020 when 97 deaths were reported, approximately 60 of which had occurred sometime in the past).

If all excess deaths were due to COVID-19, and all COVID-19 deaths were perfectly identified and reported, it would follow that (barring the distortions occasioned by the nature of reporting) the two series would be identical.

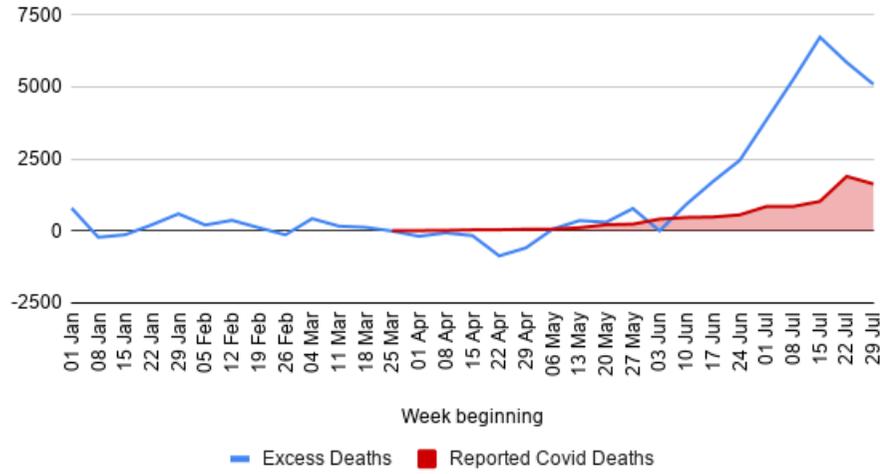
Where the pattern and level of COVID-19 deaths by time closely follows that of the excess deaths, this points to a strong congruency between the excess deaths and COVID-19 deaths. While not all excess deaths are necessarily COVID-19 related deaths, if the excess deaths fall as reported COVID-19 deaths fall, this is a strong indication that the excess mortality stems from COVID-19. The data from the Western Cape shows such a pattern, with reported COVID-19-deaths being approximately on average 2/3 of the estimated excess deaths. [An exception is the current week, where the retrospectively reported deaths on 4 August have distorted the reported COVID-19 deaths for the week beginning 29 July resulting in the reported COVID-19 deaths exceeding the estimated deaths.]

In other provinces, the correspondence between the two measures is far less satisfactory. Estimated excess deaths are greater than the reported COVID-19 deaths by a substantial margin. However, reallocating deaths to week of death (rather than reporting week) improves the consistency over time, and given the coherence of the data in the Western Cape, and the fact that in these other provinces, excess deaths emerged contemporaneously with reports of increasing COVID-19 deaths and the timing of this emergence corresponds well with the periods when substantial increases in COVID-19 infections were being reported two weeks prior, it is more probable that these gaps are explained by severe and systematic underreporting of COVID-19 deaths in those provinces, than these deaths being attributable to widespread mortality from other causes. In addition – nationally, and in the four other most affected provinces: the Eastern Cape, Free State, Gauteng, and KwaZulu-Natal, the number of estimated excess deaths has begun to decrease, a pattern consistent with COVID-19 related mortality.

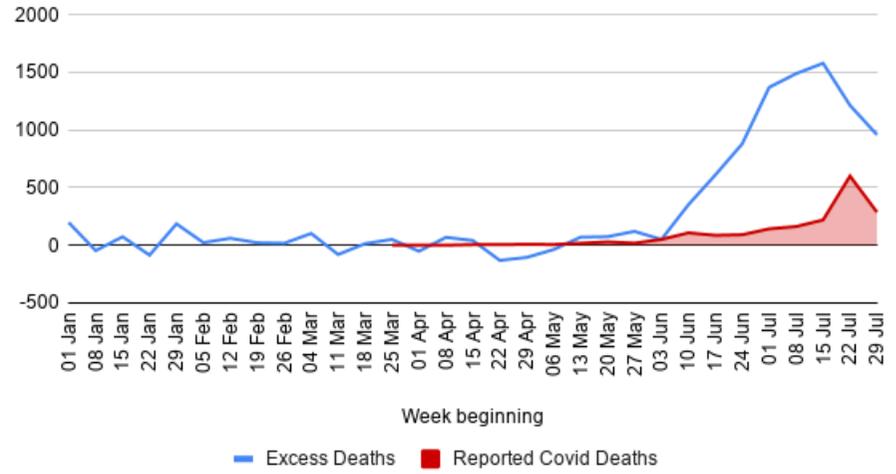
Conclusion

The complete attribution of mortality to COVID-19 is something that will require analysis of the causes of death provided by doctors on the death notifications. This will take many years to establish with any degree of finality, given the workflow for processing death registrations in South Africa. In the meantime, these investigations are strongly supportive that a significant proportion of the current excess mortality being observed in South Africa is likely to be attributable to COVID-19.

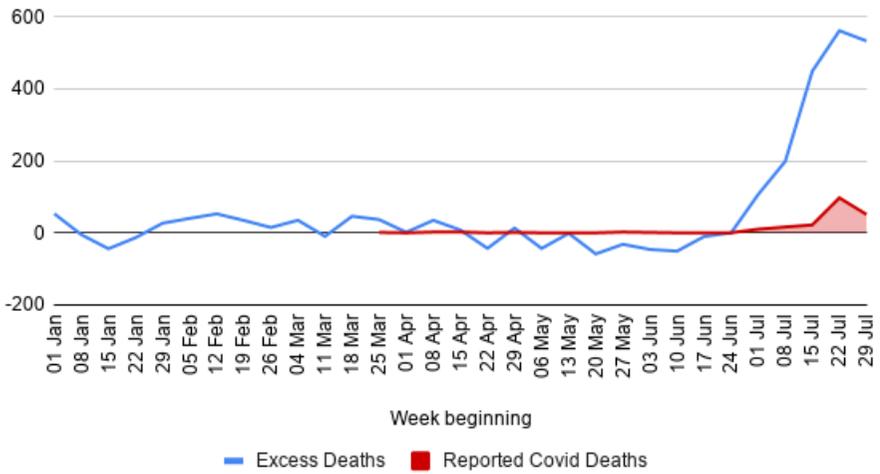
ZA (Natural) Excess Deaths and Reported Covid-19 Deaths



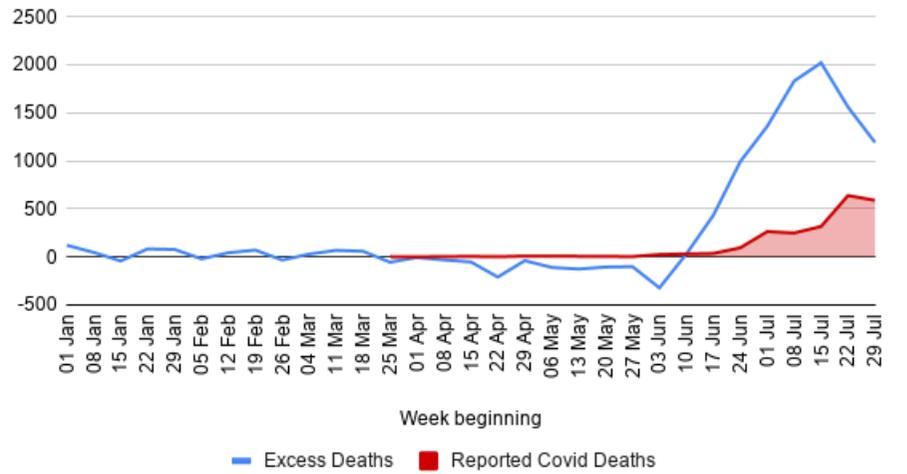
EC (Natural) Excess Deaths and Reported Covid-19 Deaths



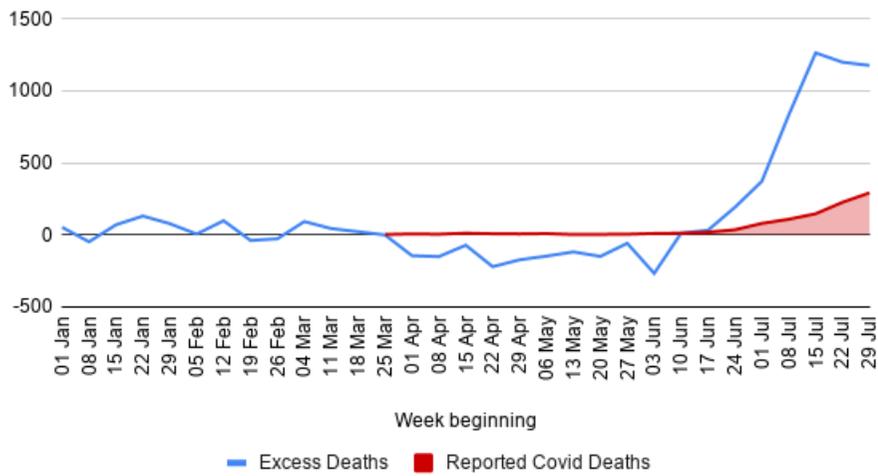
FS (Natural) Excess Deaths and Reported Covid-19 Deaths



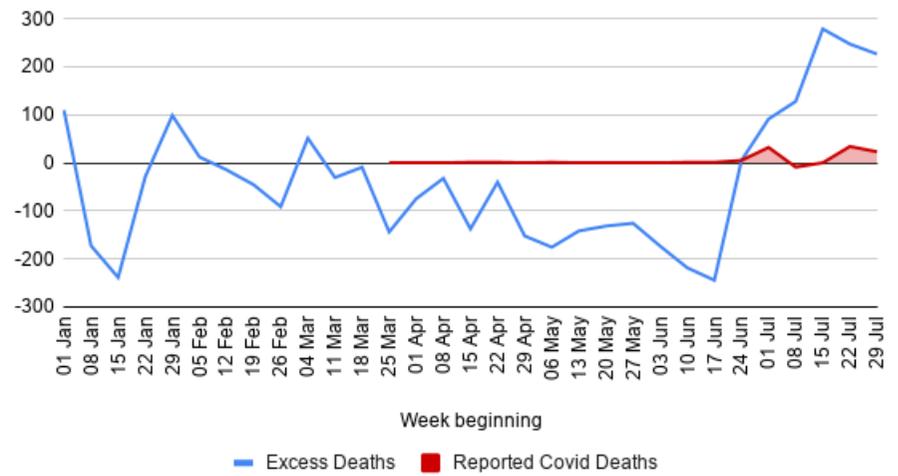
GT (Natural) Excess Deaths and Reported Covid-19 Deaths



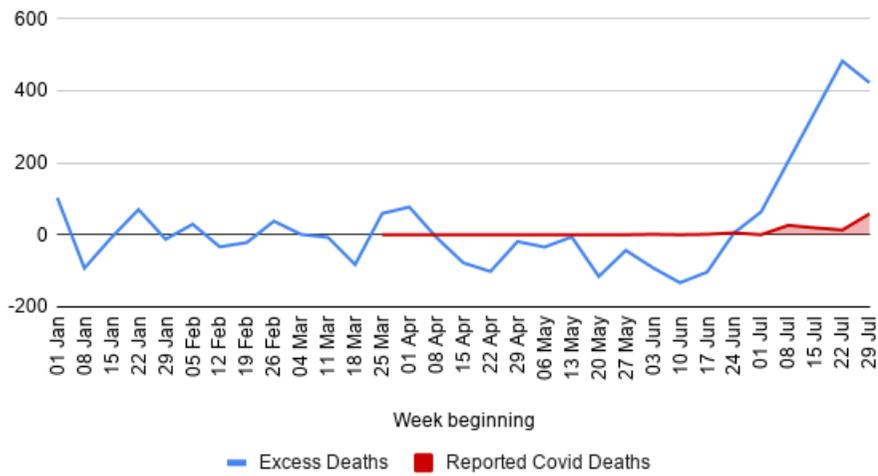
KZ (Natural) Excess Deaths and Reported Covid-19 Deaths



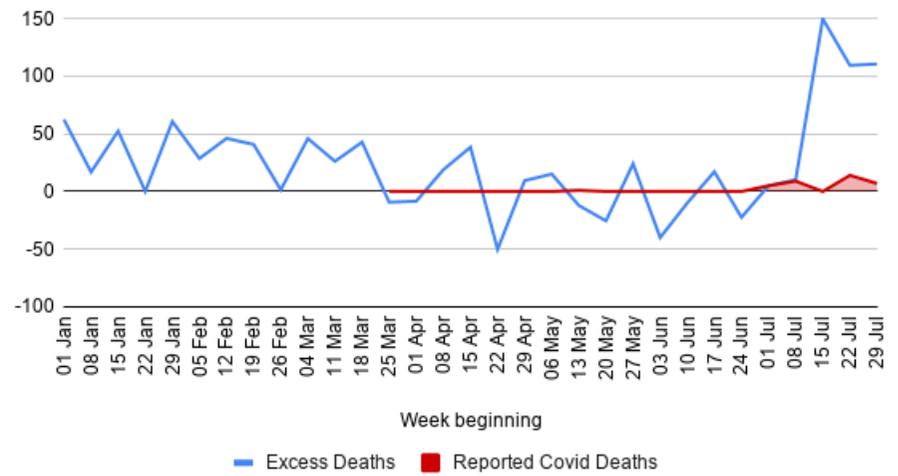
LM (Natural) Excess Deaths and Reported Covid-19 Deaths



MP (Natural) Excess Deaths and Reported Covid-19 Deaths



NC (Natural) Excess Deaths and Reported Covid-19 Deaths



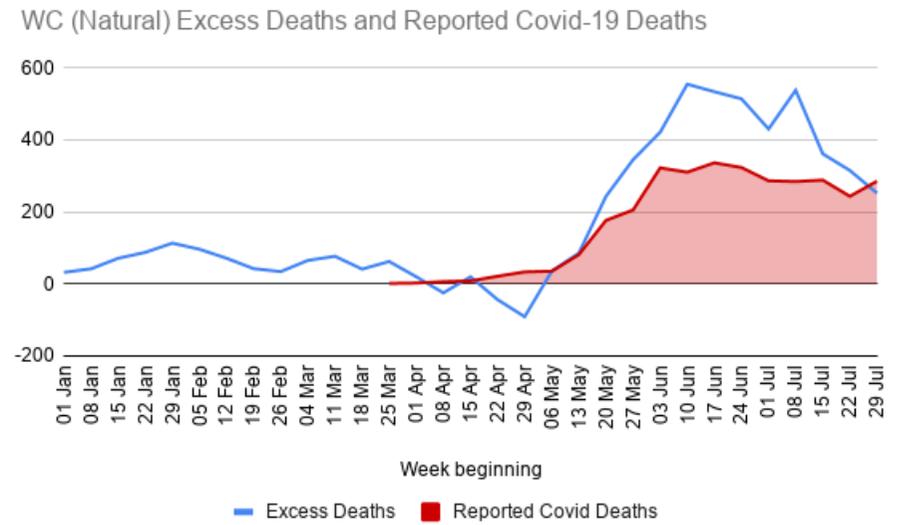
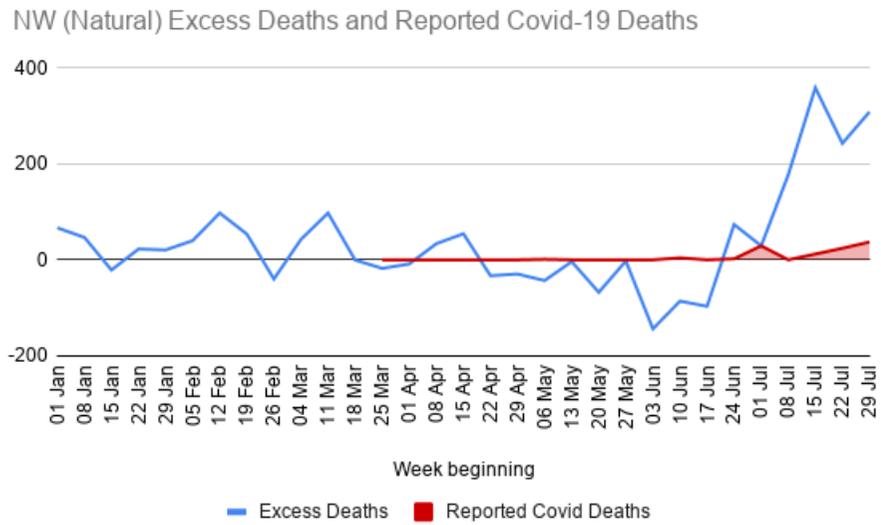


Figure 2: Excess deaths from natural causes (1+ years) and reported COVID-19 deaths for South Africa and the provinces, 1 January – 4 August 2020