

METHODOLOGICAL NOTE: PREDICTED NUMBERS OF DEATHS BY EPI-WEEK FOR SOUTH AFRICA IN 2020 AND 2021

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Background

Data on all deaths registered on the National Population Register are provided by the Department of Home Affairs to the SAMRC and have been used to prepare Annual Rapid Mortality Surveillance Reports,¹ and during 2020 to prepare Reports on Weekly Deaths.² The National Population Register does not include deaths that do not get registered with the Department of Home Affairs nor does it include deaths of people who do not have a South African ID number, making it necessary to apply adjustments in respect of both these aspects to estimate more accurately the number of deaths that have occurred.

Preparation of the weekly death reports has involved weighting the numbers to correct for incompleteness of death registration, estimating a predicted value and prediction interval for weeks after the start of 2020 and calculating the excess deaths based on the difference between the estimated (actual) weekly number and the predicted number of deaths. In addition, to enable as up-to-date estimates as possible the estimates for the most recent week needs to be adjusted for deaths that are still to be registered at the time of the report. A running ratio of the accrued number for a specific week is calculated to track the proportion of the ultimate number of deaths that are registered within the latest week. This is used to estimate an adjustment factor to be applied in the last week to provide a near real-time estimate of the deaths that had occurred. With subsequent updates of the data set, the adjustment for a specific week falls away.

Estimates of the number of excess deaths were introduced in the report on weekly deaths prepared at the end of June 2020.³ The number of excess deaths is generally calculated as the number of **all-cause** deaths in that week less the number that might be expected to have occurred. In the case of South Africa, it became apparent that the stringent lockdown implemented at the end of March reduced the number of deaths from unnatural causes significantly, making it important for the computation of excess deaths to focus on deaths from natural causes in order for the excess to more closely reflect the direct impact of the epidemic. This was important in the South African setting where unnatural deaths account for about 12% of the deaths. However, the lockdown also reduced the number of deaths from non-COVID natural causes. Thus, for the weekly reports prepared in 2020, we estimated the numbers of COVID and collateral deaths, once a clear upward trend in deaths from natural causes was evident, as the number of actual natural deaths less a baseline number determined as a proportion of the predicted number (the proportion being determined such that the excess in the week prior to the start of the rapid increase was equal to the confirmed number of COVID deaths at that point). This baseline was trended to the predicted from late June.

For 2020 historical data of the estimated actual weekly numbers of deaths for 2018 and 2019 were used to predict the number of deaths that could be expected, accounting for the seasonal variation in the weekly numbers. The Holt-Winters^{4,5} time series forecasting method was used in Excel to predict values for each week of 2020 based on a linear annual trend, allowing for a seasonal effect over the year. In addition, 95% prediction intervals were estimated for the predicted weekly number of deaths for 2020 to give a basis to assess fluctuations. When it was noticed that there was

¹ Dorrington RE, Bradshaw D, Laubscher R, Nannan N (2020). Rapid mortality surveillance report 2018. Cape Town: South African Medical Research Council.

² Bradshaw D, Laubscher R, Dorrington R, Groenewald P, Moultrie TA (2020). Report on weekly deaths in South Africa 1 January - 15 March 2020. Cape Town: Burden of Disease Research Unit, South African Medical Research Council.

³ Bradshaw D, Laubscher R, Dorrington R, Groenewald P, Moultrie TA (2020). Report on weekly deaths in South Africa 1 January – 23 June 2020 (Week 25). Cape Town: Burden of Disease Research Unit, South African Medical Research Council.

⁴ Holt CC (1957). Forecasting seasonals and trends by exponentially weighted averages International Journal of Forecasting; 20(1): 5.

⁵ Winters PR (1960). Forecasting sales by exponentially weighted moving averages. Management Science; 6(3): 31.

drop in the number of deaths of infants associated with the inability to register births during lockdown level 5, it was decided to report on the deaths of persons 1+ years and older.⁶

Methodological changes

The above approach was developed piecemeal as the COVID-19 pandemic developed, working with the best data available at the time, in the hope (if not expectation) that the worst of the pandemic would be behind us by the end of 2020. Unfortunately, that has not been the case and so, as we move into 2021 it has been necessary to refine the process to, inter alia, produce predictions for 2021, ensuring that the national estimate is consistent with the sum of the estimates for the provinces, and taking into account the release of vital registration data to include registrations up to the close of 2017 by Stats SA.

We have also used the opportunity to change to reporting the number of deaths by an 'Epi-week' consistent with CDC and many NICD reports. The week runs from Sunday to Saturday, ensuring continuity of weeks from one year to the next. (Previously, the weeks were counted from 1 January and, in 2020, ran from Wednesday-Tuesday).

This methodological note provides details of the approaches that we have used to set up the monitoring of mortality in South Africa for 2021. We intend to continue reporting the deaths for persons 1+ years and older, until we have been able to assess the impact of lockdown and COVID-19 on birth registration and the effect that has the number of infant deaths reported on the NPR.

Change in adjustment for incompleteness of death registration and recording of deaths on the NPR

As before, the numbers of deaths are adjusted by means of weighting to account for incomplete registration of deaths and those that do not have a South African ID number. The weights have been calculated by age, sex, metro/non-metro, province, and natural/unnatural cause to be consistent with the weights applied in the annual Rapid Mortality Surveillance Reports. While we have built up a good sense of the adjustment at a national level through the annual RMS reports and the National Burden of Disease Study, estimating completeness of registration of deaths below national level is challenging, particularly given limitations of data available to inform such an exercise, and has required numerous assumptions. Completeness of death registration improves with age with the lowest completeness observed for infants.⁷

The adjustment for incompleteness of recording of deaths on the NPR was re-estimated taking into account the data released by Stats SA in 2020, which extends the series of cause-of-death data to the end of 2017. With the exception of KwaZulu-Natal (and eThekweni in particular) the impact of the changes is relatively small. But the updated data shows that for eThekweni the data used to determine the previous adjustments (up to and including 2015) was missing a large number of late registrations, particularly for children.

The number of deaths recorded on the NPR for 2014 to 2019 are shown in Table 1 by calendar year and by epi-year (i.e., a week that spans multiple years is allocated to the year which has 4 or more days in the epi-week) as well as the estimated number of deaths for persons 1+ years and for persons all ages. It can be seen from the table that the completeness of is higher when the infant deaths are excluded.

⁶ Bradshaw D, Laubscher R, Dorrington R, Groenewald P, Moultrie TA (2020). Report on weekly deaths in South Africa 1 January – 28 April 2020 (Week 17). Cape Town: Burden of Disease Research Unit, South African Medical Research Council.

⁷ Dorrington RE, Bradshaw D, Laubscher R, Nannan N (2020). Rapid mortality surveillance report 2018. Cape Town: South African Medical Research Council.

Table 1: Estimated annual number of deaths and number reported on NPR by year, South Africa 2014-2019

	All ages					Persons 1+ years				
	Calendar year		Epi-year		Completeness (NPR/Estimate)	Calendar year		Epi-year		Completeness (NPR/Estimate)
	Estimate	NPR	Estimate	NPR		Estimate	NPR	Estimate	NPR	
2014	543,828	445,652	552,768	452,978	82%	508,558	432,315	516,918	439,422	85%
2015	539,311	448,620	537,834	447,391	83%	506,744	436,130	505,355	434,935	86%
2016	534,475	446,251	531,555	443,812	83%	505,020	434,971	502,260	432,594	86%
2017	528,967	444,091	527,517	442,874	84%	502,064	433,764	500,689	432,576	86%
2018	530,396	444,622	528,943	443,404	84%	500,607	433,185	499,236	431,998	87%
2019	528,733	442,322	527,284	441,110	84%	496,839	430,098	495,478	428,920	87%

Model to predict weekly numbers of deaths

There are strong seasonal variations in the numbers of deaths from all causes with an increase in the winter months as well as upticks at the beginning of the year. The weekly deaths from all causes are shown in Figure 2 and the trends for natural and unnatural deaths are shown in Figures 3a and 3b respectively. The trend in deaths from unnatural causes has distinct upticks, coinciding with month-ends. Additionally, the first week of the year tends to be high.

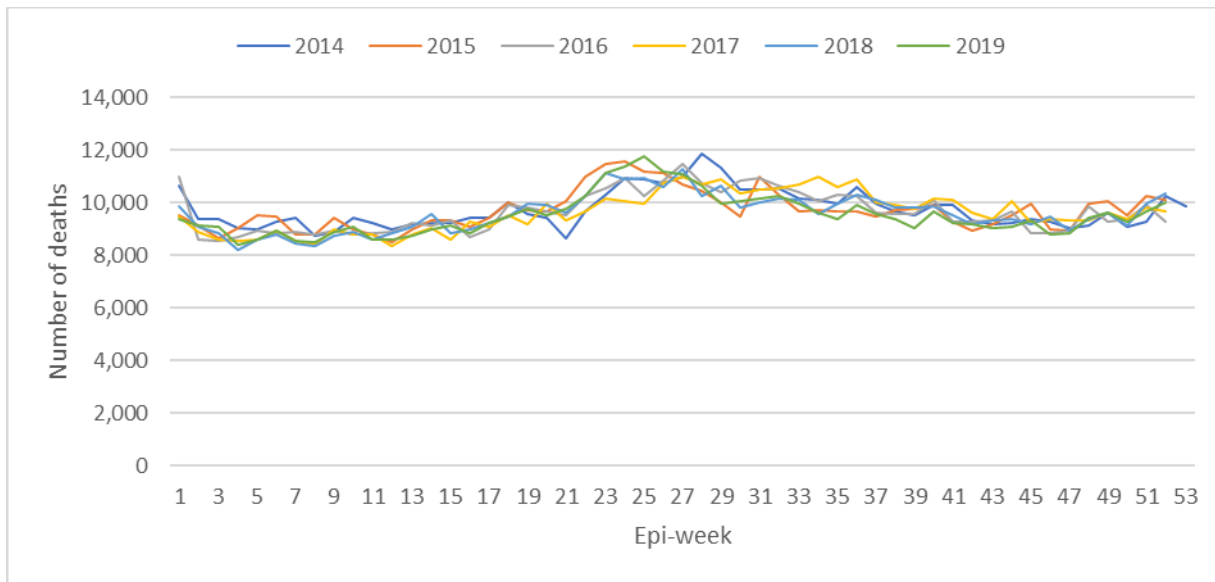


Figure 2: Weekly number of deaths by Epi-week, South Africa 2014-2019

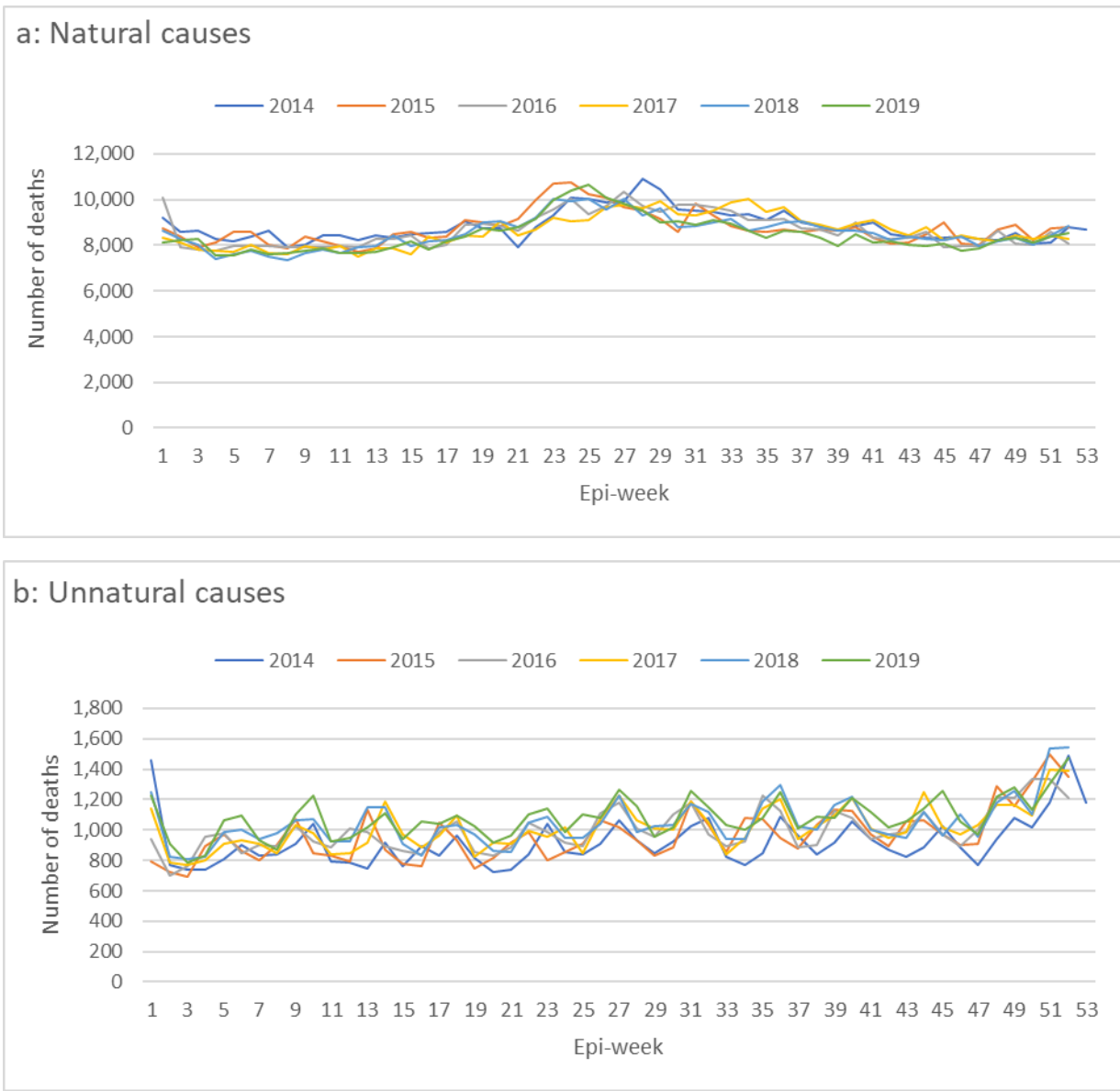


Figure 3: Weekly number of deaths from natural causes (a) and unnatural causes (b) by Epi-week, South Africa 2014-2019

For the 2020 reports on weekly deaths, we used data from 2018 and 2019 to provide forecast values. However, as we moved to develop predicted values for 2021, it was considered important to use more historical data to obtain a more robust trend for the prediction. For the 2021 predicted values, we now use data for the 6 years prior to 2020 i.e. 2014 to 2019. Given the distortion in the number of deaths in 2020 arising from COVID, we do not use data from 2020 to establish the predicted series of weekly deaths.

Poisson regression and negative binomial regression are common statistical models used for the analysis of count data. We explored using Poisson regression to model the number of weekly deaths at the provincial level but found the data do be over-dispersed and therefore chose to fit a negative binomial model to the death data after adjustment for incompleteness.

Following exploratory analysis of the data, it was decided to fit separate models to the unnatural deaths, allowing for these deaths to follow a weekly pattern that would be different from the naturals. In the case of natural deaths, we fitted separate models for the Western Cape and KwaZulu-Natal and a third model for the remaining provinces. The main reason to separate Western Cape is that it appears to have a slightly different seasonal trend while KwaZulu-Natal needed to be modelled separately because it appears to have a more rapid decline in adult mortality in recent years than in the other provinces. This was not done for unnatural deaths as the numbers of deaths are much lower than for natural.

Models were fitted using Stata and allow for an interaction between age group and sex, and independent effects of the year, province, and epi-week as categorical variables. Estimates of population size were included in the model as an “offset” term, permitting the modelling of mortality rates directly.

Thus, in effect, the following regression model was fitted to the log of the rate, calculated as the number of deaths divided by exposure time measured in person-weeks:

$$\ln\left(\frac{d_{ij}}{PW_{ij}}\right) = \ln(d_{ij}) - \ln(PW_{ij}) = \beta_0 + \beta_1 X_i + \beta_2 X_{1j} + \beta_3 X_{2j} + \dots + \beta_{n+1} X_{nj}$$

where d_{ij} is the count of deaths and PW_{ij} is the exposure (measured in person-weeks) for a particular age group i and combination of covariates j .

The statistical model produces estimates of the coefficients (the betas in the formulation above). Since calendar year was included in the covariates as a linear effect, we derive extrapolated fitted values for each epi-week of 2020 and 2021, by age, sex, and province. To derive prediction intervals for the forecasted weekly deaths, we follow the approach recommended by Vital Strategies and the World Health Organisation⁸ estimating the standard deviation based on the observed values from the previous years. Since there is considerable variability across the weeks, we have further adapted the recommended approach and created an even prediction interval over the year by taking the median of observed standard deviations for the 6 values (from each year 2014-2019) for epi-weeks 1 to 52. Data for week 53 were not included as 5 out of the 6 years did not have a 53rd week.

The predictions for the provinces and national in 2020 using this approach was reasonably consistent with 2020 deaths in periods not impacted severely by either epidemic or lockdown conditions and provides a consistent series into the epi-weeks of 2021. The 2020 model predictions for natural deaths for persons 1+ years was contrasted with forecast values using the time series model based on 2018 and 2019 data only (**Appendix 1**). The modelled estimates based on the data going back to 2014 are very similar to those based on the 2018 and 2019 data. At the provincial level, the estimates based on the 6 years 2014-2019 tend to be smoother than those based on the two years 2018-2019. However, there are some weeks in some provinces, where the numbers deaths in 2018 and 2019 did not follow the trend of the earlier years resulting in small differences in the predicted values for 2020 using the different approaches. The predicted values for the Free State are slightly higher using the model based on the longer time series and the predicted values for Mpumalanga are slightly lower.

Without additional evaluation of the metro demographic dynamics, we have not attempted to model the weekly deaths for the metropolitan areas at this stage. However, the metro data for 2018 and 2019 have been recast to Epi-week and forecast values and their prediction intervals for 2020 and 2021 have been generated using the Excel forecast function previously used.

⁸ Vital Strategies, World Health Organization (2020). Revealing the Toll of COVID-19: A Technical Package for Rapid Mortality Surveillance and Epidemic Response. New York: Vital Strategies.

The national predicted values and the prediction interval calculated for 2020 and 2021 are given in **Appendix 2** and the provincial values and metro predicted values are included in the excel sheet that can be downloaded from the [Report on Weekly Deaths in South Africa](#) website.

Excess deaths

The estimation of the number of COVID-19 and collateral (i.e., deaths arising as a result of the impact of SARS-CoV-2 epidemic and the management of this on the provision of health care) deaths is not straight-forward. Aside from focussing on the excess of natural deaths to remove the influence of reductions in unnatural deaths, it was observed that during lockdown at the start of the epidemic in 2020 the number of deaths due to natural causes fell well below the predicted number. The weekly numbers tracked the lower prediction interval, probably due to the impact of lockdown and non-pharmaceutical interventions (NPIs) on the spread of non-COVID communicable diseases. It was therefore decided to take as the expected number of deaths a proportion of the predicted number, that matched the proportion⁹ in the week prior to the week when there was a clear rapid increase in numbers (e.g., the week starting on 6 May for Cape Town, Western Cape and nationally), and the number of cumulative COVID and collateral cases was set to the number of confirmed cases up to the end of that week. Continuing to use this adjusted base until late June was supported by the observation that the number of natural deaths in the provinces less affected by COVID-19 continued to track lower than predicted numbers through to the end of June. However, following the emergence of COVID-19 in most of the provinces, and with uncertainty about the counterfactual following the seasonal winter peak in numbers of deaths, the baseline was transitioned to the predicted number of deaths by the end of July, except for the Western Cape and Limpopo where, for different reasons, the transition to predicted was assumed to take longer.

At the end of 2020 it was decided to review the methodology to take into account both the release updated cause-of-death data by Stats SA in 2020 for the years up to 2017, the need to project expected deaths for a further year, and the desire to ensure that the estimates of the national and provincial excess deaths were consistent. The above approach to estimating the excess deaths was applied to the newly estimated expected numbers of deaths for 2020, which differed from those used in 2020, with the exception that the national baseline/counterfactual was set to the sum of the provincial baselines (instead of being determined independently) as part of ensuring consistency between the national and provincial estimates.

⁹ With a small adjustment to ensure that the number of COVID deaths matched the numbers of confirmed cases for that week.

Appendix 1: Evaluation of predicted 2020 values

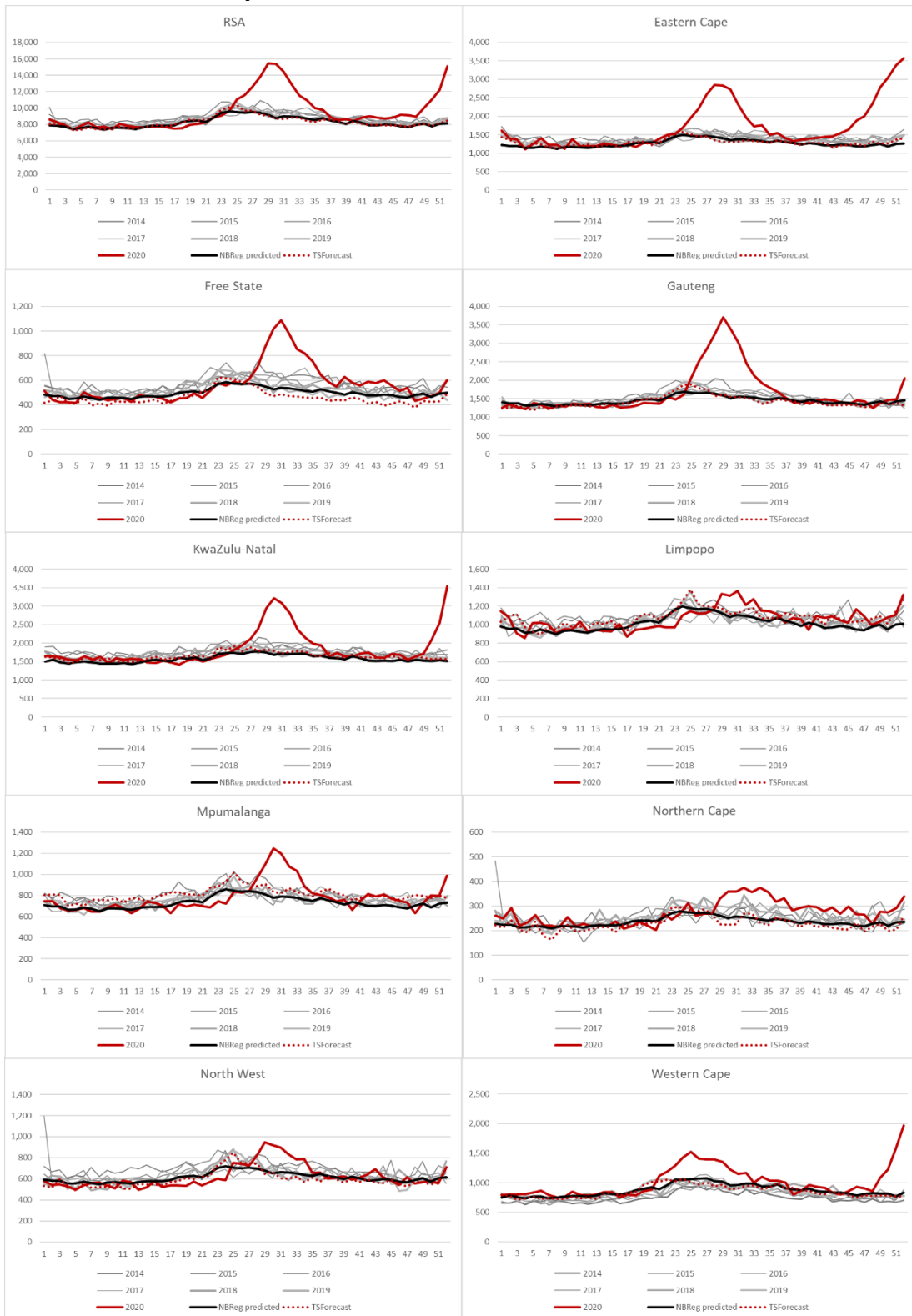


Figure A1: Predicted weekly natural deaths 1+ yrs for 2020 extrapolating from Negative Binomial regression of 2014-2019 data compared with time series forecast from 2018-2019 data and data for 2014-2020

Appendix 2: Predicted weekly deaths for persons 1+ years in 2020 and 2021, South Africa

SOUTH AFRICA										
DATE	EPI-WEEK	ALL CAUSE 1+ YRS			NATURAL 1+ YRS			UNNATURAL 1+ YRS		
		PREDICTION	PREDICTION BOUNDS		PREDICTION	PREDICTION BOUNDS		PREDICTION	PREDICTION BOUNDS	
2020										
29-Dec-19 - 4-Jan-20	1	9,002	8,437	9,567	7,874	7,312	8,436	1,128	959	1,298
5-Jan-20 - 11-Jan-20	2	8,740	8,176	9,305	7,849	7,287	8,411	891	722	1,061
12-Jan-20 - 18-Jan-20	3	8,598	8,033	9,163	7,736	7,174	8,298	861	692	1,031
19-Jan-20 - 25-Jan-20	4	8,370	7,805	8,935	7,437	6,875	7,998	934	764	1,103
26-Jan-20 - 1-Feb-20	5	8,575	8,010	9,140	7,531	6,969	8,093	1,044	874	1,213
2-Feb-20 - 8-Feb-20	6	8,758	8,193	9,323	7,717	7,155	8,278	1,042	872	1,211
9-Feb-20 - 15-Feb-20	7	8,515	7,950	9,080	7,517	6,955	8,079	998	829	1,168
16-Feb-20 - 22-Feb-20	8	8,345	7,780	8,910	7,351	6,789	7,913	994	825	1,164
23-Feb-20 - 29-Feb-20	9	8,718	8,153	9,283	7,574	7,012	8,136	1,144	974	1,313
1-Mar-20 - 7-Mar-20	10	8,740	8,175	9,305	7,614	7,053	8,176	1,125	956	1,295
8-Mar-20 - 14-Mar-20	11	8,512	7,947	9,077	7,545	6,983	8,106	968	798	1,137
15-Mar-20 - 21-Mar-20	12	8,413	7,848	8,978	7,446	6,885	8,008	967	797	1,136
22-Mar-20 - 28-Mar-20	13	8,717	8,152	9,282	7,651	7,089	8,213	1,066	897	1,236
29-Mar-20 - 4-Apr-20	14	8,957	8,392	9,522	7,846	7,284	8,408	1,111	941	1,280
5-Apr-20 - 11-Apr-20	15	8,753	8,188	9,318	7,814	7,252	8,376	939	769	1,108
12-Apr-20 - 18-Apr-20	16	8,782	8,217	9,346	7,811	7,249	8,373	970	801	1,140
19-Apr-20 - 25-Apr-20	17	8,965	8,400	9,530	7,903	7,341	8,465	1,062	893	1,232
26-Apr-20 - 2-May-20	18	9,444	8,879	10,009	8,312	7,750	8,874	1,132	962	1,301
3-May-20 - 9-May-20	19	9,380	8,815	9,945	8,414	7,853	8,976	966	796	1,135
10-May-20 - 16-May-20	20	9,440	8,875	10,005	8,492	7,930	9,054	948	779	1,118
17-May-20 - 23-May-20	21	9,250	8,685	9,815	8,277	7,716	8,839	972	803	1,142
24-May-20 - 30-May-20	22	9,909	9,344	10,474	8,802	8,240	9,364	1,107	938	1,277
31-May-20 - 6-Jun-20	23	10,493	9,928	11,058	9,393	8,831	9,955	1,100	930	1,269
7-Jun-20 - 13-Jun-20	24	10,629	10,065	11,194	9,600	9,038	10,162	1,029	860	1,199
14-Jun-20 - 20-Jun-20	25	10,529	9,964	11,094	9,508	8,946	10,070	1,021	851	1,190
21-Jun-20 - 27-Jun-20	26	10,595	10,031	11,160	9,443	8,882	10,005	1,152	983	1,321
28-Jun-20 - 4-Jul-20	27	10,806	10,241	11,371	9,539	8,977	10,101	1,267	1,097	1,436
5-Jul-20 - 11-Jul-20	28	10,507	9,942	11,072	9,390	8,828	9,952	1,116	947	1,286
12-Jul-20 - 18-Jul-20	29	10,239	9,674	10,804	9,202	8,640	9,764	1,037	868	1,207
19-Jul-20 - 25-Jul-20	30	9,888	9,323	10,453	8,800	8,238	9,362	1,088	918	1,257
26-Jul-20 - 1-Aug-20	31	10,251	9,686	10,815	8,977	8,416	9,539	1,273	1,104	1,443
2-Aug-20 - 8-Aug-20	32	10,121	9,556	10,686	8,955	8,393	9,517	1,165	996	1,335
9-Aug-20 - 15-Aug-20	33	9,851	9,287	10,416	8,869	8,307	9,431	983	813	1,152
16-Aug-20 - 22-Aug-20	34	9,722	9,157	10,287	8,687	8,125	9,249	1,035	866	1,205
23-Aug-20 - 29-Aug-20	35	9,700	9,135	10,265	8,523	7,961	9,085	1,177	1,008	1,347
30-Aug-20 - 5-Sep-20	36	10,011	9,446	10,576	8,762	8,200	9,324	1,249	1,080	1,419
6-Sep-20 - 12-Sep-20	37	9,521	8,956	10,086	8,484	7,923	9,046	1,037	867	1,206
13-Sep-20 - 19-Sep-20	38	9,394	8,829	9,959	8,320	7,759	8,882	1,073	904	1,243
20-Sep-20 - 26-Sep-20	39	9,267	8,702	9,832	8,099	7,537	8,661	1,168	998	1,337
27-Sep-20 - 3-Oct-20	40	9,672	9,107	10,237	8,410	7,848	8,972	1,262	1,092	1,431
4-Oct-20 - 10-Oct-20	41	9,266	8,701	9,830	8,181	7,619	8,743	1,085	915	1,254
11-Oct-20 - 17-Oct-20	42	8,962	8,397	9,527	7,922	7,361	8,484	1,040	870	1,209
18-Oct-20 - 24-Oct-20	43	8,961	8,396	9,526	7,898	7,337	8,460	1,063	893	1,232
25-Oct-20 - 31-Oct-20	44	9,191	8,626	9,755	8,000	7,438	8,561	1,191	1,022	1,361
1-Nov-20 - 7-Nov-20	45	9,063	8,498	9,628	7,928	7,366	8,489	1,135	966	1,305
8-Nov-20 - 14-Nov-20	46	8,825	8,261	9,390	7,774	7,212	8,336	1,051	882	1,221
15-Nov-20 - 21-Nov-20	47	8,715	8,150	9,279	7,685	7,123	8,247	1,029	860	1,199
22-Nov-20 - 28-Nov-20	48	9,239	8,674	9,804	7,961	7,399	8,523	1,277	1,108	1,447
29-Nov-20 - 5-Dec-20	49	9,379	8,814	9,944	8,081	7,520	8,643	1,298	1,128	1,467
6-Dec-20 - 12-Dec-20	50	9,015	8,450	9,579	7,758	7,196	8,320	1,256	1,087	1,426

SOUTH AFRICA										
DATE	EPI-WEEK	ALL CAUSE 1+ YRS			NATURAL 1+ YRS			UNNATURAL 1+ YRS		
		PREDICTION	PREDICTION BOUNDS		PREDICTION	PREDICTION BOUNDS		PREDICTION	PREDICTION BOUNDS	
13-Dec-20 - 19-Dec-20	51	9,528	8,963	10,093	8,048	7,486	8,610	1,480	1,311	1,650
20-Dec-20 - 26-Dec-20	52	9,632	9,067	10,197	8,156	7,594	8,717	1,477	1,307	1,646
27-Dec-20 - 2-Jan-21	53	9,416	8,851	9,980	8,141	7,579	8,703	1,274	1,105	1,444
2021										
3-Jan-21 - 9-Jan-21	1	8,912	8,347	9,477	7,757	7,195	8,319	1,155	986	1,325
10-Jan-21 - 16-Jan-21	2	8,645	8,080	9,210	7,732	7,170	8,294	913	743	1,082
17-Jan-21 - 23-Jan-21	3	8,504	7,939	9,069	7,622	7,060	8,184	882	713	1,051
24-Jan-21 - 30-Jan-21	4	8,282	7,717	8,847	7,326	6,764	7,888	956	787	1,126
31-Jan-21 - 6-Feb-21	5	8,488	7,923	9,053	7,419	6,857	7,981	1,069	899	1,238
7-Feb-21 - 13-Feb-21	6	8,668	8,103	9,233	7,602	7,040	8,163	1,067	897	1,236
14-Feb-21 - 20-Feb-21	7	8,427	7,862	8,992	7,405	6,843	7,966	1,022	853	1,192
21-Feb-21 - 27-Feb-21	8	8,260	7,695	8,825	7,242	6,680	7,804	1,018	849	1,187
28-Feb-21 - 6-Mar-21	9	8,633	8,068	9,198	7,462	6,900	8,024	1,171	1,002	1,341
7-Mar-21 - 13-Mar-21	10	8,654	8,089	9,219	7,502	6,940	8,064	1,152	983	1,322
14-Mar-21 - 20-Mar-21	11	8,424	7,859	8,989	7,433	6,871	7,995	991	821	1,160
21-Mar-21 - 27-Mar-21	12	8,327	7,762	8,891	7,337	6,775	7,898	990	821	1,159
28-Mar-21 - 3-Apr-21	13	8,629	8,064	9,194	7,537	6,975	8,099	1,092	922	1,261
4-Apr-21 - 10-Apr-21	14	8,868	8,303	9,432	7,730	7,168	8,292	1,138	968	1,307
11-Apr-21 - 17-Apr-21	15	8,661	8,096	9,225	7,699	7,137	8,261	961	792	1,131
18-Apr-21 - 24-Apr-21	16	8,690	8,125	9,255	7,696	7,134	8,258	994	824	1,163
25-Apr-21 - 1-May-21	17	8,875	8,310	9,440	7,787	7,225	8,349	1,088	918	1,257
2-May-21 - 8-May-21	18	9,349	8,784	9,914	8,190	7,628	8,752	1,159	990	1,328
9-May-21 - 15-May-21	19	9,281	8,716	9,846	8,293	7,731	8,854	989	819	1,158
16-May-21 - 22-May-21	20	9,341	8,776	9,906	8,370	7,808	8,932	971	801	1,140
23-May-21 - 29-May-21	21	9,154	8,589	9,719	8,159	7,597	8,720	995	826	1,165
30-May-21 - 5-Jun-21	22	9,810	9,245	10,375	8,676	8,114	9,238	1,134	964	1,303
6-Jun-21 - 12-Jun-21	23	10,385	9,820	10,950	9,259	8,698	9,821	1,126	957	1,295
13-Jun-21 - 19-Jun-21	24	10,519	9,954	11,083	9,464	8,903	10,026	1,054	885	1,224
20-Jun-21 - 26-Jun-21	25	10,420	9,855	10,985	9,374	8,812	9,936	1,045	876	1,215
27-Jun-21 - 3-Jul-21	26	10,492	9,927	11,057	9,312	8,750	9,874	1,180	1,010	1,349
4-Jul-21 - 10-Jul-21	27	10,703	10,138	11,268	9,406	8,844	9,968	1,297	1,127	1,466
11-Jul-21 - 17-Jul-21	28	10,401	9,836	10,966	9,258	8,696	9,820	1,143	974	1,313
18-Jul-21 - 24-Jul-21	29	10,135	9,570	10,700	9,073	8,511	9,635	1,062	893	1,231
25-Jul-21 - 31-Jul-21	30	9,790	9,225	10,355	8,676	8,114	9,238	1,114	944	1,283
1-Aug-21 - 7-Aug-21	31	10,153	9,589	10,718	8,850	8,288	9,412	1,304	1,134	1,473
8-Aug-21 - 14-Aug-21	32	10,021	9,456	10,586	8,828	8,266	9,390	1,193	1,024	1,363
15-Aug-21 - 21-Aug-21	33	9,749	9,184	10,314	8,743	8,181	9,305	1,006	837	1,176
22-Aug-21 - 28-Aug-21	34	9,623	9,058	10,188	8,563	8,001	9,125	1,060	890	1,229
29-Aug-21 - 4-Sep-21	35	9,607	9,042	10,172	8,402	7,840	8,963	1,205	1,036	1,375
5-Sep-21 - 11-Sep-21	36	9,917	9,352	10,482	8,638	8,076	9,200	1,279	1,110	1,449
12-Sep-21 - 18-Sep-21	37	9,424	8,859	9,989	8,363	7,801	8,925	1,061	892	1,231
19-Sep-21 - 25-Sep-21	38	9,301	8,736	9,866	8,202	7,640	8,764	1,099	930	1,268
26-Sep-21 - 2-Oct-21	39	9,179	8,614	9,744	7,983	7,421	8,545	1,196	1,026	1,365
3-Oct-21 - 9-Oct-21	40	9,580	9,016	10,145	8,289	7,727	8,850	1,292	1,123	1,461
10-Oct-21 - 16-Oct-21	41	9,173	8,609	9,738	8,063	7,501	8,625	1,111	941	1,280
17-Oct-21 - 23-Oct-21	42	8,873	8,308	9,438	7,809	7,247	8,371	1,065	895	1,234
24-Oct-21 - 30-Oct-21	43	8,873	8,308	9,438	7,785	7,223	8,347	1,088	919	1,258
31-Oct-21 - 6-Nov-21	44	9,103	8,538	9,668	7,884	7,322	8,445	1,220	1,050	1,389
7-Nov-21 - 13-Nov-21	45	8,975	8,410	9,540	7,813	7,251	8,375	1,162	993	1,332
14-Nov-21 - 20-Nov-21	46	8,737	8,172	9,302	7,660	7,098	8,222	1,077	907	1,246
21-Nov-21 - 27-Nov-21	47	8,629	8,064	9,193	7,574	7,013	8,136	1,054	885	1,224
28-Nov-21 - 4-Dec-21	48	9,153	8,588	9,718	7,845	7,284	8,407	1,308	1,138	1,477
5-Dec-21 - 11-Dec-21	49	9,293	8,728	9,858	7,964	7,402	8,526	1,329	1,159	1,498

SOUTH AFRICA										
DATE	EPI-WEEK	ALL CAUSE 1+ YRS			NATURAL 1+ YRS			UNNATURAL 1+ YRS		
		PREDICTION	PREDICTION BOUNDS		PREDICTION	PREDICTION BOUNDS		PREDICTION	PREDICTION BOUNDS	
12-Dec-21 - 18-Dec-21	50	8,933	8,368	9,498	7,647	7,085	8,209	1,286	1,117	1,456
19-Dec-21 - 25-Dec-21	51	9,445	8,880	10,010	7,929	7,367	8,491	1,516	1,346	1,685
26-Dec-21 - 2-Jan-22	52	9,549	8,984	10,114	8,037	7,475	8,599	1,512	1,343	1,682