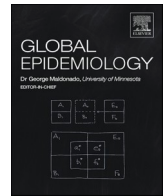




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COVID-19 in South Africa: Correcting the record

In their article “COVID-19 in South Africa” Broadbent, Combrink and Smart [1] state that “[c]ontrary to widespread political and popular views, no changes in the shape of the [COVID-19 case] curve can be attributed to the introduction or easing of any regulation” and assert as self-evident “the apparent unresponsiveness of the epidemic to lockdown measures.” To support this conclusion which, if true, would have important public health implications, the authors use demonstrably inaccurate and incomplete data, present incorrect and deceptive graphs and offer no empirical analysis.

Any conclusion reached from such a deficient approach would at best be a lucky guess that has no place in a peer-reviewed scientific journal (even under the label “International Perspective”). It could misinform policy and lead to disastrous public health consequences.

Data – much of it incorrect (see below) – are presented from early March until late August 2020. Furthermore, Broadbent et al., present no explanation of the methodology employed to reach their conclusion. It appears that they did nothing more than “read off” (authors’ words) or eyeball the epidemic curve.¹ We consulted six standard graduate-level epidemiological textbooks [2–7] and three leading infectious disease epidemiology books [8–10] and could find no mention of “read[ing] off” as a valid epidemiological method. Any valid analysis would need to account for an approximate 11-day lag period since that is how long it takes on average from COVID-19 transmission to detection and cases detected today were the result of transmission 11 days ago [11]. This would be exceedingly difficult to do if “read[ing] off” a graph is your analytical method.

Myriad epidemiological methods are available to rigorously examine the impact of lockdown orders on new COVID cases; the authors employed none of these methods. Yet, the lack of analysis or scientific rigour does not stop the authors from making broad and unsubstantiated conclusions.

In addition to failing to provide any statistical analysis, the article makes numerous factual errors which are easily verifiable from publicly available data. Dates on which regulations were implemented are incorrect. Significant regulations are omitted. Daily case counts are frequently wrong. For example, on 7 days in which the authors report zero cases, there were in fact at least 15,586 cases. We detail these and other errors below.

Such material errors in both the exposure and the outcome variables introduce significant bias, rendering the claimed results invalid. In this case, the biases introduced would likely result in error towards the null, making it more likely to conclude that there was no impact of restrictions when in fact there was.

The lack of analysis in the paper and numerous incorrect dates and missing case counts are troubling enough. But compounding this further

is the fact that the authors have cited this article on numerous occasions to claim in the popular- and pseudo-scientific press, under titles like “Lockdown didn’t work in South Africa: why it shouldn’t happen again” that they have “reviewed the evidence for the effectiveness of the lockdown” and concluded that “lockdown was not an effective strategy” in South Africa [12,13]. Let us be clear: no scientific review of the evidence was presented by the authors, nor did they provide any empirical analysis that could justify the statement that lockdowns were ineffective.

Such lack of analysis twinned with wildly unjustified conclusions are consistent with the authors’ confident prediction on October 15, 2020 that “there is currently little reason to fear a severe second wave [of COVID-19] in South Africa” [12]. That confidence was betrayed by reality just three weeks later when South Africa’s second wave did in fact hit, significantly worse than the first, with the 7-day average deaths peaking 94% higher than in the first wave and the 7-day average case counts peaking 51% higher than in the first wave [14]. Furthermore, a third wave gripped South Africa in mid-2021, with the number of daily cases surpassing the previous two peaks [14]. Such incorrect and dangerous statements - which if taken seriously would have had disastrous public health consequences - demonstrate again the importance of science over guesswork.

Incorrect dates

Numerous dates cited for the imposition or relaxation of restrictions are incorrect. The paper states:

“The South African government responded early, enacting a State of Disaster on 15 March. Initial restrictions were moderate (restrictions on bars and restaurants, tourism, travel) but from 27 March a full lockdown was implemented prohibiting leaving the home for any non-essential purpose (including exercise) and providing a restrictive list of essential activities, shutting down most economic activity. The response was subsequently categorized by level, with 5 being the most severe. Transitions to levels 4, 3, 2, and 1 occurred on 1 May, 13 July, 19 August and 21 September respectively.”

Two of these dates are not correct:

- The transition from level 4 to level 3 was not on 13 July 2020. It occurred 6 weeks earlier, on 1 June 2020 [South African Government Gazette 43364 [15]].
- The transition from level 3 to level 2 was not on 19 August 2020. It occurred 1 day earlier, on 18 August 2020. [South African Government Gazette 43620 [16,17]].

¹ In the same paragraph, the authors contradict themselves, first cautioning against “reading off” and then provide no analysis other than “reading off.”

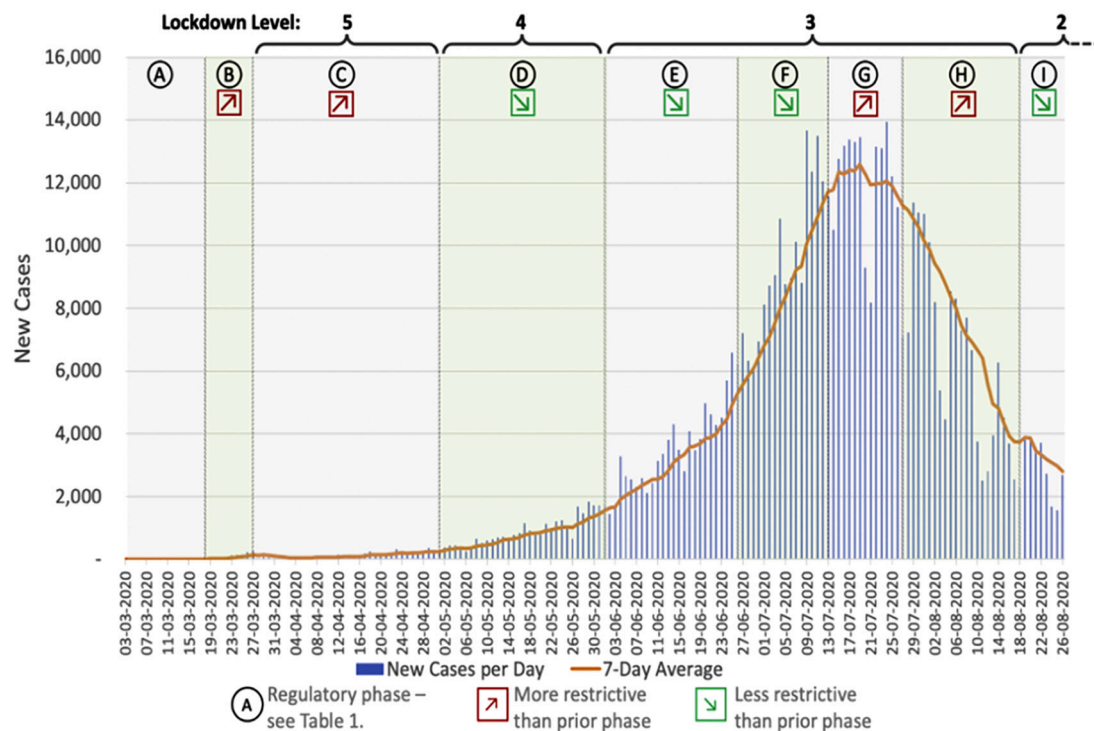


Fig. 1. Correct COVID-19 cases in South Africa and related lockdown measures.

Significant regulatory events omitted

In addition to incorrect dates, the authors ignore significant changes to the severity of lockdown levels during the period under review. Most notable omissions include:

- On 13 July 2020 – a date on which the paper claims that restrictions were eased – significantly more stringent behavioural restrictions were imposed. These restrictions included the banning of liquor sales and the introduction of a 9 pm-to-4 am curfew [South African Government Gazette 43521 [18]].²
- Public schools were closed for up to 4 weeks, grade-dependent, on 27 July 2020 [South African Department of Basic Education, Government Gazette 43578 [19]].³

None of these changes in regulations are noted in the paper’s text or on its graphs, despite the fact that the school closure, curfew and liquor sales ban may well have impacted many people’s social and mixing behaviour in profound ways. By failing to note these significant changes in lockdown regulations, the authors obscure any impact these changes may have had.

Errors on charts: dates

The illustration of the dates of various lockdown levels on charts in the paper are vague, misleading and inaccurate:

- o Arrows labelled “Level 5 Lockdown”, “Level 4 Lockdown” and “Level 3 Lockdown” show neither the start-dates nor end-dates of these phases nor, necessarily, their mid-points. Instead, the placement of these arrows appears arbitrary and inconsistent.
- o Arrow labelled “Lockdown Level 2” points to a date at which the country was still under Lockdown Level 3.

The incorrect placement of the arrows in relation to the various inflection points on the daily case count curve can easily create a visual impression supporting the authors’ conclusion that infections and regulations are disassociated from each other. Since the arrows themselves are arbitrarily placed and demonstrably incorrect in some cases, these conclusions cannot be justified.

Errors on charts: cases

In addition to the misclassification of the exposure variables mentioned above, the outcome variables were also flawed. For example, the chart titled “Fig. 1. Cases” contains significant errors in the daily infection count and, as an apparent result thereof, also has errors in what appears to be the rolling 7-day average curve (the curve is not described in the chart’s legend).

- o The chart shows there were no new cases on or around the following dates: 19, 20, 21 and 22 May 2020; 8 June; 20 July. In fact, on those days there were 767, 803, 1134, 988, 2594 and 9300 new cases respectively, with similarly significant case counts on the neighbouring dates [14].⁴

² The liquor ban lasted until 18 August [South African Government Gazette 43620 [16,17]].Curfew hours were adjusted to 10 pm-to-4 am from 1 August [South African Government Gazette 43577 [35]].Curfew hours were further shortened to midnight-to-4am on 21 September 2020 [South African Government Gazette 43725 [36]].

³ Note that school closures were announced by President Cyril Ramaphosa in a speech on 23 July 2020 but not officially gazetted until after that. <https://www.gov.za/speeches/president-cyril-ramaphosa-progress-national-effort-contain-coronavirus-COVID-19-pandemic-23> accessed 1 March 2021.

⁴ There is no evidence of the zero-case days appearing in earlier data sets. For the period under review, the referenced source is unchanged compared to the 1 September 2020 snapshot on the same repository. Furthermore, this source is consistent with the daily official government press releases from the respective dates, available at <https://sacoronavirus.co.za/category/press-releases-and-notices>. Accessed 5 March 2021.

- o The shape of what appears to be the 7-day-average line responds to these spurious zeroes, suggesting that the error is in the underlying dataset rather than being a mere graphical error.

In an effort to correct the record, we created Fig. 1 which addresses all of the above errors and omissions. It overlays the correct dates of changes to regulatory restrictions on the (corrected) daily case data. In addition, Table 1 describes the various regulatory changes over time that are indicated by the bands along x-axis in Fig. 1.

Methodology absent

Broadbent et al. offer no explanation of the methodology they applied to reach the conclusion that lockdown restrictions had no impact on case counts, other than “reading off” a chart.

They refer to the presence or absence of a “change in trajectory (viewed on a logarithmic scale)” of the cumulative case count. In principle, the slope of a curve plotted against a logarithmic scale does indicate the curve’s exponential growth rate. Although the growth rate alone is indeed mathematically descriptive, it is standard epidemiological practice to use a more tangible metric like (untransformed) daily case counts or doubling time.

Regardless of how the growth is expressed, it needs to be quantified before any meaningful comparison to the exposure variable can be attempted and conclusions reached. The paper identifies only two inflection points on the curve and characterises them exclusively in qualitative terms: “a sharp easing off” in March and “gradual easing that began in the later part of July”. There is no presentation of any quantification of this “change in trajectory” – it appears to be a purely visual inspection. Relying on visual inspection to conclude that there were no changes in the shape of curve is not science. As a result, the authors have overlooked the significance of quantifiable changes on the curve.

In addition to the lack of analysis beyond “reading off” a graph, the selection of the log of cumulative cases as the main outcome is both deceptive and unscientific. We reviewed fifteen of the most cited papers on the impact of COVID restrictions, all published in leading peer-review journals like *Science*, *Nature* and *Lancet* [20–34].

Although examining essentially the same question about the impact of restrictions on COVID-19 cases, not one of these fifteen studies used the log of cumulative cases as their outcome. The reasons are simple: the log of cumulative cases is the outcome measure that would be among the least amenable to change as a result of restrictions. Cumulative cases (almost) always go up and transforming them to the log scale adds further to the deception. If one wanted to unpack the true relationship between restrictions and cases, choosing the outcome that is least sensitive to change appears disingenuous. Daily case counts and epidemic doubling time are but two outcome measures that are widely used precisely because they are sensitive to changes in restrictions.

COVID policies are complex and their immediate impact is not always easily measured. Strong conclusions, however, require correspondingly strong evidence. Broadbent et al. instead supply weak and incorrect evidence which they then use to draw strong conclusions, far beyond what their ostensible analysis allows. Whether and to what extent lockdown measures have reduced new infections is a debatable point with critical public health implications. Using incorrect data and visual estimations cannot yield a valid scientific result. Guesswork is no substitute for scientific enquiry, nor a basis on which to conclude unequivocally that lockdowns do not work.

Declaration of Competing Interest

None.

Table 1
Timing and features of lockdown restrictions in South Africa, March to August 2020.

Phase	Start Date	Lockdown Level	Salient features	More stringent (↗) or less stringent (↘) than previous phase
A	Pre-pandemic		Pre-pandemic status quo.	
B	18 March 2020	First regulations under newly-declared disaster. Pre-lockdown.	Gathering sizes limited. Schools closed.	↗
C	27 March	Level 5 lockdown	Everyone confined to their homes except for essential and emergency activities. Borders closed. Inter-provincial travel banned. Liquor and tobacco sales banned.	↗
D	1 May	Level 4 lockdown	Limited re-opening of specified businesses and retail. Outdoor exercise permitted 6 am–9 am. Mandatory mask-wearing in public. Curfew 8 pm–5 am.	↘
E	1 June	Level 3 lockdown	Most people allowed to return to work. Re-opening of most retail & services. Limited liquor sales permitted. Limited domestic travel permitted. Phased re-opening of schools. Curfew lifted.	↘
F	26 June	Adjusted level 3 lockdown	Additional classes of businesses permitted to re-open. On-premises dining permitted at restaurants.	↘
G	13 July	Adjusted level 3 lockdown	All liquor sales again prohibited. Curfew 9 pm–4 am (ceased by 1 h, to 10 pm–4 am on 1 August).	↗
H	27 July	Adjusted level 3 lockdown	Public schools closed for up to 4 weeks, grade dependent.	↗
I	18 August	Level 2 lockdown	Liquor sales permitted with less limitations than originally imposed on 1 June. Tobacco sales permitted. Additional classes of businesses permitted to re-open.	↘

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