COVID-19 reported deaths and excess deaths in South Africa

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COVID-19 Actuaries Response Group – Learn. Share. Educate. Influence.

Summary

There are significant difficulties measuring, analysing and interpreting various numbers related to COVID-19. In turn, there are also difficulties with reported deaths and excess deaths. In this article we try to assess and compare excess death with reported death figures for South Africa and show some estimates as to the extent of underreporting.

Introduction

In this bulletin we review death reporting for COVID-19 in South Africa, with some comparison to the United Kingdom and other global regions.

- South Africa reported deaths are shown together with comparisons of Case Fatality Rates (CFRs) that may be indicating reporting deficiencies.
- The excess death estimates produced by the South African Medical Research Council (MRC) is reviewed together with daily reported COVID-19 deaths.
- A comparison between reported deaths and excess deaths indicates that significant under-reporting exists.
- The MRC estimates more than 22,000 excess deaths in South Africa to date, whereas just over 7,250 COVID-19 deaths are reported. South Africa could be reporting as little as one third of COVID-19 deaths.
- In the Western Cape roughly three quarter of excess deaths are reported as COVID-19 related, however in Gauteng, Eastern Cape and KwaZulu-Natal only roughly one quarter of deaths are reported.

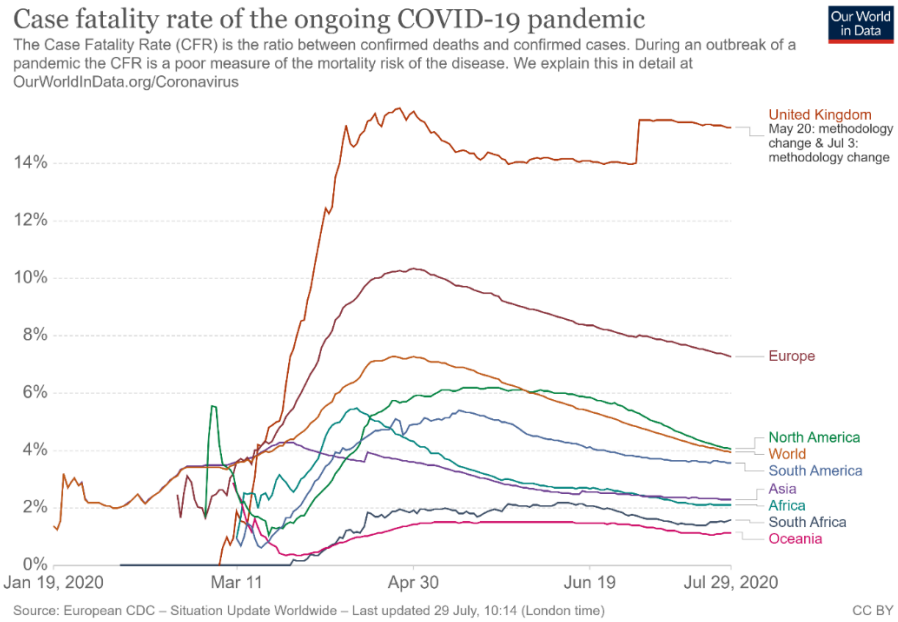
COVID-19 Reported Deaths in South Africa

The South African Department of Health (DoH) and the National Institute of Communicable Diseases (NICD) publish COVID-19 cases and deaths on a daily basis [1].

The cumulative cases and deaths are tabulated below (up to 28 July 2020):

Province	Reported Deaths	Confirmed Cases
Eastern Cape	1,545	75,067
Free State	154	18,134
Gauteng	1,680	164,584
KwaZulu-Natal	685	68,101
Limpopo	67	7,502
Mpumalanga	65	11,552
Northern Cape	29	3,997
North West	72	17,791
Western Cape	2,960	92,983
South Africa	**7,257**	**459,761**

South Africa has over 7,000 reported deaths from over 450,000 cases. The number of deaths seem very low compared to the UK, which has around 300,000 confirmed cases at the time of writing, but far more deaths. Indeed, when you compare the CFR to date a stark difference emerges.

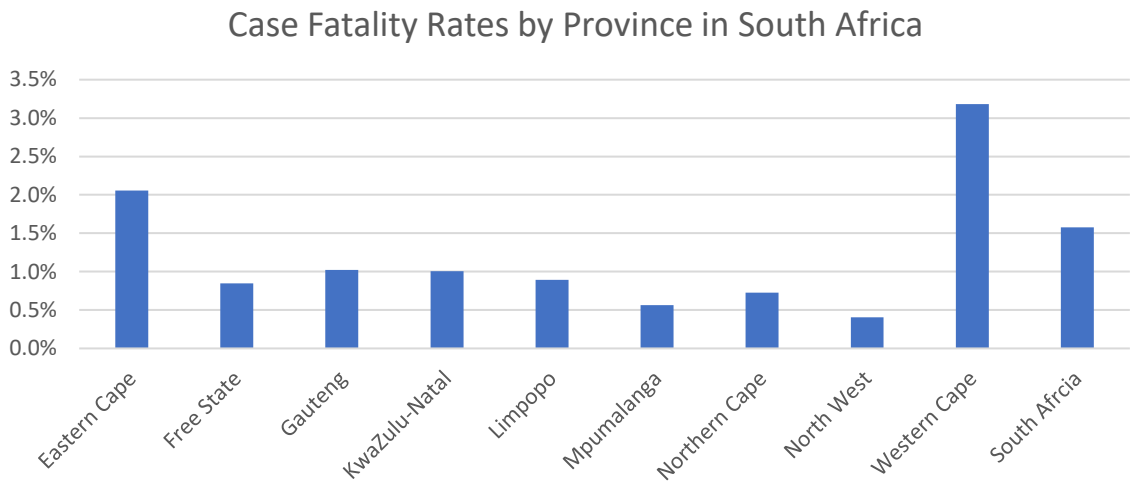


South Africa has a very low CFR compared to most world regions and compared to the UK. Why might that be the case? One would expect CFRs to be dependent on various factors including:

- Level of testing and how it is changing over time. The less testing that is done, the more likely it is focussed on those with more severe symptoms, pushing observed CFRs up. COVID-19 deaths may also be missed without adequate testing. There were significant backlogs in testing in South Africa during the early months of the pandemic (which have now reduced) – which should have resulted in an elevated CFR.
- The comorbidity profile of the country. Some excess COVID-19 mortality is likely to be related to existing comorbidities in the South African population such as cardiovascular disease and diabetes.
- The quality and capacity of the health care system. We know that the health care system in South Africa is not on par with more developed nations which would lead us to expect a higher CFR.
- South Africa has a much younger population compared to the UK and in an earlier report we showed that one might expect fewer deaths for the same number of infections in South Africa [2]. This is an important factor explaining South Africa's lower CFR.
- The phase stage of the epidemic (infections increase 3 to 4 weeks in advance of deaths). With cases still increasing nationally – CFR should be based on cases counted some weeks back. Comparing deaths to current case count thus gives a misleading impression of low CFR.

Taken together, the above still implies that there may be a question on reporting of deaths. South Africa's low CFR compared to the majority of world regions may be misleading.

If we dig into South Africa's data a bit more and calculate CFRs by province, we see the following:



It appears that the Western Cape's CFR is more in line with other regions, but other provinces are very low. Even the Eastern Cape's figure, which is a bit higher, only increased recently when 400 deaths were reported in a single day on 22 July.

Reporting in general for a number of provinces seems to be "batched" with days of low deaths then what appear to be batches of deaths reported together. This should not materially affect the figures, unless delays are substantial.

Weekly Reported Deaths in South Africa

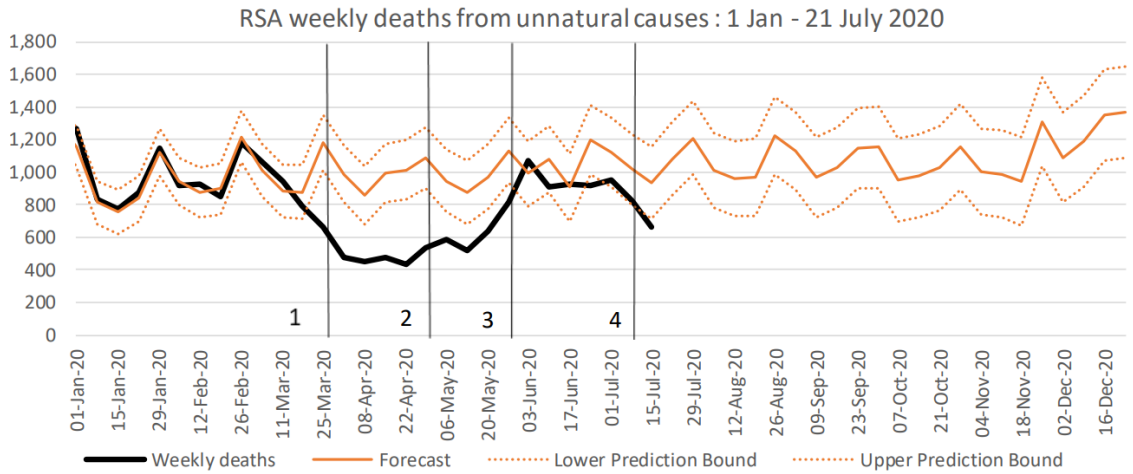
South Africa, until recently, did not have weekly deaths reports, but the South African Medical Research Council established such reporting this year (to aid in monitoring the epidemic) [3]. The first report was released on 30 March 2020 just after South Africa went into lockdown.

The first insights to emerge from these reports was that lockdown had the additional effect of reducing South Africa's deaths due to a reduction in deaths from non-natural causes. This has been ascribed to the reduction in road accidents, as well as the banning of the sale of alcohol which may have reduced the associated accidents and violent deaths.

A chart from one of the MRC reports is included below. The orange lines represent estimates for non-natural deaths based on 2018 and 2019. The vertical lines correspond to:

1. Introduction of lockdown level 5 (the most stringent, including a ban on the sale of alcohol).
2. Lockdown Level 4 with a curfew.
3. Lockdown level 3 including the resumption of the sale of alcohol.
4. Curfew reintroduced together with a new ban on alcohol sales.

This is a confounding factor in excess deaths analyses based on these reports – excess deaths due to COVID-19 causes may appear dampened due to non-natural causes of death that have been avoided. This, and the fact that South Africa's lockdown was relatively early, meant that South Africa had negative excess deaths up until the end of April.



Another confounding factor is that the virus in South Africa arrived in autumn when excess deaths are expected to coincide with the typical winter deaths. It seems likely that the measures implemented to stop the spread of COVID-19 have also slowed the regular flu season to a large degree (as seems to be evident elsewhere in the southern hemisphere as well). The WHO reports [4] that "in the temperate zones of the southern hemisphere, the influenza season has not commenced". This is in a report with data up to 5 July 2020. So South Africa (and other countries in the southern hemisphere) are likely to also see lower deaths from natural causes than might typically be seen.

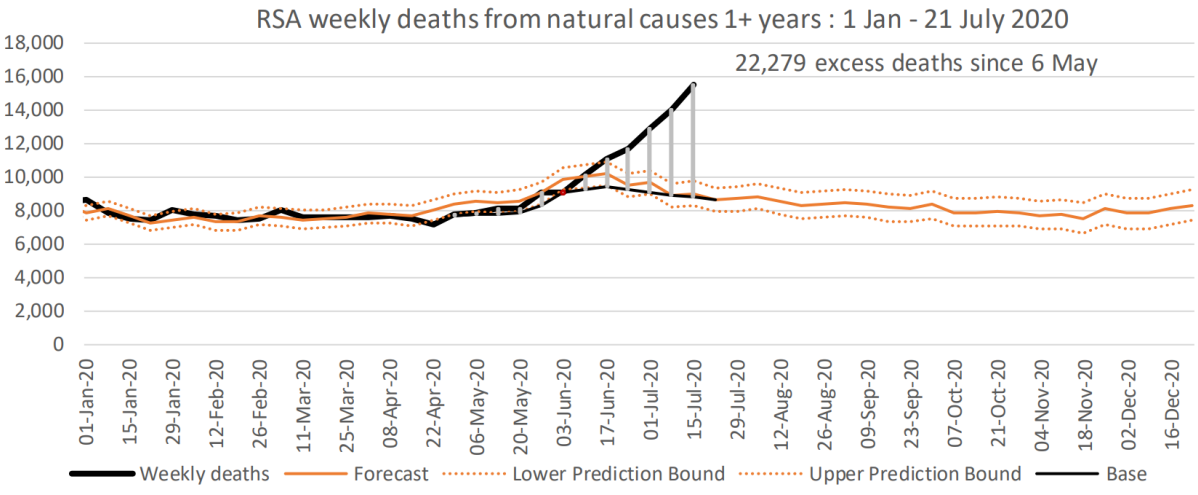
Excess Deaths in South Africa

Since the weekly report covering the period ending 13 June the MRC researchers [3] have included estimates for excess deaths. However, given the above problems it is unclear how they estimate excess deaths?

Firstly, to avoid changes in accidental deaths due to changes in lockdown stringency the MRC researchers focussed on deaths from natural causes only.

Secondly, the researchers noted the lower level of natural deaths prior to the start of lockdown in comparison to earlier years, tracking close to the bottom level of the confidence interval for the forecast for deaths in South Africa from prior years of data. When they noted a sharp increase in deaths from this level, they assumed that this is the point at which excess deaths had started and measured from this point.

The following chart produced by the researchers illustrates this:



Excess deaths are calculated from 6 May and are measured as a difference from the bottom end of the "natural causes" forecasted range. Based on this methodology the researchers estimate 22,279 excess deaths for South Africa overall (the breakdown by province is shown in the next section).

The researchers state that this is a reasonable approach given the limitations they face. Further analysis with more comprehensive data, potentially including cause of death, would reveal whether this is indeed correct.

The method adopted could be either over or underestimating excess deaths due to COVID-19. It should however also be noted that deaths are now well exceeding the upper prediction bound of expected death forecasts

Excess Deaths vs. Reported Deaths

Given that the MRC researchers also estimate excess deaths by province we can attempt to compare the excess deaths with deaths being reported for COVID-19.

There are some problems with this:

1. We do not know the cause of these excess deaths.
2. The NCID/DoH deaths are by reported date, and the MRC figures are by date of death with adjustments for delayed registration of death.

The MRC authors note "that although the bulk of these estimates of the 'excess deaths' are likely to be due to COVID-19 and related causes, an unknown proportion may be due to other natural causes associated with a relaxing of lockdown."

In the analysis below we assume that, on average, it takes 7 days after the date of death for a death to be reported by the DoH/NICD.

We can then estimate completeness of reporting of COVID-19 deaths by comparing to COVID-19 reported deaths (in each province) over the same date ranges (but delayed by 7 days).

The result is tabulated below:

Province	Excess Deaths	Reported COVID-19 Deaths	**Percentage** Complete
Eastern Cape	6 411	1 545	24%
Free State	752	154	20%
Gauteng	6 620	1 680	25%
KwaZulu-Natal	2 632	685	26%
Limpopo	527	67	13%
Mpumalanga	627	65	10%
Northern Cape	164	29	18%
North West	566	72	13%
Western Cape	4 133	2 960	72%
South Africa	**22 279**	**7 257**	**33%**

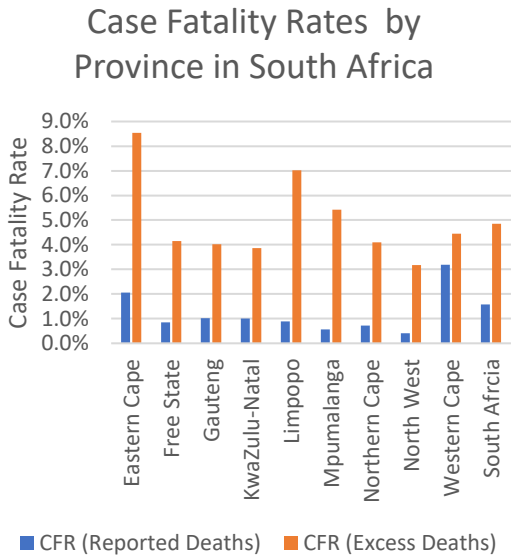
Based on the above assumptions South Africa could be reporting as little as a third of deaths. In the Western Cape three quarter of deaths are reported as COVID-19 related, however in Gauteng, Eastern Cape and KwaZulu-Natal only roughly a quarter of deaths are reported as such.

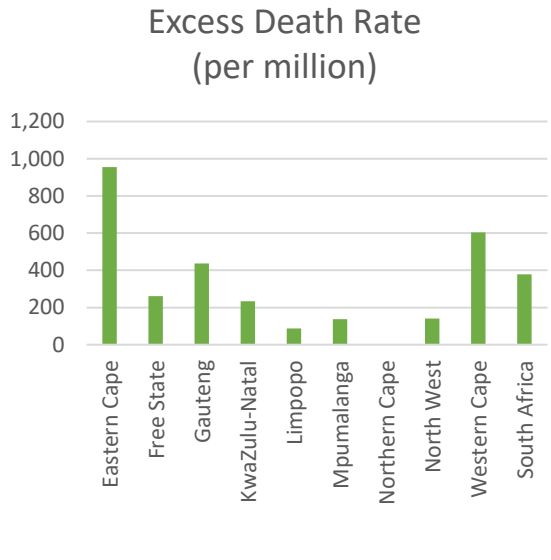
We note that the Western Cape shows 72% of excess deaths being reported as COVID-19 deaths. Based on this figure it is likely that national direct COVID-19 deaths make up the majority of deaths (at least more than say 75%), which illustrates the extent of under reporting in many regions.

Adjusted CFRs and Population Excess Mortality

In the figure below, the CFRs are calculated using excess deaths (but without adjustment for each region's stage in the epidemic). We observe that, with this adjustment, the CFRs are more comparable between provinces and also the CFR for South Africa is now more comparable with CFRs from other regions around the world. This may be an overestimate as some of the excess deaths may not be directly attributable to COVID-19 cases, but may be an underestimate due to deaths from current infection not yet having occurred.

The chart on the right below shows excess death rate per million population. These two charts together indicate that excess deaths are correlated to COVID-19 cases and have not consistently increased across all provinces. Some have argued that lockdown and the economy may be causing more deaths than COVID-19. If that were the case, we would expect to see a higher excess death rate in all provinces, not just those that have been impacted by the epidemic.





Conclusion

Based on this report it is estimated that only ~26% of South Africa's excess deaths are reported. In the Western Cape, COVID-19 deaths represent 72% of excess deaths indicating a robust reporting mechanism. In stark contrast, the other provinces are only reporting COVID-19 deaths of a quarter (or less) of the excess deaths. This highlights the challenges with under-reporting.

Furthermore adjusting observed CFRs in South Africa results in a more consistent result for CFRs emerging by province, as well as a CFR for South Africa that's closer to the average CFR for the world [5]. Allowing for a lag in the epidemic and comparing to cases from some weeks prior would further increase SA's CFR rates, which may be investigated in a future report.

It is likely that the majority of the excess deaths relate directly to COVID-19 but there may also be some excess death attributable to health system constraints.

The conclusion then, as has been observed in the UK and elsewhere, is that the best measure of the overall impact of the pandemic is through calculating excess deaths.

References

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