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How to do social distancing in a shack:

COVID-19 in the South African context

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'How to do social distancing in a shack: COVID-19 in the South African context'

The somewhat ironic title for this special issue captures a dilemma that we seek to address: how to bring together the best thinking in the social sciences and the biomedical sciences to work through the complex challenges posed by COVID-19. How, indeed, does one do social distancing in a shack?

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How to do social distancing in a shack: COVID-19 in the South African context

The somewhat ironic title for this special issue captures a dilemma that we seek to address: how to bring together the best thinking in the social sciences and the biomedical sciences to work through the complex challenges posed by COVID-19. How, indeed, does one do social distancing in a shack, or expect people to survive by shutting down the economy in a country where one third of the population is unemployed and Government is unable to offer a meaningful social security net? In the early months of the pandemic, the social and policy interventions in South Africa (and other African countries) were very much based on middle-class sensibilities – that for every citizen there is adequate housing with ample physical spaces that allow for this important mitigation measure called social distancing. Furthermore, the notion that people could be restricted to their households for weeks on end, when savings are meagre to non-existent in large numbers of households to support day-to-day survival, seemingly was oblivious to the realities of the country in which we live. Instead of adopting a pragmatic approach, Government tried to strong-arm the enforcement of what amounted to be among the most restrictive regulations globally. There are, for example, memorable incidents where military personnel on the streets of a township tried to force people off the streets and back into their dwellings, with tragic consequences.[1,2]

More than two years since the start of the pandemic-enforced lockdown, we now have good science and improved policy to make sense of COVID-19 and its effects, as well as better insights into the future management of pandemics. What did we learn?

Two sociologists make a convincing argument that a narrow biomedical approach was dangerous in underdeveloped locales because it failed to account for realities like poverty, food insecurity, gender-based violence, and insecure housing. Van Wyk and Reddy's powerful insights on governance raise a critical question: how do you govern people without a social safety net inside a pandemic? The implication is clear: that countries cannot afford to manage a complex pandemic without social science expertise represented on the governing authorities that oversee pandemics, now and into the future.

Also in this collection, an interdisciplinary team of UK and South African scholars give empirical flesh to the conceptually rich study on pandemic governance. Ellison and his colleagues found that people in temporary structures were more likely to report non-compliance or difficulty in complying with lockdown restrictions compared to those in more formal housing arrangements. The face of non-compliance was black, underemployed and undereducated. The lack of basic facilities (like private or indoor toilets) disabled the capacity to comply with lockdown restrictions. There was no science or policy or politics that accounted for these complexities of compliance at the height of the pandemic.

Pursuing the theme of compliance, another interdisciplinary collaboration led by Theron argues that social behaviour in relation to lockdown measures is best studied at the level of groups rather than individuals. That is, there are characteristics of young people as a demographic group that uniquely explains compliance behaviours such as forgetfulness and preferences that interact with real-life conditions such as crowded public spaces (e.g. taxi transportation). Mitigating risk and enabling compliance therefore means understanding the target group.

A second and related theme in the collection is concerned with ethics and consent. Can vaccines be mandated? A scholar of medical ethics, Moodley makes the case for vaccine mandates on the grounds of 'the greater good' argument where individual rights have to be balanced out against co-morbid health in a vulnerable society, high levels of fatigue among health workers, overburdened hospitals, and the risks of non-treatment for other chronic illnesses displaced by the prioritisation of COVID-19 patients.

Even if vaccines are mandated, there is still the tricky issue of obtaining consent. Nair and colleagues studied the problem of electronic consent for enrolment among healthcare professionals in the largest trial of a COVID-19 vaccine – the SISONKE Trial. Here, too, interesting findings emerged. Most respondents (71.5%) were motivated to participate by access to the vaccine, but almost a third (32%) did not realise that breakthrough infections and adverse events had to be reported two years on; and that is for a sample of healthcare professionals.

Joubert and colleagues, a group of Stellenbosch data scientists, examine *who gets heard* in terms of expert opinion on the pandemic in various media outlets; in other words, the question of representation. Male scientists dominate, as do the medical sciences. What is not mentioned in terms of the history of racial inequalities in South African science, is that the two most prominent experts in the media were black medical scientists who became household names because of their exposure in the press and formidable achievements in their respective fields.

Hoare outlines her lived experience as a liaison psychiatrist working as part of a frontline COVID-team in a large public hospital and explores several important themes, including vulnerability in health care, connection with patient experience, group processing of trauma, reintegration following trauma, and the importance of embedded mental health care in all health systems.

Also, there is a focus on pandemic impacts on the well-being of school children. As an education psychologist, Maree examines how career counselling can serve the needs of children suffering from COVID effects in their communities by giving them a sense of agency, dignity and purpose that better prepares them for the world of work.

Indeed, the precarity of women's academic work was made much more visible and indeed exacerbated during the lockdown, as shown in the article by Walters et al. Many women were on short-term contracts, funded by soft money and their continued employment depended on significant progress in research, publication and higher

degrees. All of this was thrown into jeopardy, with broader implications for gender and equity in higher education.

From the biomedical perspective, South Africa has very much led on the African continent and has been at the international forefront of research on COVID-19. The scope of science activity featured in this special issue is illustrative of the need to further invest in strengthening research capacity in South Africa. In 2018/2019, research funding in South Africa constituted 0.75% of the gross domestic product[3] – significantly lower than the 1.64% spent across all upper middle countries[4]. Nevertheless, the COVID-19 pandemic emerged at a time when there was already an entrenched culture of scientific investigation around other infectious disease such as HIV, tuberculosis and many other vaccine-preventable diseases. South African scientists in the biomedical field across different spheres of interest, rapidly transitioned their research efforts towards COVID-19.

Leveraging on more than a decade long programme of surveillance on respiratory viruses, the National Institute for Communicable Diseases rapidly established itself as a trusted source of information on the burden of COVID-19 in South Africa. The establishment of the DATCOV platform – an active national COVID-19 vaccine surveillance system for COVID-19 hospital admissions in South Africa – transcended the private and public sectors. Using the DATCOV platform, Jassat et al. highlight the structural socio-economic inequities in South Africa which have influenced risk of poor outcome among patients hospitalised with COVID-19. In-hospital COVID-19 mortality rates were 1.2- to 1.3-fold higher in black African patients, coloured patients and patients of Indian descent compared to white patients. Further inequity in quality of health care is alluded to by a 1.5-fold greater risk of death in patients admitted to the public health sector, compared with the private health sector where patients were more likely to be managed in intensive care units and with interventions such as mechanical ventilation.

Despite the numerous lockdowns and restrictions in South Africa, the benefits thereof are questionable. The initial and current narrative from Government to justify the lockdowns and more recent ongoing regulations is to protect people from being infected by SARS-CoV-2. Nevertheless, the experience over the past 27 months clearly demonstrates that lockdowns and many COVID-19 regulations in South Africa largely failed in preventing SARS-CoV-2 infections from transpiring. Suliman and Mtsweni, leveraging data from DATCOV and other sources, detail almost predictable recurrence of COVID-19 wave resurgences, usually underpinned by the evolution of new variants of concern. One of the most recent variants of concern was Omicron, which is relatively evasive to neutralising antibodies induced by the current generation of COVID-19 vaccines or infection by earlier variants or wild-type SARS-CoV-2. Nevertheless, over time and despite only modest uptake of COVID-19 vaccines in South Africa, there has been decoupling of SARS-CoV-2 infections and progression to severe disease and death. Their summation from the trajectory of COVID-19 waves in South Africa, indicates that restrictions and various non-pharmaceutical interventions did not prevent large numbers of infections from transpiring. This conclusion is corroborated by a sero-survey undertaken just prior to the onset of the Omicron wave in Gauteng (where one quarter of the South African population lives), which indicated that 73% of adults had been infected by SARS-CoV-2 at least once even before the onset of the Omicron wave, and that recorded COVID-19 cases in Gauteng were less than 10% of the number of people who had been infected.[5] Also, the massive decoupling of infections and severe COVID-19 in Gauteng, with the Omicron wave contributing to less than 5% of all COVID-19 deaths since the start of the pandemic through to mid-January 2022, was attributed to widespread evolution of immunity from past infection and complemented by modest vaccine roll-out.[5] Even though the evolving immunity has been inadequate in sustaining protection against SARS-CoV-2 infection, particularly when variants able to evade neutralising antibodies emerge, the widespread immunity underpins the protection against severe COVID-19 and likely heralds the tail-end of the COVID-19 pandemic.

Further testimony to South Africa not having been spared the brunt of the COVID-19 pandemic is the analysis by Bradshaw et al. on deaths attributable to COVID-19 based on excess mortality calculations. Similar to the sero-survey demonstrating an under-ascertainment of COVID-19 cases in South Africa, there has also been an unsurprising under-reporting of COVID-19 deaths. Using the National Population Registry, Bradshaw et al. demonstrate that recorded COVID-19 deaths are three-fold lower than the number of deaths attributable to COVID-19 based on excess mortality modelling estimates. Strengthening the case that the majority of the excess deaths are indeed attributable to COVID-19, was the synchronous temporality of the trajectory of recorded COVID-19 deaths and excess mortality estimates. Compared with a country such as the UK, where there is marginal difference between the recorded COVID-19 deaths and COVID-19 attributable deaths based on excess mortality estimates, the COVID-19 mortality rate in South Africa as of 7 May 2022 (523 per 100 000) was more than two-fold higher than that in the UK (197 per 100 000) and higher than the global estimate of 250 per 100 000.[6,7] Furthermore, illustrative of inequities in the quality of health care in South Africa, was the heterogeneity in COVID-19 attributable deaths calculated using the excess mortality approach, which ranged from 391 per 100 000 in the Western Cape, to 658 and 725 per 100 000 in the neighbouring Eastern Cape and Northern Cape Provinces, respectively.[6] Despite South Africa being among few African countries which have been able to track COVID-19 attributable deaths using a National Population Registry, Bradshaw et al. argue the need for the civil registration and vital statistics system to be re-engineered to enable timely access to cause of death information for public health actions.

Rees et al. report on the attempts during the course of the pandemic to ensure timely access to new medical interventions in Africa. Nevertheless, despite the numerous attempts at ensuring equity of access to new biologicals to manage the COVID-19 pandemic, access and, more so, timeliness of access to life-saving interventions has remained elusive to low-income as well as many middle-income countries. Illustrative of such inequity is the roll-out of COVID-19 vaccines. As of 20 May 2022, more than 11.76 billion doses of COVID-19 vaccine had been administered globally, with 66% of the global population having received at least one dose of COVID-19 vaccine; but less than 17% of people from developing countries had received at least a single dose.[8] Contributing to the delayed roll-out of COVID-19 vaccines, particularly in African countries, is the lack of research and development on vaccines in general, and near absence of vaccine-manufacturing capabilities spanning from production of active biological ingredients through to eventual fill and finish.

In addition, the intellectual property rights around COVID-19 vaccines, the development of which has received large financial support from the public purse, have stubbornly remained in place. The resistance to wavering of the agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) related to COVID-19 vaccines contributed to not being able to timeously scale up manufacture of the vaccines when demand was at its height and the need for vaccines was greatest – prior to the evolution of widespread infection-induced immunity. Dos Santos et al. discuss what the future direction of intellectual property rights should be in the context of a pandemic public health emergency. Addressing the impasse of wavering of the TRIPS Agreement at the World Trade Organization, they call for the adoption of a sustainable and comprehensive intellectual property framework that is responsive to health emergencies, and for a TRIPS Agreement waiver under the framework of the International Treaty on Pandemics. Nevertheless, the benefits of such a waiver to Africa would only be realised if there was substantial investment in manufacturing capabilities for vaccines. The sustainability of developing vaccine-manufacturing capacity, however, has to extend beyond a single vaccine as is evident by the imminent closure of the Aspen™ vaccine fill and finish facility for the replication-deficient adenovirus 26 COVID-19 vaccine (under licence of Johnson and Johnson™) due to limited orders for the vaccine across Africa.[9]

Also contributing to the slow uptake of COVID-19 vaccines in Africa, over and above the scarcity of local research and development of vaccines, is the limited number of vaccine studies undertaken on the continent. In general, most companies have pursued clinical evaluation of their vaccines primarily in high-income and some middle-income

countries (including South Africa). There has been limited evaluation of COVID-19 vaccines in Africa. In their systematic review, Wiysonge et al. provide insight into the paucity of COVID-19 vaccine trials undertaken in Africa, which is required to provide insight into vaccine effectiveness in the context of settings different to those of high-income countries. Only 7% of the 1453 COVID-19 vaccine trials had African participating sites. Of 108 randomised trials being conducted on vaccines against COVID-19 in Africa by 30 April 2022, 83% were evaluating candidate COVID-19 vaccines. Notably, 58 (54%) of the studies were being done in South Africa. Furthermore, 30% of the vaccine studies were funded by industry and 84% by institutions based outside the host country. The virtual absence of local funding once again emphasises the under-investment in research and development of vaccines in Africa, as well as under-investment by Government in providing financial support to local scientists and their dependency on external funding sources.

Progress is, however, possible, as is evident from the ability to leverage our current skill set to advance the research and development agenda on vaccines in South Africa and Africa more generally. The ability to leverage our existing skill set and expertise to further the local development of vaccines is demonstrated in the Commentary by Moyo-Gwete and Moore, who outline how they and others leveraged expertise built up around research focused on HIV to be at the forefront of understanding the immunology of COVID-19. Furthermore, South African scientists have successfully set up a messenger RNA COVID-19 hub in a short time, with the purpose of supporting COVID-19 vaccine manufacture across Africa.[10] Nevertheless, the sustainability of such ventures of local vaccine development would depend on transcending beyond the manufacture of only a COVID-19 vaccine. Sustainable vaccine manufacture in Africa requires research and development of multiple vaccines, and the political commitment and action of African Governments to procure locally, even if more costly than from elsewhere.

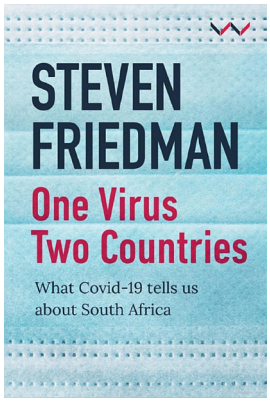
While South Africa has suffered a high burden of COVID-19 compared with many other countries of similar economic standing, partly due to the wealth gap within the country, there also have been other detrimental effects consequent to regulations aimed at preventing SARS-CoV-2 infection. An analysis by Altman on the intersection of Government's response to the COVID-19 pandemic and the economy, highlights the worsening of unemployment over the course of the pandemic. By 2021, with restrictions affecting various sectors of the economy, and the shedding of jobs, only 42% of the working population remained employed in South Africa. Modelling of different scenarios indicates that, because of the rapid and significant fall of the economy caused by policies to manage COVID-19, employment might only recover to peak 2018 levels (which itself was low) by 2024–2026. Consequently, the full societal impact of the COVID-19 pandemic is yet to materialise; and imposing and retaining ongoing regulations under the pretence of trying to prevent SARS-CoV-2 infections, when all indications are that they have failed dismally in the South African context, warrant immediate abandonment.

In short, what do these social science and education perspectives on COVID-19 reveal? First, that the conceptual, methodological, and – we would say – ideological bent of the biomedical sciences cannot provide vital insights into questions of ethics, compliance, governance, representation, well-being and the nature of (academic) work that emerge from pandemic disruption. Second, that complementary perspectives, both medical and social, can lead to more effective management of pandemics and their efforts. And third, that context matters. In impoverished and underdeveloped communities, the parameters of conceptual understanding and the standards of intervention have to account for geographies of inequality in the global world, but also within highly unequal national contexts as in South Africa.

References

1. Karrim A. Covid-19: UN Human Rights Office concerned by excessive force, death reports during SA lockdown. News24. 2020 April 28 [cited 2022 May 21]. Available from: https://www.news24.com/news24/SouthAfrica/News/un-human-rights-office-highlights-toxic-lockdown-culture-in-sa-20200428
2. Durizzo K, Asiedu E, Van der Merwe A, Van Niekerk A, Günther I. Managing the COVID-19 pandemic in poor urban neighborhoods: The case of Accra and Johannesburg. World Dev. 2021;137, Art. #105175. https://doi.org/10.1016/j.worlddev.2020.105175
3. Van der Merwe C. South African research intensity plummets. Research Professional News. 2021 February 25 [cited 2022 May 21]. Available from: https://www.researchprofessionalnews.com/rr-news-africa-south-2021-2-south-african-research-spending-plummets/
4. The World Bank. Research and development expenditure (% of GDP) [data set]. c2021 [cited 2022 May 21]. Available from: https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS
5. Madhi SA, Kwatra G, Myers JE, Jassat W, Dhar N, Mukendi CK, et al. Population immunity and Covid-19 severity with Omicron variant in South Africa. N Engl J Med. 2022;386(14):1314–326. https://doi.org/10.1056/nejmoa2119658
6. Bradshaw D, Laubscher R, Dorrington R, Groenewald P, Moultrie T. Report on weekly deaths in South Africa, 24 – 30 Apr 2022 (Week 17) [document on the Internet]. c2022 [cited 2022 May 05]. Available from: www.samrc.ac.za/sites/default/files/files/2022-05-04/weekly30Apr2022.pdf
7. Our World in Data. Excess mortality: Cumulative number of deaths from all causes compared to projection based on previous years, per million people [data set]. c2022 [cited 2022 May 21]. Available from: https://ourworldindata.org/grapher/cumulative-excess-deaths-per-million-covid?country=MEX~PER~FRA~BRA~USA~GBR~BGR~ISR~AUS
8. Mathieu E, Ritchie H, Ortiz-Ospina E, Roser M, Hasell J, Appel C, et al. A global database of COVID-19 vaccinations. Nat Hum Behav [data set]. c2021 [cited 2022 May 21]. Available from: https://ourworldindata.org/covid-vaccinations
9. Cocks T. South Africa's Aspen COVID-19 vaccine plant risks closure after no orders, executive says. Reuters. 2022 May 02 [cited 2022 May 21]. Available from: https://www.reuters.com/business/healthcare-pharmaceuticals/safricas-aspen-covid-19-vaccine-plant-risks-closure-after-no-orders-executive-2022-05-01/
10. World Health Organization. The mRNA vaccine technology transfer hub [webpage on the Internet]. No date [cited 2022 May 21]. Available from: https://www.who.int/initiatives/the-mrna-vaccine-technology-transfer-hub

BOOK TITLE:
One virus, two countries: What COVID-19 tells us about South Africa



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One Virus, Two Countries – A critical review

One Virus, Two Countries is a sweeping polemic by the political scientist Steven Friedman, who critically evaluates the conduct of the key actors in the COVID-19 pandemic response in South Africa. The actors in this context are seen to be government, the scientists who are regarded as exercising informal influence over public perceptions, and a hoodwinked media.

The central thesis argued is that South Africa's problematic response to COVID-19 was not a failure to 'follow the science' or the overwhelming nature of the virus. Instead, he argues, it was the 'nature of the society and its division into two worlds, one focused firmly on the West as it looked down on everyone else, the other forced to make do in crowded dwellings and taxis, often deprived of the means to sustain itself, let alone protect itself'.

The ideas that flow from Western Europe and North America are therefore the only ones seen as worth considering. Innovations flowing from the rest of Africa or outside of the Western mindset are not worth pursuing by either government or scientists.

Friedman regards the strong calls by key scientists such as Glenda Gray and Shabir Madhi – who challenged the official government positions and argued for the abandonment of the strict lockdowns and inefficient test-and-trace strategies – as evidence of this 'First World' bias. Friedman suggests that, were it not for this bias, the 'better' COVID-19 outcomes in the rest of Africa offered evidence for alternative, more productive strategies.

The book, however, falls far short of an insightful critique of the various COVID actors as it largely retrofits questionable 'evidence' and arguments to confirm a pre-determined thesis.

Only four central features of the main thesis are discussed here as it is not possible to go into all the many weaknesses of the book.

First, the initial 'hard lockdown' in South Africa, far from arising from 'Western science', was a 'cut and paste' of the Chinese Communist Party's strategy in Wuhan. The flawed assumption was that the virus could be substantially contained or even eliminated by a one-off concerted effort to separate the infected from the susceptible population. However, two factors ended this dream quite quickly: (1) reinfections due to waning antibodies and emergent variants were discovered; and (2) the virus spread across the globe. Seen together, the virus was unavoidably endemic, and country-specific non-pharmaceutical prevention strategies could only buy time at massive cost, but not solve the problem.

Second, official reports on COVID infections and deaths substantially understate the true picture in all countries. For instance, excess mortality statistics in South Africa, which rely on the death registration system, show that true COVID mortality is three times higher than the officially recognised facility-based COVID deaths. Extrapolating from excess deaths suggests substantial under-reporting of COVID incidence and hospitalisations. However, for much of Africa, even the death registration systems are too weak to produce reliable excess death reports. Officially reported incidence, severe illness and COVID deaths will also be affected by extremely constrained testing capability.

The sub-Saharan African bias in favour of a young predominantly rural population, does create a strong case for lower severe illness and mortality, regardless of how their health systems respond. The emerging evidence, however, suggests that Africa, including South Africa, has instead faced a devastating but (officially) under-reported pandemic.

The World Health Organization COVID statistics also cannot be used for a comparison of relative country performance, as the data are contaminated by variations in testing strategies and the reliability of mortality reporting. For instance, community-based (United Kingdom) and whole of population (China) testing approaches include substantially more asymptomatic cases in their infection reporting than settings in which testing capacity and finances are constrained. South Africa, for instance, only has the capacity to test presenting suspected cases, the results of which cannot be compared to the data coming out of high-testing countries. The rest of Africa has less capacity than South Africa to adopt widespread testing, let alone implement onerous and widespread rapid contact tracing and confinement regimes.

Third, the widespread devastation caused by Level five lockdown in South Africa indicates this was a very high-risk approach. Closing the economy crippled public finances and generated massive unemployment and associated social hardship. A mere 30 days of total lockdown reduced annualised gross domestic product by seven percentage points and took two and a half million people out of employment.

Despite this sacrifice, the first wave appeared unaffected. This is evidenced by the consistency of the wave patterns from March 2020 to the present. The peaks are mid-July and late December every year. Had the lockdown achieved anything, the first wave peak would have been delayed to August or September.

Each new wave after the first is driven by waning immunity from previous waves and variants that escape prior immunity. People are therefore being infected multiple times. By the fourth wave, the combined effects of prior infection and vaccination finally decoupled infections from severe illness and death.

Prevention through restrictions has therefore not proven to be efficacious. Government strategies merely adjusted to this reality, which had little to do with any failure to defer to African success stories or the influence of ideologically blinded scientists.

Fourth, 'Western countries' were by no means uniform in their response. Some locked down, while others did not. Some implemented stringent test, trace and confinement regimes while others did not. No 'First World' notion of science drove decisions. Instead, most countries had to make context-relevant decisions under conditions of uncertainty and slowly emerging evidence. 'Following the science' was always code for asking scientists and other experts to exercise their judgement or to legitimise politically unpopular interventions. Ultimately, the only consensus that did emerge was that vaccines offered the most effective prevention option to end the pandemic, even if it did not generate herd immunity. This is just plain common sense and is now based on actual science.

Unfortunately, this book suffers from the kind of prejudice it claims to expose. There is, however, a dire need for a substantive critique of all that has happened from January 2020 to date. Sadly, this book is not it.

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Adding up the numbers: COVID-19 in South Africa

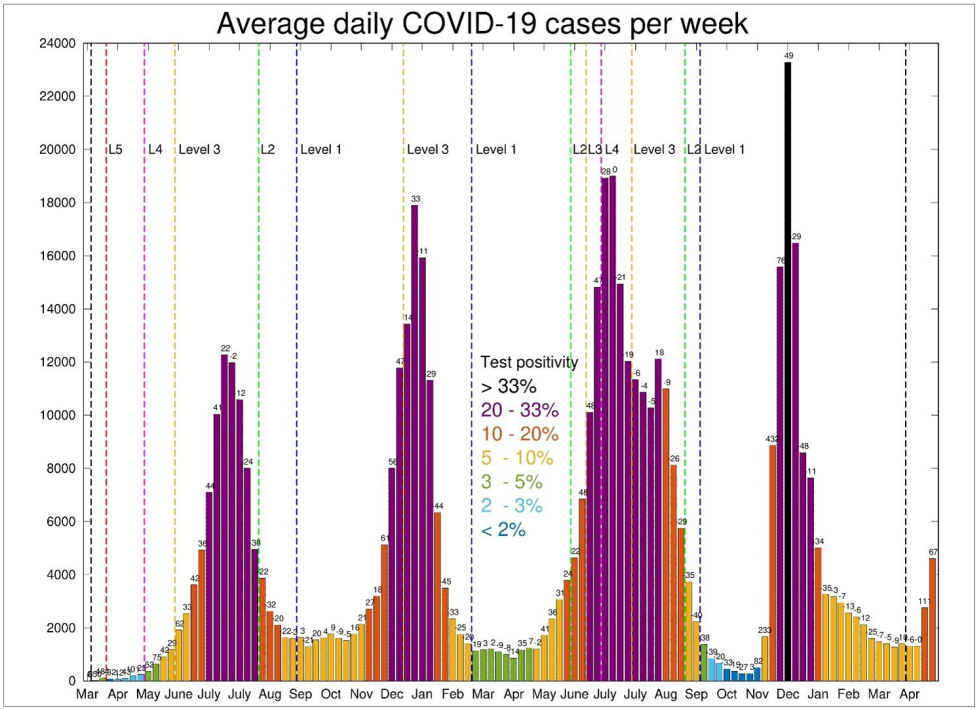
Significance:

The SARS-CoV-2 pandemic has wreaked havoc globally, with over half a billion people infected and millions of lives lost. The pandemic has also interrupted every aspect of our lives, with most governments imposing various interventions and restrictions on people's movement and behaviour to minimise the impact of the virus and save lives. The debate among scholars on the effectiveness of the interventions and restrictions, particularly in the context of a developing country like South Africa, continues. The data and scientific evidence indicate that non-pharmaceutical interventions, and particularly the implementation and adherence thereto, may have been ineffective in terms of containment in the South African context and had minimal impact in stopping the spread of the SARS-CoV-2 virus.

COVID-19 epidemiological trajectory and outlook

The SARS coronavirus (SARS-CoV-2) was declared a pandemic by the World Health Organization (WHO) in early 2020 and has wreaked havoc globally, with over half a billion people infected and 13.3–16.6 million lives lost.[1] The South African Department of Health reported its first case on 5 March 2020.[2] Since then, and as of 30 April 2022, a total of 3 791 925 SARS-CoV-2 cases or 6314 per million people have been recorded, according to data by South Africa's National Institute for Communicable Diseases (NICD).[3] Whilst this number represents a significant total, it remains a substantial underestimate of the true number of infections in the country since the start of the pandemic.

The COVID-19 epidemiological trajectory for South Africa up to the end of April 2022 is shown in Figure 1, where the average number of daily confirmed cases over each epi-week is plotted from the start of the pandemic. Also shown by the colour of the bars in Figure 1 are the average test percentage positivity rates, which are discussed further in the next section. Since March 2020, South Africa has experienced four surges or waves of heightened SARS coronavirus transmission. These surges or waves of infections can clearly be seen in Figure 1. The onset of these waves in South Africa has been regular or predictable, occurring every 6 months and lasting for a duration of approximately 3 months each. The 3 months between resurgences have seen low levels of SARS-CoV-2 transmission at differing baseline levels.



Data source: NICD[3]

Figure 1: Average daily COVID-19 cases per week in South Africa.

Each of the surges or waves in South Africa have been driven by a new or different SARS-CoV-2 variant that became dominant over that wave. The first wave was driven by the original or wild type variant over the winter months of 2020. This was followed by a Beta-driven second wave in the summer of 2020 and 2021, soon to be followed by a Delta-driven winter wave in 2021. Towards the end of 2021, the highly transmissible Omicron variant emerged in the Gauteng Province and quickly spread throughout the country, and across the world, driving a fourth wave of infections in South Africa.

Also shown in Figure 1, by the dashed vertical lines, are the alert levels or lockdown levels imposed at various times since the initial State of Disaster was declared in South Africa on 15 March 2020. The effectiveness of these lockdowns remains an ongoing debate among scholars.[4,5] A strict level 5 lockdown was implemented soon after on 26 March 2020. However, even the harsh restrictions on movement and social interactions under this alert level were not enough to contain or eliminate the virus and prevent the onward spread of infection. The difficulty in a developing country to social distance for extended periods of time, as well as the lack of resources and funding to support such efforts, made it clear that a zero-COVID policy would not be feasible in South Africa.[6] This intervention though likely did delay the onset of the first wave, reducing what could have been an even worse scenario. Public health policy shifted to one of mitigation and of protection of the healthcare system for the remaining waves, rather than an attempt to eliminate ongoing transmission, as is evidenced by the increasing levels of restrictions during the second and third waves. The timing of these restrictions, and arguably the implementation and adherence thereto, was always to mitigate the onward transmission and protect healthcare systems from being overwhelmed. During the Omicron or fourth wave, the healthcare system was burdened but under no pressure of being completely overwhelmed and therefore no additional restrictions were implemented. Non-pharmaceutical interventions, including social distancing and restrictions on gatherings, also come with significant socio-economic costs which are arguably no longer feasible or sustainable in South Africa.

A total of 3 791 925 cases, representing approximately 6.2% of South Africa's total population, were confirmed as of 30 April 2022. However, this total does not take into account recurrent infections nor foreigners and visitors; therefore, the confirmed cases likely represent an even lower proportion of South Africa's total population. South Africa remains the most affected country on the African continent by total number of confirmed SARS-CoV-2 cases, and accounts for almost one third of the total cases reported across the continent since the start of the pandemic. There is an ascertainment bias in South Africa, due to more developed laboratory infrastructure as well as the deployment of funds towards testing as compared to other African countries. However, this total remains lower than many countries across Europe, Asia, and the Americas.[7] So, is that a fair reflection of reality and, if so, what has South Africa done right? Unfortunately, it is difficult to make one-to-one case comparisons across countries due to differences in the rate of and access to SARS-CoV-2 testing, which directly affects the total number of cases detected. According to recently published seroprevalence surveys[8], the estimated levels of immunity in Gauteng are more than 70%. This figure includes acquired immunity through vaccination and natural immunity due to previous infection, and being a representative sample is likely a good estimate of the overall seroprevalence across the country. According to the national vaccination dashboard[9], 21 305 271 individuals in the country had received at least a single vaccination dose by 30 April 2022, representing only 35% of the population. With some of those also having been previously infected, the high seroprevalence estimate implies that a large proportion of the population had been previously infected, and many were either asymptomatic or had not presented for testing, thereby resulting in the significant undercount of true infections. With such a high level of infection having occurred, the question arises as to whether the non-pharmaceutical interventions imposed in South Africa, including lockdowns, social distancing and mask-wearing, were effective in preventing or containing the onward transmission of infection of the SARS coronavirus?

Influence of coronavirus testing rates

Testing for SARS-CoV-2 in South Africa has for the most part been limited. Widespread testing can be an efficient tool to curb the onward transmission of the virus, but this needs to be done proactively and in combination with the efficient tracking and isolation of contacts of positive cases. Further, this type of testing strategy needs to be done in a mass randomised manner, ensuring that a representative sample of the population are screened.

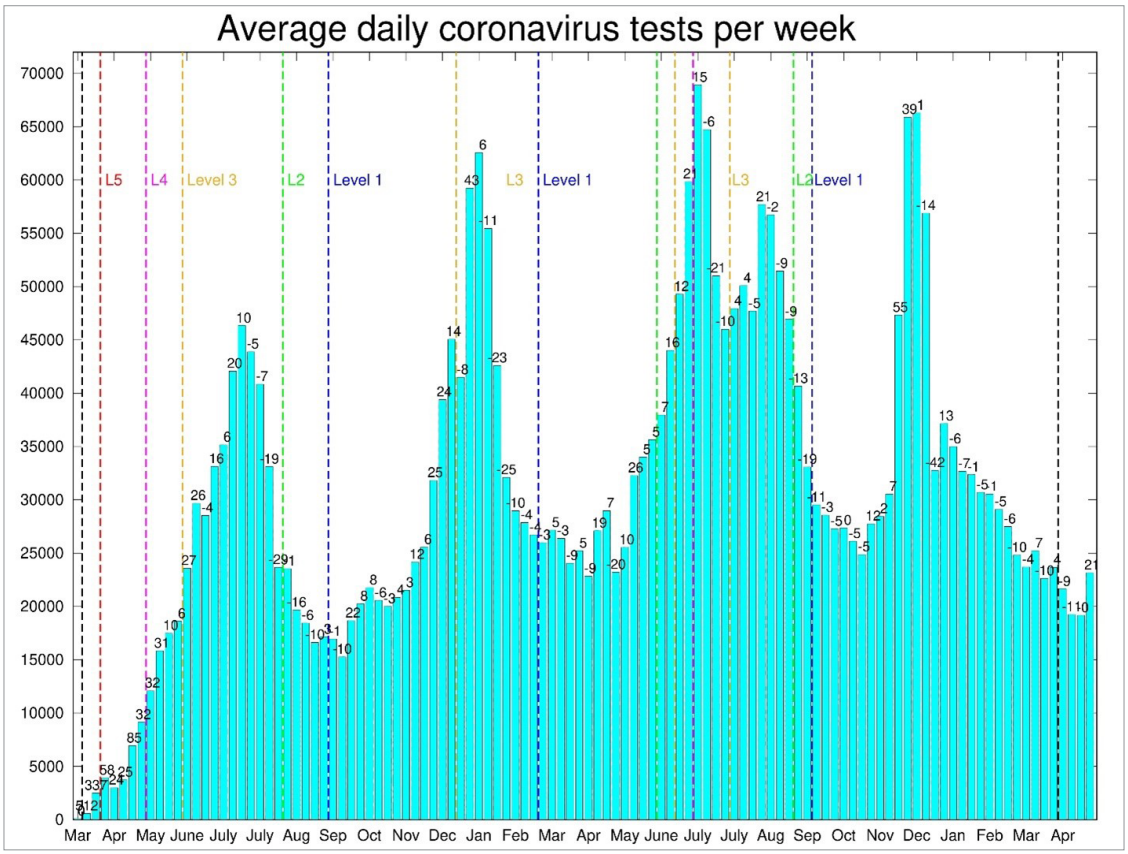
In South Africa, the coronavirus testing strategy has not been one that can effectively curb onward spread of the virus, but rather a diagnostic tool to retrospectively identify mostly symptomatic infections. This is because testing is largely driven by those presenting for testing after either showing symptoms of the virus or coming into contact with a person who had recently tested positive. The average number of tests conducted daily in South Africa are shown in Figure 2 on a per weekly basis, according to data by the NICD.[3] Counterintuitively, the testing curve has followed the infection curve, rising as a surge of infections is experienced and dropping to a low baseline during the inter-wave periods. Contributing factors for the low testing rates in South Africa, as compared to developed countries, are the lack of resources and the limited funding. The former has meant that laboratories cannot cope with the demand, particularly during surges, resulting in strict testing criteria and testing limited to only those most at risk or patients admitted to hospitals, while the latter further limits access to testing as it is a costly affair for the average South African citizen.

Confirmed case rates are limited by testing rates and testing capacity. With many people not having access to testing, the reported number of cases vastly underestimates the actual number of infections that have occurred. To account for the variability in testing rates, and hence absolute case numbers, a useful metric of test percentage positivity can be utilised, as also shown in Figure 1. This metric is the proportion of positive tests or confirmed cases and is expressed as a percentage of the total number of tests conducted, thereby eliminating the variability of absolute tests conducted. For context, the WHO has recommended that this metric remain under 5%. However, in South Africa, this metric has been above 20% during periods of high prevalence, even rising to above 33%, as can be seen in Figure 1. Based on this metric, it can be estimated that the official case counts are at least ten times lower than the true figure. The high percentage test positivity again confirms that the actual number of infections in South Africa is significantly under-counted.

Public and private COVID-19 hospital admissions

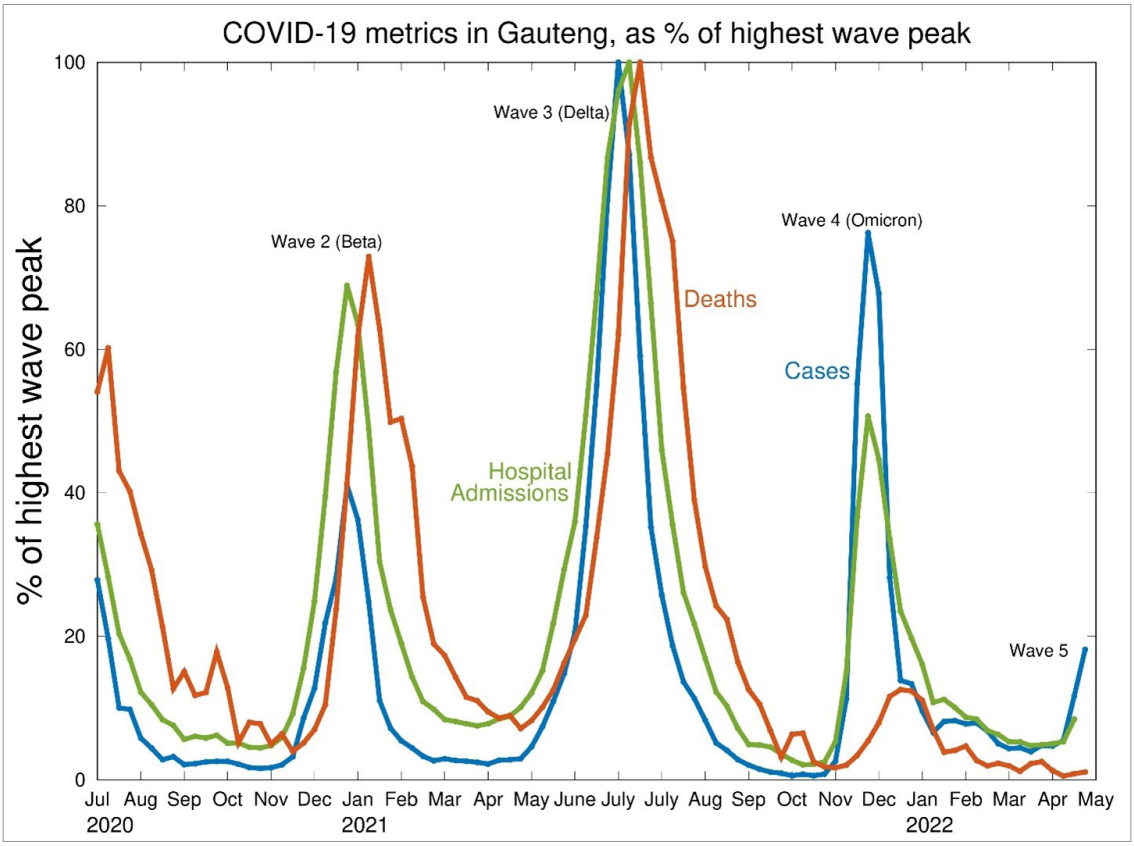
Ultimately, the role of non-pharmaceutical interventions is to reduce the burden on hospitals and, by ensuring hospitals are not overwhelmed, allowing all patients the best access to healthcare facilities and treatment. Hospitalisations for COVID-19 are a lagging indicator, lagging case trends by 1–3 weeks. For the first three waves in South Africa, COVID-19 hospitalisation trends closely followed the trends in cases, making it predictable and affording the opportunity to plan and prepare healthcare facilities and resources as a surge in case rates was encountered. However, during the fourth or Omicron wave in South Africa, this strong link between cases and hospital admissions decoupled or de-linked. While many infections still occurred, due to the most transmissible SARS-CoV-2 variant yet, there were proportionately fewer severe outcomes of hospitalisation and significantly fewer deaths. A comparison between the trends in COVID-19 metrics of cases, hospital admissions, and deaths for the province of Gauteng is shown in Figure 3. The strong link between cases and hospitalisations for the first three waves, followed by a decoupling during the Omicron wave, is evident.

This decoupling between trends during the Omicron wave can be attributed primarily to the high levels of population immunity in the South African community and to the emergence of a variant that is less virulent than previous strains. Estimates from seroprevalence surveys[8] indicate levels of immunity of over 70%. With only 35% of the population having received at least a single vaccination dose[9], the remaining percentage of immunity is due to natural immunity from previous infection. Whilst high levels of population immunity are favourable, and likely to continue to offer protection from severe disease[10], this does confirm that the non-pharmaceutical interventions implemented over the past 2 years were not as effective in completely preventing such a large proportion of the population from getting infected in the first place. However, the interventions were effective in slowing down the rate of infection, thereby preventing spikes in severe disease and lessening the impact on health services during surges.



Data source: NICD[3]

Figure 2: Average daily SARS-CoV-2 tests conducted in South Africa.



Data sources: NDoH[2], NICD[3], NICD DATCOV[11]

Figure 3: COVID-19 metrics of cases, hospital admissions, and deaths, in Gauteng, as a percentage of highest wave peak.

Estimates of mortality during the pandemic

The number of COVID-19 deaths reported in South Africa since the start of the pandemic exceeds one hundred thousand, at 100 363 as of 30 April 2022 or 167.2 when expressed as a rate per 100 000 population.[2] This figure is the highest of all countries on the African continent and accounts for almost 40% of the total reported deaths on the continent.[7] Whilst significantly high, it is still an underestimate of the true number of deaths due to the virus over the course of the pandemic. Figure 4 compares official COVID-19 deaths nationally as reported by the South African Department of Health[2], with those deaths occurring in hospitals as collated by the NICD DATCOV surveillance reporting[8], as well as total excess deaths over the same period as published by the South African Medical Research Council[12]. Based on the trends in the data as well as the timing and geographical spread of the excess deaths, it is clear that the official COVID-19 death toll in South Africa is an underestimate and the true figure is likely two to three times higher than the official count. This places the upper bound estimate of COVID-19 mortality in South Africa at 520 per 100 000 population, making it one of the highest death rates in the world.[7]

These mortality figures confirm that the high levels of population immunity as per current seroprevalence estimates across South Africa have come at a high cost, with many lives lost since the emergence of the SARS coronavirus in the country. However, the high level of population immunity is now an advantage as it does offer protection against severe disease from current SARS-CoV-2 variants in circulation, as South Africa experienced during its Omicron wave in late 2021 and as shown in Figure 5. Consequently, in reaching these high levels of population immunity, it is evident that many millions of South Africans have been infected over the past 2 years and thousands of lives have consequently been lost.

Concluding remarks

With SARS-CoV-2 likely to remain in circulation for the foreseeable future, it is known that the virus will mutate as it continues to replicate, but the pathogenicity and severity of future variants remains unknown. This raises the question of whether previously utilised measures and non-pharmaceutical interventions will still be necessary in the future, particularly in the South African context. The data and evidence suggest that these non-pharmaceutical interventions likely delayed the transmission of the virus but had little effect in mitigating or eliminating onward transmission. The difficulties in correctly applying and implementing these measures in a developing country like South Africa and effectiveness thereof, and particularly the harmful socio-economic consequences of such measures, needs to be realised. The majority of South Africans have had some exposure to the virus, and whilst this has come at a terrible cost, it points to the fact that previous measures and non-pharmaceutical interventions, and in particular the implementation and adherence thereto, were largely ineffective in containment of infections in the South African context.

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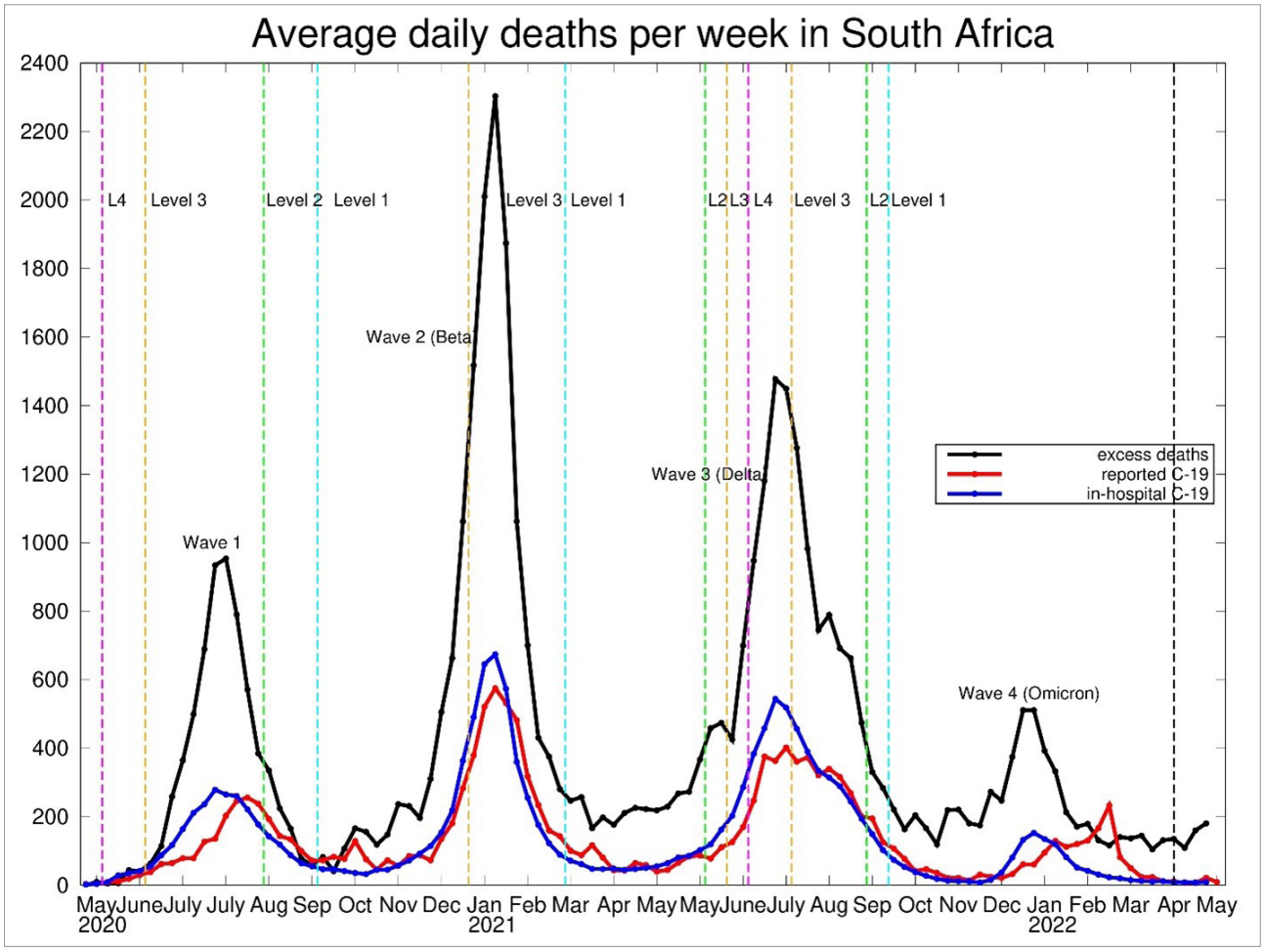
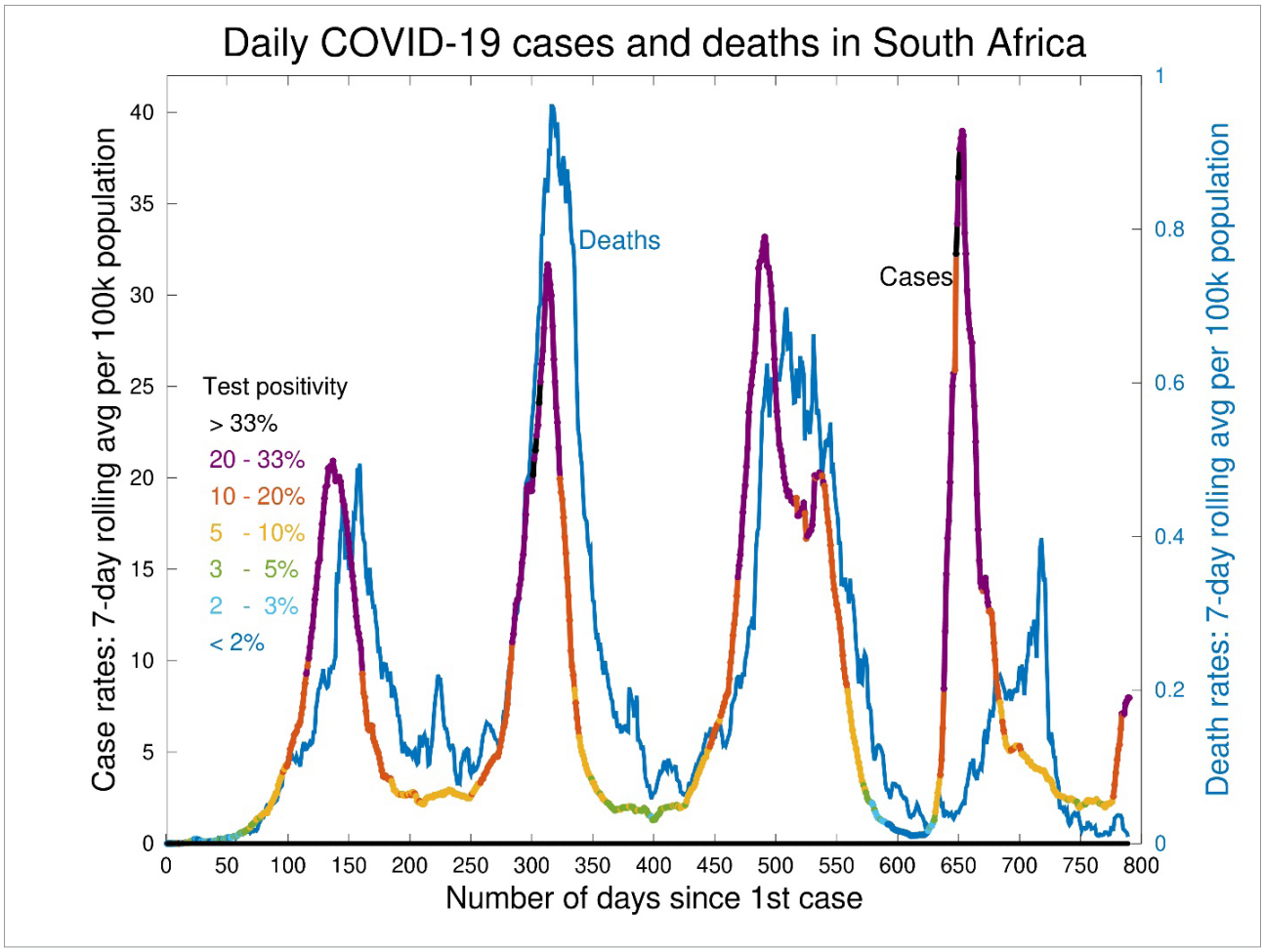


Data sources: NDoH[2], NICD DATCOV[11], SAMRC[12]

Figure 4: Mortality rates during the COVID-19 pandemic in South Africa.



Data sources: NDoH[2], NICD[3]

Figure 5: Comparison of daily COVID-19 cases and reported deaths in South Africa.

DATCOV Surveillance for hospitalisation data, and the South African Medical Research Council for data on excess deaths.

Competing Interests

We have no competing interests to declare.

References

1. Knutson V, Aleshin-Guendel S, Karlinsky A, Msemburi W, Wakefield J. Estimating global and country-specific excess mortality during the COVID-19 pandemic [preprint]. c2022 [cited 2022 May 04]. Available from: https://cdn.who.int/media/docs/default-source/world-health-data-platform/covid-19-excessmortality/covid-methods-paper-revision.pdf?sfvrsn=2465306b_1&download=true
2. National Department of Health, South Africa (NDoH). SA Corona Virus Online Resource and News Portal [homepage on the Internet]. No date [cited 2022 May 01]. Available from: https://sacoronavirus.co.za/
3. South African National Institute for Communicable Diseases (NICD). National COVID-19 daily report – NICD [webpage on the Internet]. No date [cited 2022 May 01]. Available from: https://www.nicd.ac.za/diseases-a-z-index/disease-index-covid-19/surveillance-reports/national-covid-19-daily-report/
4. Mbunge E. Effects of COVID-19 in South African health system and society: An explanatory study. Diabetes Metab Syndr. 2020;14(6):1809–1814. https://doi.org/10.1016/j.dsx.2020.09.016
5. Mabuka T, Ncube N, Ross M, Silaji A, Macharia W, Ndemera T, et al. The impact of non-pharmaceutical interventions on the first COVID-19 epidemic wave in South Africa [preprint]. medRxiv. 2021.06.29.21259625. https://doi.org/10.1101/2021.06.29.21259625
6. Noorbhai H, Suliman R. A mathematical model and strategy to guide the reopening of BRICS economies during the COVID-19 pandemic. In: Azar AT, Hassanien AE, editors. Modeling, control and drug development for COVID-19 outbreak prevention. Studies in Systems, Decision and Control. Volume 366. Cham: Springer; 2022. https://doi.org/10.1007/978-3-030-72834-2_22
7. Our World in Data (OWID). COVID-19 data explorer [webpage on the Internet]. No date [cited 2022 May 02]. Available from: https://ourworldindata.org/explorers/coronavirus-data-explorer
8. Madhi SA, Kwatra G, Myers JE, Jassat W, Dhar N, Mukendi CK. Population immunity and Covid-19 severity with Omicron variant in South Africa. N Engl J Med. 2022;386:1314–1326. https://doi.org/10.1056/NEJMoa2119658
9. National Department of Health, South Africa (NDoH). COVID-19 public dashboard [webpage on the Internet]. No date [cited 2022 Apr 30]. Available from: https://app.powerbi.com/w?r=eyJrIjoiMDNlNTMyZWUtYjkyYS00NGE1LTliZTktZDI4MDU0ZTU0OTk1IiwidCI6ImE1MTczNzFjLWYzMTYtNDg0Yy1hYzVjLTk4Yjc2MTI3NzkwYSIsImMiOjI9
10. Keeton R, Tincho MB, Ngomti A, Baguma R, Benede N, Suzuki A, et al. T cell responses to SARS-CoV-2 spike cross-recognize Omicron. Nature. 2022;603:488–492. https://doi.org/10.1038/s41586-022-04460-3
11. South African National Institute for Communicable Diseases (NICD). Daily hospital surveillance (DATCOV) report – NICD [webpage on the Internet]. No date [cited 2022 May 01]. Available from: https://www.nicd.ac.za/diseases-a-z-index/disease-index-covid-19/surveillance-reports/daily-hospital-surveillance-datcov-report/
12. South African Medical Research Council (SAMRC). Report on weekly deaths in South Africa [webpage on the Internet]. No date [cited 2022 May 04]. Available from: https://www.samrc.ac.za/reports/report-weekly-deaths-south-africa

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Challenges in addressing inequity in access to COVID-19 diagnostics, therapeutics and vaccines in Africa

Significance:

Although the global response to COVID-19 has demonstrated that some progress has been made in ensuring timely access to new medical interventions in Africa, much more needs to be done to strengthen the global systems that enable equitable access to health technologies during public health emergencies.

The development of COVID-19 diagnostics, therapeutics and vaccines has been a remarkable technical achievement. By the end of 2021, hundreds of diagnostic tests, including rapid antigen tests enabling self-testing, had received regulatory approval from national authorities. Multiple existing medicines had been repurposed and novel therapeutics had been included in World Health Organization (WHO) guidance for the treatment and prevention of COVID-19.[1,2] As at the end of February 2022, 14 WHO emergency use listings had been issued, covering ten vaccine products, and a further five vaccines were under review.[3]

However, access to these COVID-19 technologies has been slow and unequal in low- and middle-income countries (LMICs), and particularly in Africa. For example, while vaccine coverage is near universal in many high-income countries, only 10% of the populations in low-income countries have received at least one dose of a COVID-19 vaccine.[4]

Access has been hampered for a range of reasons. With limited supplies and global manufacturing capacity, manufacturers have prioritised high-income countries paying premium prices. Some countries have also imposed export restrictions on finished vaccines and/or raw materials. Despite modelling showing that, in the medium term, more lives would be saved by equitable global distribution, hoarding of COVID-19 vaccines by high-income countries has been the norm.[5]

Affordability is a key barrier. The average cost of a dose of COVID-19 vaccine varies between USD2 and USD40, while distribution costs average USD3.70 per double-vaccinated individual. It has been estimated that high-income countries have to increase their health expenditure by 0.8% to vaccinate 70% of their population but low-income countries have to increase it by 56.6%.[6]

Local obstacles to the introduction of COVID-19 vaccines have also played a role in limiting access. A lack of health system preparedness in countries with weak healthcare systems, as well as limited local evidence, for example on the effectiveness of different vaccines or the nature of circulating strains, has contributed to delayed availability of vaccines, which has contributed to significant vaccine hesitancy in Africa.

This Commentary draws lessons from Africa's struggles for access to health technologies, including those for COVID-19. It identifies the interventions needed to enhance access, in order to strengthen pandemic preparedness and protect the health of the people of Africa.

Lessons from history

Despite its high disease burden, Africa has typically been slow to gain access to new medical technologies. The object lesson was provided by the response to HIV/AIDS in the 1990s. Despite the development of combination antiretroviral therapy in the late 1990s, access to these medicines was hampered by their high and monopolistic pricing, protected by intellectual property provisions. In South Africa, access to affordable, generic antiretrovirals was enabled by remarkable grassroots activism, with the Treatment Action Campaign utilising a range of innovative tactics to shift opinion and change practices.[7]

A more recent example is provided by the 2009 H1N1 influenza pandemic. As concerns about the pandemic grew, high-income countries acted swiftly to secure supplies of newly developed H1N1-specific vaccine. The USA alone signed agreements accounting for up to 60% of global supply capacity.[8] LMICs had little opportunity to secure early supplies. H1N1-specific vaccines did not arrive in Africa through global mechanisms until 2010, once demand had declined (owing to the lower-than-expected severity of infections) and high-income countries were able to donate surplus vaccines for global distribution.

As H1N1 influenza was a global pandemic, high-income countries had an incentive to invest in rapid vaccine development. For infections of epidemic potential that primarily affect Africa, such as Lassa fever or Ebola virus disease, this incentive has been lacking. When Ebola struck West African countries in 2014, no vaccines or therapeutics were available. Lack of both preparedness and coordination led to significant delays in clinical trials of Ebola interventions, and only one vaccine trial was completed during the outbreak.

Making progress

Global health financing interventions, such as the Global Fund against AIDS, Tuberculosis and Malaria (GFATM), the President's Emergency Plan for AIDS Relief (PEPFAR), the President's Malaria Initiative (PMI) and Unitaid, have addressed access to health technologies in LMICs. Both the GFATM and PEPFAR have focused on the provision of quality-assured generic medicines, whereas Unitaid has sought to employ a range of market-shaping interventions to

improve access to affordable diagnostics and preventive and therapeutic technologies, such as through the establishment of the Medicines Patent Pool and support of the WHO prequalification programme. Established in 2000, the Global Alliance for Vaccines and Immunization (now Gavi, the Vaccine Alliance) sought to lower vaccine prices for low-income countries by fostering predictable long-term markets. Mechanisms have been introduced to enhance affordability, including tiered pricing schemes and advance market commitment mechanisms, which pool demand from individual countries to help create a sustainable market. For pneumococcal conjugate vaccine (PCV), a donor commitment of USD1.5 billion stimulated the development of new vaccines that have been used to immunise over 150 million children, saving more than 700 000 lives.[9] These efforts have helped to ensure that, in the African region, 68% of infants received the third dose of PCV in 2020, compared to 3% in 2010.[10]

For new and emerging infectious diseases, efforts such as the WHO R&D Blueprint are coordinating research into pathogens of epidemic potential, while the Coalition for Epidemic Preparedness Innovations (CEPI) has been established to drive vaccine development for priority pathogens.

Collectively, these mechanisms have contributed to significant progress in enhancing access to new medical technologies in Africa, and in LMICs more generally. Ebola vaccines were available to be deployed during the 2018 Ebola outbreak in the Democratic Republic of the Congo and trials of multiple Ebola therapeutics were initiated. Global stockpiles have been established for Ebola vaccines, as well as for other new vaccines against diseases with epidemic potential affecting Africa, including yellow fever vaccine, typhoid conjugate vaccine and oral cholera vaccine. CEPI was already funding the development of vaccines for Middle East respiratory syndrome (MERS), caused by a coronavirus, which pivoted to focus on COVID-19. CEPI also supported work on novel vaccine platform technologies with the potential to accelerate vaccine development for emerging pathogens. CEPI has spearheaded the '100-day challenge' – to ensure a new vaccine is available within 100 days of the identification of a new pandemic threat.[11]

Responding to COVID-19

In response to the COVID-19 pandemic, the global community set up the Access to COVID-19 Tools Accelerator (ACT-A), a multi-stakeholder partnership to support innovation and globally equitable access to COVID-19 vaccines, therapeutics and diagnostics.[12] ACT-A has separate 'pillars' aimed at improving access to diagnostics, treatment and vaccines, and strengthening health systems.

The vaccine pillar of ACT-A, COVAX, aims to support countries in meeting the 70% global vaccination target in 2022, building on the Gavi model. Although COVAX distributed its one billionth dose of COVID-19 vaccine by January 2022, it has not delivered as rapidly or as equitably as many had hoped. Its activities have been hampered by the slow pace with which some donor countries have provided their pledged financial support, but in particular by a lack of political commitment to global solidarity, despite multiple calls from the WHO's Director-General. With global supplies limited, many high-income countries have not only prioritised their own populations but have also procured many more vaccine doses than they actually need ('vaccine hoarding'). Furthermore, countries have donated vaccines nearing the end of their shelf life. Nearly 3 million doses donated to Africa expired before they could be used (although this is less than 1% of total donations).[13]

Affordability remains a major challenge. There is little transparency on COVID-19 vaccine costs globally. AstraZeneca pledged to make its ChAdOx1 vaccine available at cost during the pandemic, but prices vary internationally (and it has recently changed its policy and now intends to make a modest profit). There is some evidence that companies are charging high-income countries a premium. What is almost certainly true is that the manufacturing costs of commonly used vaccines (less than USD1 a dose) are substantially lower than the prices being charged (USD10–20, and possibly more).[14] Moreover, manufacturing costs might also be significantly lower in lower-cost environments such as LMICs, and yet, pre-COVID, African vaccine manufacturers had received little investment.

Less visible progress has been made in ACT-A's therapeutics 'pillar'. As of January 2022, WHO had made 14 recommendations for COVID-19 therapeutics.[15] Some, such as dexamethasone, are widely available and relatively affordable. Others, such as the monoclonal antibodies, are only available in limited quantities and at high prices. Most also require intravenous administration, limiting their application in ambulatory care. Newer products, even when repurposed, such as baricitinib and tocilizumab, are still patent-protected in some LMICs. For example, although baricitinib was recommended by WHO in January 2022 for the treatment of severe or critical COVID-19, the available generic versions cannot be sold in many countries, including South Africa. In July 2021, the manufacturer's list price for baricitinib in the USA was more than USD2000 per treatment course.[16]

Access has also been limited by availability. A co-packaged presentation of nirmatrelvir and ritonavir received emergency use authorisation from the US Food and Drug Administration (FDA) in late 2021. However, advance purchase agreements concluded with high-income countries are likely to leave little or no stock available for LMICs. Although the initial prices charged in high-income countries would place the product out of reach for many LMICs, the manufacturer has committed to a tiered pricing approach and has indicated a willingness to discuss third-party manufacture.[17]

Another oral antiviral intended for the treatment of ambulant patients, molnupiravir, also received FDA emergency use authorisation in late 2021. Although the price demanded in high-income countries would be unaffordable to many LMICs, the manufacturer has entered into voluntary licence agreements with generic manufacturers in India[18] and has also licensed the UN-backed Medicines Patent Pool[19]. In South Africa, the generic versions will be restricted to the public sector, but both innovator and generic products are under review by the South African Health Products Regulatory Authority (SAHPRA). Through ACT-A, an agreement has been signed with UNICEF to distribute up to 3 million courses of molnupiravir in more than 100 LMICs in the first half of 2022.[20] ACT-A is also engaging with the developers of baricitinib and sotrovimab to ensure access in LMICs.[21]

Delayed access to effective COVID-19 therapeutics will hamper the ability of countries in the region to control COVID-19 in community settings. It will also likely lead to the use of ineffective alternatives, squandering resources and potentially leading to avoidable harm.

Diagnostic tests for COVID-19, initially dependent only on sophisticated laboratory-based polymerase chain reaction (PCR) testing, have posed particular challenges in Africa. By March 2020, 43 African countries had developed the competence to perform these tests, but access to the necessary reagents was limited.[22] Not only were the costs of diagnostics an issue, but national health systems were faced with a large number of potential suppliers, not all of which provided quality diagnostics. LMIC regulatory bodies were often ill-prepared to regulate diagnostics. The resultant level of testing was predictably lower than would be expected, given the continent's population.[23] Nonetheless, capacity for genome sequencing has increased dramatically, from two African laboratories at the outset to more than 900.[24]

Given the high prices demanded for novel diagnostics, vaccines and therapeutics, as well as limited production capacity, there have been calls to bypass intellectual property restrictions in order to advance access. In October 2020, India and South Africa proposed that a waiver be granted from the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) for COVID-19 technologies. Although it is theoretically possible to rely on World Trade Organization (WTO) processes in times of public health emergencies, several high-income countries, including the United Kingdom and European Union, have repeatedly blocked the introduction of TRIPS waivers, and there has been little progress to date.[25]

It has been argued that there is insufficient capacity to manufacture complex products such as mRNA vaccines in LMICs, yet studies have

identified more than 100 possible sites, including seven in Africa.[26] Indeed, an mRNA vaccine manufacturing hub has been established in South Africa (see below). However, its freedom to operate may be compromised by the risk of intellectual property infringements. Although Moderna (one of the mRNA vaccine developers) has stated that it does not intend to enforce its rights in 92 COVAX countries to prevent COVID-19 mRNA vaccine production[27], its position could change at any time.

Learning the lessons from COVID-19

The COVID-19 pandemic has highlighted significant shortcomings in the global response to pandemics. Lessons need to be learned, in particular to ensure greater equity in access to new technologies during public health emergencies.

One important priority is to **strengthen global and regional health leadership**. WHO needs more authority to act in accord with global public health priorities, and clarity is urgently needed on the objectives and governance of the proposed new intergovernmental negotiating body for pandemic preparedness and responses.[28] The International Health Regulations system needs to be reviewed and updated to ensure that it is fit for purpose. Bodies such as the Africa Centre for Disease Control and Prevention (Africa CDC) need to be at the forefront of efforts to coordinate responses in Africa. Countries need to show political leadership with prioritisation of pandemic preparedness, transparency around data sharing, and strengthening of health systems and health research capacity, to enhance resilience to public health threats.

Comprehensive surveillance is essential for detecting and tracking the next pandemic threat. Surveillance systems need to be strengthened, including in areas such as laboratory capacity, genomic surveillance and wastewater monitoring. Systems must be in place to ensure rapid **sharing of data** with global repositories. Data sharing needs to be incentivised and geopolitical challenges to data sharing addressed. Precipitate reactions, such as the travel bans imposed on South Africa after the identification of the Omicron variant, are not evidence-based and do not encourage rapid sharing of data.

A commitment to equitable access must be more deeply embedded in **product development**. Public investments in basic research or clinical trials are critical to most new medical interventions. However, little support was offered to LMIC scientists for COVID-19 research – a pattern that should be addressed in future. While tiered pricing is needed, other mechanisms – such as licensing, patent pooling, technology transfer and IP waivers – must be considered. There may also be space for IP-free products, following the model adopted for the COVID-19 protein subunit vaccine Corbevax, developed by researchers at the Texas Children's Hospital Center for Vaccine Development and Baylor College of Medicine, and licensed to Indian company Biological E Ltd.[29]

There is also an urgent need to strengthen and diversify **manufacturing capacity**. Although centralisation generates efficiency savings, local manufacturing is vital to mitigate the risk of vaccine hoarding or export restrictions, as seen for COVID-19, and is therefore an essential aspect of pandemic preparedness. The tenth meeting of the International Heath Regulations (2005) Emergency Committee urged WHO to continue working with industry on voluntary licence agreements and other approaches to increase access to vaccines, therapeutics and diagnostics.[30]

Despite accounting for 14% of the world's population, Africa is responsible for around 1% of the world's vaccine production. The Addis Declaration on Immunisation, signed by African heads of state in 2017, included a commitment to 'promote and invest in regional capacity for the development and production of vaccines'. The Partnership for African Vaccine Manufacturing (PAVM), set up by the African Union and Africa CDC in 2021, has set as a target that 60% of the continent's routine vaccine needs, or between 1.4 and 1.7 billion doses yearly, should be met by local manufacturing by 2040.[31]

One priority is implementation of a 'hub and spoke' model for mRNA vaccine technology transfer, coordinated by WHO, to transfer a comprehensive technology package and provide training to manufacturers in LMICs. This could be expanded to other vaccine technologies. A technology transfer hub for mRNA vaccines is being built by a South African consortium comprising Biovac and Afrigen Biologics and Vaccines South Africa, with support from WHO, a network of universities, Africa CDC, and partners from COVAX to help boost and scale up vaccine production in Africa.[32]

Further strengthening of **regulatory systems** will also be essential. National capacity building is being supported by increased country and donor support, and greater international cooperation, for example through the African Vaccine Regulatory Forum (AVAREF) and WHO. Capacity for clinical trials approval and monitoring, health product licensing and post-marketing surveillance needs to be bolstered. Greater collaboration between regulatory authorities, including data sharing, will be critical. The nascent African Medicines Agency could play an important role.

Also important are greater use of **international standards in vaccine evaluation**, to aid comparisons across studies and meta-analyses, and harmonisation of regulatory approaches. Bodies such as the International Coalition of Medicines Regulatory Authorities have set an important example by developing guidelines to promote greater global consistency in the evaluation of COVID-19 vaccines.[33]

Despite significant challenges, **COVAX** has begun to deliver on its promises. Its long-term future now needs to be secured, given its potential to provide a mechanism to ensure access to vaccines against future pandemic threats and epidemic-prone diseases. A sustainable model and permanent home, for example within Gavi, are needed to maintain its operations during inter-pandemic periods. In parallel, the pandemic has highlighted the need for a strengthened WHO, able to assume an expanded leadership role to respond to future pandemics and other health emergencies.

Further strengthening of **pandemic preparedness** remains a high priority for Africa. Continued investment in laboratory and community surveillance infrastructure, as well as health workforce development and strategies to address chronic shortages in the health workforce, are needed to enable comprehensive surveillance and the ability to undertake clinical research in emergency situations.

Finally, efforts are needed to ensure that new interventions can be **rapidly implemented at scale and reach all populations**. This will require effective health systems strengthening, particularly of primary healthcare systems, as part of the drive towards universal health coverage. More generally, the Immunization Agenda 2030 (IA2030), the global immunisation strategy for 2021–2023, prioritises the strengthening of national immunisation programmes. **Civil society** has a crucial role to play in community mobilisation, in partnering with national programmes to deliver immunisation services, in holding governments accountable for their commitments, and in reminding the global community that equitable access is core to addressing pandemics.

Conclusions

Despite some progress, the COVID-19 pandemic has highlighted a range of obstacles to timely access to new health technologies on the Africa continent. To address these obstacles, there is a need to strengthen existing structures and mechanisms of proven value, such as WHO, CEPI, Gavi, the Africa CDC and pandemic preparedness networks, as well as newly created platforms such as COVAX. This must be matched by country commitments to strengthen health systems so that they can deliver vaccines, therapeutics and diagnostics to all populations.

These structures need to be combined with imaginative solutions that acknowledge the limited purchasing power of LMICs. There have been some encouraging signs of progress during the COVID-19 pandemic, including AstraZeneca's initial decision to make its vaccine available at cost, Merck's moves to enhance the availability of molnupiravir, the licensing agreements with the Medicines Patent Pool, and the development of the 'open source' vaccine Corbevax.

As with all past public health crises, concerted efforts are still required to advance global equity in access to new health technologies. Collectively, the mRNA vaccine producers (Pfizer, BioNTech and Moderna) have projected profits of USD34 billion in 2021.[34] Their efforts to develop safe and effective vaccines have relied on public-sector investments in people, basic research and trials. Furthermore, it is reasonable to ask whether these enormous private gains are justified given the public health consequences – the lost lives, the life-long disability, and the lengthening of the pandemic – caused by limited and inequitable global access to critical health technologies.

Competing interests

H.R. is a Member of the South African Ministerial Advisory Committee on COVID-19, the South African Ministerial Advisory Committee on COVID-19 Vaccines, and the National Essential Medicines List. A.G. is a Member of the South African Ministerial Advisory Committee on COVID-19, the National Essential Medicines List, the Ministerial Advisory Committee on COVID-19 Therapeutics, and a number of technical advisory committees at the South African Health Products Regulatory Authority, and Chair of the Proposal Review Committee at Unitaid.

References

1. Agarwal A, Rochwerg B, Lamontagne F, Siemieniuk RA, Agoritsas T, Askie L, et al. A living WHO guideline on drugs for Covid-19. BMJ. 2020;370, m3379. https://doi.org/10.1136/bmj.m3379
2. Lamontagne F, Agoritsa T, Siemieniuk R, Rochwerg B, Bartoszko J, Askie L, et al. A living WHO guideline on drugs to prevent Covid-19. BMJ. 2021;372, n526. https://doi.org/10.1136/bmj.n526
3. World Health Organization (WHO). Status of COVID-19 vaccines within WHO EUL/PQ evaluation process. Geneva: WHO; 2022. Available from: https://extranet.who.int/pqweb/sites/default/files/documents/Status_COVID_VAX_02March2022.pdf
4. Our World in Data. Coronavirus (COVID-19) vaccinations [webpage on the Internet]. No date [cited 2022 Mar 15]. Available from: https://ourworldindata.org/covid-vaccinations
5. Ye Y, Zhang Q, Wei X, Cao Z, Yuan H-Y, Zeng DD. Equitable access to COVID-19 vaccines makes a life-saving difference to all countries. Nat Hum Behav. 2022;6:207–216. https://doi.org/10.1038/s41562-022-01289-8
6. United Nations Development Programme (UNDP). Vaccine affordability [webpage on the Internet]. No date [cited 2022 Mar 15]. Available from: https://data.undp.org/vaccine-equity/affordability/
7. Heywood M. South Africa's Treatment Action Campaign: Combining law and social mobilization to realize the right to health. J Human Rights Practice. 2009;1(1):14–39. https://doi.org/10.1093/jhuman/hun006
8. Santos Rutschman A. Is there a cure for vaccine nationalism? Curr Hist. 2021;120(822):9–14. https://doi.org/10.1525/curh.2021.120.822.9
9. Kremer M, Levin J, Snyder CM. Advance market commitments: insights from theory and experience. AEA Papers and Proceedings. 2020;110:269–273. https://doi.org/10.1257/pandp.20201017
10. UNICEF. UNICEF Data Warehouse. Indicator: Percentage of surviving infants who received the third dose of pneumococcal conjugate-containing vaccine (PCV) [webpage on the Internet]. No date [cited 2022 Mar 15]. Available from: https://data.unicef.org/resources/data_explorer/unicef_f/?ag=UNICEF&df=GLOBAL_DATAFLOW&ver=1.0&dq=WHO_REG_GLOBAL+WHO_AFRO+WHO_AMRO+WHO_EMRO+WHO_EURO+WHO_SEARO+WHO_WPRO.IMMUNISATION+IM_PCV3..&startPeriod=2010&endPeriod=2020&lastnobservations=1
11. Coalition for Epidemic Preparedness Innovations (CEPI). 100 days [webpage on the Internet]. No date [cited 2022 Mar 15]. Available from: https://100days.cepi.net
12. Moon S, Armstrong J, Hutler B, Upshur R, Katz R, Atuire C, et al. Governing the access to COVID-19 Tools Accelerator: Towards greater participation, transparency, and accountability. Lancet. 2022;399:487–494. https://doi.org/10.1016/S0140-6736(21)02344-8
13. Jerving S. Less than 1% COVID-19 vaccines supplied to African countries expired. Devex. 20 January 2022. Available from: https://www.devex.com/news/less-than-1-covid-19-vaccines-supplied-to-african-countries-expired-102493
14. Light DW, Lexchin J. The costs of coronavirus vaccines and their pricing. J R Soc Med. 2021;114(11):502–504. https://doi.org/10.1177/01410768211053006
15. World Health Organization (WHO). Therapeutics and COVID-19: Living guideline. Geneva: WHO; 2022. Available from: https://www.who.int/publications/i/item/WHO-2019-nCoV-therapeutics-2022.1
16. Medecins Sans Frontieres (MSF). MSF responds to latest WHO recommendation for COVID-19 medicine baricitinib. c2022 [cited 2022 Mar 15]. Available from: https://www.doctorswithoutborders.org/what-we-do/news-stories/news/msf-responds-latest-who-recommendation-covid-19-medicine-baricitinib
17. Pfizer. Pfizer's novel COVID-19 oral antiviral treatment candidate reduced risk of hospitalization or death by 89% in interim analysis of Phase 2/3 EPIC-HR Study [media release]. 5 November 2021. Available from: https://www.pfizer.com/news/press-release/press-release-detail/pfizers-novel-covid-19-oral-antiviral-treatment-candidate
18. Merck. Amid humanitarian crisis in India, Merck announces voluntary licensing agreements with five Indian generics manufacturers to accelerate and expand global access to molnupiravir, an investigational oral therapeutic for the treatment of COVID-19 [media release]. 27 April 2021. Available from: https://www.merck.com/news/amid-humanitarian-crisis-in-india-merck-announces-voluntary-licensing-agreements-with-five-indian-generics-manufacturers-to-accelerate-and-expand-global-access-to-molnupiravir-an-investigational-ora/
19. Merck. The Medicines Patent Pool (MPP) and Merck enter into license agreement for molnupiravir, an investigational oral antiviral COVID-19 medicine, to increase broad access in low- and middle-income countries [media release]. 27 October 2021. Available from: https://www.merck.com/news/the-medicines-patent-pool-mpp-and-merck-enter-into-license-agreement-for-molnupiravir-an-investigational-oral-antiviral-covid-19-medicine-to-increase-broad-access-in-low-and-middle-income-countri/
20. Merck. Merck and Ridgeback announce supply agreement with UNICEF for molnupiravir, an investigational oral antiviral COVID-19 medicine [media release]. 18 January 2022. Available from: https://www.merck.com/news/merck-and-ridgeback-announce-supply-agreement-with-unicef-for-molnupiravir-an-investigational-oral-antiviral-covid-19-medicine/
21. World Health Organization (WHO). WHO recommends two new drugs to treat COVID-19 [media release]. 14 January 2022. Available from: https://www.who.int/news/item/14-01-2022-who-recommends-two-new-drugs-to-treat-covid-19
22. Nkengasong J. Let Africa into the market for COVID-19 diagnostics. Nature. 2020;580:565. https://doi.org/10.1038/d41586-020-01265-0
23. Our World in Data. Coronavirus (COVID-19) vaccinations: The scale of testing compared to the scale of the outbreak [webpage on the Internet]. No date [cited 2022 Mar 15]. Available from: https://ourworldindata.org/coronavirus-testing#the-scale-of-testing-compared-to-the-scale-of-the-outbreak
24. Reliefweb. Africa on track to control COVID-19 pandemic in 2022 [media release]. 10 February 2022. Available from: https://reliefweb.int/report/world/africa-track-control-covid-19-pandemic-2022
25. Green A. Where are we on COVID-19 after a year of TRIPS waiver negotiations? Devex. 7 October 2021. Available from: https://www.devex.com/news/where-are-we-on-covid-19-after-a-year-of-trips-waiver-negotiations-101795
26. Medecins Sans Frontieres (MSF). Pharmaceutical firms across Asia, Africa and Latin America with potential to manufacture mRNA vaccines. Geneva: Medecins Sans Frontieres; 2021. Available from: https://msfaccess.org/pharmaceutical-firms-across-asia-africa-and-latin-america-potential-manufacture-mrna-vaccines
27. Loftus P. Moderna signals it may enforce Covid-19 vaccine patents in wealthy nations. Wall Street Journal. 7 March 2022. Available from: https://www.wsj.com/articles/moderna-signals-it-may-enforce-covid-19-vaccine-patents-in-wealthy-nations-11646699609?mod=hp_lead_pos3
28. Ravelo JL. US 'not reluctant' as WHA agrees to negotiate pandemic accord. Devex. 2 December 2021. Available from: https://www.devex.com/news/us-not-reluctant-as-wha-agrees-to-negotiate-pandemic-accord-102209

29. Hotez PJ, Bottazzi ME. A COVID vaccine for all. Sci Am. 30 December 2021. Available from: https://www.scientificamerican.com/article/a-covid-vaccine-for-all/

30. World Health Organization (WHO). Statement on the tenth meeting of the International Heath Regulations (2005) Emergency Committee regarding the coronavirus disease (COVID-19) pandemic [media release]. 19 January 2022. Available from: https://www.who.int/news/item/19-01-2022-statement-on-the-tenth-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-coronavirus-disease-(covid-19)-pandemic

31. Uwiringiyimana C. Africa needs to make own vaccines but hurdles are high, experts say. Reuters. 7 December 2021. https://www.reuters.com/business/healthcare-pharmaceuticals/africa-needs-make-own-vaccines-hurdles-are-high-experts-say-2021-12-07/

32. World Health Organization (WHO). Towards Africa's first mRNA vaccine technology transfer hub [media release]. 17 September 2021. Available from: https://www.afro.who.int/news/towards-africas-first-mrna-vaccine-technology-transfer-hub

33. International Coalition of Medicines Regulatory Authorities (ICMRA). ICMRA statement for healthcare professionals: How COVID-19 vaccines will be regulated for safety and effectiveness. ICMRA; 2021. Available from: https://www.icmra.info/drupal/en/covid-19/vaccines_confidence_statement_for_hcps

34. Pfizer, BioNTech and Moderna making $1,000 profit every second while world's poorest countries remain largely unvaccinated [media release]. Oxfam International. 16 November 2021. Available from: https://www.oxfam.org/en/press-releases/pfizer-biontech-and-moderna-making-1000-profit-every-second-while-worlds-poorest

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Leveraging on past investment in understanding the immunology of COVID-19 – the South African experience

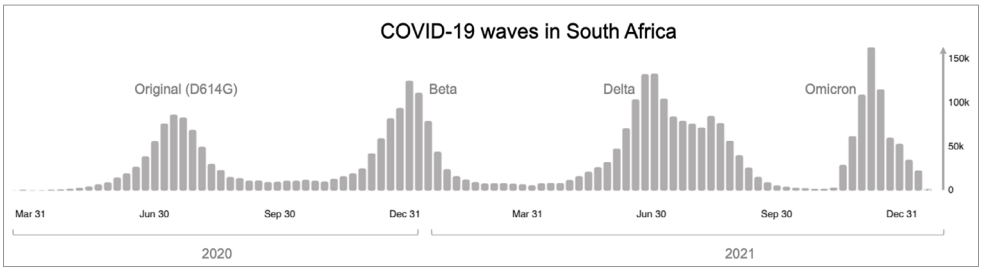
Significance:

The COVID-19 pandemic, and in particular the emergence of viral variants, resulted in an enormous global public health crisis. South African scientists, with a long history of studying viral evolution and antibody responses, were well positioned to pivot their research to focus on SARS-CoV-2. Using the expertise and infrastructure developed over decades for HIV vaccine research, South Africa took a leadership role in studying the antibody response elicited by SARS-CoV-2 infection and vaccination. We describe key scientific outcomes of those studies, and the drivers of a successful national response.

The emergence and evolution of SARS-CoV-2 in South Africa

The first confirmed case of SARS-CoV-2 in South Africa was identified on 5 March 2020; since then, the country has experienced over 3.5 million confirmed cases and over 94 000 confirmed deaths as of 25 January 2022.[1] The first wave of infections from June to August 2020 was driven by the original virus containing a D614G mutation (Figure 1). This mutation was not associated with immune escape but rather with increased transmissibility, and was the first indication that SARS-CoV-2 variants would become relevant to public health.[2] The second wave of infections in South Africa was driven by the Beta variant and lasted from December 2020 to February 2021. The Beta variant was first identified in South Africa, likely emerging from the Eastern Cape and rapidly disseminating through the country and to many other regions around the world.[3]

Despite the roll-out of the Janssen/Johnson & Johnson single-dose Ad26.COV2.S vaccine to healthcare workers from March 2021 and the rollout of the Pfizer BNT162b2 vaccine to the general adult population by August 2021, vaccination roll-out in South Africa was slow and the country experienced a deadly third wave that was dominated by the Delta variant, which was first identified in India.[4] This wave has been the longest lasting wave so far, starting in May 2021 until August 2021 and resulted in high levels of mortality and morbidity (Figure 1). The fourth wave of infections was driven by the neutralisation-resistant, highly transmissible Omicron variant which, like the Beta variant, was first described in South Africa and has now rapidly spread worldwide.[5] The Omicron variant was first identified in November 2021 and drove a fourth wave peaking relatively early in December 2021. By the end of January 2022, the fourth wave had ended, having resulted in fewer hospitalisations and deaths than prior waves (Figure 1).



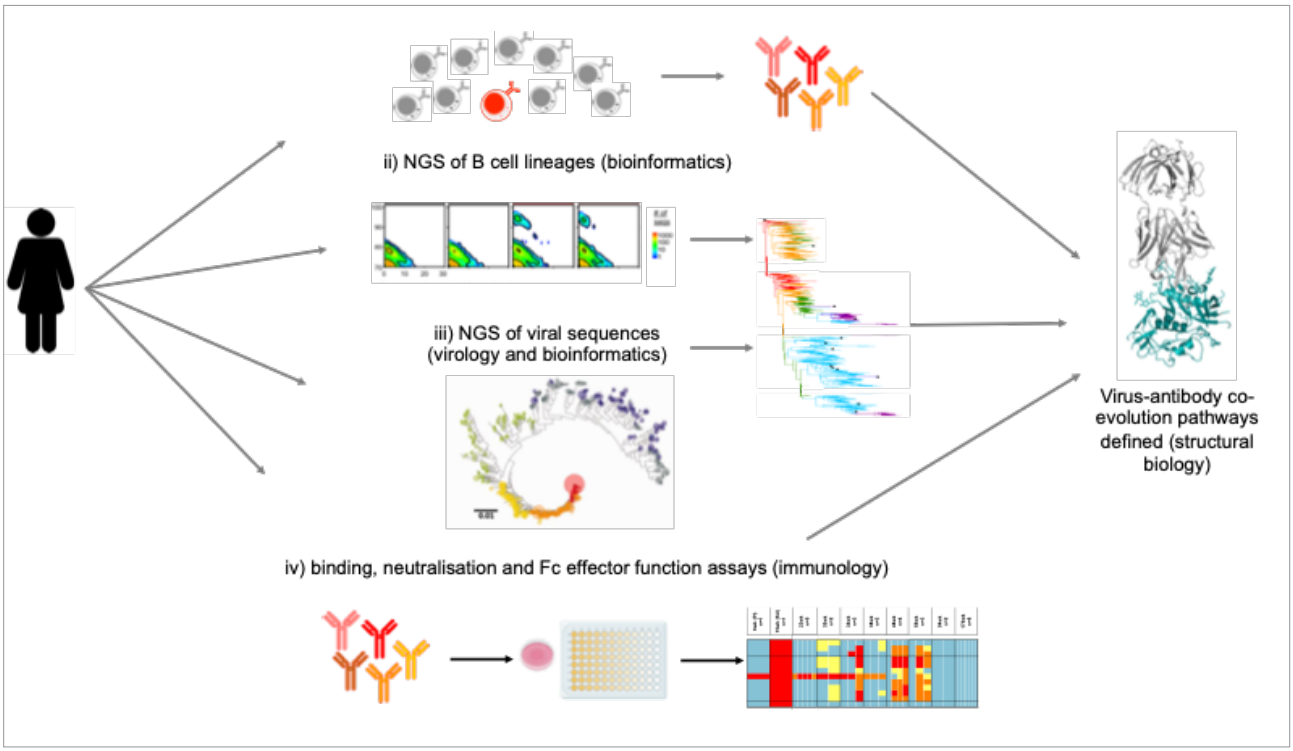
Source: Adapted from WHO COVID-19 dashboard[1]; accessed 25 January 2022

Figure 1: The four COVID-19 waves in South Africa. Since March 2020 when the first case of SARS-CoV-2 infection was identified in South Africa, the country has experienced four waves of infection which have been fuelled by different variants, resulting in high morbidity and mortality.

The COVID-19 pandemic, and in particular the emergence of viral variants in South Africa, resulted in an enormous public health crisis. As a laboratory of the National Institute for Communicable Diseases with a strong history in studying viral evolution and antibody responses, we at the Antibody Immunity Research Unit (AIRU) made the decision to pivot our research to focus on SARS-CoV-2. Over the last 2 years, we have made use of the expertise and infrastructure we have developed over more than 20 years of HIV vaccine research, to study the antibody response elicited by SARS-CoV-2 infection and vaccination. Here we reflect on how leveraging past investment in HIV vaccine research in South Africa resulted in our national ability to make major contributions to understanding the immunology of COVID-19.

The transfer of skills from HIV vaccine research to SARS-CoV-2 antibody research

For the past 20 years, the AIRU has focused on understanding the interplay between the antibody response that develops in HIV-infected individuals, and the evolution of the virus in that same person. We have extremely strong ties with the Centre for the AIDS Programme of Research in South Africa (CAPRISA), led by Prof. Salim Abdool Karim, who established a cohort of young women in 2002 and followed them for years, in many cases



NGS, next-generation sequencing
Components of the figure were generated using www.biorender.com

Figure 2: Tools used in HIV research that have been pivoted towards SARS-CoV-2 research. The Laboratory has focused on characterising the antibody response in HIV-infected individuals as well as tracking the evolution of the virus over time. We have used our combined skills across multiple platforms to answer key questions in the HIV field and have adapted these technologies to study antibody responses to SARS-CoV-2.

after they became HIV infected. From this cohort we have access to invaluable plasma and cell samples from acute infection through to chronic infection. This allowed us to track how the antibody response develops over time and changes as the virus mutates, both impacting the evolution of one another.[6-8] These virus–antibody co-evolution studies have enabled us to understand how special antibodies, known as broadly neutralising antibodies (bNAbs), develop and mature over time. These bNAbs are widely assumed to be essential for a future HIV vaccine because they are able to recognise and neutralise diverse, global HIV strains, despite the ever-evolving nature of the virus. Therefore, producing such a response upon vaccination would be desirable for HIV prevention. However, in HIV infection, these broadly neutralising antibodies are rare, and only develop after many years in a subset of individuals (less than 20%). Therefore, understanding the best path to quickly produce these antibodies is a key question in the HIV vaccine field. We use various tools across a wide range of biological sciences to answer these questions. These platforms include virology, immunology, structural biology, and bioinformatics, with senior members of the team leading niche areas in a highly collaborative, multidisciplinary model of research (Figure 2).

Transitioning from HIV to SARS-CoV-2 antibody research

Strong, long-lasting collaborations have been a key factor to the success of the AIRU, enabling the team to rapidly learn and adopt state-of-the-art technologies. Over the years, we have established lasting collaborations throughout the globe (Figure 3). Many of the collaborators who we have worked with over the past 20 years have also re-focused to study SARS-CoV-2 and we have continued working together. The pandemic has also resulted in the development of new collaborations, mostly in South Africa (Figure 3). Prior to the pandemic, the AIRU had a strong focus on building collaborations with other basic scientists; however, during the last 2 years, the Unit has become increasingly connected with clinicians and epidemiologists, enabling us to have a strong translational focus. This connection has strengthened our research, and that of our collaborators, enabling individuals with different perspectives to tackle a common question in a more innovative manner. In addition, laboratories around the world have rapidly shared reagents, consumables which are in short supply, as well as their data, enabling the field to move extraordinarily fast. The use of preprint servers to disseminate data rapidly has increased as researchers aim to share their latest findings prior to formal peer review. While lack of peer review comes with obvious disadvantages, these are offset by increased transparency and timely sharing of results.

Throughout the pandemic, it was not only staff members in the Laboratory who contributed to SARS-CoV-2 research, but also the master's and PhD students whom we mentor. During the 'hard lockdown' which occurred in the first wave, many students were unable to access the Laboratory, which led to uncertainty about whether their degree programmes would be delayed. Nonetheless, when they returned to the Laboratory when restrictions were eased and non-essential work could resume, most students volunteered to help with the SARS-CoV-2 components of the research while they caught up on their own individual research projects.

Funding bodies have also been critical in facilitating the research we conduct, both pre- and post-COVID-19 pandemic. We have historically received much of our laboratory funding from grants provided through the US National Institutes of Health (NIH), the International AIDS Vaccine Initiative (IAVI)), and the United States Agency for International Development (USAID). Fogarty grants from the NIH provided essential medium-term training for students and staff to be hosted in international laboratories. This international funding was essential in developing our expertise and platforms for HIV research. However, since the COVID-19 pandemic hit, we have been strongly supported by local government funding agencies through the South African Medical Research Council and the South African Department of Science and Innovation. Local government support has been key to the success of the country's research and development and enabled South African researchers to be internationally recognised leaders in SARS-CoV-2 research. Although

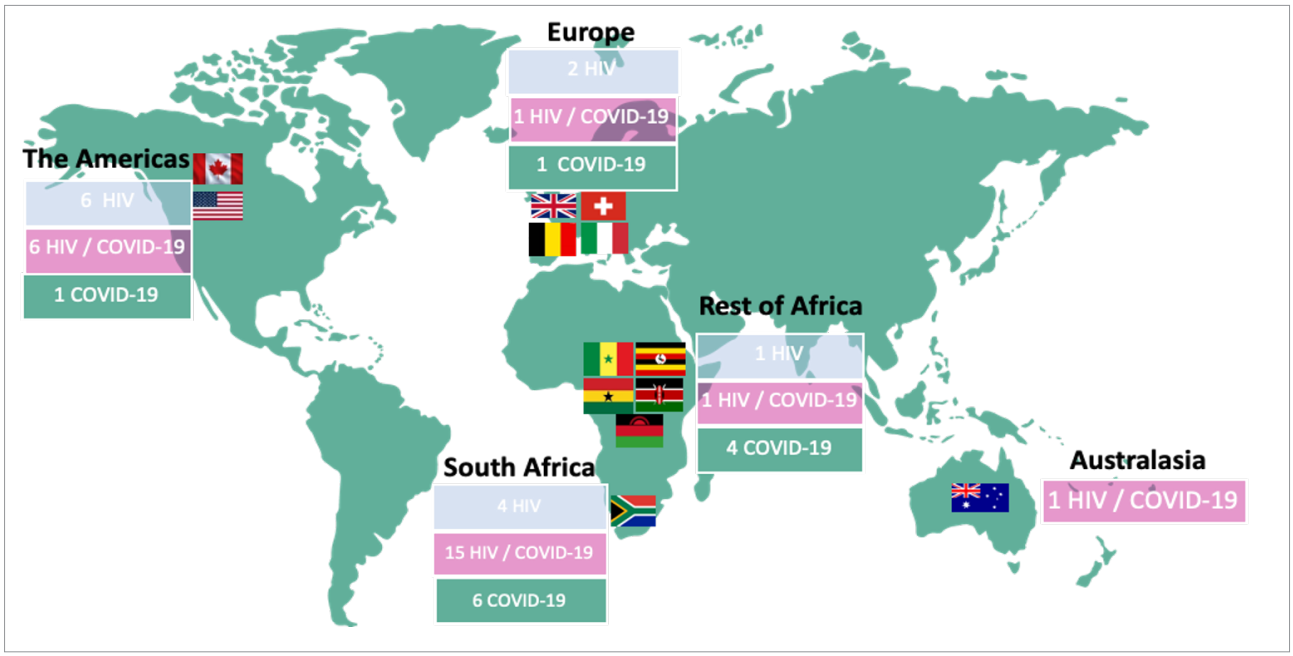


Figure 3: Map of global collaborations. One of the reasons for the success of the Laboratory is our collaborations which span across the globe and across disciplines. We have established HIV-related collaborations (blue), COVID-19-related collaborations (green) and collaborations which span both HIV and SARS-CoV-2 viruses (pink). The number of collaborators in each region is shown as a number in each box. The location of the collaborators is shown by a flag on the continent.

this emergency short-term funding has been crucial and timely, sustainable funding will be essential to ensure that research efforts are not jeopardised once the pandemic stabilises.

Key findings from our SARS-CoV-2 research over the past 2 years

The AIRU has been very involved in research on the virology, bioinformatics and structural biology of SARS-CoV-2, all of which was enabled by our previous studies on HIV. Upon the emergence of the Beta variant, our experience and knowledge of structural biology from HIV studies enabled our Unit to identify the key mutations within the receptor-binding domain and the N-terminal domain that would likely confer neutralisation resistance. Having identified them, we introduced these mutations into the spike protein of the original virus and tested them for binding and neutralisation. The data showed that the Beta variant was extremely neutralisation resistant compared to the original virus.[9] Beta was the first SARS-CoV-2 variant to contain major immune escape mutations that affect neutralisation by key antibody classes that target the SARS-CoV-2 spike protein.[9] These data led to a follow-up study looking at the response elicited by Beta variant infection. Interestingly, we found that individuals infected with the Beta variant had more cross-reactive antibodies, with a minimal drop in potency against the original virus and no drop in potency against the Gamma variant.[10] This suggested the possibility that Beta could form the basis of an improved second-generation vaccine.

We also characterised the antibody response to the Delta variant in South Africa and continued to be very involved in the virology and bioinformatics aspects of the pandemic with the discovery of the C.1.2 lineage, again using our experience of studying HIV envelope evolution, which is also driven in large part by antibody pressure.[11] The C.1.2 variant contained approximately 34 mutations in the spike protein and our immunological analysis showed neutralisation resistance of this variant towards plasma from vaccination and prior infection.[11] We continue to use our bioinformatics expertise to contribute to surveillance efforts across the country for detection of emerging variants. As our Laboratory is part of the Next-Generation Sequencing South Africa (NGS-SA) Consortium, we were at the forefront, together with our collaborators, in identifying the novel Omicron variant.[5] Similarly, as for Beta and C.1.2, our structural biology knowledge allowed us to postulate that the RBD and NTD mutations in the Omicron variant would likely render this variant highly neutralisation resistant. We also contributed to a study showing neutralisation resistance of Omicron in individuals.[12] Our next-generation sequencing expertise, honed over many years of HIV work, continues to be utilised in the high-throughput sequencing of not only viral genes but antibody genes from individuals with prior COVID-19 disease and/or after vaccination.

Early in the pandemic, we rapidly developed and implemented serological binding and neutralisation assays that enabled us to measure antibodies from individuals who had been infected with SARS-CoV-2. This work was enabled by previous HIV collaborations which accelerated development of assays, and enabled swapping of samples and concordance assays which gave us confidence that our new assays were comparable with data being generated internationally. In this role, we contributed to a convalescent plasma trial aimed at treating SARS-CoV-2 infected individuals with antibodies from recovered patients. This was work conducted in collaboration with the South African National Blood Service.[13] We have also been part of sero-survey studies, not only in South Africa but in other African countries too.[14]

In addition to understanding the immune response in individuals infected with the virus, we also embarked on large collaborations to understand the antibody response elicited by COVID-19 vaccines in the South African population. We have been part of serology studies looking at the ChAdOx1 nCoV-19 (AZD1222) vaccine in the South African context during the first and second waves of infection[15] and characterised the response to the same vaccine in South African HIV-infected individuals[16]. Our data showed that HIV-infected individuals developed strong antibody responses after vaccination. However, the Beta variant was able to escape plasma neutralisation responses elicited by the ChAdOx1 vaccine which raised concern about the efficacy of the vaccine during the Beta wave. The clinical data indicated that the ChAdOx1 vaccine had reduced efficacy against the Beta variant, although the trial was small, and on the basis of these data, roll-out of this vaccine was halted, and other vaccines were deployed. Although this decision has since been questioned based on what we now know about humoral and T cell immunity, this is the best example of how our basic research helped inform policy in real time in South Africa.

As the single-dose Ad26.COV2.S vaccine developed by Johnson & Johnson is one of the two approved vaccines in the country, we have also been extensively involved in characterising the antibody response elicited by this vaccine. During the Beta wave, we tested plasma from individuals vaccinated with the Ad26.COV2.S vaccine and found significant drops in neutralisation against the Beta variant despite high binding cross-reactivity.[17] In collaboration with a research team led by Prof. Wendy Burgers and Prof. Ntobeko Ntusi from the University of Cape Town who looked at the T cell response, we assessed binding, neutralisation and Fc effector function assays in individuals with no prior infection or who were previously infected, followed by Ad26.COV2.S vaccination. We found that individuals with prior infection mounted significantly higher levels of immune responses upon vaccination compared to previously uninfected individuals.[18] The inverse is also true; individuals who were vaccinated with the Ad26.COV2.S vaccine and then had a breakthrough SARS-CoV-2 infection had potent antibody responses which were cross-reactive against a variety of variants of concern, including Omicron, as well as SARS-CoV-1.[19]

The immunology research we undertake also spans flow cytometry and cell sorting techniques which were implemented to study the immune response to HIV infection, and to enable isolation of potent neutralising antibodies. We have successfully isolated monoclonal antibodies from individuals who recovered from SARS-CoV-2 infection, including an antibody that recognises a shared epitope on Beta and Omicron.[20] We are currently implementing high-throughput antibody isolation techniques which will allow us to isolate numerous, diverse monoclonal antibodies at a rapid pace, and which will also feed back into accelerating our HIV work. Our antibody isolation work forms part of a larger network of laboratories that have received support from the Bill and Melinda Gates Foundation. The Global Immunology and Immune Sequencing for Epidemic Response (GIISER) programme aims to facilitate the rapid isolation and characterisation of novel SARS-CoV-2 antibodies and use them for various applications such as therapeutics, diagnostics and immunogen design. The goal of the programme is to build expertise across the developing world, not only for use in SARS-CoV-2 research but also for other current and future pathogens.

Summary

Over the last 20 years, the AIRU has focused on understanding the development of broadly neutralising antibodies which target HIV. Since the start of the COVID-19 pandemic, we have pivoted our research to include studying the SARS-CoV-2 antibody response. The quick transition was facilitated by the already established expertise and infrastructure that was developed over two decades for HIV work. Without prior funding, support from government agencies and international grants, our Laboratory and many other South African laboratories would not have been able to perform this important research in such an effective manner. This past investment enabled the country to track the evolution of variants of concern, to define their phenotypic characteristics, and to evaluate immune responses to vaccination and infection in South Africa. The response to the SARS-CoV-2 pandemic has highlighted the fact that science can progress faster if laboratories around the world participate in collaborative science. This includes greater resource sharing as well as the development and preservation of existing tools to allow for open data sharing. The sustainable availability of funding is crucial in the development of strong centres of research excellence, and, therefore, increased funding from local and international funding agencies, across various fields, would aid in the advancement of science globally. Lessons learnt from the COVID-19 pandemic should be used to advance research to combat diseases which have been with us longer than SARS-CoV-2, such as HIV/AIDS, as well as to plan for future pandemics.

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Competing interests

We have no competing interests to declare.

References

1. World Health Organization (WHO). WHO Coronavirus disease (COVID-19) dashboard [database on the Internet]. Geneva: WHO; 2020 [cited 2022 Jan 25]. Available from: https://covid19.who.int/region/afro/country/za
2. Zhou B, Thao TTN, Hoffmann D, Taddeo A, Ebert N, Labroussaa F, et al. SARS-CoV-2 spike D614G change enhances replication and transmission. Nature. 2021;592(7852):122–127. http://dx.doi.org/10.1038/s41586-021-03361-1
3. Tegally H, Wilkinson E, Giovanetti M, Iranzadeh A, Fonseca V, Giandhari J, et al. Detection of a SARS-CoV-2 variant of concern in South Africa. Nature. 2021;592(7854):438–443. http://dx.doi.org/10.1038/s41586-021-03402-9
4. Tegally H, Wilkinson E, Althaus CL, Giovanetti M, San JE, Giandhari J, et al. Rapid replacement of the Beta variant by the Delta variant in South Africa [preprint]. medRxiv. 2021:2021.09.23.21264018. http://dx.doi.org/10.1101/2021.09.23.21264018
5. Viana R, Moyo S, Amoako DG, Tegally H, Scheepers C, Althaus CL, et al. Rapid epidemic expansion of the SARS-CoV-2 Omicron variant in southern Africa [preprint]. medRxiv. 2021:2021.12.19.21268028. http://dx.doi.org/10.1101/2021.12.19.21268028
6. Bhiman JN, Anthony C, Doria-Rose NA, Karimanzira O, Schramm CA, Khoza T, et al. Viral variants that initiate and drive maturation of V1V2-directed HIV-1 broadly neutralizing antibodies. Nat Med. 2015;21(11):1332–1336. http://dx.doi.org/10.1038/nm.3963
7. Wibmer CK, Bhiman JN, Gray ES, Tumba N, Abdool Karim SS, Williamson C, et al. Viral escape from HIV-1 neutralizing antibodies drives increased plasma neutralization breadth through sequential recognition of multiple epitopes and immunotypes. PLoS Pathog. 2013;9(10), e1003738. http://dx.doi.org/10.1371/journal.ppat.1003738
8. Doria-Rose NA, Schramm CA, Gorman J, Moore PL, Bhiman JN, Dekosky BJ, et al. Developmental pathway for potent V1V2-directed HIV-neutralizing antibodies. Nature. 2014;509(7498):55–62. http://dx.doi.org/10.1038/nature13036
9. Wibmer CK, Ayres F, Hermanus T, Madzivhandila M, Kgagudi P, Oosthuysen B, et al. SARS-CoV-2 501Y. V2 escapes neutralization by South African COVID-19 donor plasma. Nature Med. 2021;27(4):622–625. http://dx.doi.org/10.1038/s41591-021-01285-x
10. Moyo-Gwete T, Madzivhandila M, Makhado Z, Ayres F, Mhlanga D, Oosthuysen B, et al. Cross-reactive neutralizing antibody responses elicited by SARS-CoV-2 501Y.V2 (B.1.351). N Engl J Med. 2021(384):2161–2163. http://dx.doi.org/10.1056/NEJMc2104192
11. Scheepers C, Everatt J, Amoako DG, Tegally H, Wibmer CK, Mnguni A, et al. Emergence and phenotypic characterization of C.1.2, a globally detected lineage that rapidly accumulated mutations of concern [preprint]. medRxiv. 2021:2021.08.20.21262342. http://dx.doi.org/10.1101/2021.08.20.21262342
12. Cele S, Jackson L, Khan K, Khoury D, Moyo-Gwete T, Tegally H, et al. Omicron extensively but incompletely escapes Pfizer BNT162b2 neutralization. Nature. 2022;602:654–656. http://dx.doi.org/10.1038/d41586-021-03824-5
13. Glatt TN, Hilton C, Nyoni C, Swarts A, Swanevelder R, Cowley J, et al. Rapid and successful implementation of a COVID-19 convalescent plasma programme – The South African experience. Viruses. 2021;13(10):2050. http://dx.doi.org/10.3390/v13102050
14. Mandolo J, Msefula J, Henrion MYR, Brown C, Moyo B, Samon A, et al. SARS-CoV-2 exposure in Malawian blood donors: An analysis of seroprevalence and variant dynamics between January 2020 and July 2021. BMC Med. 2021;19(1):303. http://dx.doi.org/10.1186/s12916-021-02187-y
15. Madhi SA, Baillie V, Cutland CL, Voysey M, Koen AL, Fairlie L, et al. Efficacy of the ChAdOx1 nCoV-19 Covid-19 Vaccine against the B.1.351 Variant. N Engl J Med. 2021;384(20):1885–1898. http://dx.doi.org/10.1056/NEJMoa2102214

16. Madhi SA, Koen AL, Izu A, Fairlie L, Cutland CL, Baillie V, et al. Safety and immunogenicity of the ChAdOx1 nCoV-19 (AZD1222) vaccine against SARS-CoV-2 in people living with and without HIV in South Africa: An interim analysis of a randomised, double-blind, placebo-controlled, phase 1B/2A trial. Lancet HIV. 2021;8(9):e568–e580. http://dx.doi.org/10.1016/S2352-3018(21)00157-0

17. Moore PL, Moyo-Gwete T, Hermanus T, Kgagudi P, Ayres F, Makhado Z, et al. Neutralizing antibodies elicited by the Ad26.COV2.S COVID-19 vaccine show reduced activity against 501Y.V2 (B.1.351), despite protection against severe disease by this variant [preprint]. bioRxiv. 2021:2021.06.09.447722. http://dx.doi.org/10.1101/2021.06.09.447722

18. Keeton R, Richardson SI, Moyo-Gwete T, Hermanus T, Tincho MB, Benede N, et al. Prior infection with SARS-CoV-2 boosts and broadens Ad26.COV2.S immunogenicity in a variant dependent manner [preprint]. medRxiv. 2021:2021.07.24.21261037. http://dx.doi.org/10.1101/2021.07.24.21261037

19. Kitchin D, Richardson SI, Van der Mescht MA, Motlou T, Mzindle N, Moyo-Gwete T, et al. Ad26. COV2. S breakthrough infections induce high titers of antibodies capable of neutralizing variants of concern [preprint]. medRxiv. 2021.11.08.21266049. http://dx.doi.org/10.1101/2021.11.08.21266049

20. Moyo-Gwete T, Madzivhandila M, Mkhize N, Kgagudi P, Ayres F, Lambson B, et al. Shared N417-dependent epitope on the SARS-CoV-2 Omicron, Beta and Delta-plus variants [preprint]. medRxiv. 2022. https://doi.org/10.1101/2022.04.24.22273395

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Provision of mental health care to healthcare workers during COVID-19: A call for the practice of vulnerability

Significance:

The Commentary outlines the lived experience of a liaison psychiatrist working as part of a frontline COVID-team in a large public hospital in Cape Town, South Africa and explores several important themes including vulnerability in health care, connection with patient experience, group processing of trauma, reintegration following trauma, and the importance of embedded mental health care in all health systems. The frontline psychological experience has been similar to wartime combat and the collective stressors experienced by healthcare workers must be recognised as such to ensure appropriate support is provided to help them recover.

> *The human soul doesn't want to be advised or fixed, it simply wants to be seen, heard and companioned exactly as it is. When we make that kind of deep bow to the soul of a suffering person, our respect reinforces the soul's healing.*
>
> Parker Palmer

The mental health impact of COVID-19 on patients admitted with COVID pneumonia and on healthcare workers is well established and a number of supportive interventions have been described.[1] However, little experience has been shared from low- and middle-income countries like South Africa, where the burden of the pandemic has been compounded by the burden of HIV and TB[2], COVID-19 vaccine inequities[3], an already fragile health system, and, critically, a social context of inequality, normative violence, and national infrastructure challenges[4]. This Commentary outlines the experience of a liaison psychiatrist working in a COVID-19 frontline team of a large public-sector hospital in Cape Town (Groote Schuur Hospital), to reflect on key lessons for supporting the mental health of patients and staff in challenging contexts.

In a pre-COVID-19 pandemic world, it might have been harder to explain that thoughts, feelings and emotions are inextricably intertwined, not only with the body and illness in general, but with society as a whole. Every person reading this, whether you have personally had COVID-19 or not, understands what it means to live through a pandemic. Everyone has experienced anxiety and fear, and has at times found it challenging to think clearly. The COVID-19 pandemic has launched a global mental health crisis, with unprecedented numbers of individuals meeting criteria for depression, anxiety and other mental health disorders in response to a range of intense stressors.[5]

The co-occurrence of mental health symptoms in patients admitted for COVID-19 is common, with studies reporting many patients experiencing significant distress, fear and anxiety.[6] The experience at Groote Schuur Hospital in the high-flow nasal oxygen (HFNO) high care units and intensive care units (ICUs), mirrors these observations. My role was to provide face-to-face support and a sense of safety for patients requiring HFNO or ICU care. In part, this role was to manage the acute psychological stress which was negatively impacting physical status but also, in providing containment, to mitigate the long-term risk of developing post-traumatic stress disorder (PTSD) post-discharge. Higher levels of anxiety and depressive symptoms during COVID-19 hospitalisations and feeling socially disconnected have predicted higher PTSD symptoms following discharge.[7] Early on, we recognised the link between panic and fear and worsening symptoms of COVID-19 pneumonia including breathlessness and oxygen requirements. We deployed brief interventions to manage fear, anxiety and distress effectively, mostly using psychological first aid[8] and also drawing on therapies such as mindfulness, cognitive behavioural therapy, problem-solving and motivational interviewing. In a modest proportion of patients, this therapy needed to be supplemented with medication, including antipsychotics and antidepressants.

Fear and anxiety are pervasive in COVID-19 high care/HFNO environments, which are described by many of our patients as 'terrifying'. HFNO failed in just over half of our patients, and the mortality in the patients who received mechanical ventilation was very high.[9] Fear was particularly marked in those who had never been admitted to hospital before or who were experiencing a severe illness and vulnerability for the first time in their lives, such as younger people who had never had to confront their mortality before. Patients themselves battling COVID-19 pneumonia witnessed many deaths and intubations and were hyperaware of what was happening to others around them in the unit, all struggling with the same condition. This situation is a stark contrast to usual inpatient care in which patients are admitted for a variety of different conditions, allowing them some degree of emotional distance from the suffering of others. Nothing before COVID-19 could prepare one for high care wards with the loud hiss of oxygen flowing at speed, the beeping of so many machines, the breathlessness of patients – these are the sounds of COVID-19. Everything is fast-paced, the tension is palpable and the reality that seconds and not minutes matter is hard-hitting.

Fear and anxiety not only impact respiratory function but also decision-making capacity. Many patients declined intubation and mechanical ventilation, even though it was desperately needed, due to fear. Creating space to listen and allow those fears and concerns to be expressed without judgement was critical to support and facilitate an improvement in capacity, facilitating consent for intubation and ICU admission. This care extended to attendance at intubations for those patients who were overwhelmed or who requested additional support. This was very common in younger people and pregnant women who not only needed intubation and ICU admission, but prior to admission

to ICU, would need a Caesarean section and were faced with the terrible reality that they may not meet their babies. A similar approach was used in patients wanting to discharge against medical advice despite being critically ill and needing HFNO. A clinical ethics consultation goes beyond issues of legal capacity and theoretical ethical principles; it also requires a knowledgeable clinician who has an understanding of the role of psychological factors in the resolution of the conflicts that are inherent in making life-and-death decisions.[10] Liaison psychiatrists are ideally placed to manage these difficult situations which tended to be more common in people who rejected scientific explanations of COVID-19 and its treatment and disclosed conspiracy theories. It was also important to support the team through complex ethical and moral dilemmas, which pose a high risk of moral injury[11] – a trauma to which doctors are particularly vulnerable.

Listening to the stories of how patients experienced this new infectious disease, learning from them and bearing witness to their journey was a fundamental component of providing care. Seeing and understanding the individual for whom we care provides meaning and purpose, and the act of connecting with these personal experiences improves clinical care and outcomes. These connections brought incredible joy when patients survived and went on to thrive. However, making these connections required tremendous courage, as we also suffered innumerable losses.

An overwhelming experience to stand in that space now quiet, empty and waiting for the next wave – and allow yourself to feel everything that happened. Crushing, it takes courage.

– Jackie Hoare

Photo by Prof. Marc Mendelson, University of Cape Town Groote Schuur Hospital

It is well established that in medical culture there is pressure to become an expert and to demonstrate ability to fix difficult situations, while remaining in control.[12] Medical cultural norms do not support healthcare workers to stand alongside their patients in their suffering or to grieve them when they die. Vulnerability and emotional pain may be experienced as humiliating, shameful, and something to be hidden.[13] In holding the pain of our patients and their loved ones, many of our COVID team were neglecting to address their own. This created an acute psychological crisis – a conflict between being a guardian of suffering and suffering – that demanded extensive emotional support. My colleagues were experiencing the unimaginable and the unspeakable.[14] However, traumatised groups isolate themselves and are difficult to access. The only way they could begin to express what they were going through was through me having an embodied experience of what they had experienced.[14] I had to become part of the COVID-19 team, I had to face the same traumas and anxieties myself and bear witness to the same suffering and death.[14]

In addition to me becoming a part of the COVID-19 team, my psychology colleague and I ran a weekly peer support group. We came to see that the many sets of tools such as resilience training, which have been developed to help medical personnel cope, although they have their place, may be experienced as positioning our colleagues as incompetent and lacking, that they needed to 'fix' something in themselves, when in fact the primary issue was not clinicians 'not coping' but a situation which was until then incomprehensible and impossible to manage.[14] Once this had been acknowledged and normalised, then there was space to reflect and share experiences. The function of the groups was to make a space where the team could feel safe and connected, not alone, to put our experiences into words and thereby address the isolation that trauma brings.[14] We created a mirror: the role of healthcare workers was to bear witness to patients' suffering and loss, the role of the groups was to bear witness to each other's suffering and loss. We understand from the literature that trauma can isolate one from those who have not been through the same experience, while at the same time binding together those who have.[14] Participating in the group also normalised and promoted individual mental health care seeking, particularly when the narrative of 'we are all navigating impossible terrain' was internalised.

The groups provided a safe space to acknowledge that we were not okay, that the masks we wore for physical protection could not shield us from the grief and loss we faced continuously. Trauma isolates; the group re-created a sense of belonging.[15] As we allowed ourselves to be vulnerable with each other, we saw the true extent of our pain. It was not 'stress': we were stressed, but our pain was not stress. We needed the right words to define our experience, we needed the right words to have the conversations that matter and to access help that would be meaningful. It was grief and it was trauma. We were grieving, mourning innumerable losses and sad. At times it was overwhelming. Without safe spaces to process, grief can fester, be rendered complex and erode our mental health.

How do we as healthcare workers dare to be vulnerable and allow ourselves to feel, when doing so opens the door to our own pain? How do we allow room for emotional processing when we have learnt to minimise feelings in order to function? We needed to process our pain to heal in the slow and uneven way that grief heals. The trauma we felt was real. But collective grief and collective trauma demand collective healing. Experiencing trauma can feel shameful and stigmatising; however, the group bore witness and affirmed.[15] We needed to deconstruct the cultural medical narrative that vulnerability is weakness and learn a different way of functioning – one where grief is acknowledged and even actively processed while still going about our work. If we allowed the reality of grief to exist, we could focus on helping ourselves and supporting each other. What sustained us, and what we will hold onto during and after this extraordinary time, are the colleagues who survived this with us. We looked out for each other and faced this catastrophe together. The solidarity of the team provided the strongest protection against despair and the strongest antidote to the frontline experience.[15]

During the waves we were driven by the intensity of the work, fuelled by a common purpose and the adrenaline rush that characterises emergency care. We were trying to minimise suffering and save lives. We adapted to survive; the immediacy of the work focused our minds and our bodies. However, between the waves, we have experienced different sets of difficulties in returning to 'normal life'. We are not simply a burnt-out workforce. We have felt separated, isolated and disconnected from the world around us. The world outside of these COVID-19 high care wards feels anaemic, slow and lacking in meaning. While this sense of dislocation may be a cognitive distortion and we are able to recognise it as such, it cannot always stop the feeling. Our lives are full of meaning, our work outside of COVID-19 full of purpose. But the exposure to the trauma of the COVID-19 wards changed us. We found it hard to connect and explain to others what we were feeling. The feelings of otherness, numbness and disconnection are barriers to reintegration between waves. Low mood, irritability, tiredness, and difficulties with eating, sleep, attention and concentration have been experienced by many. We have tried to manage these symptoms by staying connected with each other and talking about it. Normalising these experiences is important to minimise self-stigmatisation and isolation – these are all understandable reactions to traumatic experiences. A similar phenomenon has been described for soldiers returning home from deployment.[16] Now we begin

a new journey of creating a new self, of mourning the old self that the frontline experience has disrupted. Many of our relationships have been tested and forever changed by the trauma, and the old beliefs that gave meaning to our lives have been challenged.[15]

Our experience argues for the importance of integrating liaison psychiatry within COVID-19 frontline teams, and during future emergencies and health system shocks, thereby facilitating trust and a space for providing emotional support to patients and colleagues founded in shared experience.[14] Connecting with our patients as people proved vital in achieving good clinical outcomes, but carried a high emotional cost, as many did not survive. Bearing that cost was made difficult by social healthcare norms of not being allowed to suffer with and for your patients. Connecting with colleagues as people and not only co-workers and normalising vulnerability eased this difficulty. The frontline psychological experience has been similar to wartime combat and the collective stressors experienced by healthcare workers must be recognised as such to ensure appropriate support is provided to help them recover. We are practising medicine in complex and challenging times. For us to be good at our work means that we must reject false distinctions. For example, we cannot focus on the mind and exclude the body or focus on the body and exclude mental health; we must not try to choose between good mental health care and good health care – they are the same thing. Another key binary is that between us as clinicians and our patients, we are all vulnerable and all have care needs – it is this common humanity, which is in our brains, our bodies, and our lives, that should form the basis of good health care.

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Competing interests

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References

1. Tracy DK, Tarn M, Eldridge R, Cooke J, Calder J, Greenberg N. What should be done to support the mental health of healthcare staff treating COVID-19 patients? Br J Psychiatry. 2020;217:537–539. https://doi.org/10.1192/bjp.2020.109
2. Bröcker E, Louw KA, Hewett M, Burger H, Felix R, De Koker P, et al. A collaborative and evolving response to the needs of frontline workers, patients and families during the COVID-19 pandemic at Tygerberg Hospital, Western Cape Province, South Africa. S Afr Med J. 2021;111:405–408. https://doi.org/10.7196/samj.2021.v111i5.15648
3. Aryeetey E, Engebretsen E, Gornitzka Å, Maassen P, Stølen S. A step backwards in the fight against global vaccine inequities. Lancet. 2020;397:23–24. https://doi.org/10.1016/s0140-6736(20)32596-4
4. Maphumulo WT, Bhengu BR. Challenges of quality improvement in the healthcare of South Africa post-apartheid: A critical review. Curationis. 2019;42(1), Art. #1901. https://doi.org/10.4102/curationis.v42i1.1901
5. Collaborators C-19 MD. Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. Lancet. 2021;398:1700–1712. https://doi.org/10.1016/s0140-6736(21)02143-7
6. Dong F, Liu H, Dai N, Yang M, Liu J. A living systematic review of the psychological problems in people suffering from COVID-19. J Affect Disorders. 2021;292:172–188. https://doi.org/10.1016/j.jad.2021.05.060
7. Matalon N, Dorman-Ilan S, Hasson-Ohayon I, Hertz-Palmor N, Shani S, Basel D, et al. Trajectories of post-traumatic stress symptoms, anxiety, and depression in hospitalized COVID-19 patients: A one-month follow-up. J Psychosom Res. 2021;143:110399. https://doi.org/10.1016/j.jpsychores.2021.110399
8. Shah K, Bedi S, Onyeaka H, Singh R, Chaudhari G. The role of psychological first aid to support public mental health in the COVID-19 pandemic. Cureus J Med Sci. 2020;12, e8821. https://doi.org/10.7759/cureus.8821
9. Calligaro GL, Lalla U, Audley G, Gina P, Miller MG, Mendelson M, et al. The utility of high-flow nasal oxygen for severe COVID-19 pneumonia in a resource-constrained setting: A multi-centre prospective observational study. eClinicalMedicine. 2020;28, Art. #100570. https://doi.org/10.1016/j.eclinm.2020.100570
10. Kornfeld DS. Consultation-liaison psychiatry: Contributions to medical practice. Am J Psychiatry. 2002;159:1964–1972. https://doi.org/10.1176/appi.ajp.159.12.1964
11. Grobler C. COVID-19: Mental health and clinical equipoise in the face of moral injury. S Afr J Bioeth Law. 2020;13:21–22. https://doi.org/10.7196/sajbl.2020.v13i1.00724
12. Shapiro J. Perspective: Does medical education promote professional alexithymia? A call for attending to the emotions of patients and self in medical training. Acad Med. 2011;86:326–332. https://doi.org/10.1097/acm.0b013e3182088833
13. Miles S. Addressing shame: What role does shame play in the formation of a modern medical professional identity? BJPsych Bull. 2020;44:1–5. https://doi.org/10.1192/bjb.2019.49
14. Hoare J, Frenkel L. South Africa. Lancet Psychiatry. 2021;8:865. https://doi.org/10.1016/s2215-0366(21)00365-5
15. Herman JL. Recovery from psychological trauma: Recovery from psychological trauma. Psychiatry Clin Neurosci. 1998;52:S105–S110. https://doi.org/10.1046/j.1440-1819.1998.0520s5s145.x
16. Freytes IM, LeLaurin JH, Zickmund SL, Resende RD, Uphold CR. Exploring the post-deployment reintegration experiences of veterans with PTSD and their significant others. Am J Orthopsychiatry. 2017;87(2):149–156. https://doi.org/10.1037/ort0000211

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Randomised trials of COVID-19 vaccines in Africa – charting the path forward

Vaccines have played a critical role in controlling disease outbreaks, hence the proliferation of the development and testing of multiple vaccine candidates during the COVID-19 pandemic. Randomised trials are gold standards for evaluating the safety and efficacy of pharmaceutical interventions such as COVID-19 vaccines. However, contextual differences may attenuate effects of COVID-19 vaccines. Thus, the need to conduct COVID-19 vaccine trials in all settings, including in Africa. We conducted a cross-sectional analysis of planned, ongoing, and completed COVID-19 vaccine trials in Africa. We searched the South African National Clinical Trials Register, Pan African Clinical Trials Registry, and International Clinical Trials Registry Platform (ICTRP) on 12 January and 30 April 2022; and complemented this with a search of ClinicalTrials.gov on 17 May 2022. We screened the search output and included randomised trials with at least one recruitment site in Africa. We identified only 108 eligible trials: 90 (83%) evaluating candidate COVID-19 vaccines, 11 (10%) assessing if existing vaccines could prevent SARS-CoV-2 infection, and 7 (7%) evaluating interventions for improving COVID-19 vaccination coverage. South Africa had the highest number of trials at 58 (54%). Beyond South Africa, countries with more than 10 trial sites include Kenya, Ghana, Egypt, Uganda, and Zimbabwe. Among the trials, 14 (13%) do not have principal investigators based in Africa, 39 (30%) are funded by industry, and 91 (84%) are funded by institutions based outside the host country. COVID-19 vaccine trials with recruitment sites in Africa represented only 7% of the 1453 COVID-19 vaccine trials in the ICTRP. The paucity of COVID-19 vaccine trials conducted on the African continent is a cause for concern. This has implications for the role that Africa may play in future pandemics.

Significance:

- There are generally very few vaccine trials conducted in Africa, relative to the rest of the world.
- The limited vaccine trials in Africa could be attributed to limited expertise and resources, both human and material, as well as lack of perceived market.
- It is reassuring that many COVID-19 vaccines are planned, being conducted, or have been conducted in multiple African countries; but there is a need for more African public sector funding for vaccine trials on the continent.

Introduction

Vaccination is one of the greatest achievements of the 20th and 21st centuries.[1] In the context of the coronavirus disease 2019 (COVID-19) pandemic, vaccination is the world's greatest hope of reducing the burden of the pandemic. Decisions regarding COVID-19 vaccination, including the type of vaccine, the number of doses and schedule of vaccination, and interventions for increasing coverage, should be informed by the best available scientific evidence. The randomised trial constitutes the summit of the hierarchy of scientific evidence on the safety and efficacy of vaccines and other healthcare interventions.[2] Randomised trials have shown that multiple vaccines reduce the risk of acquiring infection with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and/or the severity of COVID-19.[3,4] South Africa participated in randomised trials for several of these vaccines[5-11], starting with the Oxford-AstraZeneca vaccine in mid-2020[5,6].

These COVID-19 vaccines were subsequently approved or authorised for emergency use in South Africa and other African countries.[12] However, before the availability of these vaccines in African countries, new SARS-CoV-2 variants emerged, some with multiple mutations.[13,14] These mutations have been shown to reduce vaccine-induced protection[15,16] and their prevalence varies considerably across time and place[13,14]. A high prevalence of such variants could thus potentially warrant a change in COVID-19 vaccination regimens. In addition, studies of vaccinated people who are on immunosuppressive medications in the context of solid organ transplants or other conditions have suggested inadequate humoral immune response to standard vaccine regimens and resultant impaired protection from SARS-CoV-2 infection and disease.[17-19]

Another condition that potentially influences vaccine-induced immunity is HIV.[20,21] The prevalence of HIV varies widely across countries, with several countries in southern Africa having the highest prevalence in the world.[22,23] The wide geographical variation in HIV prevalence could thus potentially influence decisions regarding dosing schedules for COVID-19 vaccines. In addition, concerns have been raised regarding the safety of candidate vaccines using adenovirus type 5 as the antigen delivery platform in people at high risk of acquiring HIV infection.[24-26] Some candidate COVID-19 vaccines employ adenovirus type 5 as the viral vector[27], and would require rigorous evaluations in South Africa and other African settings with high background HIV prevalence.

The potential influence of population differences on vaccine-induced immunity necessitates the conduct of vaccine randomised trials in all settings, including African countries. That was the rationale for this study, which aimed to provide a cross-sectional description of COVID-19 vaccine trials in Africa.

Data and methods

We searched the South African National Clinical Trials Register (SANCTR), the Pan African Clinical Trials Registry (PACTR), and the World Health Organization (WHO) International Clinical Trials Registry Platform (ICTRP)[28,29] on 30 April 2022 and ClinicalTrials.gov on 17 May 2022.

We defined eligibility criteria as trials with at least one site in an African country which assessed the safety, immunogenicity, and/or efficacy of (new or existing) vaccines for prevention of SARS-CoV-2 infection or disease, or which assessed the efficacy of interventions for improving uptake of COVID-19 vaccination. Following discussion of the search strategy among the researchers, one researcher conducted the search on 12 January 2022 and 30 April 2022 combining the search terms "COVID-19", "COVID 19", "SARS-CoV2", "SARS-CoV-2", and "Coronavirus" in the ICTRP, PACTR, and SANCTR. In addition, the same researcher conducted a search in ClinicalTrials.gov on 17 May 2022 for trials registered from 01 April 2022 to 17 May 2022. The researcher created a master data file with the search output from the three databases and screened the titles and abstracts for eligibility, discarding clearly ineligible studies. Two researchers then assessed the full texts of the remaining records for eligibility, resolving discrepancies by discussion and consensus. The two researchers then discussed their results with a third researcher and the final list of included studies was arrived at by consensus among the three researchers. Two researchers independently extracted pre-defined data from included trial records, resolving differences through discussion and consensus, with arbitration by a third researcher. We conducted descriptive analyses of extracted data in Microsoft Excel™.

Results

Our search found 14 603 COVID-19 records. We screened the titles of these records and excluded 14 427 non-vaccine articles and duplicate records. We then screened the full texts of the remaining 176 potentially eligible vaccine-related records and excluded 68. The latter were excluded either because they were not randomised trials or because they assessed non-vaccine COVID-19 prevention interventions. The remaining 108 trial records were deemed eligible and included in this review. The search and selection processes are shown in Figure 1.

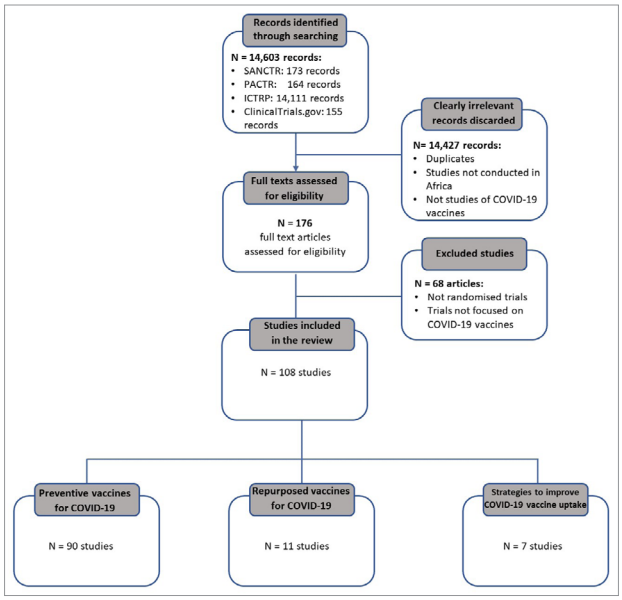

Figure 1: Flow chart showing study search and selection processes.

A total of 50% (n=54) of the trials had not yet started enrolment, 47% (n=51) were ongoing, 2% (n=2) had completed enrolment, and the status of 1% (n=1) was indicated as withdrawn. Phase 1 trials comprise 16% (n=17), 15% (n=16) are phase 2 trials, 8% (n=9) are phase 2/3 trials, 44% (n=48) are phase 3 trials, 3% (n=3) are phase 4 trials, and 14% (n=15) did not specify the trial phase. The majority (90%; n=97) of trials are recruiting people 18 years and above.

Four fifths (83%; n=90) of the trials focused on new COVID-19 candidate vaccines, 10% (n=11) assessed the effects of repurposed vaccines – including Bacille Calmette-Guérin (BCG), measles-mumps-rubella (MMR), and oral polio vaccine (OPV) – and the rest of the trials (7%) assessed effects of strategies to increase COVID-19 vaccine uptake. The candidate COVID-19 vaccines being tested in these trials use a wide range of platforms, including whole virus vaccines, protein-based vaccines, viral-vector vaccines, and nucleic acid vaccines.

Among the 108 trials, 35% (n=38) are single-site trials, 32% (n=35) are recruiting from multiple sites within one country, and 32% (n=35) are multinational trials. With 58 (54%) trials, South Africa had the highest number of trials. Other countries with multiple trial recruitment centres include (in decreasing order) Kenya, Ghana, Egypt, Uganda, and Zimbabwe; each with 15 or more trial recruitment centres (Figure 2).

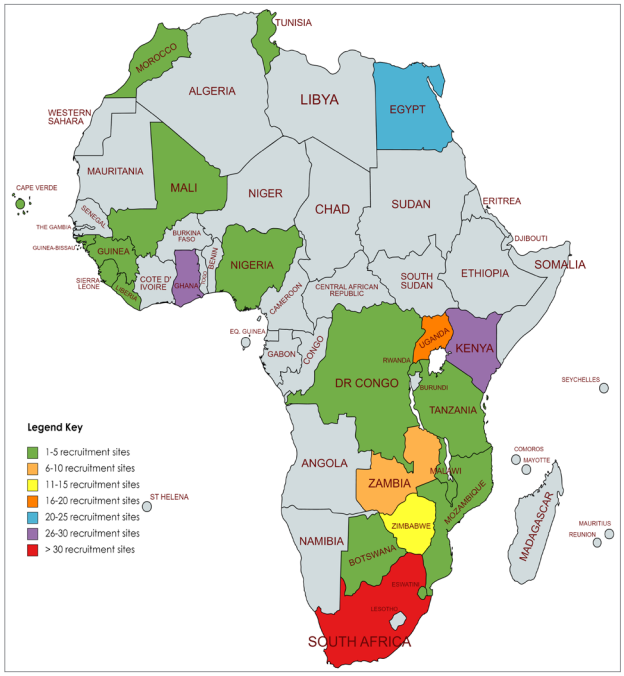

Figure 2: Location of recruitment centres of COVID-19 vaccine trials in Africa.

The principal investigators were based in African countries in 76 (70%) trials and outside Africa in 14 (13%) of the trials. In 18 (17%) trials, the location of the principal investigator was not provided. A small proportion (15%, n=16) of the trials had a summary of the results in the registry record. The funding for the trials came from industry in 30% (n=39), charities and foundations in 13% (n=14), non-industry funding agencies in 7% (n=9), universities in 6% (n=8), and governmental bodies in 5% (n=6) of the 108 trials. Similarly, the trial sponsors were from industry in 54% (n=67), universities in 20% (n=24), charities and foundations in 13% (n=14), professional societies in 6% (n=7), and non-industry funding agencies in 5% (n=6) of trials. Trials were sponsored from the African country where recruitment took place in 27% (n=29) and funded from the recruitment country in 16% (n=17) of the trials. Most sponsors (21%; n=23) and funders (19%; n=21) were from the United States of America. Other countries that sponsored five or more trials include China (13%; n=14), the Netherlands (8%; n=9), the United Kingdom (7%; n=8), and Germany (7%; n=8). Similarly, countries that funded five or more trials include China (10%; n=11), the United Kingdom (6%; n=6), and the Netherlands (5%; n=5).

On 19 May 2022, we found 1453 non-duplicate COVID-19 vaccine trial records in the ICTRP; only 108 (7%) of which had at least one recruitment site on the African continent.

Discussion

COVID-19 continues to be reported globally, with many countries reporting their highest daily infection numbers in late 2021 owing to the Omicron variant.[14,15,30,31] It is without a doubt that vaccination is one of the most effective public health interventions for life-threatening infectious diseases.[1,12] Since the beginning of this pandemic, efforts have been made to rapidly develop vaccines and therapeutics against COVID-19.[12]

At the beginning of the pandemic, Maguire and colleagues conducted searches between 23 March 2020 and 03 April 2020 in clinical trial registries and identified 728 COVID-19 studies – 294 (40%) of them randomised trials.[32] The distribution of these trials was centred in the countries most affected by COVID-19 in the previous 2 months, such as China, with very few trials planned in Africa.

We sought to describe clinical trial registry data on COVID-19 vaccine trials conducted in Africa using four registry databases (ICTRP, ClinicalTrials.gov, PACTR, and SANCTR). The ICTRP is a one-stop portal for clinical trial registry data from primary registers.[29] It was established following the Ministerial Summit on Health Research in November 2004, whose participants called for WHO to facilitate the establishment of 'a network of international clinical trials registers to ensure a single point of access and the unambiguous identification of trials'[33]. This was further expanded on during the 58th World Health Assembly that called on the global scientific community, international partners, the private sector, civil society, and other relevant stakeholders to 'establish a voluntary platform to link clinical trial registers'; a call which was supported by the International Committee of Medical Journal Editors.[33] The ICTRP facilitates prospective registration of all clinical trials and the public accessibility of that information.[29] Within the ICTRP, there is a WHO Registry Network of prospective trial registries with a forum to exchange information and establish best practices for clinical trial registration. The WHO Registry Network comprises primary registries, partner registries, and data providers. There are currently 17 primary registries in the WHO Registry Network which send data to the ICTRP monthly.[29] The only member of the WHO Registry Network in Africa is PACTR, which is hosted by the South African Medical Research Council.[28,29] PACTR was established in 2007 as the AIDS, Tuberculosis, and Malaria Clinical Trials Registry.[33] The scope of the registry expanded in 2009 to include all diseases. PACTR registers trials according to ICTRP guidelines and sends data files monthly to the ICTRP.[28] The largest provider of monthly data on randomised trials to the ICTRP is ClinicalTrials.gov, a registry based in the United States of America.[34] There is a 1-month delay between registration in PACTR and ClinicalTrials.gov, and accessibility in ICTRP as data files are sent from both registries to the ICTRP monthly. Therefore, we conducted additional searches in both PACTR and ClinicalTrials.gov where we expected most African trials to be registered.

The South African Medical Research Council also hosts SANCTR[35], which contains updated information on clinical trials being conducted in South Africa but is not yet a member of the WHO Registry Network. In 2005, the South African National Department of Health established SANCTR and mandated that all new trials planned to be conducted in South Africa be registered in the registry.[35] SANCTR is independent of PACTR, ClinicalTrials.gov, and the ICTRP as SANCTR does not feed data to any of these databases. It was necessary to search all four databases (i.e. ICTRP, ClinicalTrials.gov, PACTR, and SANCTR) to ensure that we did not miss any ongoing or planned trial in Africa.

We identified 108 vaccine-related trials conducted in Africa with South Africa having the highest number of recruitment sites as of 30 April 2022. In these clinical trials, it is encouraging that most of the principal investigators are from Africa. We further show that one third of the trials conducted in Africa are multi-site studies within the same country, while one third are multi-country studies. However, only a small proportion of the trials are funded by the African public sector.

The pandemic has prompted extraordinary efforts in research and development globally, but of the close to 1500 randomised trials of COVID-19 vaccines underway worldwide, only a small number are taking place in Africa.

There is a need for more research in Africa to provide context-specific information on the safety and efficacy of new drugs and vaccines in African populations.[36,37] The scarcity of COVID-19 trials in Africa may be attributed to uneven development of infrastructure and clinical facilities as well as the volatility of clinical regulatory timelines. In addition, commercial interests and perceived low value of the market for vaccines in Africa could be another major reason for low vaccine clinical trial activity in Africa. However, it is important to emphasise the need for clinical trial data on vaccines in different settings owing to the diversity of populations, the prevalence of background co-morbidities, and contextual differences within and across continents. More randomised trials are needed in Africa to assess the efficacy of existing COVID-19 vaccines against new variants of SARS-CoV-2 such as Omicron, which is the rapidly spreading variant of concern since late 2021.[14]

Conclusion

The paucity of COVID-19 vaccine trials conducted on the African continent is a cause for concern. This has implications for the role that Africa may play in future pandemics. The continent needs to allocate public funds to fund research, development, and innovation; invest in clinical trial capacity; and improve regulatory pathways to facilitate timely participation in vaccine trials.

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Competing interests

Three authors (C.S.W., D.N. and L.M.) are involved in managing the South African National Clinical Trials Register and the Pan African Clinical Trials Registry. Two authors (A.G. and G.G.) are principal investigators of some of the ongoing COVID-19 vaccine trials registered in the databases searched for this study. The authors have no author competing interests to declare.

Authors' contributions

C.S.W.: Conceptualisation, methodology, interpretation of results, writing of the initial draft of the manuscript, revision of subsequent versions of the manuscript, approval of final version of manuscript. D.N. and L.M.: Methodology, data collection, data analysis and interpretation, writing of the initial draft of the manuscript, revision of subsequent versions of the manuscript, approval of final version of manuscript. A.G.: Methodology, interpretation of results, revision of subsequent versions of the manuscript, approval of final version of manuscript. G.G.: Conceptualisation, interpretation of results, revision of subsequent versions of the manuscript, approval of final version of manuscript.

References

1. Centers for Disease Control and Prevention (CDC). Ten great public health achievements – United States, 1900-1999. Morbidity and Mortality Weekly Report. 1999;48(12):241–243.
2. Akobeng AK. Understanding randomised controlled trials. Arch Dis Childh. 2005;90(8):840–844. https://doi.org/10.1136/adc.2004.058222
3. Collie S, Champion J, Moultrie H, Bekker LG, Gray G. Effectiveness of BNT162b2 vaccine against Omicron variant in South Africa. New Engl J Med. 2022;386(5):494–496. https://doi.org/10.1056/NEJMc2119270
4. Khan K, Lustig G, Bernstein M, Archary D, Cele S, Karim F, et al. Immunogenicity of SARS-CoV-2 infection and Ad26.CoV2.S vaccination in people living with HIV. Clin Infect Dis. Forthcoming 2022. https://doi.org/10.1093/cid/ciab1008
5. Madhi SA, Baillie V, Cutland CL, Voysey M, Koen AL, Fairlie L, et al. Efficacy of the ChAdOx1 nCoV-19 Covid-19 vaccine against the B.1.351 variant. New Engl J Med. 2021;384(20):1885–1898. https://doi.org/10.1056/NEJMoa2102214
6. Madhi SA, Izu A, Pollard AJ. ChAdOx1 nCoV-19 vaccine efficacy against the B.1.351 variant. Reply. New Engl J Med. 2021;385(6):571–572. https://doi.org/10.1056/NEJMc2110093

7. Shinde V, Bhikha S, Hoosain Z, Archary M, Bhorat Q, Fairlie L, et al. Efficacy of NVX-CoV2373 Covid-19 vaccine against the B.1.351 variant. New Engl J Med. 2021;384(20):1899–1909. https://doi.org/10.1056/NEJMoa2103055

8. Sadoff J, Le Gars M, Shukarev G, Heerwegh D, Truyers C, De Groot AM, et al. Interim results of a Phase 1-2a trial of Ad26.COV2.S Covid-19 vaccine. New Engl J Med. 2021;384(19):1824–1835. https://doi.org/10.1056/NEJMoa2034201

9. Sadoff J, Gray G, Vandebosch A, Cardenas V, Shukarev G, Grinsztejn B, et al. Safety and efficacy of single-dose Ad26.COV2.S vaccine against Covid-19. New Engl J Med. 2021;384(23):2187–2201. https://doi.org/10.1056/NEJMoa2101544

10. Polack FP, Thomas SJ, Kitchin N, Absalon J, Gurtman A, Lockhart S, et al. Safety and efficacy of the BNT162b2 mRNA Covid-19 vaccine. New Engl J Med. 2020;383(27):2603–2615. https://doi.org/10.1056/NEJMoa2034577

11. Gray G, Collie S, Goga A, Garrett N, Champion J, Seocharan I, et al. Effectiveness of Ad26.COV2.S and BNT162b2 vaccines against Omicron variant in South Africa. New Engl J Med. 4 May 2022. https://doi.org/10.1056/NEJMc2202061

12. Wiysonge CS, Gray GE, Dhai A. The development of vaccines and immunological therapies in pandemics. In: Dhai A, Ballot D, Veller M, editors. Pandemics and health care: Principles, processes and practice. Cape Town: Juta and Company (Pty) Ltd; 2021. p. 244–261.

13. Abdool Karim SS, De Oliveira T. New SARS-CoV-2 variants – Clinical, public health, and vaccine implications. New Engl J Med. 2021;384(19):1866-1868. https://doi.org/10.1056/NEJMc2100362

14. Viana R, Moyo S, Amoako DG, Tegally H, Scheepers C, Althaus CL, et al. Rapid epidemic expansion of the SARS-CoV-2 Omicron variant in southern Africa. Nature. 2022;603:679–686. https://doi.org/10.1038/s41586-022-04411-y

15. Cele S, Jackson L, Khoury DS, Khan K, Moyo-Gwete T, Tegally H, et al. Omicron extensively but incompletely escapes Pfizer BNT162b2 neutralization. Nature. 2022;602:654–656. https://doi.org/10.1038/d41586-021-03824-5

16. Riou C, Keeton R, Moyo-Gwete T, Hermanus T, Kgagudi P, Baguma R, et al. Escape from recognition of SARS-CoV-2 Beta variant spike epitopes but overall preservation of T cell immunity. Sci Transl Med. 2021;14(631),eabj6824. https://doi.org/10.1126/scitranslmed.abj6824

17. Connolly CM, Boyarsky BJ, Ruddy JA, Werbel WA, Christopher-Stine L, Garonzik-Wang JM, et al. Absence of humoral response after two-dose SARS-CoV-2 messenger RNA vaccination in patients with rheumatic and musculoskeletal diseases: A case series. Ann Intern Med. 2021;174(9):1332–1334. https://doi.org/10.7326/M21-1451

18. Bergman P, Blennow O, Hansson L, Mielke S, Nowak P, Chen P, et al. Safety and efficacy of the mRNA BNT162b2 vaccine against SARS-CoV-2 in five groups of immunocompromised patients and healthy controls in a prospective open-label clinical trial. eBioMedicine. 2021;74, Art. #103705. https://doi.org/10.1016/j.ebiom.2021.103705

19. Erol Ç, Yanık Yalçın T, Sarı N, Bayraktar N, Ayvazoğlu Soy E, Yavuz Çolak M, et al. Differences in antibody responses between an inactivated SARS-CoV-2 vaccine and the BNT162b2 mRNA vaccine in solid-organ transplant recipients. Exp Clin Transplant. 2021;19(12):1334–1340. https://doi.org/10.6002/ect.2021.0402

20. Ruddy JA, Boyarsky BJ, Bailey JR, Karaba AH, Garonzik-Wang JM, Segev DL, et al. Safety and antibody response to two-dose SARS-CoV-2 messenger RNA vaccination in persons with HIV. AIDS (London, England). 2021;35(14):2399-2401. https://doi.org/10.1097/QAD.0000000000003017

21. Ruddy JA, Boyarsky BJ, Werbel WA, Bailey JR, Karaba AH, Garonzik-Wang JM, et al. Safety and antibody response to the first dose of severe acute respiratory syndrome coronavirus 2 messenger RNA vaccine in persons with HIV. AIDS. 2021;35(11):1872–1874. https://doi.org/10.1097/QAD.0000000000002945

22. GBD-2017. Global, regional, and national incidence, prevalence, and mortality of HIV, 1980-2017, and forecasts to 2030, for 195 countries and territories: A systematic analysis for the Global Burden of Diseases, Injuries, and Risk Factors Study 2017. Lancet HIV. 2019;6(12):e831–e859.

23. Gona PN, Gona CM, Ballout S, Rao SR, Kimokoti R, Mapoma CC, et al. Burden and changes in HIV/AIDS morbidity and mortality in Southern Africa Development Community Countries, 1990-2017. BMC Public Health. 2020;20(1):867. https://doi.org/10.1186/s12889-020-08988-9

24. Buchbinder SP, Mehrotra DV, Duerr A, Fitzgerald DW, Mogg R, Li D, et al. Efficacy assessment of a cell-mediated immunity HIV-1 vaccine (the Step Study): A double-blind, randomised, placebo-controlled, test-of-concept trial. Lancet. 2008;372(9653):1881–1893. https://doi.org/10.1016/S0140-6736(08)61591-3

25. Huang Y, Follmann D, Nason M, Zhang L, Huang Y, Mehrotra DV, et al. Effect of rAd5-Vector HIV-1 preventive vaccines on HIV-1 acquisition: A participant-level meta-analysis of randomized trials. PLoS ONE. 2015;10(9), e0136626. https://doi.org/10.1371/journal.pone.0136626

26. Gray GE, Allen M, Moodie Z, Churchyard G, Bekker LG, Nchabeleng M, et al. Safety and efficacy of the HVTN 503/Phambili study of a clade-B-based HIV-1 vaccine in South Africa: A double-blind, randomised, placebo-controlled test-of-concept phase 2b study. Lancet Infect Dis. 2011;11(7):507–515. https://doi.org/10.1016/S1473-3099(11)70098-6

27. Logunov DY, Dolzhikova IV, Shcheblyakov DV, Tukhvatulin AI, Zubkova OV, Dzharullaeva AS, et al. Safety and efficacy of an rAd26 and rAd5 vector-based heterologous prime-boost COVID-19 vaccine: An interim analysis of a randomised controlled phase 3 trial in Russia. Lancet. 2021;397(10275):671-681. https://doi.org/10.1016/S0140-6736(21)00234-8

28. Ndwandwe DE, Runeyi S, Pienaar E, Mathebula L, Hohlfeld A, Wiysonge CS. Practices and trends in clinical trial registration in the Pan African Clinical Trials Registry (PACTR): A descriptive analysis of registration data. BMJ Open. 2022;12(1), e057474. https://doi.org/10.1136/bmjopen-2021-057474

29. World Health Organization. International Clinical Trials Registry Platform (ICTRP) [webpage on the Internet]. No date [cited 2022 Feb 08]. Available from: https://www.who.int/clinical-trials-registry-platform

30. GBD. Pandemic preparedness and COVID-19: An exploratory analysis of infection and fatality rates, and contextual factors associated with preparedness in 177 countries, from Jan 1, 2020, to Sept 30, 2021. Lancet. 2022;399:1489–1512. https://doi.org/10.1016/S0140-6736(22)00172-6

31. Mahase E. Omicron: South Africa says fourth wave peak has passed as it lifts curfew. BMJ. 2022;376, o7. https://doi.org/10.1136/bmj.o7

32. Maguire BJ, McLean ARD, Rashan S, Antonio ES, Bagaria J, Bentounsi Z, et al. Baseline results of a living systematic review for COVID-19 clinical trial registrations [version 1; peer review: 2 approved]. Wellcome Open Res. 2020;5:116. https://doi.org/10.12688/wellcomeopenres.15933.1

33. Abrams A, Siegfried N. A Pan African Clinical Trials Registry for the specific needs of triallists on the continent. S Afr Med J. 2010;100(5):294–295. https://doi.org/10.7196/SAMJ.3933

34. Merson L, Ndwandwe D, Malinga T, Paparella G, Oneil K, Karam G, et al. Promotion of data sharing needs more than an emergency: An analysis of trends across clinical trials registered on the International Clinical Trials Registry Platform [version 1; peer review: 2 approved]. Wellcome Open Res. 2022;7:101. https://doi.org/10.12688/wellcomeopenres.17700.1

35. National Department of Health, South Africa. South African National Clinical Trials Register [webpage on the Internet]. No date [cited 2022 Feb 08]. Available from: https://sanctr.samrc.ac.za/

36. Agoro R. In the COVID-19 era, let's keep an eye on clinical trials in Africa. J Glob Health. 2020;10(2), Art. #020312. https://doi.org/10.7189/jogh.10.020312

37. Nkeck JR, Ndoadoumgue AL, Temgoua MN. COVID 19 pandemic, status of clinical trials in Africa on May 2020: Need to reinforce. Pan Afr Med J. 2020;35(suppl 2):87. https://doi.org/10.11604/pamj.supp.2020.35.2.24349

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The ethics behind mandatory COVID-19 vaccination post-Omicron: The South African context

The legitimacy of mandatory vaccine policies is underscored by a public health ethics framework based on the principles of limited autonomy, social justice and the common good. Ideally, vaccine uptake ought to occur on a voluntary basis as an act of solidarity to ensure that everyone is protected. Given that the altruistic approach has failed and vaccine uptake remains sub-optimal in South Africa, in this paper, I argue for vaccine mandates, in a post-Omicron context. This viewpoint is substantiated by several considerations. Healthcare workers are fatigued after 2 years of treating COVID-19 and many are still treating patients with post-viral syndromes, mental health conditions and cardiovascular complications. Health systems remain under pressure as people with non-COVID diseases, neglected during the pandemic, are also now presenting to medical practices and hospitals. Although South Africa has emerged from a relatively less severe fourth wave of COVID-19, there have been many deaths. Vaccine and natural immunity in a relatively young general population has been advantageous. However, the country has a high prevalence of HIV and those who are untreated may not be able to clear the coronavirus easily. Similarly chronic illnesses place many at risk for severe disease from COVID variants, especially if unvaccinated. The future is shrouded in uncertainty. The next variant could be similar to or less severe than Omicron, yet still impact negatively on health systems, education and the economy. Physical distancing is not ideal in many low socio-economic settings, making vaccines an important component of our prevention toolbox. Our safest option now is to ensure that as many South Africans as possible are vaccinated and receive boosters. Vaccine mandates work to achieve this end.

Significance:

The legitimacy of COVID-19 vaccine mandates post-Omicron is explored from an ethical perspective, given that the fifth wave remains unpredictable in South Africa – a country with a high prevalence of HIV, vulnerable unvaccinated adults and children, and fragile public health systems. The emergence of new variants is uncertain. However, vaccines are central to an appropriate response to protect public health, health systems and the economy.

Introduction

A vibrant debate on mandatory vaccines was triggered in 2021.[1,2] In response to the COVID-19 pandemic, ethicists, scientists and legal experts have argued strongly for compulsory vaccination[3-5], especially in the context of the emergence of new variants and high numbers of unvaccinated people globally[6]. Scientists and clinicians have expressed fears that vaccine hesitancy and poor vaccine coverage have the potential to lead to the development of variants that would be resistant to existing vaccines. On 25 November 2021, South African scientists announced a new variant discovered in Botswana, now globally known as Omicron.[7] This new 'variant of concern' resulted in global chaos – financial markets tumbled, unjustifiable travel restrictions were imposed on various southern African countries, and health facilities started preparing for a new surge of patient admissions.[8]

The Omicron variant, despite its genetically concerning highly mutated profile, has had a variable clinical impact across the globe, depending on a country's co-morbidity profile, age distribution, obesity prevalence, vaccination status and incidence of prior infection.[9] High transmissibility has overwhelmed some health systems[10] and some of the vulnerable patients who were unvaccinated or partially vaccinated became seriously ill or died. In the USA, where there are large numbers of unvaccinated people, during a 7-week period from mid-December 2021 to early February 2022, 100 000 people died.[11] This brought the death toll from COVID-19 in that country to almost 1 million. In South Africa, the rise of new cases was dramatically faster than in previous waves; the peak of infections was reached rapidly and then started to tail off with approximately 1557 new cases per day at the end of March 2022. By the end of April 2022, new cases had risen to 5062 per day. Of the 1912 COVID patients in hospital in South Africa on 29 March 2022, 76% were unvaccinated.[12] A combination of factors led to a relatively less severe wave in South Africa – high levels of natural immunity from exposure during the previous waves when vaccines were not available in the country, moderate vaccine-induced immunity, mandatory masking policies, warm weather and a relatively younger population compared to many countries in the Global North.[13] Despite this scenario, and in anticipation of a fifth wave closer to winter in the southern hemisphere, there are several compelling reasons to improve vaccine uptake and to use the most efficient and ethically justifiable way to do so. The ethical and public health justifications for vaccine mandates in South Africa, post-Omicron, are explored in this article.

Ethical justification for vaccine mandates

Pre-requisites: Supply, safety and efficacy

An important pre-requisite for implementing vaccine mandates in high-risk environments is an adequate, free and accessible supply of safe and effective COVID-19 vaccines. This condition has been met in South Africa despite global vaccine inequity.[14,15] While current vaccination centres are widely distributed throughout the country and are

supplemented by pop-up vaccination sites, there is room for improvement in terms of even better access via primary healthcare providers and hospitals. The Omicron variant has created concern about vaccine efficacy due to breakthrough infections in partially and fully vaccinated people, especially those with co-morbidities. However, the vaccines currently available in South Africa (Pfizer and Johnson & Johnson) have proven efficacy in reducing severe illness and death.[16,17] Some argue that rapid development of COVID-19 vaccines means that safety and efficacy standards were bypassed. However, mRNA technology has been in development for the past two to three decades.[18] Furthermore, billions of COVID-19 vaccine doses have been administered globally and have demonstrated good safety data. This includes protection from severe disease and death in most cases. Only a minority, most with underlying risk factors, have experienced serious side effects.[19-22] In most cases, these side effects are temporary and reversible.[19-22]

Natural COVID-19 infections, on the other hand, may be mild, moderate or severe. Depending on underlying conditions, obesity and other risk factors, irrespective of age, the impact on health could be severe and persist long after the acute infection.[23] Complications described in a recent study of 11 million people who had natural COVID-19 infections included increased risk of cardiovascular disease – cerebrovascular disorders (strokes), dysrhythmias, ischaemic and non-ischaemic heart disease, pericarditis, myocarditis, heart failure and thromboembolic disease.[24] These risks were detected among people who were not hospitalised during the acute phase of the infection and increased if they were hospitalised or admitted to intensive care.[24] This study provides evidence that 'the risk and 1-year burden of cardiovascular disease in survivors of acute COVID-19 are substantial'[24]. Overall, comparing the complications of natural COVID-19 infection, with vaccine side effects, the risk–benefit assessment favours vaccines as a safer option.

A public health ethics approach

Having established the safety and efficacy of COVID-19 vaccines, a public health ethics approach is best suited to guide decision-making and policy development. Such an approach is based on the principles of solidarity, efficiency, effectiveness, transparency and proportionality.[25] This approach is intended to save lives and minimise disease during a public health outbreak, to use limited resources efficiently, to create social cohesion in the public interest, and to build public trust. In addition, a human rights framework supports this approach. The Siracusa Principles on the Limitation and Derogation Provisions in the International Covenant on Civil and Political Rights adopted by the United Nations Economic and Social Council in 1985, have reference.[26] These principles are now firmly enshrined in international human rights law and standards and are reflected in Section 36 of the South African Constitution[27] that deals with limitation of rights. According to these principles, any restriction on human rights must be based in law. The *National Health Act No. 61 of 2003*[28], via regulations relating to notifiable medical conditions, and the *Disaster Management Act*[29] apply. Furthermore, restrictions on individual rights imposed via vaccination must be based on a legitimate objective and must be strictly necessary for the achievement of the policy objective. The objectives of reducing the risk of transmission of infection, reducing severe disease, minimising death, and preserving health systems and health personnel are unambiguously in the public interest.

Procedural justice

In the corporate setting and other work environments, guidelines for implementing vaccine mandates are based on the rights of employees and employers to a safe working environment.[30] Procedural justice underscores the implementation. A process of risk assessment in the workplace, employee engagement, and consideration of exemptions and alternatives are critical. Medical exemptions include a severe allergic reaction to the first dose of a COVID-19 vaccine, allergy to specific components of a vaccine and a few other medical indications. These include a prior diagnosis of an autoimmune inflammatory condition affecting the neurological, haematological or cardiovascular systems such as Guillain-Barré syndrome and immune thrombocytopaenic purpura. Some medical conditions (haemophilia or Von Willebrand's disease) may be associated with a bleeding risk, especially intramuscular bleeding post vaccination.[31]

Authentic religious objections are rare as most major world religions promote vaccination. Religious teachings generally support vaccination as an 'act of love' and a moral obligation towards fellow human beings.[32] Some groups have raised arguments based on a misperception that COVID-19 vaccines contain aborted foetal cells. Decades ago, these cells were used to create 'immortal' cell lines for vaccine and other drug research including research for several processed food additives. Many commonly used drugs were developed based on this type of research such as aspirin, Brufen®, Tylenol®, Benadryl, azithromycin and Zoloft®.[33] Claiming a religious objection based on aborted foetal cell associated research would require people to refuse to take a wide range of medication that they have already been using for decades. Such arguments therefore fail the test of consistency and authenticity.[34]

The South African Bill of Rights (section 36) specifies that any limitation of rights must be 'reasonable and justifiable in an open and democratic society based on human dignity, equality and freedom' and that the restriction must be proportional to the purpose of the limitation. Crucially, such restrictions must be based on scientific evidence and should not be arbitrary, discriminatory or unreasonable.

A public health ethics approach supports limitation of individual rights for the greater good and promotion of solidarity. Despite this, the South African government failed to implement mandates when they were most needed. It is, therefore, mainly private organisations that are implementing vaccine mandates.[35] In operationalising vaccination, according to the Siracusa Principles and the limitation clause of the Constitution, the least restrictive and intrusive means must be used. Options that are less restrictive than mandates include nudges and incentives. Some retail outlets are offering incentives to vaccination; these initiatives constitute a less restrictive strategy than mandatory vaccination, but as a behavioural strategy they may have small, only temporary benefits, increasing health promoting behaviours by 2–5 percentage points on average.[36] Such strategies have been implemented with variable efficacy in pre-pandemic times. They are unlikely to drive vaccine uptake sufficiently to control the pandemic. Vaccine mandates, on the other hand, have been shown to increase vaccine uptake by around 18 percentage points.[37] In South Africa, the private health insurer Discovery Limited successfully increased vaccine uptake amongst employees from 22% in September 2021 to 94% in November 2021.[38] Globally, studies are now emerging to demonstrate the efficacy of vaccine mandates.[39] Despite legal challenges to vaccine mandates in various work environments, the Commission for Conciliation, Mediation and Arbitration (CCMA), has so far supported vaccine mandates and ruled in favour of employers.[40,41]

Further ethical and public health considerations

Sub-optimal vaccine uptake

Despite adequate supplies of vaccines in South Africa for over a year, coupled with education campaigns and improved access across the country, we remain well below the target of 300 000 doses per day. For the past month (March 2022), vaccine uptake has consistently remained at under 80 000 doses a day. Under these circumstances, the potential for vaccine wastage looms large. Previous media publications have already alluded to undisclosed wastage.[42,43] This ought to have been a stimulus for government to introduce mandates because vaccine wastage, in and of itself, is unethical. Further reports from the Department of Health indicate that South Africa has 30 million vaccine doses for 2022. While Johnson & Johnson doses will only expire in 2023, around 90 000 Pfizer vaccines were destroyed due to expiration on 31 March 2022 as vaccine uptake had not improved in South Africa. Further doses of Pfizer vaccines will expire in June–July 2022.[44]

Children are at risk in South Africa and other sub-Saharan countries

Globally, there were higher numbers of hospitalisations of children during the fourth wave than during previous waves due to the high transmissibility of the Omicron variant.[45] In sub-Saharan African

countries including South Africa, children with underlying conditions had higher morbidity and mortality related to Omicron infection than children in high-income countries.[46] Given that vaccine rollout started in adults, children over 5 years were offered vaccines only recently and uptake has not been sufficient. With schools reopening in South Africa, this is a high-risk group to trigger further outbreaks. In the Western Cape alone, only 19.27% of those aged 12–17 years are vaccinated with at least one dose.[47] Given that South Africa has a culture of multigenerational households, the youth risk infecting older family members who are also likely to have a higher prevalence of co-morbidities. Most importantly, compared to the previous three waves, more young people died of COVID-19 during the recent fourth wave.[44]

The immunosuppressed remain at risk

HIV and COVID-19 are synergistic pandemics in South Africa. Almost 8 million of our population of 60 million is infected with HIV.[48] During the past 2 years, access to antiretroviral treatment has been sub-optimal. Furthermore, socio-economic conditions in South Africa make physical distancing challenging in informal settlements. Unsurprisingly, many HIV-infected people have low CD4 counts and are at risk of contracting other infections, including COVID-19. Studies have shown that HIV infection resulted in doubling of mortality resulting from COVID-19. This group of patients remains at high risk for COVID-19 and must be prioritised for vaccines and boosters.[49]

Health systems remain under pressure

Although severity of disease with Omicron was significantly reduced, and healthcare institutions coped with the fourth wave admissions, it is important not to overlook the context of the national burden of all-cause disease. South Africa has a high burden from diseases including tuberculosis, HIV and non-communicable conditions.[50] All these may increase the risk of developing severe COVID-19 infection. During the four waves of COVID-19 infection, hospitals diverted treatment away from other non-COVID conditions and de-escalated elective procedures and surgery. For many patients with chronic conditions, treatment was interrupted and illnesses spiraled out of control. This was the harsh reality and consequence of unvaccinated patients occupying hospitals beds and ICUs unnecessarily.[51] If the fifth wave has a variant as severe or less severe than Omicron but with similar or higher transmissibility, hospitals could easily be overwhelmed, especially if uptake of booster doses is poor and if the 31.65% over 50 years in the Western Cape alone, remain unvaccinated.[47] In some high-income countries, monoclonal antibodies are in routine use in hospitals to treat COVID-19 symptoms.[52] This is not the case in South Africa. Even though antiviral drugs like Paxlovid™ may become available in some settings to treat COVID-19 in the first 3 days of symptom onset, this will not be an option in South Africa due to potential high costs and lack of early diagnosis. Post-viral syndromes or long COVID linger for several months after natural infection and are straining clinical services globally including in South Africa.[53] A study of 6180 participants aged 18–69 years compared the risk of the vaccinated contracting long COVID compared to the unvaccinated. Researchers found a 41.1% decrease in the odds of self-reported long COVID at least 3 months later compared to socio-demographically similar study participants who were unvaccinated when infected.[54] Even more concerning are the long-term cardiovascular complications of natural COVID-19. If up to a year after a natural COVID-19 infection, even those who were not hospitalised for COVID-19 develop serious cardiovascular complications like stroke, thromboses and dysrhythmias, hospitals and medical practices could be busier than during pre-pandemic times.[24] Recent studies have also shown that natural COVID-19 infection causes significant brain damage.[55] As we approach winter, co-infection with SARS-CoV-2 and influenza viruses will pose a substantial risk as studies show worse outcomes when both viral illnesses co-exist.[56]

Compassion fatigue amongst healthcare professionals

The pandemic has been physically and emotionally exhausting for healthcare professionals globally. South Africa is no exception. Healthcare professionals are becoming less sympathetic towards those who deliberately decline vaccines, especially if they have no medical contraindication to justify an exemption.[57] Many have witnessed severe illness or death predominantly amongst the unvaccinated or partially vaccinated in the fourth wave.[58] Critical care staff have noted that patients who do not have COVID-19 have been deprived of timeous care or access to an ICU because critical care units have been overrun by non-compliant COVID-19 patients despite an abundant vaccine supply in South Africa. If the fifth wave is closer to winter in South Africa, hospitals could become extremely busy due to a combination of illnesses. This will include COVID-19 and severe influenza, those with post-COVID-19 complications from the previous four waves, and non-COVID illnesses and trauma. A potential ethical dilemma could arise should critical care beds become severely limited. When all these patients are competing for beds, will vaccination status as a surrogate for prognosis become an important deciding factor? The basis for triage criteria is prognosis. Other factors being equal, an unvaccinated person may have a worse chance of recovery from severe COVID-19 than would a fully vaccinated person.[58] Triage decisions are challenging logistically and raise complex ethical concerns. It is important to document accurately the reasons patients refused to be vaccinated, within a supportive context where health professionals offer appropriate counselling to increase uptake. It may not be easily defensible to use vaccination status as a triage criterion in the absence of full documentation around reasons why vaccination has not taken place. Although it is unlikely that fully vaccinated and boosted patients will develop severe disease in future waves, co-infection with influenza could exacerbate the clinical presentation.[56] It is highly likely that partially vaccinated patients will be at risk. If, however, unvaccinated patients fill ICU and care facilities, this may reduce access for patients with non-COVID-19 illnesses requiring hospitalisation or critical care, and this is worrying. The death rate in the USA is about 13-fold higher in unvaccinated patients compared to those who have had two vaccine doses.[59] In South Africa, 90% of hospital patients who died were either unvaccinated or partially vaccinated.[58]

Mandatory vaccination in health or care environments

Healthcare professionals are duty bound to protect patients and prevent harm – *primum non nocere*. Patient safety is a primary ethical obligation. It is also essential that health workers are appropriately protected. The South African Constitution in section 23 indicates that 'Everyone has a right to fair labour practices'[27]. Everyone includes employers and employees. It is incumbent on employees as far as possible to ensure a safe working environment for all. Counselling of medical and care staff about the benefits of vaccination is important, but within the context of the *Disaster Management Act*[29] and the *National Health Act*[28], the issue of public interest, health and safety also needs to be considered. Competing entitlements in the Bill of Rights can be resolved through appropriate application of section 36 of the South African Constitution in which limitation of rights in the interest of the public good may occur.

Vaccine mandates on university campuses

University campuses are high risk because they involve congregate activities in indoor lecture venues and in residences. Furthermore, the nature of academic programmes is such that unnecessary interruptions must be avoided at all costs. Outbreaks at academic institutions will potentially involve large numbers of students and staff making these settings high risk for 'superspreader' events.[59] Despite the potential for a new variant to cause relatively less severe disease, those who are symptomatic will need to isolate for a minimum of a week. Where many students are involved from different disciplines, the potential for disruption of teaching and/or examinations is substantial. Academic and administrative staff who are older and who may have co-morbidities are at risk in multigenerational contexts. Those with immunosuppression due to HIV and other diseases are also at risk. The University of the Witwatersrand and the University of the Western Cape, among others, have implemented vaccine mandates[60]; University of Cape Town and Stellenbosch University are in the process of stakeholder engagement as part of the policy development process[31,61]. Transitioning from online teaching to in-person education is imperative in South Africa given the digital divide between privileged and historically disadvantaged students. Vaccine mandates on university campuses are in the best interests of students and staff alike.

Vaccine mandates for international travel

International travel currently is impossible without proof of COVID-19 vaccination and negative test results, even post-Omicron. Prior to the pandemic, yellow fever vaccination was mandatory for entry into some countries. This is authorised by annex 7 of the International Health Regulations (2005) that provide an 'overarching legal framework that defines countries' rights and obligations in handling public health events and emergencies that have the potential to cross borders'[62]. Intended to protect the rights of travellers and airline staff, these regulations are legally binding in 196 countries. Article 31 of the International Health Regulations allows governments to require 'proof of vaccination or other prophylaxis, legitimising vaccine mandates in the context of international travel'. Consequently, vaccine mandates for airline travel are likely to be required for several months until COVID-19 is no longer regarded as a public health threat.

Recommendations

As long as COVID-19 incidence is high in some countries (in Europe, UK, Hong Kong), it remains a global threat due to international travel.[63,64] All indoor congregate settings remain high risk environments in South Africa, even post-Omicron. The duration of exposure and ventilation are important contributing factors. Using the number of occupants as the only factor in indoor settings where prolonged exposure occurs (university campuses), is insufficient. Vaccine mandates and masking are important in such settings. Likewise, in indoor venues where masks are removed, such as restaurants or communal campus dining halls, proof of vaccination or recent negative COVID-19 tests (within 72 hours) are essential.

Conclusion

The combined effect of vaccine derived and natural immunity, warm weather and a younger population resulted in a less severe fourth or 'Omicron' wave in South Africa. Unlike healthcare systems in Europe and the USA, our hospitals were busy but not completely overwhelmed during this wave. In many ways, Omicron provided evidence that vaccines work. As we exit the fourth wave, a cautiously optimistic approach is warranted. However, South Africa has a high burden of disease that increases the risk of developing severe COVID-19 infection. This risk exists even if the next variant, predicted to appear in late April to May 2022[64,65], is more or less transmissible than Omicron. Long COVID and cardiovascular complications of COVID-19[18] remain a challenge. Socio-economic impacts could potentially be catastrophic as clinical severity is unpredictable at the time a new variant is announced. The unvaccinated account for the majority of severe infections, blocking beds for patients with serious non-COVID conditions. Vaccines, including boosters, remain the mainstay of prevention and mandates will improve vaccine uptake, protect health and health systems and promote economic revival. A combination of non-pharmacological measures and high vaccine coverage will prepare us better for the fifth wave, irrespective of its severity. In South Africa, vaccine mandates for high-risk congregate settings will help us to achieve this end. The Department of Health has published new and somewhat confusing regulations that require vaccine certificates or negative COVID-19 tests in all indoor congregate settings exceeding 1000 people. Likewise, this requirement holds in outdoor venues exceeding 2000 people.[66] While this is a small step in the right direction, it leaves many other indoor congregate settings such as university campuses open to potential spread of infection where less than 1000 students spend long hours in indoor settings.

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Competing interests

I have no competing interests to declare.

References

1. De Vos P. The government could – and should – compel vaccinations in South Africa for the greater good. The Daily Maverick. 2021 Feb 07 [cited 2022 Mar 29]. Available from: https://www.dailymaverick.co.za/opinionista/2021-02-07-the-government-could-and-should-compel-vaccinations-in-south-africa-for-the-greater-good/
2. Moodley K. Why COVID-19 vaccines should be mandatory in South Africa. The Conversation. 2021 Nov 10 [cited 2022 Mar 29]. Available from: https://theconversation.com/why-covid-19-vaccines-should-be-mandatory-in-south-africa-165682
3. Cheadle H. Mandatory vaccine policies will survive a constitutional challenge. The Daily Maverick. 2021 Nov 10 [cited 2022 Mar 29]. Available from: https://www.dailymaverick.co.za/article/2021-11-10-mandatory-vaccine-policies-will-survive-a-constitutional-challenge-legal-expert-halton-cheadle/
4. De Vos P. The law and the greater good: Why I support a Covid-19 vaccine requirement at UCT. The Daily Maverick. 2021 Sep 15 [cited 2022 Mar 29]. Available from: https://www.dailymaverick.co.za/article/2021-09-15-the-law-and-the-greater-good-why-i-support-a-covid-19-vaccine-requirement-at-uct-part-two/
5. Moodley K. Vaccine mandates in South Africa: Where are they most needed? The Conversation. 2021 Dec 07 [cited 2022 Mar 29]. Available from: https://theconversation.com/vaccine-mandates-in-south-africa-where-are-they-most-needed-173253
6. Meuller B, Lutz E. US has far higher death rate than other wealthy countries. New York Times. 2022 Feb 01 [cited 2022 Mar 29]. Available from: https://www.nytimes.com/interactive/2022/02/01/science/covid-deaths-united-states.html
7. National Institute of Communicable Diseases. New variant detected in South Africa [webpage on the Internet]. c2021 [cited 2022 Mar 29]. Available from: https://www.nicd.ac.za/new-covid-19-variant-detected-in-south-africa/#:~:text=The%20National%20Institute%20for%20Communicable,positive%20cases%20of%20variant%20B
8. Mendelson M, Venter F, Moshabela M, Gray G, Blumberg L, de Oliveira T, et al. The political theatre of the UK's travel ban on South Africa. Lancet. 2021;398(10318):2211–2213. https://doi.org/10.1016/S0140-6736(21)02752-5
9. Mahase E. Omicron: South Africa says fourth wave peak has passed as it lifts curfew. BMJ. 2022;376, o7. https://doi.org/10.1136/bmj.o7
10. Mahase E. Covid-19: Hospital admission 50-70% less likely with omicron than delta, but transmission a major concern. BMJ. 2021;375, n3151. https://doi.org/10.1136/bmj.n3151
11. Bosman J, Smith M. US Covid death toll surpasses 900 000 as Omicron spread slows. New York Times. 2022 Feb 08 [cited 2022 Mar 29]. Available from: https://www.nytimes.com/2022/02/04/us/us-covid-deaths.html
12. South African Department of Health. Update on Covid-19 [webpage on the Internet]. SAcoronavirus. c2022 [cited 2022 Mar 30]. Available from: https://sacoronavirus.co.za/2022/03/29/update-on-covid-19-tuesday-29-march-2022/
13. The Scientists Collective. Variants, the fourth wave, vaccines and the unlikelihood of herd immunity: What might happen in South Africa? Daily Maverick. 2021 Nov 15 [cited 2022 Mar 30]. Available from: https://www.dailymaverick.co.za/article/2021-08-15-variants-the-fourth-wave-vaccines-and-the-unlikelihood-of-herd-immunity-what-might-happen-in-south-africa/
14. Moodley K, Rossouw T. What could fair allocation of an efficacious COVID-19 vaccine look like in South Africa? The Lancet Global Health. 2021;9(2):106-107. https://doi.org/10.1016/S2214-109X(20)30474-5
15. Moodley K. Vaccine inequity is unethical. Nat Hum Behav. 2022;6(2):168-169. https://doi.org/10.1038/s41562-022-01295-w
16. Collie S, Champion J, Moultrie H, Bekker L-G, Gray G. Effectiveness of BNT162b2 vaccine against omicron variant in South Africa. New Engl J Med. 2022;386(5):494–496. https://doi.org/10.1056/NEJMc2119270
17. Bekker L-G, Garrett N, Goga A, Fairall L, Reddy T, Yende-Zuma N, et al. Effectiveness of the Ad26.COV2.S vaccine in health-care workers in South Africa (the Sisonke study): Results from a single-arm, open-label, phase 3B, implementation study. The Lancet. 2022;399(10330):1141–1153. https://doi.org/10.1016/S0140-6736(22)00007-1

18. Zhang C, Maruggi G, Shan H, Li J. Advances in mRNA vaccines for infectious diseases. Front Immunol. 2019;10. https://doi.org/10.3389/fimmu.2019.00594

19. Polack FP, Thomas SJ, Kitchin N, Absalon J, Gurtman A, Lockhart S, et al. Safety and efficacy of the BNT162b2 mRNA Covid-19 vaccine. N Engl J Med. 2020;383(27):2603–2615. https://doi.org/10.1056/NEJMoa2034577

20. Anand P, Stahel VP. The safety of Covid-19 mRNA vaccines: A review. Patient safety in surgery. 2021;15(1):20. https://doi.org/10.1186/s13037-021-00291-9

21. Takuva S, Takalani A, Seocharan I, Yende-Zuma N, Reddy T, Engelbrecht I, et al. Safety of the single-dose Ad26.CoV2.S vaccine among healthcare workers in the phase 3b Sisonke study in South Africa [preprint]. medRxiv. 2021 Dec 21. https://doi.org/10.1101/2021.12.20.21267967

22. Barda N, Dagan N, Ben-Shlomo Y, Kepten E, Waxman J, Ohana R, et al. Safety of the BNT162b2 mRNA Covid-19 vaccine in a nationwide setting. New Engl J Med. 2021;385(12):1078–1090. https://doi.org/10.1056/NEJMoa2110475

23. Crook H, Raza S, Nowell J, Young M, Edison P. Long covid-mechanisms, risk factors, and management. BMJ. 2021;374, n1648. https://doi.org/10.1136/bmj.n1648

24. Xie Y, Xu E, Bowe B, Al-Aly Z. Long-term cardiovascular outcomes of COVID-19. Nat Med. 2022;28(3):583–590. https://doi.org/10.1038/s41591-022-01689-3

25. Schröder-Bäck P, Duncan P, Sherlaw W, Brall C, Czabanowska K. Teaching seven principles for public health ethics: Towards a curriculum for a short course on ethics in public health programmes. BMC Med Ethics. 2014;15(1):73. https://doi.org/10.1186/1472-6939-15-73

26. United Nations Economic and Social Council. Siracusa Principles on the limitations and derogation of provisions in the International Covenant on Civil and Political Rights [document on the Internet]. c1984 [cited 2022 Mar 29]. Available from: https://www.refworld.org/pdfid/4672bc122.pdf

27. Constitution of the Republic of South Africa. No 108 of 1996. Government Gazette; 1996. Available from: https://www.gov.za/sites/default/files/images/a108-96.pdf

28. Republic of South Africa. National Health Act 61 of 2003. Available from: https://www.gov.za/documents/national-health-act

29. Republic of South Africa. Declaration of a National State of Disaster. Disaster Management Act, Republic of South Africa. Government Gazette No. 43096:313; 2022. Available from: https://www.gov.za/sites/default/files/gcis_document/202004/43217gon457s.pdf

30. Department of Employment and Labour. Employment and Labour Minister issues new direction with regard to vaccination in the workplace [webpage on the Internet]. c2021 [cited 2022 Mar 29]. Available from: https://www.labour.gov.za/employment-and-labour-minister-issues-new-direction-with-regard-to-vaccination-in-the-workplace

31. University of Cape Town. Call for comment on draft UCT vaccine mandate policy [webpage on the Internet]. c2022 [cited 2022 Mar 29]. Available from: https://www.news.uct.ac.za/article/-2021-12-20-call-for-comment-on-draft-uct-vaccine-mandate-policy

32. Watkins D. Pope Francis urges people to get vaccinated against Covid-19. Vatican News. 2021 Aug 18 [cited 2022 Mar 29]. Available from: https://www.vaticannews.va/en/pope/news/2021-08/pope-francis-appeal-covid-19-vaccines-act-of-love.html

33. Zimmerman RK. Helping patients with ethical concerns about COVID-19 vaccines in light of fetal cell lines used in some COVID-19 vaccines. Vaccine. 2021;39(31):4242–4244. https://doi.org/10.1016/j.vaccine.2021.06.027

34. Wynia MK, Harter TD, Eberl JT. Why a universal COVID-19 vaccine mandate is ethical today. Health Affairs Blog. c2021 [cited 2022 Mar 29]. Available from: https://www.healthaffairs.org/do/10.1377/forefront.20211029.682797/full/

35. Gore A. Why we are mandating vaccines for Discovery's SA based employees. Business Day. 2021 Sep 06 [cited 2022 Mar 29]. Available from: https://www.businesslive.co.za/bd/opinion/2021-09-05-adrian-gore-why-we-are-mandating-vaccines-for-discoverys-sa-based-employees/

36. Klüver H, Hartmann F, Humphreys M, Geissler F, Giesecke J. Incentives can spur COVID-19 vaccination uptake. Proc Natl Acad Sci USA. 2021;118(36), e2109543118. https://doi.org/10.1073/pnas.2109543118

37. Community Preventive Services Task Force. Increasing appropriate vaccination: Vaccination requirements for childcare, school and college attendance [document on the Internet]. c2016 [cited 2022 Mar 29]. Available from: https://www.thecommunityguide.org/sites/default/files/assets/Vaccination-Requirements-for-Attendance_1.pdf

38. BusinessTech. Why Discovery introduced mandatory vaccines in South Africa and why some workers said no [webpage on the Internet]. c2021 [cited 2022 Mar 29]. Available from: https://businesstech.co.za/news/business/543028/why-discovery-introduced-mandatory-vaccines-in-south-africa-and-why-some-workers-said-no/

39. Mills MC, Rüttenauer T. The effect of mandatory COVID-19 certificates on vaccine uptake: Synthetic-control modelling of six countries. The Lancet Public Health. 2022;7(1):15–22. https://doi.org/10.1016/S2468-2667(21)00273-5

40. Medical Brief. CCMA again rules in favour of employers over mandatory vaccinations [webpage on the Internet]. c2022 [cited 2022 Mar 29]. Available from: https://www.medicalbrief.co.za/ccma-again-rules-in-favour-of-employers-over-mandatory-vaccinations/

41. Medical Brief. Solidarity's urgent application to stop vaccine mandate dismissed by labour court [webpage on the Internet]. c2022 [cited 2022 Mar 29]. Available from: https://www.medicalbrief.co.za/solidaritys-urgent-application-to-stop-vaccine-mandate-dismissed-by-labour-court/

42. Tshikalange S. Low wastage of covid-19 vaccines in Gauteng at 0.12%. TimesLive. 2021 Jul 07 [cited 2022 Mar 29]. Available from: https://www.timeslive.co.za/news/south-africa/2021-07-07-low-wastage-of-covid-19-vaccines-in-gauteng-at-012/

43. Covid vaccines wasted – Gauteng. The Citizen. 2021 Nov 16 [cited 2022 Mar 29]. Available from: https://www.citizen.co.za/news/covid-19/2909983/3636-covid-vaccines-wasted-gauteng/

44. Crisp N, Acting Deputy Director General, Department of Health, Republic of South Africa: Cape Talk Radio interview with John Maytham; 2022 [cited 2022 Mar 29]. Available from: https://lifepodcasts.fm/podcasts/144-afternoon-drive-with-john-maytham/episode/598632-the-sinopharm-roll-out

45. Wang L, Berger NA, Kaelber DC, Davis PB, Volkow ND, Xu R. COVID infection severity in children under 5 years old before and after Omicron emergence in the US [preprint]. medRxiv. 2022 Jan 13. https://doi.org/10.1101/2022.01.12.22269179

46. Nachega JB, Sam-Agudu NA, Machekano RN, Rabie H, Van der Zalm MM, Redfern A, et al. Assessment of clinical outcomes among children and adolescents hospitalized with COVID-19 in 6 sub-Saharan African countries. JAMA Pediatrics. 2022;176(3), e216436. https://doi.org/10.1136/bmjgh-2021-008315

47. Western Cape Department of Health. COVID-19 Dashboard [webpage on the Internet]. c2022 [cited 2022 Mar 29]. Available from: https://coronavirus.westerncape.gov.za/vaccine-dashboard

48. Freer J, Mudaly V. HIV and covid-19 in South Africa. BMJ. 2022;376, e069807. https://doi.org/10.1136/bmj-2021-069807

49. Davies M-A. HIV and risk of COVID-19 death: A population cohort study from the Western Cape Province, South Africa [preprint]. medRxiv. 2020 Jul 3. https://doi.org/10.1101/2020.07.02.20145185

50. Mayosi BM, Lawn JE, Van Niekerk A, Bradshaw D, Abdool Karim SS, Coovadia HM, et al. Health in South Africa: Changes and challenges since 2009. The Lancet. 2012;380(9858):2029–2043. https://doi.org/10.1016/S0140-6736(12)61814-5

51. Mendelsohn AS, de Sá A, Morden E, Botha B, Boulle A, Paleker M, et al. COVID-19 wave 4 in Western Cape Province, South Africa: Fewer hospitalisations, but new challenges for a depleted workforce. S Afr Med J. 2022;112(2):13496. https://doi.org/10.7196/SAMJ.2022.v112i2.16348

52. Ledford H. Hundreds of COVID trials could provide a deluge of new drugs. Nature. 2022;603:25–27. https://doi.org/10.1038/d41586-022-00562-0

53. Mendelson M, Nel J, Blumberg L, Madhi SA, Dryden M, Stevens W, et al. Long-COVID: An evolving problem with an extensive impact. S Afr Med J. 2020;111(1):10. https://doi.org/10.7196/SAMJ.2020.v111i11.15433

54. Ayoubkhani D, Bosworth M, King S. Self-reported long COVID after two doses of a coronavirus (COVID-19) vaccine in the UK [webpage on the Internet]. c2022 [cited 2022 Mar 29]. Available from: https://bit.ly/3jzApx2

55. Douaud G, Lee S, Alfaro-Almagro F, Arthofer C, Wang C, McCarthy P, et al. SARS-CoV-2 is associated with changes in brain structure in UK Biobank. Nature. Forthcoming 2022. https://doi.org/10.1038/s41586-022-04569-5

56. Swets MC, Russell CD, Harrison EM, Docherty AB, Lone N, Girvan M, et al. SARS-CoV-2 co-infection with influenza viruses, respiratory syncytial virus, or adenoviruses. The Lancet. Forthcoming 2022. https://doi.org/10.1016/S0140-6736(22)00383-X

57. Moodley K. COVID-19: 'A pandemic of the unvaccinated'? Compassion fatigue among healthcare professionals in South Africa. S Afr Med J. 2021;111(11):1040–1041.

58. Ebrahim Z. More than 90% of hospital deaths in the 4th wave are unvaccinated. IOL. 2021 Dec 17 [cited 2022 Mar 29]. Available from: https://www.news24.com/health24/medical/infectious-diseases/coronavirus/covid-19-more-than-90-of-hospital-deaths-in-4th-wave-are-in-unvaccinated-partially-vaccinated-people-20211217

59. Johnson AG, Amin AB, Ali AR, Hoots B, Cadwell BL, Arora S, et al. COVID-19 incidence and death rates among unvaccinated and fully vaccinated adults with and without booster doses during periods of delta and omicron variant emergence - 25 U.S. Jurisdictions, April 4–December 25, 2021. MMWR Morb Mortal Wkly Rep. 2022;71(4):132–138. https://doi.org/10.15585/mmwr.mm7104e2

60. Makhafola G. UFS joins Wits and UWC in implementing vaccine mandates for staff students on campus. News24. 2021 Nov 27 [cited 2022 Mar 29]. Available from: https://www.news24.com/news24/southafrica/news/ufs-joins-wits-and-uwc-in-implementing-vaccine-mandate-for-staff-students-on-campus-20211127

61. Stellenbosch University. Have your say about intended vaccine rule [webpage on the Internet]. c2021 [cited 2022 Mar 29]. Available from: https://www.sun.ac.za/english/Lists/news/DispForm.aspx?ID=8810

62. World Health Organization. International Health Regulations [webpage on the Internet]. c2021 [cited 2022 Mar 29]. Available from: https://www.who.int/health-topics/international-health-regulations#tab=tab_1

63. Rahimi F, Talebi Bezmin Abadi A. The Omicron subvariant BA.2: Birth of a new challenge during the COVID-19 pandemic. Int J Surg. 2022;99:106261. https://doi.org/10.1016/j.ijsu.2022.106261

64. Gu H, Xie R, Adam DC, Tsui JL-H, Chu DK, Chang LDJ, et al. Genomic epidemiology of SARS-CoV-2 under an elimination strategy in Hong Kong. Nat Commun. 2022;13(1):736. https://doi.org/10.1038/s41467-022-28420-7

65. Meterlerkamp T. South Africa's fourth wave is waning but don't celebrate just yet say experts. The Daily Maverick. 2022 Jan 18 [cited 2022 Mar 29]. Available from: https://www.dailymaverick.co.za/article/2022-01-18-south-africas-fourth-wave-is-waning-but-dont-celebrate-just-yet-say-experts/

66. South African Government. Coronavirus alert level 1 [webpage on the Internet]. 2022 [cited 2022 Mar 29]. Available from: https://www.gov.za/covid-19/about/coronavirus-covid-19-alert-level-1

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Electronic consent in a COVID-19 vaccine implementation trial in South Africa: Participant perspectives

The COVID-19 pandemic has warranted modifications to clinical research implementation to ensure adherence to public health and safety measures. Often, this modification has necessitated a deviation from the traditional face-to-face approach to an electronic or hybrid consent process. We assessed the acceptability and preference for electronic consent and explored understanding of the electronic consent information – an outcome which is vital in providing reassurance that consent is provided with full appreciation of the risks and benefits of study participation. In this descriptive study, healthcare professionals (HCPs) were invited, through a database of HCP contacts, snowball sampling and advertisement, to participate in an online survey between 14 July 2021 and 17 September 2021, to explore their experiences of providing electronic consent for enrolment into the largest implementation trial of a COVID vaccine in South Africa (SISONKE Trial). Descriptive analysis was used to characterise respondents and categorical data were expressed as frequencies. The prevalence of recurring responses to open-ended questions allowed for the identification of themes. A total of 1025 HCPs completed the online survey. Access to a COVID-19 vaccine was the strongest motivating factor for enrolment (82.3%) into the SISONKE Trial. Over a third of participants (38.6%) were not able to discuss the study with research staff. While the majority of participants (85.2%) indicated that online consent was acceptable, it was recognised that acceptability was context specific. Although 64% indicated awareness that reporting both a positive COVID test and adverse events were requirements, a significant percentage (32%) did not recall that the reporting period was 2 years. The electronic consent process was easily navigated by educated HCPs with access to electronic devices and data. Vaccine access was the most important motivation for participation, thus raising questions about how voluntary the consent process was and the role of desperation in deciding to participate.

Significance:

- Navigation of the electronic consent process for participation in a COVID-19 vaccine implementation trial is not a challenge for educated healthcare professionals with access to electronic devices and data. However, technical skills and access to technology may impact the integrity of the informed consent process for lay research participants.
- Motivation to join research studies for access to scarce resources impacts negatively on the authenticity of the consent processes, as participation may be informed but not truly voluntary, and is an issue that ethics committees and researchers should address.

Background

The COVID-19 pandemic has negatively impacted the implementation of clinical trials, specifically, and clinical research in general. Research and related operational activities have had to be modified to comply with COVID-19 related public health and safety measures.[1] At the same time, researchers have had to ensure adherence to ethical, legal, scientific and good clinical practice guidelines for clinical research.

Multiple guidelines and publications address the ethical and legal requirements of informed consent.[2,3] The consent process involves providing information on the research study in question and the implications of participation on the potential volunteer. Implications include the appreciation of risks, obligations and benefits, time, inconvenience and expenses, compensation for possible injury, confidentiality and protection of personal information.[4,5] Informed consent has rightfully been described as a dynamic process and not a single event.[6,7] New information that could impact the risk–benefit ratio of the study must be communicated so that an informed decision can be made about ongoing study participation. It is also a requirement that a copy of the signed consent form be made available to the study participant.[2,8]

Methods of obtaining consent have included traditional face-to-face interactions with signing of a paper consent form, to alternative methods including online consent with an electronic signature and a hybrid method of online/telephonic discussions followed by the signing of a paper form.[9] Traditional methods of obtaining consent may not be practical in the setting of implementation or pragmatic clinical trials that are evaluating or comparing different standards of care.[9] Implementation and pragmatic trials serve to provide information to policymakers on mechanisms to streamline delivery processes of effective health interventions rather than to evaluate the efficacy or safety of the interventions.[9] Although South African guidelines do not address the use of altered consent, this approach may be used in implementation/pragmatic trials as per guidelines in the USA if the research meets the requirements of minimal risk and does not impact the rights or welfare of participants, if participants will be provided additional information after study procedures are completed, and if obtaining traditional consent is not

practical.[8] Logistical reasons alone – such as cost, convenience and need for study implementation to be fast-tracked – are not legitimate reasons for use of altered consent.[10] US Food and Drug Administration regulations allow for use of altered consent in emergency situations in which there is immediate threat to life and an alternative to the test product is not available.[11]

To assist in understanding of the content of the informed consent form, supplemental material, in the form of interactive exercises, quizzes and links to relevant information, is often used. In studies evaluating user experiences, it has been found, that even when electronic consenting was supplemented with various links to informational material, respondents rarely opted to look at this material.[12]

Research has been undertaken on the perspectives of research ethics committees and researchers on electronic consent processes.[7,13,14] However, the perspectives of research participants have not been explored in depth, especially in sub-Saharan Africa. A scoping review identified published research on electronic informed consent in North America, Europe, Asia and Oceania, but not from sub-Saharan Africa.[12]

We assessed the preferences, acceptability and understanding of the electronic consent information and process among healthcare professionals (HCPs) from a diverse range of health science disciplines enrolled in a phase 3b COVID-19 vaccine trial (SISONKE) in South Africa between February 2021 and May 2021. The SISONKE Trial was one of the largest 'implementation' trials conducted in South Africa, under pandemic conditions and in a context of no vaccine availability for general roll-out.[15,16] At the time of trial implementation, it was a high-risk study conducted with a vaccine that had only emergency use authorisation in some countries.[17] To date, significant serious or special interest adverse events have been reported.[18] Therefore, an assessment, post-consent, of participants' motivation to enrol in the trial and their understanding of adverse event reporting requirements is of relevance.

Method

We undertook an independent descriptive survey amongst a sample of healthcare professionals (HCPs) and academics who had enrolled in the SISONKE Trial. Between 14 July 2021 and 17 September 2021, we invited trial enrolees to participate in an online survey on the electronic consent process of the SISONKE Trial. Recruitment of participants was through a database of HCP contacts maintained by the Centre for Medical Ethics and Law (Stellenbosch University), snowball sampling, and advertisement via professional bodies (Colleges of Medicine of South Africa, South African Medical Association, and Independent Practitioner Associations), an academic institution (Stellenbosch University's Faculty of Medicine and Health Sciences), a public tertiary level teaching hospital (Tygerberg Hospital), and a private hospital group (Mediclinic). A broader sample of HCPs from public and private hospitals and institutions across South Africa were invited via a weekly medical news digest. All HCPs participated in their personal capacities and provided online consent prior to completion of the survey.

Ethics approval was received from Stellenbosch University's Faculty of Medicine and Health Sciences Health Research Ethics Committee (reference number: N21/06/018_COVID-19) and the research ethics committee of Mediclinic SA (reference: 20210727). Institutional approval was received from Stellenbosch University and the Western Cape Provincial Department of Health.

The design and content of the survey questionnaire were based on a literature review and the researchers' experience with factors that are likely to influence understanding, acceptability and preference for electronic consent. The survey was created using SUNsurveys Checkbox® 7 Version 2018 Q2. To confirm relevance, validity and reliability, the survey was piloted among seven HCPs and researchers with experience in the design of online surveys and research ethics. The final survey consisted of open and closed questions.

Data analysis

Survey responses were exported to Statistical Package for Social Science (IBM SPSS Statistics 27.0) for analysis. Descriptive analysis was used to characterise respondents and categorical data were expressed as frequencies. An online proportion calculator was used to calculate 95% confidence intervals using frequencies.

NVivo qualitative data analysis software (QSR International Pty Ltd. Version 12, 2018) was used to analyse the data. The prevalence of recurring responses to open-ended questions allowed for inductive coding and subsequently the identification of themes. During the analysis, two authors independently analysed the data. The generated themes were compared and discussed until consensus was reached. Trustworthiness was achieved by sharing and discussing themes among the study team.

Table 1: Characteristics of survey participants ($n=1025$)

Characteristic	*N* (%)
Age (years)	
18–29	80 (7.8)
30–39	265 (25.9)
40–49	276 (26.9)
>50	404 (39.4)
Location (province)	
Eastern Cape	18 (1.8)
Free State	23 (2.2)
Gauteng	177 (17.3)
KwaZulu-Natal	89 (8.7)
Limpopo	2 (0.2)
Mpumalanga	11(1.1)
Northern Cape	6 (0.6)
North West	3 (0.3)
Western Cape	696 (67.9)
Type of healthcare facility/institution	
Public healthcare facility	469 (45.8)
Private healthcare facility	236 (23.0)
Independent practice	53 (5.2)
Academic institution	187 (18.2)
Other	80 (7.8)
Position/role	
Healthcare worker	653 (63.7)
Academic staff	123 (12.0)
Both healthcare worker and academic staff	249 (24.3)
Previous experience as a research participant	
Yes	426 (41.6)
No	599 (58.4)
Previous experience as part of a research team	
Yes	514 (50.1)
No	511 (49.9)

Results

Respondent characteristics

A total of 1025 HCPs completed the online survey. The majority of respondents were younger than 50 years of age (621/1025, 60.6%). Responses were received from all nine provinces of South Africa, with the majority of responses received from the Western Cape (67.9%) followed by Gauteng (17.3%) and KwaZulu-Natal (8.7%) (Table 1).

HCPs comprised 63.7% of the sample, 12% were academics and 24.3% identified as occupying both roles. Half of the respondents reported having been part of a research team previously (Table 1).

Motivation to join the SISONKE Trial

The majority of respondents indicated that they enrolled in the SISONKE Trial to access a COVID-19 vaccine (844/1025, 82.3%), to protect themselves (757/1025, 73.9%) or to prevent inadvertent exposure of family members through themselves (780/1025, 76.1%) to SARS-COV-2. This finding is supported by the following anonymised responses:

> *Being in the clinical field, it really left no options for not taking the vaccine. It can't really be considered a trial in which we had great choice; we had no choice of the vaccine we could take (would have preferred a mRNA based vaccine) as the government had no clear plan.* (PID 1337636)

> *People consented for fear of losing their lives and were desperate for protection.* (PID 1333708)

> *Very grateful to be included in the trial.* (PID 1334644)

A further 65.9% (625/1025) regarded it as a duty to receive a COVID-19 vaccine for the public good, to allow the country to reach herd immunity. Pressure from family members, peers, community members (30/1025, 2.9%), negative impact on employment (25/1025, 2.4%) or positive impact on employment (123/1025, 12%) impacted the decision to participate the least.

Technical enablers or challenges

The majority of respondents used their own electronic devices (961/1025, 93.8%), had Internet/data access (963/1024, 94%) and the technical skills to complete the electronic informed consent process independently (989/1024, 96.5%). Over three quarters (907/1025, 88.5%) agreed that both the electronic consent document and the information leaflet were easily accessible. Whilst 6.7% (69/1024 respondents) indicated that they did not access the consent form at all. Trust and confidence in the research process compensated for difficulty in accessing study related information:

> *But I could not access/see/find the actual study information or text about the consent. When I tried to go back and search for it I still couldn't see it. But I trusted in the research process.* (PID 1337168)

Characteristics of the consent process

In total, over two thirds of respondents (733/1019, 71.9%) indicated that they had thoroughly read the consent document. Access to the consent form and ability to discuss the content of the form or the study procedures prior to providing consent are annotated in Table 2. The lack of opportunity for the majority of SISONKE Trial participants (59.5%) to discuss the consent document with the study staff or doctors is reflected by the following participants' comments:

> *Information was lacking. I needed vaccine and had no choice as to agree. No consent, no vaccine is the rule. So, I had no choice.* (PID 1335027)

> *Not informed that participation in this vaccine study would exclude me from receiving vaccination as part of the national vaccination rollout. I am now not eligible to receive the (likely) more effective Pfizer vaccine because I have been 'vaccinated' with an incompletely validated vaccine. I will NEVER participate in such a study again as I believe that this has compromised my ability to optimally protect myself.* (PID 1337815)

Three quarters of survey respondents (784/1025, 76.5%) indicated that being able to discuss the study with their colleagues increased the acceptability of the electronic consent process. The majority were aware of and able to access additional study material that impacted the risk–benefit ratio when it was made available, while half read this new information (Table 2).

Some respondents expressed dissatisfaction with the timeliness of or paucity of study updates:

> *I have received no updates on the preliminary trial findings as a study participant and health worker. I feel that I was used as a participant, but the investigators did not have the courtesy to provide updates on vaccine effectiveness to participants, even as data accumulated on symptomatic infections, hospital admissions and deaths during the third wave.* (PID 1336993)

> *It would be helpful if the trial heads provided feedback from time to time to all Sisonke participants on how the Janssen-J&J vaccine is doing in relation to new variants in the population, e.g., the delta variant seems not to be well-controlled by this vaccine in terms of re-infections and even transmission from such re-infections.* (PID 1337013)

Table 2: Access to consent material

	Number (%) of affirmative responses
Able to print or save a copy of the consent form	166/280 (59.3)
Able to access a copy of the consent form at a later time	89/175 (50.9)
Able to access a copy to discuss with own doctor or family	134/384 (34.9)
Able to discuss concerns with study doctor or other study staff	270/666 (40.5)
Received SMS notification of availability of new study information related to change in risk/benefit assessment	680/1025 (66.3)
Easily accessed the online new information	607/680 (59.1)
Read the new information	510/680 (49.8)

Acceptability, preference and understanding

Acceptability

The majority (873/1025, 85.2%) [95% CI: 83, 87.3] indicated that online consent was acceptable while 5.5% thought it was not (56/1025) [95% CI: 4.1, 6.9] and 9.4% opted to provide a neutral response (96/1025) [95% CI: 7.6, 11.1].

An overwhelming majority of respondents to this survey indicated that online consent was acceptable and commented on some of the advantages:

> *I can read through the information in my own time, and I don't feel obliged to participate in order not to disappoint the person taking the informed consent. I can think as long as I want, 'Google'*

> *aspects of care, ask opinions from friends and formulate questions. I can re-read the information as many times as I want.* (PID 1337857)

> *Online consent was appropriate in this case due to the nature of Covid-19 and reducing contact with people and can accommodate the big numbers and spread across the whole country easily.* (PID 1337410)

Others recommended a hybrid process or that other printed or audiovisual material be used to strengthen the online consent process:

> *Online consent must be preceded with printed pamphlets regarding the trial to allow better decision making.* (PID 1337294)

> *The consent form was very long and most people I know did not read it page for page. Perhaps if consent is read aloud in a video it would lead to better uptake.* (PID 1338552)

Over 90% (930/1025, 90.7%) of participants were confident that the personal information shared as part of providing consent would remain confidential.

Preference

When asked if online consent should be implemented rather than face-to-face consent, even if the possibility of adverse events was high, less than half (447/0125, 43.6%) [95% CI: 40.6, 46.6] agreed. A slightly lower number thought that consent should not be obtained online if risk of adverse events was high (330/1025, 32.2%) [95% CI: 29.3, 35.1], while approximately one quarter were neutral (248/1025, 24.2%) [95% CI: 21.6, 26.8].

> *Online consent is acceptable for minimal risk research such as questionnaires. I feel that for all other research, especially including participants who do not have a research and/or medical background, face to face and in depth discussion is non-negotiable.* (PID 1337963)

Understanding

One quarter of respondents were aware of the expected duration of study participation of 2 years (256/1025, 25%); while 90% (923/1025) [95% CI: 88.2, 91.9] understood that that they were required to report side effects, fewer participants were aware of the reporting duration (221/923, 23.9%) [95% CI: 21.2, 26.7]. Of the 37.6% of respondents who believed they experienced side effects, 16.5% indicated that they did not remember to report side effects while a further 3.1% logged a report only when reminded to do so. In comparison to reporting side effects, fewer participants were aware of the requirement to report a positive COVID test (685/1024, 66.8%) [95% CI: 64.0, 69.8] and a similar number (659/1024, 64.4%) [95% CI 61.4, 67.3] understood that reporting both a positive COVID test and adverse events was a requirement. About two thirds of participants (634/1025, 61.9%) [95% CI: 58.9, 64.8] were aware of the overall efficacy in preventing any infection and efficacy in preventing severe infection of the SARS-COV-2 vaccine dispensed in the SISONKE Trial.

While the majority of participants were aware of their obligations to report adverse events, some experienced challenges when attempting to log reports:

> *My wife developed severe side effects from the vaccine but there was no avenue to report.* (PID 1336930)

> *Colleagues who had vaccine adverse effects were initially unable to register complaints at Sisonke site – no one picked up phone or took the issue seriously initially.* (PID 1334487)

> *A clear portal to report adverse events was not available/frustrating. The Sisonke hotline was very regularly jammed/overcrowded. I would have found a link to report symptoms/positive covid tests very helpful.* (PID 1338552)

Respondents recognised that acceptability and understanding were context specific, as borne out by the following comments:

> *Online consent is a good idea when dealing with educated and affluent study participants (like the health workers in this study). I don't think it would be adequate if the study involved uneducated and poverty-stricken participants as there would be problems with understanding the information clearly (especially potential negative effects).* (PID 1338018)

> *Online consent should only be done if level of education allows. Participants should be educated (at least gr12 education level) and researchers need to verify the level of computer literacy.* (PID 1340990)

> *The target group for J&J vaccine was mostly highly knowledgeable. They can access information for themselves, and I think many made informed decisions. However, the low income employees such as cleaners and other low levels of education staff may have not understood and could have benefitted from face to face consent.* (PID1337344)

Discussion

While the informed consent document and information leaflet were easily accessible by the majority of participants, and electronic literacy, access to and confidence with use of technology was not a deterrent, approximately 28% of respondents indicated that they had not read the consent information completely. A survey of electronic/online consent among healthcare workers in the UK demonstrated similar results, with 33% indicating that they had not read all of the consent information.[7] Enrolling in the SISONKE Trial without reading the consent material in its entirety could be related to several factors, including motivation for enrolling in the trial to access a SARS-COV-2 vaccine, confidence in the research team and the informed consent process, pre-existing knowledge about SARS-COV-2 vaccines, the ability to supplement knowledge gaps through online searches, social media and discussion with knowledgeable HCP colleagues.

Context influences motivation and contributes to decision-making related to trial participation. Over 80% of respondents – many of whom are frontline health workers – were desperate to access any SARS-COV-2 vaccine, even though they may have had preferences, in a setting in which there was no other mechanism of access with the South African government's vaccine roll-out programme not having started. Volunteers expressing their autonomy to participate in clinical trials to access scarce resources or interventions still under investigation is not a new phenomenon and has been a historical mechanism to access scarce treatment resources.[19] This impacts negatively on the authenticity of consent processes as participation may be informed but not truly voluntary.[20]

As seen in this survey as well, fear of being infected with SARS-COV-2 and desire to protect family members from inadvertent exposure were strong motivating factors for COVID-19 vaccine uptake among employees of a Czech tertiary level hospital.[21]

A large proportion of respondents in this survey also appreciated the urgency to increase vaccine uptake in the public interest. Pressure from peers, the community and employers was not a significant motivating factor; this finding could be attributable to the survey being conducted prior to poor vaccine uptake among South Africans with the subsequent calls for mandatory vaccination in some sectors.

Other studies have noted that research participants in certain situations would decide to participate in research, even before the consent process, based on trust alone[22] or confidence in professional recommendation[23]. Participants in the SISONKE Trial may have drawn on their own experiences as HCPs, academics and researchers when obtaining consent that meets ethical and legal requirements and this may have increased acceptability.

Three quarters of respondents indicated that being able to discuss the study with colleagues increased online consent acceptability and this is consistent with findings from the UK study of healthcare workers.[7] However, there is the risk of independent decision-making being influenced by strong opinions of colleagues and others in positions of authority, such as managers within the clinical work space.[24]

Among other factors, a review of current practice for use of e-consenting, identified the use of hyperlinks to digital media and websites to provide more information useful in engaging users and enhancing comprehension of the consent document.[25]

As per the Belmont Report, comprehension is one of the three conditions for ensuring that consent is informed; the others being information provision and voluntariness.[26] While current good clinical practice guidelines do not require a test of comprehension of the risks and benefits of study participation, it is important to have reassurance that intention to participate is based on sound consideration of all the relevant information, including safety data. At the same time, not trusting the participant's capacity to make an informed choice should be avoided if study participants do not demonstrate comprehension of all aspects of the study but are able to understand key elements and possible risks associated with participation.[2]

While a test of comprehension as part of the consent process is not mandatory, assessing computer literacy in addition to comprehension of the consent document should be part of the electronic consent process in non-professional populations, and this opinion was expressed by respondents in this study. However, this suggestion raises the challenge of access to various electronic consent platforms and training in the use thereof in developing countries. Costs related to hardware and data access will be prohibitive if not covered by the study budget. Theft of expensive devices and subsequent possible harm to participants located in indigent communities must also be considered. In contrast to South African guidelines, international guidelines stipulate that study participants must have options to provide consent.[3] To control for issues related to lack of Internet or e-literacy, printed material should be available. Some study participants may prefer a printed copy which they can refer to while going through the consent process with a member of the research team[22], irrespective of whether consent is face to face or via teleconsent. Other material such as pamphlets and audiovisual material should be used to decrease the content in the consent document and enhance understanding.[25]

Consent to participate in a clinical trial initially, and throughout the duration of the study, is a dynamic ongoing process. In addition to discussions between researcher and participant initially, key elements of the consent form and the study, in addition to new information that changes the risk–benefit ratio or advises of the availability of other therapeutic/preventative options, should be discussed at every study visit by the research team, with the option for the participant to withdraw consent at any time.[7,27,28] This ongoing process is not only an opportunity to remind participants of key study facts, including requirements for reporting adverse events, but to allay fears around side effects and address myths and misconceptions. Accessibility to the research team – whether face to face or via telephone, video call or teleconference – builds trust in researchers and in the research itself. In the context of high-risk studies, preference for face-to-face consultation with researchers was expressed in this survey, and was a sentiment expressed in other studies as well.[28-30] However, access to the research team, to provide clarification and reminders to report both adverse events and a positive COVID-19 test, proved challenging for some participants of the SISONKE Trial.

While international guidelines allow for an altered consent process for implementation/pragmatic trials[10] as well as under emergency conditions[11], this is not addressed by South African guidelines. These waivers would not have been applicable to the SISONKE Trial as it did not meet the accepted definitions of an implementation or pragmatic trial or complete stipulations for an emergency situation. It is, however, worth noting that multiple research ethics committees in South Africa reviewed the SISONKE protocol and accepted and approved the research team's categorisation of the trial as a pragmatic trial as well as the altered consent process. This raises important questions around how research ethics committee members' training and research ethics guidelines in South Africa incorporate discussion of implementation trials and altered consent processes.

Limitations

This survey was implemented between 2 and 4 months after enrolment in the SISONKE Trial was completed and recall bias may have impacted responses. For South African HCPs at the time, this trial provided the only means of accessing a vaccine to protect themselves and their families against a life-threatening infection. In light of this, factors that influenced the acceptability of the consent process used in the SISONKE Trial may have been of little relevance to trial participants who felt coerced to enrol in the trial to access a vaccine. It is possible that they may have regarded the consent process merely as a means to an end. Therefore, the high acceptability of electronic consent seen in this survey may be inflated. The number of neutral responses received may be attributable to social desirability bias, with survey participants wanting to express their gratitude for access to a vaccine and to avoid being critical of the consent process or SISONKE Trial researchers. The target population of this survey is not representative of the general population who would be enrolled into a clinical trial in South Africa or any other country in sub-Saharan Africa.

Conclusion

Obtaining consent remotely is an invaluable option allowing the possibility of enrolling a large number of study participants quickly and efficiently from scattered geographical locations under conditions that preclude close contact. In the SISONKE Trial, the electronic consent process was easily navigated by educated HCPs with access to electronic devices and data. However, a significant percentage (32%) did not recall that breakthrough infections and adverse events had to be reported for a 2-year period after receiving the vaccine. Vaccine access was the most important motivation for participation, raising questions about how voluntary the consent process was. With the high likelihood of increased transmissibility of the Omicron variant of SARS-COV-2, HCPs find themselves once again in a position of no choice with respect to accessing a second vaccine via the SISONKE booster trial. At the time of writing, although recent policy changes allow for a Pfizer booster shot following one dose of the Johnson & Johnson's vaccine, HCPs who received two doses of the Johnsons & Johnson's vaccine via SISONKE, are currently not able to receive a Pfizer booster.

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Competing interests

We have no competing interests to declare.

Authors' contributions

K.M. conceptualised the study, reviewed and edited the survey instrument and protocol, was involved in participant recruitment and reviewed and edited the manuscript. G.N. developed the content of the survey instrument and the protocol, submitted the protocol for ethics committee reviews, was involved in participant recruitment and led the development

of the manuscript. S.M.K. designed the online survey instrument and was responsible for data capturing. M.M.M.J.A. undertook the data cleaning and analysis. A.E.A.O. contributed to the literature review. M.G.M.C. provided expert advice on statistical analysis. All authors read and approved the final manuscript.

References

1. McDermott MM, Newman AB. Remote research and clinical trial integrity during and after the coronavirus pandemic. JAMA. 2021;325(19):1935. https://doi.org/10.1001/jama.2021.4609
2. South African Department of Health. South African good clinical practice guidelines. 3rd ed. Pretoria: Department of Health; 2020. Available from: https://www.sahpra.org.za/wp-content/uploads/2021/06/SA-GCP-2020_Final.pdf
3. US Department of Health and Human Services. CFR – Code of Federal Regulations Title 21: CFR 50.27 [document on the Internet]. c2016 [cited 2021 Jun 15]. Available from: https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/cfrsearch.cfm?fr=50.27
4. Jefford MMR. Improvement of informed consent and the quality of consent documents. Lancet Oncol. 2008;9(5):485–493. https://doi.org/10.1016/S1470-2045(08)70128-1
5. Wendler D. What should be disclosed to research participants? Am J Bioeth. 2013;13(12):3–8. https://doi.org/10.1080/15265161.2013.851578
6. Erlen J. Informed consent: Revisiting the issues. Orthop Nurs. 2010;29(4):276–280. https://doi.org/10.1097/NOR.0b013e3181e517f1
7. McGowan CR, Houlihan CF, Kingori P, Glynn JR. The acceptability of online consent in a self-test serosurvey of responders to the 2014-2016 West African Ebola outbreak. Public Health Ethics. 2018;11(2):201–212. https://doi.org/10.1093/phe/phx027
8. US Department of Health and Human Services. Code of Federal Regulations: 45 CFR 46.117(b) (2) – Documentation of informed consent [document on the Internet]. c2019 [cited 2021 Dec 06]. Available from: https://www.hhs.gov/ohrp/regulations-and-policy/regulations/45-cfr-46/index.html#46.117
9. McKinney RE, Beskow LM, Ford DE, Lantos JD, McCall J, Patrick-Lake B, et al. Use of altered informed consent in pragmatic clinical research. Clin Trials. 2015;12(5):494–502. https://doi.org/10.1177/1740774515597688
10. US Office of Human Research Protections. Secretary's Advisory Commission on Research Protections (SACHRP). SACHRP letter to HHS Secretary [webpage on the Internet]. No date [cited 2021 Dec 06]. Available from: https://www.hhs.gov/ohrp/sachrp-committee/recommendations/2008-january-31-letter/index.html
11. US Department of Health and Human Services. CFR – Code of Federal Regulations Title 21: 21 CFR 50.23: Exception from general requirements. No date [cited 2021 Dec 06]. Available from: http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=50.23
12. Chen C, Lee P-I, Pain KJ, Delgado DCC. Replacing paper informed consent with electronic informed consent for research in academic medical centres: A scoping review. AMIA Jt Summits Transl Sci Proc AMIA Jt Summits Transl Sci Proc. 2020;2020:80–88. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7233043/
13. Buchanan EA, Hvizdak EE. Online survey tools: Ethical and methodological concerns of human research ethics committees. J Empir Res Hum Res Ethics. 2009;4(2):37–48. https://doi.org/10.1525/jer.2009.4.2.37
14. Stevens N, Edwards L, Balayah Z, Hooper R, Knowles C. Risk based survey evidence supports electronic informed consent as a recruitment method for UK clinical trials. J Clin Epidemiol. 2016;77:134–136. https://doi.org/10.1016/j.jclinepi.2016.05.005
15. Sisonke – Protecting health care workers [webpage on the Internet]. No date [cited 2021 Dec 06]. Available from: http://sisonkestudy.samrc.ac.za
16. Sisonke (Together): Open Label Trial COVID-19 (Sisonke). No date [cited 2021 Dec 06]. Available from: https://clinicaltrials.gov/ct2/show/NCT04838795
17. Fact sheet for health care providers administering vaccine (vaccination providers) emergency use authorization (EUA) of the Janssen COVID-19 vaccine to prevent corona virus disease 2019 (COVID-19). Available from: https://www.fda.gov/media/146304/download
18. Takuva S, Takalani A, Garrett N, Goga A, Peter J, Louw V, et al. Thromboembolic events in the South African Ad26.COV2.S Vaccine Study. N Engl J Med. 2021;385:570–571. https://doi.org/10.1056/NEJMc2107920
19. Gifford AI, Cunningham WE, Heslin KC. Participation in research and access to experimental treatments by HIV-infected patients. N Engl J Med. 2002;346:1373–1382. https://doi.org/10.1056/NEJMsa011565
20. Abdool Karim Q, Abdool Karim SS, Coovadia HM, Susser M. Informed consent for HIV testing in a South African hospital: Is it truly informed and truly voluntary? Am J Public Health. 1998;88(4):637–640. https://doi.org/10.2105/AJPH.88.4.637
21. Štěpánek L, Janošíková M, Nakládalová M, Štěpánek L, Boriková A, Vildová H. Motivation to COVID-19 vaccination and reasons for hesitancy in employees of a Czech tertiary care hospital: A cross-sectional survey. Vaccines. 2021;9(8):863. https://doi.org/10.3390/vaccines9080863
22. Rothwell E, Brassil D, Barton-Baxter M, Brownley KA, Dickert NW, Ford DE, et al. Informed consent: Old and new challenges in the context of the COVID-19 pandemic. J Clin Transl Sci. 2021;5(1), e105. https://doi.org/10.1017/cts.2021.401
23. Kass NE, Sugarman J, Faden R, Schoch-Spana M. Trust, the fragile foundation of contemporary biomedical research. Hastings Center Rep. 1996;26(5):25-29. https://doi.org/10.2307/3528467
24. Lynch HF, Lundin D, Meagher EA. Ethical inclusion of health care workers in Covid-19 research. Ethics Hum Res. 2021;43(2):19–27. https://doi.org/10.1002/eahr.500082
25. Skelton E, Drey N, Rutherford M, Ayers S, Malamateniou C. Electronic consenting for conducting research remotely: A review of current practice and key recommendations for using e-consenting. Int J Med Inform. 2020;143, Art. #104271. https://doi.org/10.1016/j.ijmedinf.2020.104271
26. US Department of Health and Human Services. The Belmont report: Ethical principles and guidelines for the protection of human subjects of research [document on the Internet]. c1979 date [cited 2021 Dec 06]. Available from: https://www.hhs.gov/ohrp/regulations-and-policy/belmont-report/index.html
27. Flory J, Emanuel E. Interventions to improve research participants' understanding in informed consent for research. JAMA. 2004;292(13):1593. https://doi.org/10.1001/jama.292.13.1593
28. Jayasinghe N, Moallem BI, Kakoullis M, Ojie M-J, Sar-Graycar L, Wyka K, et al. Establishing the feasibility of a tablet-based consent process with older adults: A mixed-methods study. Gerontologist. 2019;59(1):124–134. https://doi.org/10.1093/geront/gny045
29. Newlin T, McCall T, Ottmar P, Welch B, Khairat S. Assessing the satisfaction of citizens using teleconsent in clinical research. Stud Health Technol Inform. 2018;247:685–689. http://www.ncbi.nlm.nih.gov/pubmed/29678048
30. Rowbotham MC, Astin J, Greene K, Cummings SR. Interactive informed consent: Randomized comparison with paper consents. PLoS ONE. 2013;8(3), e58603. https://doi.org/10.1371/journal.pone.0058603

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COVID-19 and all-cause mortality in South Africa – the hidden deaths in the first four waves

Accurate statistics are essential for policy guidance and decisions. However, the reported number of cases and COVID-19 deaths are known to be biased due to under-ascertainment of SARS-CoV-2 and incomplete reporting of deaths. Making use of death data from the National Population Register has made it possible to track in near-real time the number of excess deaths experienced in South Africa. These data reveal considerable provincial differences in the impact of COVID-19, likely associated with differences in population age structure and density, patterns of social mixing, and differences in the prevalence of known comorbidities such as diabetes, hypertension, and obesity. As the waves unfolded, levels of natural immunity together with vaccination began to reduce levels of mortality. Mortality rates during the second (Beta) wave were much higher than mortality in the third (Delta) wave, which were higher than in either the first or the fourth (Omicron) waves. However, the cumulative death toll during the second (Beta) wave was of a similar order of magnitude as that during the third (Delta) wave due to the longer duration of the Delta wave. Near-real time monitoring of all-cause deaths should be refined to provide more granular-level information to enable district-level policy support. In the meanwhile, there is an urgent need to re-engineer the civil registration and vital statistics system to enable more timely access to cause of death information for public health actions.

Significance:

This study highlights that in South Africa there were about three times the number of excess deaths from natural causes during 2020 and 2021 than reported COVID-19 deaths. Although the cause of death remains unknown, the strong temporal correlation between excess deaths and reported COVID-19 deaths within each province indicates that the majority of excess deaths were associated with COVID-19. Many countries have found it difficult to estimate excess deaths, or to identify and report COVID-19 deaths accurately, demonstrating the value of near-real time monitoring of mortality through the use and demographic analysis of data obtained from the country's National Population Register.

Introduction

The South African Department of Health reports the number of cases and the number of COVID-19 deaths on a daily basis (https://sacoronavirus.co.za/) as does the World Health Organization (https://covid19.who.int) for member states, based on data submitted by member states. However, these numbers are known to be biased due to the backlog in reporting of cause-of-death data in South Africa, acknowledged under-ascertainment of SARS-CoV-2 and, in the case of deaths, a significant incompleteness of reporting.

In January 2022, Adam[1] wrote that 'official data report some five million COVID-19 deaths in two years, but global excess deaths are estimated at double or even quadruple that figure'. While the excess deaths in a handful of countries correspond with their number of reported COVID-19 deaths, many countries either do not track/report the number of excess deaths or understate the number of COVID-19 deaths or both. Data on excess deaths are consolidated in the World Mortality Dataset[2] and have been used, together with other data, to estimate excess deaths by *The Economist*[3], while others, such as the Institute for Health Metrics Evaluation, have developed complex projection models to estimate the total number of COVID-19 deaths[4]. In addition, the World Health Organization is working on estimating the number of excess deaths in consultation with each country but has yet to release country-level estimates.[5]

South Africa is in a unique position in sub-Saharan Africa in being able to make use of its National Population Register (NPR), after correction for deaths not recorded, to establish a near-real time monitoring system of deaths in the country.[6] This ability has been invaluable for tracking excess deaths during the pandemic and weekly reports of numbers of deaths have been made available routinely since March 2020.[7]

Analysis of the numbers of deaths in 2020 originally suggested that overall mortality was 13% higher than the number predicted before the impact of the pandemic.[8] However, as was identified by this analysis, there was a need to improve the adjustment for under-reporting, and this increased this proportion for South Africa in 2020 to 19%. It was estimated that there were 70 000–76 000 excess deaths from natural causes, well above the 28 000 reported COVID-19 deaths. In light of the extremely strong spatio-temporal correlation with the timing of SARS-CoV-2 infection, it was concluded that 85–95% of the excess natural deaths were related to COVID-19.[9] During 2020, deaths from unnatural causes halved for both male and female individuals during the stringent lockdown level 5 and it was estimated that just under 5000 unnatural deaths were averted. Most of this drop in deaths from unnatural causes was due to the periodic banning of the sale of alcohol.[10]

In this paper, we set out to identify further characteristics of the excess natural deaths in South Africa, which remains critically important as the cause-of-death data from death notifications that occurred during the COVID-19 pandemic are unlikely to be available for analysis within the next 2 to 3 years without an increase in resources to process the forms.

Methods

Data source

The use of, and adjustments made to, the data from the NPR to produce estimates of mortality in South Africa have been described elsewhere[6,8,11] and are not repeated in detail here. In short, we receive a weekly extract of deaths recorded on the NPR providing the age, sex, dates of birth and death, whether the death was due to natural or unnatural causes, and the office of the Department of Home Affairs (DHA) at which the death was notified. (It is important to note, and is a limitation of the data, that we receive no real-time cause of death information beyond the categorisation of the cause of death as natural or unnatural). The data are checked for duplicates and then updated in a database maintained by the South African Medical Research Council (SAMRC).

Although the NPR does not record deaths of those without South African national identity numbers, it is still reasonably complete (nearly 90% for adults, and around 42% for children under the age of 5).[6] Two adjustments are made to the NPR data for completeness of registration: an adjustment in respect of completeness derived from the application of indirect demographic techniques to past census data; and an adjustment in respect of those without South African identity numbers, based on the official vital statistics data compiled by Statistics South Africa.[12] The methods for the adjustments are described in more detail in the Supplementary material, but suffice it to say that because the adjustments made for under-reporting of deaths are made to both the estimate of the true numbers of and the predicted numbers of deaths, the extent of error on the estimates of excess deaths (the differences between these two estimates) is limited.

The data are processed by epidemiological week ('epi-week') beginning on a Sunday and ending on the following Saturday. However, as the data extract from the NPR is compiled on a Monday, there are deaths that may have occurred in the immediately preceding epi-week that have yet to be reported to, or processed by, the Department of Home Affairs. In order for the data to be as up to date as possible, an adjustment (about 20% for natural deaths and 50% for unnatural deaths for weeks without public holidays or significant office closures) is made to the numbers of deaths in the most recent week, as outlined in the Supplementary material. Here we report on data processed on 7 February 2022.[13]

Excess deaths

Excess deaths are determined by, first, establishing a counterfactual estimate of the number of weekly deaths (by age, sex, province (and metropolitan districts, separately), as well as natural and unnatural causes) using a negative binomial regression model to project the numbers of deaths (adjusted for incompleteness of reporting of deaths). The model, which is described in detail elsewhere[11], uses estimates of population size from the Thembisa 4.2 model[14] as an 'offset' term. The log mortality rates were modelled as:

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

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.

Second, we estimate the true number of the deaths (adjusted for those not registered and those of persons without South African identity numbers) by 'epi-week' of death, and deduct from these numbers, the counterfactual estimates by 'epi-week' to derive the number of excess deaths. Natural and unnatural deaths were modelled separately in an attempt to isolate the impact of SARS-CoV-2 on health/illness from the impacts of lockdown on unnatural causes of death given the high (by international standards, even in low- and middle-income countries) injury death rates in South Africa.[15,16]

The impact of the complete cessation of birth registration during the initial lockdown level 5 in 2020 on the registration of deaths under the age of 1 year was so substantial that the weekly monitoring of the impact of the pandemic was initially restricted to those aged 1 year and older. In addition, the temporary closure of Department of Home Affairs facilities in hospitals, and possibly some reluctance by parents to register births during the early stages of the pandemic may also have reduced birth registration and thereby the numbers of deaths under the age of 1 year captured on the NPR beyond the stringent lockdown period. Based on a comparison of the NPR numbers of child deaths with data from the District Health Information System, it appeared that infant death registration resumed to usual levels by the end of May 2020 and weekly monitoring was revised to cover deaths at all ages.[17] To do this we assumed that, because the numbers of infant deaths before and after the hiatus in birth registration were below the expected number, there were no excess infant deaths during the hiatus.

An alternative measure of the extent of excess mortality is the p-score, which tracks the excess relative to the number predicted using the relevant binomial model. Age-standardised per capita rates were calculated using indirect standardisation to the South African national population age structure projected by the Thembisa model version 4.2[14] by calculating area comparability factors (the ratio of the national per capita rate to that expected for the province if it had experienced the national age-specific rates) for each province. In addition, rates during the waves and calendar years were annualised (equivalent to 52/53 weeks) to allow for the fact that the waves last for differing numbers of weeks.

Definition of waves of deaths and correlation with reported deaths

The temporal correlations between excess deaths and reported COVID-19 deaths were investigated using the Pearson correlation coefficient (R) to indicate the direction of the association and the square of the coefficient (R^2) to provide an indication of the amount of variability in the excess deaths that is explained by the variability in reported COVID-19 deaths. The correlation analyses are based on the reported number of COVID-19 deaths using the date of occurrence (rather than reporting) of each death.

Although there are various suggestions[18,19] as to how the start and end of waves of the pandemic should be determined, these are most usually expressed in terms of the number of cases or the percentage of those who tested positive. Leaving aside issues about the accuracy of measures based on testing data, these various suggestions frequently assume that there are non-wave periods between the waves (even though there may still be people testing positive and people dying of COVID-19). This is not ideal for comparing waves of deaths, which lag the number of cases and tend to drag on after peaking, because assuming that the timing of the waves of deaths is simply that of the cases lagged by an average time from infection to death, is likely to misrepresent the wave of deaths as assuming all patients with COVID-19 have an average survival will overestimate the lag at the start of the wave and underestimate it at the end of the wave.

For these reasons we determined the starting epi-week of the waves of deaths (except the first) using COVID-19 deaths in health facilities[19] by date of death captured on the DATCOV platform on the assumption that, although these certainly do not represent all COVID-19 deaths, they reflect the timing of the waves of deaths reasonably well. Given the high correlation between the DATCOV and excess death data series there are few, if any, grounds to believe that those who die outside of health facilities die at substantially different time points in a wave than those who die within health facilities. The start-week of the first wave of excess deaths was assumed to be the week these were first apparent in the weekly excess death reports of the SAMRC/University of Cape Town. After that, the start-week of each subsequent wave was assumed to be the week after the week in which the reported hospital deaths reached a local minimum. In order to minimise distortion due to random fluctuation, a central moving average (over 3 weeks for the national and 5 weeks for the provincial) was used instead of the actual weekly number of deaths.

The protocol for the maintenance of the Rapid Mortality Surveillance (RMS) database to monitor COVID-19 mortality was approved by the SAMRC Ethics Committee (EC038-9/2020). Although this database

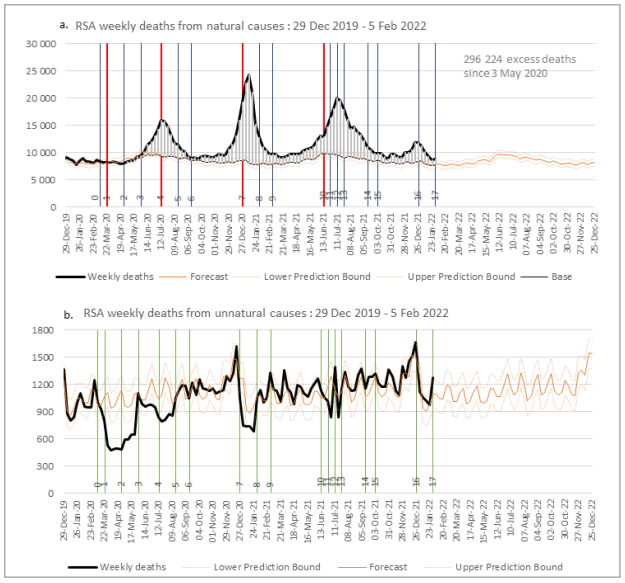
includes individual identity numbers, it does not have names or other identification fields and data security measures have been put in place to minimise the risk of unauthorised access to the records.

Results

Excess deaths

Figure 1 shows the estimated weekly numbers of (a) natural and (b) unnatural deaths in comparison with the counterfactual (predicted numbers in the absence of the pandemic) and upper and lower prediction bounds.

A few observations can be made from these figures. First, the aggregate excess mortality between 3 May 2020 and end January 2022 was high, with a total of nearly 296 000 excess natural deaths. Second, except for the initial lockdown at level 5 (numbered 1) the tightening of lockdowns was either too late (4, 7 and possibly 11) or not particularly effective in limiting the numbers of natural deaths. Finally, as has been pointed out by Moultrie et al.[10], the alcohol bans (e.g. at points 1, 7, 10 and 11 in Figure 1b) clearly reduce the number of unnatural deaths. What appears to be an exception in the week starting at 12, is a spike in unnatural deaths due to the riots in KwaZulu-Natal and Gauteng, which according to these estimates might have accounted for around 550 unnatural deaths.



*Vertical lines in order: **0**, Disaster Management Act implemented; **1**, lockdown level 5 introduced; **2**, lockdown changed to level 4, with curfew; **3**, lockdown changed to level 3, including unbanning of alcohol; **4**, alcohol re-banned and a curfew re-introduced; **5**, lockdown changed to level 2, including unbanning of alcohol; **6**, lockdown changed to level 1; **7**, lockdown changed to level 3 advanced (re-banning of alcohol and an extension of curfew); **8**, lockdown relaxed to allow sale of alcohol 4 days/week and reduce curfew; **9**, lockdown relaxed to allow sale of alcohol except during curfew and reduce curfew to 0:00–4:00; **10**, lockdown changed to level 3 advanced (limiting alcohol and extending curfew); **11**, lockdown changed to level 4, with re-banning of alcohol, curfew 21:00–4:00; **12**, unrest in KwaZulu-Natal and Gauteng; **13**, lockdown changed to level 3 advanced (alcohol 4 days/week, curfew 22:00–4:00); **14**, lockdown changed to level 2 advanced (alcohol 5 days/week, curfew 23:00–4:00); **15**, lockdown changed to level 1 advanced (no serving alcohol after 23:00, curfew 0:00–4:00, large gatherings allowed); **16**, lockdown level 1 advanced (removed limits on alcohol and curfew, allowed larger gatherings); **17**, lockdown level 1 advanced (allowed full school attendance, reduced isolation and quarantine requirements).*

Figure 1: Weekly number of natural and unnatural deaths in South Africa, 29 December 2019 – 5 February 2022. Weekly excess natural deaths are represented by grey bars between the estimated weekly numbers and the predicted numbers. Vertical lines indicate the weeks in which material changes were made to the lockdown regulations with red lines representing a tightening of restrictions to limit the spread of infections or the impact on healthcare resources.

Comparison of reported COVID-19 deaths and excess deaths

Figure 2 shows the weekly number of excess natural deaths and the number of COVID-19 deaths reported by the National Department of Health (https://sacoronavirus.co.za/). While there is a correspondence between the numbers, the excess deaths were much higher than the reported deaths.

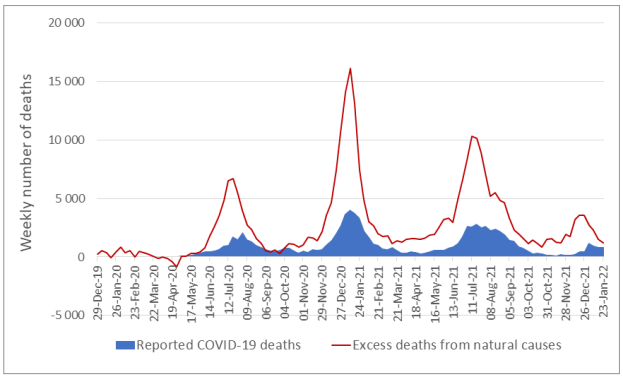


Figure 2: Weekly number of excess natural deaths and reported COVID-19 deaths in South Africa, 29 December 2019 – 5 February 2022.

Table 1 compares the number of excess deaths due to natural causes to the number of reported COVID-19 deaths up to and including the last week in January 2022, and includes the square of the correlation coefficients (all of which were positive) of these numbers over time (with the reported numbers allocated to their week of death rather than the week of reporting) to the end of 2021 (to avoid the measure being distorted by missing late reporting of COVID-19 deaths).

Table 1: Number of excess natural deaths and reported COVID-19 deaths (cumulative to 30 January 2022) and ratio and correlation by wave and province in South Africa

Category	Excess natural deaths (EDs)	Reported COVID-19 deaths (RDs)	Ratio of reported to excess deaths (RDs/EDs)	R^2 (weekly data by date of death)
South Africa	295 135	93 186	31%	94%
Wave				
1	48 857	18 457	38%	94%
2	108 061	33 128	31%	98%
3	116 343	36 268	31%	94%
4	22 483	5333	24%	63%
Province				
Eastern Cape	50 257	16 025	32%	85%
Free State	16 662	7321	44%	81%
Gauteng	58 254	19 958	34%	94%
KwaZulu-Natal	60 942	15 371	25%	95%
Limpopo	31 758	4213	13%	92%
Mpumalanga	22 795	2209	10%	65%
Northern Cape	8428	2478	29%	54%
North West	16 569	4420	27%	91%
Western Cape	30 559	21 212	69%	94%

From this we see that reported COVID-19 deaths account for around one third of the excess natural deaths, and possibly less than this in the fourth wave, although much of this difference is probably due to delays in the official reporting of deaths. Further, the percentage of excess deaths that are recorded as COVID-19 deaths is highest in the Western Cape (69%) and next, by some distance, in the Free State (44%). Most of the other provinces report percentages of excess deaths from COVID-19 of between 25% and 35%, while reporting of deaths in Limpopo and Mpumalanga is particularly poor. In addition, the correlation of the timing of the deaths is very high (R^2>90%) for the country as a whole and for five of the provinces, moderately high for the Eastern Cape and Free State (at 80–89%), but low for Mpumalanga and particularly for the Northern Cape. Finally, the ratio of reported COVID-19 deaths to excess deaths during the first three waves was similar to the national (31–38%) but much lower in the fourth wave 4 (24%). Similarly, temporal correlation was high during the first three waves (94–98%) but much lower in the fourth wave (63%).

Table 2 shows the cumulative (until the end of January 2022) excess death rates per 100 000 population. In addition, it shows annualised excess death rates to afford comparison of waves with differing durations and for each calendar year. Finally, age-standardised excess death rates per 100 000 population for the provinces are included to allow for the effect of some provinces having older populations than other provinces.

Table 2: Age-standardised cumulative excess death rate (per 100 000 population) and annualised excess death rate (per 100 000 population) by wave and year for provinces of South Africa. (Wave 4 data is through to 30 January 2022. While the extra mortality in that week was rather low, there are almost certainly additional deaths that have occurred since that date that would be attributed to that wave.)

Region	Cumulative rate	Annualised rate					
		Wave 1	Wave 2	Wave 3	Wave 4	2020	2021
South Africa	497	183	389	318	179	218	342
Province							
Eastern Cape	621	362	502	237	389	299	294
Free State	570	304	388	411	208	150	404
Gauteng	410	210	249	346	79	111	299
KwaZulu-Natal	610	233	651	300	253	178	416
Limpopo	467	100	440	353	222	419	384
Mpumalanga	509	132	467	396	183	444	410
Northern Cape	671	212	361	602	330	114	535
North West	422	117	322	395	124	63	352
Western Cape	379	154	272	249	154	130	237

These results show that, standardised by size and age distribution of the population, the cumulative excess death rate is lowest for the Western Cape, followed by Gauteng, and highest for the Northern Cape, Eastern Cape and then KwaZulu-Natal. In terms of waves, the second wave had the highest annualised excess death rate, followed by the third wave. The excess death rate in 2021 was significantly higher than that in 2020, particularly for the North West and Northern Cape. The fourth wave was of a similar magnitude to the first wave. Finally, annualised rates were particularly high in the Northern Cape's third wave, KwaZulu-Natal's second wave, and, to a lesser extent, the Eastern Cape's second wave.

Who, where and when?

The COVID-19 pandemic has affected provinces differently, both in regard to timing and to the impact on mortality. This difference is clearly demonstrated in Figure 3, which shows the p-score by epi-week for each province. The differential impact of each of the four waves is evident, with the extra mortality arising during the fourth wave being the mildest.

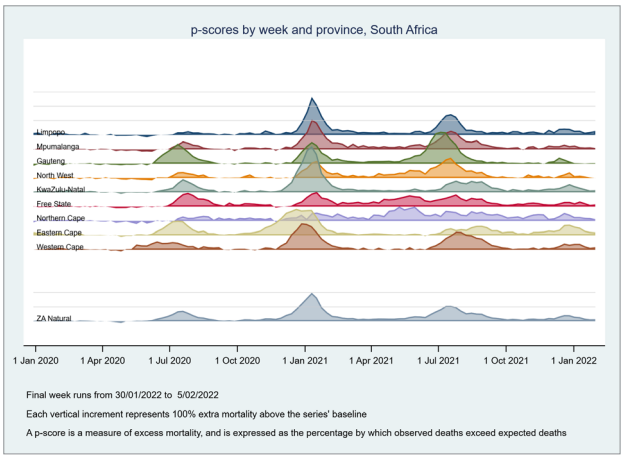


Figure 3: P-score of excess deaths in South Africa by week and province, 29 December 2019 – 5 February 2022.

From Figure 4, which shows the p-score by epi-week by age group, the consistent impact of the pandemic is apparent for the age groups 40 years and above. The impact is particularly marked for age groups 60 years and above. Fluctuations in younger age groups are more erratic and in the case of children 0–4 years, it is clear that during much of 2020, deaths were averted. In 2021, the numbers of deaths of children 0–4 years have tended to be higher than expected but generally have not breached the upper prediction bound for this age group (exceeded the upper prediction bound in only 4 weeks out of 52).

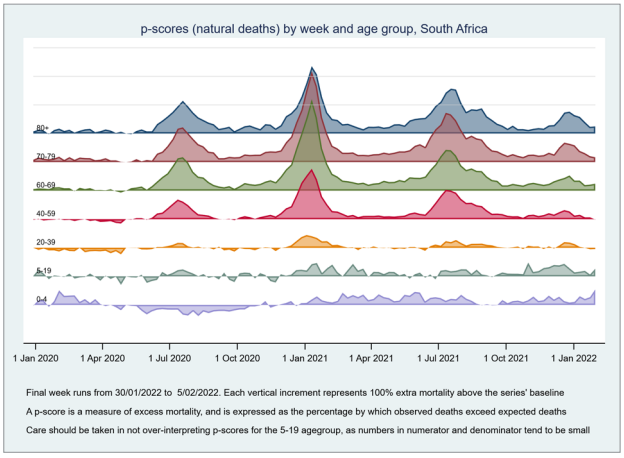


Figure 4: P-score of excess deaths in South Africa by week and age group, 29 December 2019 – 5 February 2022.

Figure 5 shows age-specific annualised excess death rates per 1000 population (a) for the four waves (male and female individuals combined) and (b) for male and female individuals over all four waves combined. From Figure 5a, we see that rates were highest for the second wave and lowest for the first and fourth waves (which are very similar) with the third wave being in between (slightly higher than the first and fourth waves). From Figure 5b, we see the distinct age pattern for COVID-19 mortality, with a rapid increase in mortality rates with age for both sexes. Although the rates are higher for male than for female individuals aged 60 years and above, they are, in fact, lower at most age groups under

60 years, with the male rate for all ages combined being about 75% of that of the rate for females of all ages (consistent with the ratio found for 2020[8]) because there are many more female than male individuals of older ages.

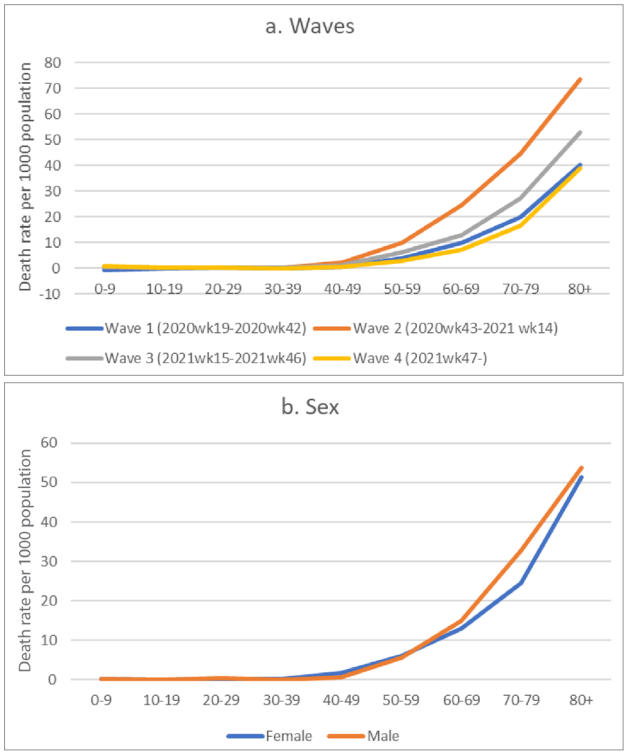


Figure 5: Age-specific annualised excess death rates (per 1000 population) by (a) wave and (b) sex in South Africa. (Excess deaths from 3 May 2020 – 29 January 2022.)

Discussion

Assuming that a large proportion of the excess deaths in each province are due to COVID-19, the results presented here (particularly, the high correlation between, and ratios of, the reported number of COVID-19 deaths and excess death for each province) show that the official reporting of COVID-19 deaths varies dramatically between provinces. While the pattern of officially reported COVID-19 deaths in the Western Cape – in particular – has closely mirrored that of the excess deaths, in absolute terms, the discrepancy between the totals is still substantial. In other provinces – particularly Limpopo and Mpumalanga – it is evident that provincial data systems have not been able to identify a very high proportion of deaths that were almost certainly due to COVID-19. Further, it appears that the quality of official reporting of COVID-19 deaths may be worsening over time.

This speaks to the importance of complete and timely official data systems, at both national and provincial levels, and offers some insight into the potential burden of COVID-19 deaths in countries with very limited or non-existent health data systems. It is not beyond the realm of possibility that many other countries in sub-Saharan Africa might have experienced the same health data system challenges that are so evident in some South African provinces.

The results here provide further insight into the timing, duration, and spread of different waves of infection in different provinces. Some of these differences are attributable to the geographic spread of infections, but these are then amplified (and perhaps confounded) by the differences in population age distribution and density, patterns of social mixing, and provincial differences in the prevalence of known comorbidities such as diabetes, hypertension, and obesity.[20]

Second, there are differences in the levels of excess mortality associated with each wave. Based on our results, mortality in the second (Beta) wave was much higher than mortality in the third wave, which was higher than in either the first or the fourth waves. The analysis and explanation of these dynamics is a matter for further research, but no doubt reflects a combination of virulence and severity of the variant, the level of natural immunity arising from past infection, as well as (certainly in the fourth wave) the role of mass vaccination against SARS-CoV-2.

Third, despite considerable provincial variations, the timing of various interventions escalating the disaster lockdown levels under the national regulations was applied almost exclusively at a national level (the only exception being the imposition of restrictions in certain districts towards the beginning of the second wave), and were largely ill-timed relative to the timing of the excess deaths. National restrictions on the sale and/or on-site consumption of alcohol had a considerable impact on unnatural deaths, but little if any impact on deaths due to natural causes. However, the period of 'hard lockdown' from March to May 2020 did have a marked effect on natural deaths, particularly among young children. Between 25 March 2020 and 17 August 2020, a tobacco sales ban was implemented in South Africa as part of the COVID-19 lockdown, based on concerns about increased transmission and severity of COVID-19 infection and disease. Although it was not clear at the time, there is strong evidence that the risk of severe illness and mortality due to COVID-19 is significantly higher for ever-smokers compared with never-smokers[21,22] but evidence for increased risk of COVID-19 infection in smokers is unconvincing[22]. While tobacco endgame-strategies ultimately include a tobacco sales ban, demand-side preconditions are required for this to be successful (namely, low smoking prevalence <10% and smoking cessation support).[23] Filby et al.[24] argue that South Africa did not meet these preconditions at the time of introducing the smoking ban. Whilst 9% of pre-lockdown smokers reported quitting due to the ban, 93% of continuing smokers purchased cigarettes through informal channels despite the ban. Given the differences in the timing of the surges experienced in the provinces, there is a need for provinces to have scope to implement interventions based on the situation in their particular province.

Fourth, the observation that male excess mortality has been consistently greater than female mortality at the older ages (60+ years) has been documented in South Africa[8] and elsewhere[25], but it appears that female excess mortality may be higher in some age groups below age 50 and the reasons for this requires further research. The ability to fully and completely identify known comorbidities among decedents, and to associate these with differential prevalence of these comorbidities by sex, may shed light on this matter.

Fifth, we caution that the full impact of the pandemic on excess mortality may take many years to be completely revealed. 'Long COVID' may contribute to mortality for some time, and the collateral deaths (in terms of missed diagnoses or treatment, for example) arising from lockdowns and the overburdening of the health system during the various waves remain unknown, making it important to continue monitoring its impact.[26]

Finally, while this paper offers detailed insight into the burden of mortality in South Africa arising during the COVID pandemic, there is almost no data from other African, developing, or low-to-middle-income countries against which to compare our results. Officially reported deaths from the disease in these settings are known to be extensively under-reported, and South Africa is but one of very few countries with the data and skills available to track excess mortality in near-to-real time. While we are unable to ascertain with certainty the proportion of excess deaths attributable to COVID-19 from the South African death data, the level of excess mortality strongly challenges the argument that Africa is somehow less affected by the pandemic than other regions of the world. Using data from Our World in Data (https://ourworldindata.org/), which uses our estimate of excess deaths from all causes (which is lower than excess deaths due to natural causes), South Africa has higher excess deaths per 100 000 population than Brazil, the UK, and the USA. Yet, given the comparatively youthful age profile of the South African population relative to these three countries, adjusting for age would make the comparison even more marked.

These results suggest that, in one of the few African countries capable of marshalling national death data, the impact of the pandemic measured through all-cause excess deaths has been anything but mild. However, South Africa is not a bellwether for Africa: its population is somewhat older than that of most African countries and has higher prevalence of co-morbidities, being relatively wealthier than most other African countries. In addition, South Africa has a very high HIV burden.

Study limitations

The counterfactual is based on data for the period 2014–2019, assuming that the trends in historical mortality rates and population numbers persist, and does not take into account other perturbations in the numbers of deaths. In addition, there is considerable uncertainty around what proportion of the excess deaths was due to COVID-19 (directly or indirectly) and the true range of uncertainty about the estimate of excess deaths.

Conclusion

This research raises important questions about the ability of most low-income and possibly some middle-income countries, particularly those in sub-Saharan Africa, to generate appropriate, accurate, timely, and reliable data to inform national responses to novel pandemics of the size and scale of COVID-19. That we know so much about the South African experience during the COVID-19 pandemic is because the country has a National Population Register, which is updated with fact of death data from a fairly complete civil registration and vital statistics (CRVS) system.

Tracking excess deaths from natural causes has revealed substantial and concerning discrepancies in the quality and utility of the country's disease surveillance data at a provincial level. Despite major data challenges, the near-real time system has provided strong and more reliable information about the true impact of COVID-19 on the South African population. However, there is little room for complacency. The time it takes to report on the causes of death currently suggests that the CRVS needs urgent re-engineering, including electronic death registration. Local-level surveillance in the Western Cape has demonstrated that with further training of medical personnel involved in the certification of death and with appropriate political and bureaucratic will, the quality and utility of these data can be improved immensely.[27]

Finally, the maintenance and enhancement of the only near-real time mortality surveillance system cannot be allowed to be deprioritised as the pandemic dissipates. The after-effects of COVID-19 are likely to affect population health for many years to come, and a near-real time mortality surveillance system should ideally be augmented, refined, and further developed in conjunction with CRVS to provide near-real time cause of death data to inform policy response to other communicable diseases, and in time to add to the evidence base about the burden of disease in South Africa.

Competing interests

We have no competing interests to declare.

Authors' contributions

Conceptualisation: All. Methodology: R.D., D.B., T.M., R.L. Data collection: R.L. Data analysis: R.D., R.L., D.B. Data curation: R.L. Writing – the initial draft: D.B., R.D., T.M. Writing – revisions: All. Funding acquisition: P.G., D.B.

References

1. Adam D. The pandemic's true death toll: Millions more than official counts. Nature. 2022;601(7893):312–315. https://doi.org/10.1038/d41586-022-00104-8
2. Karlinsky A, Kobak D. Tracking excess mortality across countries during the COVID-19 pandemic with the World Mortality Dataset. eLife 2021;10, e69336. https://doi.org/10.7554/eLife.69336
3. The pandemic's true deaths toll. The Economist. c2020 [cited 2022 Feb 02]. Available from: https://www.economist.com/graphic-detail/coronavirus-excess-deaths-estimates
4. Institute for Health Metrics Evaluation. COVID-19 projections [webpage on the Internet]. c2022 [cited 2022 Feb 02]. Available from: https://covid19.healthdata.org/japan?view=cumulative-deaths&tab=trend
5. World Health Organization. The true death toll of COVID-19: Estimating global excess mortality [webpage on the Internet]. c2021 [cited 2022 Feb 02]. Available from: https://www.who.int/data/stories/the-true-death-toll-of-covid-19-estimating-global-excess-mortality
6. Dorrington RE, Moultrie TA, Laubscher R, Groenewald PJ, Bradshaw D. Rapid mortality surveillance using a national population register to monitor excess deaths during SARS-CoV-2 pandemic in South Africa. Genus. 2021;77(1):19. https://doi.org/10.1186/s41118-021-00134-6
7. Bradshaw D, Laubscher R, Dorrington RE, Groenewald P, Moultrie TA. Weekly deaths in South Africa 1 January – 15 March 2020. Cape Town: South African Medical Research Council; 2020.
8. Bradshaw D, Dorrington RE, Laubscher R, Moultrie TA, Groenewald P. Tracking mortality in near to real-time provides essential information about the impact of the COVID-19 pandemic in South Africa in 2020. S Afr Med J. 2021;111(8):732–740. https://doi.org/10.7196/SAMJ.2021.v111i8.15809
9. Moultrie TA, Dorrington R, Laubscher R, Groenewald P, Bradshaw D. Correlation of excess natural deaths with other measures of the COVID-19 pandemic in South Africa [document on the Internet]. Cape Town: Burden of Disease Research Unit, South African Medical Research Council; 2021. Available from: https://www.samrc.ac.za/sites/default/files/files/2021-03-03/CorrelationExcessDeaths.pdf
10. Moultrie TA, Dorrington RE, Laubscher R, Groenewald P, Parry CDH, Matzopoulos R, et al. Unnatural deaths, alcohol bans and curfews: Evidence from a quasi-natural experiment during COVID-19. S Afr Med J. 2021;111(9):834–837.
11. Dorrington R, Bradshaw D, Laubscher R, Groenewald P, Moultrie TA. Methodological note: Predicted numbers of death by epi-week for South Africa in 2020 and 2021 [document on the Internet]. Cape Town: Burden of Disease Research Unit, South African Medical Research Council; 2021. Available from: https://www.samrc.ac.za/sites/default/files/files/2021-01-24/Methodological%20Note%20on%20Predicted%20Weekly%20Deaths%2020_Jan_2021.pdf
12. Statistics South Africa. Mortality and causes of death in South Africa, 2017: Findings from death notification. Statistical release P0309.3 Mortality 2017. Pretoria: Statistics South Africa; 2020. Available from: https://www.statssa.gov.za/publications/P03093/P030932017.pdf
13. Bradshaw D, Laubscher R, Dorrington R, Groenewald P, Moultrie TA. Report on weekly deaths in South Africa 1 January 2020 – 5 January 2021 (Week 53) [document on the Internet]. Cape Town: Burden of Disease Research Unit, South African Medical Research Council; 2020. Available from: https://www.samrc.ac.za/sites/default/files/files/2021-01-13/weekly5Jan2021.pdf
14. Johnson LF, Dorrington RE, Moolla H. HIV epidemic drivers in South Africa: A model-based evaluation of factors accounting for inter-provincial differences in HIV prevalence and incidence trends. South Afr J HIV Med. 2017;18(1):695. https://doi.org/10.4102/sajhivmed.v18i1.695
15. Matzopoulos R, Prinsloo M, Bradshaw D, Pillay-van Wyk V, Gwebushe N, Mathews S, et al. The Injury Mortality Survey: A national study of injury mortality levels and causes in South Africa in 2009. Cape Town: South African Medical Research Council; 2012.
16. Matzopoulos R, Prinsloo M, Pillay-van Wyk V, Gwebushe N, Mathews S, Martin LJ, et al. Injury-related mortality in South Africa: A retrospective descriptive study of postmortem investigations. Bull World Health Organ. 2015;93(5):303–313. https://doi.org/10.2471/BLT.14.145771
17. Bradshaw D, Laubscher R, Dorrington R, Groenewald P, Moultrie TA. Report on weekly deaths in South Africa 8 - 14 August 2021 (Week 32) [document on the Internet]. Cape Town: Burden of Disease Research Unit, South African Medical Research Council; 2021. Available from: https://www.samrc.ac.za/sites/default/files/files/2021-08-18/weekly14Aug2021.pdf

18. NICD-NHLS Centre for Respiratory Diseases and Meningitis. Proposed definition of COVID-19 wave in South Africa. Communicable Diseases Communique. 2021;20(11):3–4. Available from: https://www.nicd.ac.za/wp-content/uploads/2021/11/Proposed-definition-of-COVID-19-wave-in-South-Africa.pdf

19. South African COVID-19 Modelling Consortium. COVID-19 modelling update: Considerations for the third wave, including the impact of the Delta variant of concern. Johannesburg: National Institute for Communicable Diseases; 2021. Available from: https://www.nicd.ac.za/wp-content/uploads/2021/07/SACMC-Third-wave-report-inlcuding-Delta-variant.pdf

20. National Department of Health, Statistics South Africa, South African Medical Research Council and ICF. South Africa Demographic and Health Survey 2016 [data set on the Internet]. c2019 [cited 2020 Oct 20). Available from: https://www.statssa.gov.za/publications/Report%2003-00-09/Report%2003-00-092016.pdf

21. Patanavanich R, Glantz SA. Smoking is associated with worse outcomes of COVID-19 particularly among younger adults: A systematic review and meta-analysis. BMC Public Health. 2021;21(1):1554. https://doi.org/10.1186/s12889-021-11579-x

22. Clancy L, Gallus S, Leung J, Egbe CO. Tobacco and COVID-19: Understanding the science and policy implications. Tobacco Induced Dis. 2020;18:105. https://doi.org/10.18332/tid/131035

23. Smith EA, Malone RE. An argument for phasing out sales of cigarettes. Tobacco Control. 2020;29(6):703–708. https://doi.org/10.1136/tobaccocontrol-2019-055079

24. Filby S, Van der Zee K, Van Walbeek C. The temporary ban on tobacco sales in South Africa: Lessons for endgame strategies. Tobacco Control. Forthcoming 2021. https://doi.org/10.1136/tobaccocontrol-2020-056209

25. Nimgaonkar I, Valeri L, Susser E, Hussain S, Sunderram J, Aviv A. The age pattern of the male-to-female ratio in mortality from COVID-19 mirrors that of cardiovascular disease in the general population. Aging. 2021;13(3):3190-3201. https://doi.org/10.18632/aging.202639

26. Tobías A, Riffe T, Ramiro D, Trias-Llimós S. Forthcoming challenges for COVID-19 data collection. The Lancet Public Health. Forthcoming 2022. https://doi.org/10.1016/S2468-2667(22)00029-9

27. Groenewald P, Bradshaw D, Daniels J, Zinyakatira N, Matzopoulos R, Bourne D, et al. Local-level mortality surveillance in resource-limited settings: a case study of Cape Town highlights disparities in health. Bull World Health Organ. 2010;88(6):444–451. https://doi.org/10.2471/BLT.09.069435

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EDITOR:
Pascal Bessong

The intersection of age, sex, race and socio-economic status in COVID-19 hospital admissions and deaths in South Africa

Older age, male sex, and non-white race have been reported to be risk factors for COVID-19 mortality. Few studies have explored how these intersecting factors contribute to COVID-19 outcomes. This study aimed to compare demographic characteristics and trends in SARS-CoV-2 admissions and the health care they received. Hospital admission data were collected through DATCOV, an active national COVID-19 surveillance programme. Descriptive analysis was used to compare admissions and deaths by age, sex, race, and health sector as a proxy for socio-economic status. COVID-19 mortality and healthcare utilisation were compared by race using random effect multivariable logistic regression models. On multivariable analysis, black African patients (adjusted OR [aOR] 1.3, 95% confidence interval [CI] 1.2, 1.3), coloured patients (aOR 1.2, 95% CI 1.1, 1.3), and patients of Indian descent (aOR 1.2, 95% CI 1.2, 1.3) had increased risk of in-hospital COVID-19 mortality compared to white patients; and admission in the public health sector (aOR 1.5, 95% CI 1.5, 1.6) was associated with increased risk of mortality compared to those in the private sector. There were higher percentages of COVID-19 hospitalised individuals treated in ICU, ventilated, and treated with supplemental oxygen in the private compared to the public sector. There were increased odds of non-white patients being treated in ICU or ventilated in the private sector, but decreased odds of black African patients being treated in ICU (aOR 0.5; 95% CI 0.4, 0.5) or ventilated (aOR 0.5; 95% CI 0.4, 0.6) compared to white patients in the public sector. These findings demonstrate the importance of collecting and analysing data on race and socio-economic status to ensure that disease control measures address the most vulnerable populations affected by COVID-19.

Significance:

- These findings demonstrate the importance of collecting data on socio-economic status and race alongside age and sex, to identify the populations most vulnerable to COVID-19.
- This study allows a better understanding of the pre-existing inequalities that predispose some groups to poor disease outcomes and yet more limited access to health interventions.
- Interventions adapted for the most vulnerable populations are likely to be more effective.
- The national government must provide efficient and inclusive non-discriminatory health services, and urgently improve access to ICU, ventilation and oxygen in the public sector.
- Transformation of the healthcare system is long overdue, including narrowing the gap in resources between the private and public sectors.

Introduction

South Africa has experienced a high burden of COVID-19 and recorded over 3.6 million laboratory confirmed cases and 96 993 deaths as of 13 February 2022.[1] The official reported COVID-19 cases and deaths are an underestimate as indicated by sero-surveys and alternative methods for analysing COVID-19 attributable deaths. A population-based sero-survey undertaken in Gauteng prior to the onset of the fourth COVID-19 wave that was dominated by the Omicron variant, reported that 68% of people not vaccinated against COVID-19 were sero-positive[2], which implies that 10.5 million infections had taken place by then, compared with only 2.9 million cases being officially recorded as of 25 November 2021[3]. Furthermore, the South Africa Medical Research Council estimated 298 879 excess deaths between 3 May 2020 and 13 February 2022 attributable to COVID-19[4], which is three-fold higher than the 96 993 recorded deaths since the start of the pandemic through to 13 February 2022.

The risks for severe COVID-19 disease are disproportionately born among different communities. Older age, male sex, minority race groups, and lower socio-economic status (SES) have been shown to be associated with severe COVID-19 disease and death.[5-7] People from vulnerable racial and ethnic groups in many regions have been reported to be disproportionately affected by COVID-19, and have experienced increased risk of infection, hospitalisation and death.[8-10] This risk has also been reported in South Africa from a study of a large cohort of hospitalised patients, which demonstrated that non-white race was associated with increased risk of COVID-19 mortality.[11]

Race and SES are an important predictor of inequality in South Africa. South Africa is an upper-middle-income country with the distinction of having the highest level of income inequality in the world.[12] Black Africans, the unemployed, the less educated and female-headed households are most affected by poverty.[12,13] Racial classification was introduced by the apartheid regime and remains entrenched in South African society, with four defined race groups. In 2011, South Africans classified themselves in the census, resulting in 2020 mid-

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year population estimates of 80.8% being black African, 8.8% as coloured, 2.6% as Indian descent and 7.8% as white ancestry.[14]

Race and SES have an impact on health burden globally and in South Africa. Racial/ethnic and SES disparities in health have been linked to higher risk of infectious diseases and poorer disease outcomes[15], as well as reduced life expectancy and mortality[16]. South Africa has a significant burden of disease related to communicable and non-communicable disease, trauma, and injuries, with a disproportionate share borne by poor black Africans.[17]

An understanding of the relationship between race and other demographic characteristics with COVID-19 hospitalisation and mortality is important to effectively address the burden of disease among the most affected populations and to inform public health policy. In this study, we aimed to describe the trends and characteristics of SARS-CoV-2 admissions and the health care they received, and compare demographic characteristics of age, sex and race, as well as SES.

Methods

Study design, setting and data source

This study was a cross-sectional analysis using data collected from DATCOV, a national active surveillance system for COVID-19 hospital admissions in South Africa, between 5 March 2020 and 8 January 2022. DATCOV contains data on all individuals who had a positive real-time reverse transcription polymerase chain reaction (rRT-PCR) assay for SARS-CoV-2 or a positive SARS-CoV-2 antigen test, with a confirmed duration of stay in hospital of one full day or longer, regardless of reason for admission. The case reporting form, adapted from the World Health Organization's COVID-19 case reporting tool, contains basic demographic data (age, sex, and race which was self-defined by the patient as black African, white, coloured, Indian ancestry or other race group); exposures such as occupation; potential risk factors such as obesity, comorbid diseases and pregnancy status; treatment and outcomes. Race information was missing in 156 061/439 448 (35.5%) of patients. The Human Research Ethics Committee (Medical) at the University of the Witwatersrand (Johannesburg, South Africa) approved the project protocol as part of a national surveillance programme (M160667).

Data analysis

The wave periods were defined from the week South Africa crossed a weekly incidence risk of 30 cases per 100 000 persons at the start and end of the waves.[18]

- Pre-wave 1: week 10 (2020) – week 23 (2020) [5 March – 6 June 2020]
- Wave 1: week 24 (2020) – week 34 (2020) [7 June – 22 August 2020]
- Post-wave 1: week 35 (2020) – week 46 (2020) [23 August – 14 November 2020]
- Wave 2: week 47 (2020) – week 5 (2021) [15 November 2020 – 6 February 2021]
- Post-wave 2: week 6 (2021) – week 18 (2021) [7 February – 8 May 2021]
- Wave 3: week 19 (2021) – week 37 (2021) [9 May – 18 September 2021]
- Post-wave 3: week 38 (2021) – week 46 (2021) [19 September – 20 November 2021]
- Wave 4: week 47 (2021) – week 3 (2022) [21 November 2021 – 22 January 2022]

In addition, periods were combined to create four distinct wave periods that corresponded to the periods during which SARS-CoV-2 variants circulated: D614G in the first wave, Beta in the second wave, Delta in the third wave and Omicron in the fourth wave.

COVID-19 in-hospital mortality was defined as a death related to COVID-19 that occurred during the hospital stay and excluded deaths that occurred because of other causes or after discharge from hospital. Case-fatality risk was calculated among individuals with in-hospital outcome, i.e. COVID-19 deaths divided by COVID-19 deaths plus COVID-19 discharges, excluding individuals who were still admitted in hospital at the time of analysis. For the calculation of cumulative incidence, Stats SA mid-year population estimates for 2020 were utilised.[14]

Categorical variables were presented as frequencies and percentages, while continuous variables such as age were expressed as median and interquartile range (IQR). Chi-square and Kruskal–Wallis tests were used to compare proportions and median difference where appropriate.

Multivariable logistic regression analysis was performed to identify (1) the potential factors associated with COVID-19 in-hospital mortality and (2) the odds of being treated in ICU and ventilated, by race. Age, sex, race, presence of a comorbidity (hypertension, diabetes, chronic cardiac disease, chronic pulmonary disease and asthma, chronic renal disease, malignancy in the past 5 years, obesity, HIV, and past and current tuberculosis), health sector, province and wave period were considered as potential risk factors for COVID-19 in-hospital mortality. Socio-economic variables were not collected. Health sector of admission was used as a proxy for SES, with people admitted in public sector hospitals considered to be from lower SES and people admitted in private sector hospitals assumed to be from higher SES. There is strong alignment of individuals with higher SES being employed and able to afford medical insurance and seek private hospital care, while those of lower SES who are unable to afford private medical insurance are not able to access private hospital care. We assessed all variables that were significant with a *p*-value of less than 0.2 in the univariate analysis and excluded non-significant

factors ($p \geq 0.05$) with manual backward elimination. Statistical analyses were performed using STATA software version 16 (Stata Corp®, College Station, Texas, USA).

Results

Between 5 March 2020 and 8 January 2022, 386 171 admissions and 91 180 deaths were reported from 646 hospitals in South Africa.

Admission trends

The median age of hospitalised COVID-19 cases was 53 (38–65) years, which was similar among black African patients, coloured patients and patients of Indian descent, but higher among white patients (median age: 61 [IQR 50–73] years; $p<0.001$) (Table 1). Most COVID-19 hospitalised patients were in the 40–59-year age group ($n=160\ 172$, 36.5%), whilst only 5.9% ($n=25\ 999$) were in the <20-year age group ($p<0.001$). COVID-19 admissions were highest amongst the 40–59-year age group in patients of Indian descent (44.2%), coloured patients (39.6%), and black African patients (35.7%), while the highest percentage of admissions among white patients was in the 60–79-year (40.9%) age group. Overall, there were more admissions among female patients (55.4%) than male patients ($p<0.001$); however, the trend was reversed with more admissions amongst male patients in those of Indian descent (55.4%) and white ancestry (54.2%). Among 282 496 patients with known race, the cumulative number of COVID-19 hospitalisations was 215 539 (76.3%) among black African patients, 32 672 (11.6%) in white patients, 19 784 (7.0%) among coloured patients and 14 501 (5.1%) in patients of Indian descent.

The number (and percentage) of admissions with no reported comorbidities was 6235 (43.0%) among those of Indian descent and 13 112 (40.1%) of white ancestry, compared with 4 663 (23.6%) among coloured and 60 317 (28.0%) among black African patients. Hypertension (115 032; 26.4%) and diabetes (74 544; 17.1%) were the most prevalent comorbidities amongst all race groups, but comorbidities with high prevalence in black patients were HIV (19 939; 9.3%) and current TB (1176; 1.1%); in white patients were malignancy (383; 1.2%) and obesity (2532; 8.1%); and in patients of Indian descent was chronic cardiac disease (676; 4.7%).

The highest number of COVID-19 hospitalisations was reported during the third wave dominated by the Delta variant (147 582), followed by the second wave which was dominated by the Beta variant (105 985), the first wave which was due to the wild-type virus (71 410) and, finally, the fourth wave (42 746) which was dominated by the Omicron variant.

The highest percentage of total admissions among black African patients was in the first (61 389/106 326; 57.7%) and fourth waves (22 904/42 746; 53.6%); among white patients in the third wave (17 509/157 205; 11.1%), among coloured patients in the third wave (7716/157 205; 4.9%) and among those of Indian descent in the second wave (5033/132 899; 3.8%). In the fourth wave, coloured patients, white patients and those of Indian descent accounted for a lower percentage of total admissions than for the prior three waves ($p<0.001$), whereas black African patients accounted for a higher percentage of total admissions in the fourth wave compared to the second and third waves ($p<0.001$).

The percentage of total admissions per wave decreased from the first to third wave among black African individuals and increased from the third to fourth wave (Figure 1). The percentage of total admissions per wave increased from the first to third wave among coloured people, people of Indian descent and white people, and then decreased from the third to fourth wave. The percentage of total admissions in which race was unknown increased with each wave.

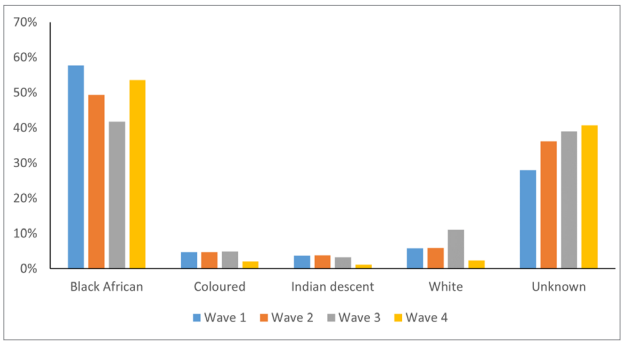

Figure 1: Percentage of COVID-19 admissions, by race group and wave period, in South Africa from 5 March 2020 to 8 January 2022.

Incidence of COVID-19 admissions and deaths

The incidence of COVID-19 admissions (per 100 000 persons) increased with age. While the overall incidence was higher in female (526.8) than male (417.0) individuals, it was higher in female individuals <60 years and in male individuals ≥60 years (Table 2). The incidence of admissions was highest among people of Indian descent (940.4) and was 446.9 in black African people, 376.5 in coloured people and 697.7 in white people. The incidence of admissions was higher in female than male individuals among black African and coloured people, and higher in male individuals among those of Indian descent and white ancestry.

The incidence risk of in-hospital COVID-19 deaths (per 100 000 persons) increased with age (Table 3). While overall incidence was higher in female (115.6) than male patients (104.3), it was higher in female patients <40 years and in male patients ≥40 years. Incidence of deaths was highest among patients of Indian descent (218.0), followed by white patients (157.2), black African patients (104.3), and coloured patients (89.0). Overall, in the 20–79-year age group, incidence of COVID-19 deaths was highest in those of Indian descent, whilst being highest among black African patients in the <20-year and ≥80-year age groups.

Factors associated with mortality

On multivariable analysis, black African (adjusted odds ratio [aOR] 1.3, 95% confidence interval [CI] 1.2, 1.3), coloured (aOR 1.2, 95% CI 1.1, 1.3), Indian descent (aOR 1.2, 95% CI 1.2, 1.3) and patients of other races (aOR 1.4, 95% CI 1.4, 1.5) had increased risk of in-hospital COVID-19 mortality compared to white patients. Furthermore, admission in the public health sector (aOR 1.5, 95% CI 1.5, 1.6) was associated with increased risk of mortality compared with admission to the private sector (Table 4). Other factors associated with in-hospital mortality were ages of 20–39 years (aOR 3.1, 95% CI 2.7, 3.6), 40–59 years aOR 8.6, 95% CI 7.4, 9.9), 60–79 years (aOR 19.4, 95% CI 16.8, 22.2) and ≥80 years (aOR 35.2, 95% CI 30.6, 40.6) compared to <20 years; male sex (aOR 1.3, 95% CI 1.3, 1.4); hypertension (aOR 1.1, 95% CI 1.0, 1.1), diabetes (aOR 1.4, 95% CI 1.3, 1.4), chronic cardiac disease (aOR 1.2, 95% CI 1.1, 1.3), chronic kidney disease (aOR 1.6, 95% CI 1.5, 1.7), malignancy (aOR 1.6, 95% CI 1.4, 1.9), HIV (aOR 1.3, 95% CI 1.2, 1.4), current TB (aOR 1.4, 95% CI 1.2, 1.6), and current and past TB (aOR 1.4, 95% CI 1.2, 1.6) compared to no history of or current TB. Also, being hospitalised in the Eastern Cape (aOR 1.9, 95% CI 1.8, 2.0), Free State (aOR 1.3, 95% CI 1.3, 1.4), Gauteng (aOR 1.4, 95%CI 1.4, 1.5), KwaZulu-Natal (aOR 1.5, 95% CI 1.4, 1.6), Limpopo (aOR 1.7, 95% CI 1.6, 1.9), Mpumalanga (aOR 1.4, 95% CI 1.3, 1.5), North West (aOR 1.2, 95% CI 1.0, 1.2) and Northern Cape (aOR 1.4, 95% CI 1.3, 1.6) was associated with higher in-hospital mortality compared with hospitalisation in the Western Cape. Individuals also had higher risk of mortality if admitted during the second wave (aOR 1.5, 95% CI 1.4, 1.5) or third wave (aOR 1.3, 95% CI 1.3, 1.4), but lower risk of mortality if admitted during the fourth wave (aOR 0.4, 95% CI 0.3, 0.4) compared with admission during the first wave. Factors associated with COVID-19 mortality amongst respective race groups are presented in Supplementary table 1.

Table 1: Characteristics of in-hospital COVID-19 patients by race group in South Africa, 5 March 2020 to 8 January 2021

Characteristics	Total *N*=439 448	Black African *n*=215 539 (49.1%)	Coloured *n*=19 784 (4.5%)	Indian descent *n*=14 501 (3.3%)	White *n*=32 672 (7.4%)	Other/unknown *n*=156 952 (35.7%)	*p*-value
Age (years), median [IQR]	53 [38–65]	50 [35–63]	53 [40–64]	54 [43–65]	61 [50–73]	54 [39–66]	<0.001
Age group							**<0.001**
<20 years	25 999 (5.9)	15 299 (7.1)	1198 (6.1)	317 (2.2)	681 (2.1)	8482 (5.4)	
20–39 years	94 425 (21.5)	54 668 (25.4)	3722(18.8)	2390 (16.5)	3175 (9.7)	30 470 (19.4)	
40–59 years	160 172 (36.5)	76 935 (35.7)	7850 (39.6)	6405 (44.2)	11 262 (34.5)	57 720 (36.8)	
60–79 years	129 006 (29.4)	57 821 (26.8)	6029 (30.5)	4685 (32.3)	13 370 (40.9)	47 101 (30.0)	
≥80 years	27 604 (6.3)	10 610 (4.9)	964 (4.9)	700 (4.8)	4173 (12.8)	11 157 (7.1)	
Unknown age	2264 (0.5)	206 (0.1)	21 (0.1)	4 (0.3)	11 (0)	2022 (1.3)	
Sex							**<0.001**
Female	243 648 (55.4)	128 761 (59.7)	10 552 (53.4)	6466 (44.6)	14 983 (45.8)	82 886 (52.8)	
Male	195 531 (44.5)	86 633 (40.2)	9226 (46.6)	8031 (55.4)	17 680 (54.2)	73 961 (47.1)	
Unknown	269 (0.1)	145 (0.1)	6 (0)	4 (0)	9 (0)	105 (0.1)	
Comorbid condition							**<0.001**
No	160 376 (36.5)	60 317 (28.0)	4663 (23.6)	6235 (43.0)	13 112 (40.1)	76 049 (48.5)	
Yes	172 707 (39.3)	87 084 (40.4)	7731 (39.1)	6117 (21.2)	14 904 (45.6)	56 871 (36.2)	
Unknown	106 365 (24.2)	68 138 (31.6)	7390 (37.4)	2149 (14.8)	4656 (14.3)	24 032 (15.3)	
Hypertension							**<0.001**
No	203 941 (46.8)	80 367 (37.4)	6532 (33.0)	7623 (52.7)	15 757 (48.2)	93 662 (60.9)	
Yes	115 032 (26.4)	56 738 (26.4)	5458 (27.6)	4332 (29.9)	11 820 (36.2)	36 684 (23.9)	
Unknown	116 702 (26.8)	77 876 (36.2)	7784 (39.4)	2519 (17.4)	5087 (15.6)	23 436 (15.2)	
Diabetes mellitus							**<0.001**
No	232 842 (53.4)	93 916 (43.7)	7970 (40.3)	8142 (56.2)	21 749 (66.6)	101 065 (65.7)	
Yes	74 544 (17.1)	35 899 (16.7)	3542 (17.9)	3669 (25.4)	4988 (15.3)	26 446 (17.2)	
Unknown	128 288 (29.5)	85 166 (39.6)	8262 (41.8)	2663 (18.4)	5926 (18.1)	26 271 (17.1)	
Chronic cardiac disease							**<0.001**
No	284 047 (64.6)	107 280 (49.8)	9946 (50.3)	10 509 (72.4)	24 439 (74.8)	131 873 (84.0)	
Yes	6977 (1.6)	3801 (1.8)	539 (2.7)	676 (4.7)	1390 (4.3)	571 (0.4)	
Unknown	148 424 (33.8)	104 458 (48.4)	9299 (7.0)	3316 (22.9)	6843 (20.9)	24 508 (15.6)	
Chronic pulmonary disease/asthma							**<0.001**
No	269 597 (63.1)	103 786 (50.0)	9527 (48.9)	10 336 (72.1)	23 851 (73.8)	122 097 (79.4)	
Yes	20 729 (4.8)	6848 (3.3)	980 (5.0)	710 (5.0)	1863 (5.8)	10 328 (6.7)	
Unknown	137 212 (32.1)	97 061 (46.7)	8989 (46.1)	3279 (22.9)	6598 (20.4)	21 285 (13.9)	
Chronic renal disease							**<0.001**
No	282 116 (64.8)	107 137 (49.8)	10 103 (51.1)	10 765 (74.3)	25 282 (77.4)	128 829 (83.8)	
Yes	7146 (1.6)	2701 (1.3)	300 (1.5)	221 (1.5)	335 (1.0)	3589 (2.3)	
Unknown	146 412 (33.6)	105 143 (48.9)	9371 (6.4)	3488 (24.1)	7046 (21.6)	21 364 (13.9)	

Table 1 continues...

...Table 1 continued

Characteristics	Total *N*=439 448	Black African *n*=215 539 (49.1%)	Coloured *n*=19 784 (4.5%)	Indian descent *n*=14 501 (3.3%)	White *n*=32 672 (7.4%)	Other/unknown *n*=156 952 (35.7%)	*p*-value
Malignancy							**<0.001**
No	286 804 (65.8)	108 315 (50.4)	10 239 (51.8)	10 926 (75.5)	25 168 (77.0)	132 156 (85.9)	
Yes	1821 (0.4)	1000 (0.5)	118 (0.6)	81 (0.6)	383 (1.2)	239 (0.2)	
Unknown	147 049 (33.8)	105 666 (49.2)	9417 (47.6)	3467 (23.9)	7112 (21.8)	21 387 (13.9)	
HIV							**<0.001**
No	269 640 (61.9)	96 747 (45.0)	9985 (50.5)	10 848 (74.9)	25 272 (77.4)	126 788 (82.4)	
Yes	26 273 (6.0)	19 939 (9.3)	485 (2.5)	68 (0.5)	103 (0.3)	5678 (3.7)	
Unknown	139 761 (32.1)	98 295 (45.7)	9304 (47.0)	3558 (24.6)	7288 (22.3)	21 316 (13.9)	
Tuberculosis							**<0.001**
No	270 557 (96.5)	99 373 (96.6)	9733 (97.2)	10 714 (99.6)	24 583 (99.7)	126 154 (95.5)	
Previous	5713 (2.0)	1546 (1.5)	118 (1.2)	24 (0.2)	29 (0.1)	3 996 (3.0)	
Current	1706 (0.6)	1176 (1.1)	92 (0.9)	13 (0.1)	36 (0.2)	389 (0.3)	
Current and past	2466 (0.9)	831 (0.8)	75 (0.8)	5 (0.1)	7 (0)	1548 (1.2)	
Obesity							**<0.001**
No	79 803 (18.8)	60 331 (28.3)	4455 (23.2)	3169 (22.7)	4515 (14.4)	7333 (5.0)	
Yes	15 589 (3.7)	11 061 (5.2)	1137 (5.9)	500 (3.6)	2532 (8.1)	359 (0.2)	
Unknown	328 711 (77.5)	141 544 (66.5)	13 595 (70.9)	10 286 (73.7)	24 417 (77.6)	138 869 (94.7)	
Wave period							**<0.001**
Pre-wave 1	9760 (2.2)	5631(2.6)	679 (3.4)	319 (2.2)	429 (1.3)	2702 (1.7)	
Wave 1	71 410 (19.3)	42 707 (19.8)	2686 (13.5)	3033 (20.9)	4234 (12.9)	18 750 (12.0)	
Post-wave 1	25 156 (5.7)	13 051 (6.1)	1596 (8.1)	612 (4.2)	1552 (4.7)	8345 (5.3)	
Wave 2	105 985 (24.1)	51 611 (23.9)	5056 (25.6)	4432 (30.6)	5806 (17.8)	39 080 (24.9)	
Post-wave 2	26 914 (6.1)	13 976 (6.5)	1136 (5.7)	601 (4.1)	2105 (6.4)	9096 (5.8)	
Wave 3	147 582 (33.6)	60 950 (28.3)	7139 (36.1)	4817 (33.2)	16 824 (51.5)	57 852 (36.9)	
Post-wave 3	9623 (2.2))	4688 (2.2)	577 (2.9)	216 (1.5)	685 (2.1)	3457 (2.2)	
Wave 4	42 746 (9.7)	22 904 (10.6)	913 (4.6)	466 (3.2)	1035 (3.2)	17 428 (11.1)	

Health services characteristics of cases of COVID-19 admissions

Overall, there were more admissions in the public sector (232 615; 52.9%) than in the private sector (206 833; 47.1%) (p<0.001; Table 5). Furthermore, people of Indian descent (10 880; 75.0%) ($p<0.001$) and white people (25 862; 79.2%) ($p<0.001$) were more likely to be hospitalised in the private sector than in the public sector. Compared to other race groups, a lower percentage of black African patients were treated in ICU (9.0%) ($p<0.001$), in high care (8.2%) ($p<0.001$) or were ventilated (5.1%) ($p<0.001$), whilst a higher percentage of white patients were treated with supplemental oxygen (61.6%) ($p<0.0001$).

Overall, there was a higher percentage of individuals treated in ICU in the private (45 792/206 833; 22.1%) compared to the public sector (12 550/232 615; 5.4%), across all age groups >20 years ($p<0.001$ for all); and across all race groups ($p<0.001$ for all) (Table 6). The percentage treated in ICU was highest among individuals aged 40–59 years in the public sector (4760; 6.4%) and among 60–79 years in the private sector (17 171; 29.3%). The lowest percentage of people treated in ICU were black African, in both the public (8435; 5.3%) and private sectors (10 982; 19.4%) ($p<0.001$ for both). The highest percentage treated in ICU in the public and private sectors were people of Indian descent (10.1% and 24.4%) and white people (8.8% and 23.3%).

There was a higher percentage of individuals ventilated in the private (19 800/206 833; 9.6%) compared to the public sector (7818/232 615; 3.4%) overall and across all age groups >20 years ($p<0.001$ for all). A higher percentage of individuals were ventilated in the private sector across all race groups ($p<0.001$ for all) except for those of Indian descent for whom a similar percentage were ventilated in public and private sectors (Table 6). In the public sector, the lowest percentage of patients ventilated were black African (6213; 3.9%) and the highest percentages were those of Indian descent (308; 8.5%) and white (477; 7.0%). In the private sector, the lowest percentage of patients ventilated were black African (4833; 8.5%) and those of Indian descent (924; 8.5%) and the highest percentage ventilated were coloured (956; 10.7%).

There was a higher percentage of individuals who received supplemental oxygen in the private (95 703/206 833; 46.3%) compared to the public sector (87 023/232 615; 37.4%), overall and across all age groups >20 years ($p<0.001$ for all) (Table 6). In the public sector, the lowest percentage of patients who received supplemental oxygen were black African (73 800; 46.4%) and the highest percentage who received supplemental oxygen were those of Indian descent (2096; 57.9%).

Table 2: Incidence risk of COVID-19 admissions (per 100 000 people) by age group, sex and race, South Africa, 5 March 2020 to 8 January 2022

Age category (years)	Male			Female			Total incidence risk
	Population mid-2020	Number of COVID-19 admissions	Incidence risk	Population mid-2020	Number of COVID-19 admissions	Incidence risk	
Black African							
<20	9 412 555	7029	74.7	9 224 565	8225	89.2	81.8
20–39	8 740 918	18 937	216.6	8 621 573	35 701	414.1	314.7
40–59	4 112 412	33 116	805.3	4 650 769	43 798	941.7	877.7
60–79	1 176 527	24 017	2041.3	1 937 390	33 763	1742.7	1855.5
≥80	77 062	3449	4475.6	199 956	7153	3577.3	3827.2
All ages	23 519 474	86 548	368.0	24 634 253	128 640	522.2	446.9
Coloured							
<20	921 642	594	64.5	897 967	604	67.3	65.8
20–39	837 744	1470	175.5	834 314	2250	269.7	222.5
40–59	570 179	3968	695.9	626 288	3880	619.5	655.9
60–79	212 647	2797	1315.3	299 946	3231	1077.2	1176.0
≥80	12 992	387	2978.8	34 021	576	1693.1	2048.4
All ages	2 555 204	9216	360.7	2 692 536	10 541	391.5	376.5
Indian descent							
<20	195 653	172	87.9	186 972	144	77.0	82.6
20–39	286 733	1209	421.6	235 644	1180	500.8	457.3
40–59	213 573	3754	1757.7	201 617	2650	1314.4	1542.4
60–79	85 051	2574	3026.4	112 737	2110	1871.6	2368.2
≥80	6652	319	4795.6	16 481	381	2311.8	3026.0
All ages	787 662	8 028	1019.2	753 451	6465	858.1	940.4
White							
<20	499 395	339	67.9	486 785	341	70.1	69.0
20–39	563 398	1404	249.2	563 840	1770	313.9	281.6
40–59	637 149	6521	1023.5	674 175	4737	702.6	858.5
60–79	477 067	7534	1579.2	547 852	5835	1065.1	1304.4
≥80	89 526	1876	2095.5	140 583	2296	1633.2	1813.1
All ages	2 266 535	17 674	779.8	2 413 235	14 979	620.7	697.7
All race groups							
<20	11 029 245	8134	73.7	10 796 289	9314	86.3	79.9
20–39	10 428 793	23 020	220.7	10 255 371	40 901	398.8	309.0
40–59	5 533 313	47 359	855.9	6 152 849	55 065	895.0	876.5
60–79	1 951 289	36 922	1892.2	2 897 925	44 939	1550.7	1688.1
≥80	186 232	6031	3238.4	391 041	10 406	2661.1	2847.4
All ages	29 128 872	121 466	417.0	30 493 475	160 625	526.8	473.1

Table 3: Incidence of COVID-19 deaths (per 100 000 people) by age group, sex and race, South Africa, 5 March 2020 to 8 January 2022

Age category (years)	Male			Female			Total incidence risk
	Population mid-2020	Number of COVID-19 deaths	Incidence risk	Population mid-2020	Number of COVID-19 deaths	Incidence risk	
Black African							
<20	9 412 555	287	3.0	9 224 565	306	3.3	3.2
20–39	8 740 918	1 910	21.9	8 621 573	2 520	29.2	25.5
40–59	4 112 412	7 372	179.3	4 650 769	9 024	194.0	187.1
60–79	1 176 527	10 251	871.3	1 937 390	13 305	686.7	756.5
≥80	77 062	1 788	2320.2	199 956	3 485	1742.9	1903.5
All ages	23 519 474	21 608	91.9	24 634 253	28 640	116.3	104.3
Coloured							
<20	921 642	12	1.3	897 967	8	0.9	1.1
20–39	837 744	142	17.0	834 314	165	19.8	18.4
40–59	570 179	861	151.0	626 288	717	114.5	131.9
60–79	212 647	1 090	512.6	299 946	1 173	391.1	441.5
≥80	12 992	199	1531.7	34 021	301	884.7	1063.5
All ages	2 555 204	2 304	90.2	2 692 536	2 364	87.8	89.0
Indian descent							
<20	195 653	3	1.5	186 972	4	2.1	1.8
20–39	286 733	123	42.9	235 644	95	40.3	41.7
40–59	213 573	747	349.8	201 617	452	224.2	288.8
60–79	85 051	965	1134.6	112 737	659	584.5	821.1
≥80	6 652	154	2315.1	16 481	158	958.7	1348.7
All ages	787 662	1 992	252.9	753 451	1 368	181.6	218.0
White							
<20	499 395	6	1.2	486 785	8	1.6	1.4
20–39	563 398	116	20.6	563 840	82	14.5	17.6
40–59	637 149	1 070	167.9	674 175	634	94.0	129.9
60–79	477 067	2 431	509.6	547 852	1 407	256.8	374.5
≥80	89 526	851	950.6	140 583	752	534.9	696.6
All ages	2 266 535	4 474	197.4	2 413 235	2 883	119.5	157.2
All race groups							
<20	11 029 245	308	2.8	10 796 289	326	3.0	2.9
20–39	10 428 793	2 291	22.0	10 255 371	2 862	27.9	24.9
40–59	5 533 313	10 050	181.6	6 152 849	10 827	176.0	178.6
60–79	1 951 289	14 737	755.2	2 897 925	16 544	570.9	645.1
≥80	186 232	2 992	1606.6	391 041	4 696	1200.9	1331.8
All ages	291 28 872	30 378	104.3	30 493 475	35 255	115.6	110.1

Table 4: Multivariable analysis of factors associated with in-hospital COVID-19 mortality, South Africa, 5 March 2020 to 8 January 2022 (N=423 385)

Characteristics	Case fatality risk *n/N* (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	*p*-value
Age group				
<20 years	759/24 553 (3.0)	Ref	Ref	
20–39 years	7054/90 387 (7.8)	2.7 (2.5, 2.9)	3.1 (2.7, 3.6)	**<0.001**
40–59 years	31 062/155 421 (20.0)	7.8 (7.3, 8.4)	8.6 (7.4, 9.9)	**<0.001**
60–79 years	46 480/124 392 (37.4)	18.7 (17.4, 20.1)	19.4 (16.8, 22.2)	**<0.001**
≥80 years	12 374/26 429 (46.8)	27.6 (25.6, 29.8)	35.2 (30.6, 40.6)	**<0.001**
Sex				
Female	50 416/234 947 (21.5)	Ref	Ref	
Male	47 459/188 204 (25.2)	1.2 (1.2, 1.3)	1.3 (1.3, 1.4)	**<0.001**
Race				
White	7358/31 892 (23.0)	Ref	Ref	
Black African	50 297/204 651 (24.6)	1.1 (1.0, 1.1)	1.3 (1.2, 1.3)	**<0.001**
Coloured	4671/19 059 (24.5)	1.0 (1.0, 1.1)	1.2 (1.1, 1.3)	**<0.001**
Indian descent	3360/14 132 (23.8)	1.0 (0.9, 1.1)	1.2 (1.2, 1.3)	**<0.001**
Other/unknown	32 225/153 651 (21.0)	0.8 (0.8, 0.9)	1.4 (1.4, 1.5)	**<0.001**
Hypertension				
No	36 722/199 049 (18.5)	Ref	Ref	
Yes	36 108/111 397 (32.6)	2.1 (2.1, 2.2)	1.1 (1.0, 1.1)	**<0.001**
Diabetes				
No	44 204/226 963 (19.5)	Ref	Ref	
Yes	24 832/72 624 (34.2)	2.1 (2.1, 2.2)	1.4 (1.3, 1.4)	**<0.001**
Chronic cardiac disease				
No	60 704/277 540 (21.9)	Ref	Ref	
Yes	2495/6663 (37.5)	2.1 (2.0, 2.2)	1.2 (1.1, 1.3)	**<0.001**
Chronic kidney disease				
No	59 580/275 564 (21.6)	Ref	Ref	
Yes	3145/6965 (45.2)	3.0 (2.8, 3.1)	1.6 (1.5, 1.7)	**<0.001**
Malignancy				
No	61 683/280 193 (22.0)	Ref	Ref	
Yes	656/1730 (37.9)	2.2 (2.0, 2.4)	1.6 (1.4, 1.9)	**<0.001**
Tuberculosis				
No	57 792/264 568 (21.8)	Ref	Ref	0.089
Previous	1346/5521 (24.4)	1.2 (1.1, 1.2)	1.1 (0.9, 1.2)	**<0.001**
Current	397/1596 (24.9)	1.2 (1.1, 1.3)	1.4 (1.2, 1.6)	**<0.001**
Current and previous	538/2372 (22.7)	1.0 (0.9, 1.2)	1.4 (1.2, 1.6)	
HIV				
No	57 621/263 688 (21.9)	Ref	Ref	
Yes	6052/24 799 (24.4)	1.2 (1.1, 1.2)	1.3 (1.2, 1.4)	**<0.001**
Sector				
Private	38 335/202 930 (18.9)	Ref	Ref	
Public	59 576/220 455 (27.0)	1.6 (1.5, 1.6)	1.5 (1.5, 1.6)	**<0.001**

Table 4 continues...

...Table 4 continued

Characteristics	Case fatality risk *n/N* (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	*p*-value
Province				
Western Cape	17 712/83 116 (21.3)	Ref	Ref	
Eastern Cape	12 653/41 176 (30.7)	1.6 (1.6, 1.7)	1.9 (1.8, 2.0)	**<0.001**
Free State	5810/25 621 (22.7)	1.1 (1.0, 1.1)	1.3 (1.3, 1.4)	**<0.001**
Gauteng	28 721/129 722 (22.1)	1.0 (1.0, 1.1)	1.4 (1.4, 1.5)	**<0.001**
KwaZulu-Natal	16 325/70 737 (23.1)	1.1 (1.0, 1.1)	1.5 (1.4, 1.6)	**<0.001**
Limpopo	5079/17 553 (28.9)	1.5 (1.4, 1.6)	1.7 (1.6, 1.9)	**<0.001**
Mpumalanga	4656/18 537 (25.1)	1.2 (1.2, 1.3)	1.4 (1.3, 1.5)	**<0.001**
North West	4614/27 254 (16.9)	0.7 (0.7, 0.8)	1.2 (1.0, 1.2)	**<0.001**
Northern Cape	2341/9669 (24.2)	1.2 (1.1, 1.2)	1.4 (1.3, 1.6)	**<0.001**
Wave period				
Wave 1	15 163/70 409 (21.5)	Ref	Ref	
Wave 2	11 593/41 039 (28.3)	1.4 (1.4-1.5)	1.5 (1.4-1.5)	**<0.001**
Wave 3	55 067/209 451 (26.3)	1.3 (1.2-1.3)	1.3 (1.3-1.4)	**<0.001**
Wave 4	3356/34 621 (9.7)	0.4 (0.3-0.4	0.4 (0.3-0.4)	**<0.001**

OR, odds ratio; 95% CI, 95% confidence interval

Table 5: Description of settings of care for in-hospital COVID-19 patients by race, South Africa, 5 March 2020 to 8 January 2022

Characteristic	Total *N*=439 448	Black African *n*=215 539 (49.1%)	Coloured *n*=19 784 (4.5%)	Indian descent *n*=14 501 (3.3%)	White *n*=32 672 (7.4%)	Others/unknown *n*=156 952 (35.7%)	*p*-value
Health sector							**<0.001**
Private sector	206 833 (47.1)	56 495 (26.2)	8972 (45.4)	10 880 (75.0)	25 862 (79.2)	104 624 (66.7)	
Public sector	232 615 (52.9)	159 044 (73.8)	10 812 (54.6)	3621 (25.0)	6810 (20.8)	52 328 (33.3)	
Treated in ICU							**<0.001**
No	381 106 (86.7)	196 122 (91.0)	16 952 (85.7)	11 482 (79.2)	26 033 (79.7)	130 517 (83.2)	
Yes	58 342 (13.3)	19 417 (9.0)	2832 (14.3)	3019 (20.8)	6639 (20.3)	26 435 (16.8)	
Treated in High Care							**<0.001**
No	402 267 (91.5)	197 849 (91.8)	17 152 (86.7)	12 133 (83.7)	28 601 (87.5)	146 532 (93.4)	
Yes	37 181 (8.5)	17 690 (8.2)	2632 (13.3)	2368 (16.3)	4071 (12.5)	10 420 (6.6)	
Received ventilation							**<0.001**
No	411 830 (93.7)	204 493 (94.9)	18 239 (92.2)	13 269 (91.5)	29 932 (91.6)	145 897 (93.0)	
Yes	27 618 (6.3)	11 046 (5.1)	1545 (7.8)	1232 (8.5)	2740 (8.4)	11 055 (7.0)	
Received oxygen							**<0.001**
No	256 722 (58.4)	117 081 (54.3)	9 807 (49.6)	6 872 (47.4)	12 531 (38.4)	110 431 (70.4)	
Yes	182 726 (41.6)	98 458 (45.7)	9 977 (50.4)	7 629 (52.6)	20 141 (61.6)	46 521 (29.6)	

In the private sector, the lowest percentage of patients who received supplemental oxygen were black African (24 658; 43.6%) and the highest percentage who received supplemental oxygen were white (16 374; 63.3%).

Of all the COVID-19 patients who died in hospital, 68 775/97 911 (70.2%) were not treated in ICU, which differed by sector: 39.9% in the private sector and 89.7% in the public sector were not treated in ICU (Table 7). There was also a difference by race group, with black African (3238; 38.0%) and white (2386; 44.8%) decedents having the highest percentage of non-ICU treatment in the private sector; and black African (37 530; 89.9%) highest in the public sector.

On multivariate analysis, adjusting for age, sex, individual comorbidities and province, in the private sector, there were increased odds of being treated in ICU for black African (aOR 1.1; 95% CI 1.0, 1.1) and coloured (aOR 1.3; 95% CI 1.2, 1.4) patients and patients of Indian descent (aOR 1.3; 95% CI 1.2, 1.4) compared to white patients. In contrast, in the public sector, there were decreased odds of being treated in ICU for black African patients (aOR 0.5; 95% CI 0.4, 0.5) compared to white patients (Table 8). Similar trends were observed for ventilation of patients (Table 9).

Table 6: Description of settings of care for in-hospital COVID-19 patients by health sector, age and race group, South Africa, 5 March 2020 to 8 January 2022 (*N*=439 448)

Characteristic	Total	Public	Private	*p*-value
Treated in ICU				
<20 years	1432/25 977 (5.5%)	834/15 637 (5.3%)	598/10 340 (5.8%)	0.120
20-39 years	6945/94 425 (7.4%)	2600/57 461 (4.5%)	4345/36 964 (11.7)	<0.001
40-59 years	25 345/160 172 (15.8%)	4760/74 004 (6.4%)	20 585/86 168 (23.9%)	<0.001
60-79 years	21 005/129 006 (16.3)	3834/70 364 (5.4%)	17 171/58 642 (29.3%)	<0.001
≥80 years	3356/27 604 (12.2%)	478/13 593 (3.5%)	2878/14 011 (20.5%)	<0.001
Unknown age	259/2264 (11.4%)	44/1 556 (2.8%)	215/708 (30.4%)	<0.001
Treated in ICU				
Black African	19 417/215 539 (9.0%)	8435/159 044 (5.3%)	10 982/56 495 (19.4%)	<0.001
Coloured	2832/19 784 (14.3%)	772/10 812 (7.1%)	2060/8972 (23.0%)	<0.001
Indian descent	3019/14 501 (20.8%)	367/3 621 (10.1%)	2652/10 880 (24.4%)	<0.001
White	6639/32 672 (20.3%)	600/6 810 (8.8%)	6039/25 862 (23.3%)	<0.001
Unknown	26 435/156 952 (16.8%)	2378/52 328 (4.5%)	24 059/104 624 (23.0%)	<0.001
Received ventilation				
<20 years	543/25 977 (2.1%)	387/15 637 (2.5%)	156/10 340 (1.5%)	<0.001
20–39 years	2966/94 425 (3.1%)	1392/57 461 (2.4%)	1574/36 964 (4.3%)	<0.001
40–59 years	12 275/160 172 (7.7%)	2931/74 004 (4.0%)	9344/86 168 (10.8%)	<0.001
60–79 years	10 564/129 006 (8.2%)	2745/70 364 (3.9%)	7819/58 642 (13.3%)	<0.001
≥80 years	1198/27 604 (4.3%)	358/13 593 (2.6%)	840/14 011 (6.0%)	<0.001
Unknown age	72/2 264 (3.2%)	5/1 556 (0.3%)	67/708 (9.5%)	<0.001
Received ventilation				
Black African	11 046/215 539 (5.1%)	6213/159 044 (3.9%)	4833/56 495 (8.5%)	<0.001
Coloured	1545/19 784 (7.8%)	589/10 812 (5.4%)	956/8972 (10.7%)	<0.001
Indian descent	1232/14 501 (8.5%)	308/ 621 (8.5%)	924/10 880 (8.5%)	<0.001
White	2740/32 672 (8.4%)	477/6810 (7.0%)	2263/25 862 (8.7%)	<0.001
Unknown	11 055/156 952 (7.0%)	231/52 328 (0.4%)	10 824/104 624 (10.3%)	<0.001
Received oxygen				
<20 years	4134/25 977 (15.9%)	2826/15 637 (18.1%)	1308/10 340 (12.6%)	<0.001
20–39 years	24 875/94 425 (26.3%)	14 060/57 461 (24.5%)	10 815/36 964 (29.3%)	<0.001
40–59 years	73 072/160 172 (45.6%)	29 859/74 004 (40.3%)	43 213/86 168 (50.1%)	<0.001
60–79 years	65 763/129 006 (51.0%)	33 379/70 364 (47.4%)	32 384/58 642 (55.2%)	<0.001
≥80 years	14 662/27 604 (53.1%)	6821/13 593 (50.2%)	7841/14 011 (56.0%)	<0.001
Unknown age	220/2264 (9.7%)	78/1556 (5.0%)	142/708 (20.1%)	<0.001
Received oxygen				
Black African	98 458/215 539 (45.7%)	73 800/159 044 (46.4%)	24 658/56 495 (43.6%)	<0.001
Coloured	9977/19 784 (50.4%)	5423/10 812 (50.2%)	4554/8972 (50.8%)	<0.001
Indian descent	7629/14 501 (52.6%)	2096/3621 (57.9%)	5533/10 880 (50.8%)	<0.001
White	20 141/32 672 (61.6%)	3767/6810 (55.3%)	16 374/25 862 (63.3%)	<0.001
Unknown	46 521/156 952 (29.6%)	1937/52 328 (3.7%)	44 584/104 624 (42.6%)	<0.001

Discussion

While the associations of age, sex and race with risk of COVID-19 mortality have been well established, our study reveals insights into the intersection of age, gender, race, and SES (using health sector of admission as a proxy) with COVID-19 mortality in South Africa. We propose that the COVID-19 mortality disparities revealed in this study were due to multiple intersecting risk factors affecting COVID-19 exposure, susceptibility to infection, and differences in access to care, as reported in other studies.[19,20] These risk factors have underlying structural and social determinants which the World Health Organization defines as 'the conditions in which people are born, grow, work, live, and age and people's access to power, money and resources'[21]. Attributing poor clinical outcomes in vulnerable race groups solely to genetics and biological differences has historically been responsible for marginalising their health needs.

Table 7: COVID-19 in-hospital deaths not treated in ICU by race group, South Africa, 5 March 2020 to 8 January 2022 (*N*=97 911)

Race	Private *n*/*N* (%)	Public *n*/*N* (%)	Total *n*/*N* (%)
Black African	3238/8532 (38.0%)	37 530/41 765 (89.9%)	40 768/50 297(81.1%)
Coloured	651/1748 (37.2%)	2576/2923 (88.1%)	3227/4671 (69.1%)
Indian descent	750/2202 (34.1%)	921/1158 (79.5%)	1671/3360 (49.7%)
White	2386/5323 (44.8%)	1731/2035 (85.1%)	4117/7358 (56.0%)
Other/unknown	8287/20 530 (40.4%)	10 705/11 695 (91.5%)	18 992/32 225 (59.0%)
Total	**15 312/38 335 (39.9%)**	**53 463/59 576 (89.7%)**	**68 775/97 911 (70.2%)**

Table 8: Factors associated with being treated in ICU, among (1) all patients, (2) private sector patients, and (3) public sector patients, South Africa, 5 March 2020 to 8 January 2022 (model adjusted for age, sex, individual comorbidities, and province)

Race	All patients		Private sector		Public sector	
	n (%) *N*=58 342	aOR (95% CI)	*n* (%) *N*=45 792	aOR (95% CI)	*n* (%) *N*=12 550	aOR (95% CI)
White	6639 (11.4%)	Ref	6039 (13.2%)	Ref	600 (4.8%)	Ref
Black African	19 417 (33.3%)	1.0 (1.0, 1.1)	10 982 (24.0%)	1.1 (1.0, 1.1)	8435 (67.2%)	0.5 (0.4, 0.5)
Coloured	2832 (4.8%)	1.4 (1.3, 1.6)	2060 (4.5%)	1.3 (1.2, 1.4)	772 (6.2%)	0.9 (0.7, 1.1)
Indian descent	3019 (5.2%)	1.3 (1.2, 1.4)	2657 (5.8%)	1.3 (1.2, 1.4)	367 (2.9%)	0.8 (0.6, 1.0)
Other/unknown	26 435 (45.3%)	1.3 (1.3, 1.4)	24 059 (52.5%)	1.4 (1.3, 1.4)	2376 (18.9%)	0.4 (0.3, 0.5)

aOR, adjusted odds ratio; 95% CI, 95% confidence interval

Table 9: Factors associated with receiving invasive mechanical ventilation, among (1) all patients, (2) private sector patients, and (3) public sector, South Africa, 5 March 2020 to 8 January 2022 (model adjusted for age, sex, individual comorbidities, and province)

Race	All patients		Private sector		Public sector	
	n (%) *N*=27 618	aOR (95%CI)	*n* (%) *N*=19 800	aOR (95%CI)	*n* (%) *N*=7818	aOR (95%CI)
White	2740 (10.0%)	Ref	2263 (11.4%)	Ref	477 (6.1%)	Ref
Black African	11 046 (40.0%)	1.4 (1.4, 1.5)	4833 (24.4%)	1.4 (1.3, 1.5)	6213 (79.5%)	0.5 (0.4, 0.6)
Coloured	1545 (5.6%)	2.1 (1.9, 2.3)	956 (4.8%)	1.6 (1.4, 1.8)	589 (7.5%)	1.1 (0.9, 1.4)
Indian descent	1232 (4.5%)	1.5 (1.3, 1.6)	924 (4.7%)	1.4 (1.2, 1.5)	308 (3.9%)	1.1 (0.8, 1.5)
Other/unknown	11 055 (40.0%)	1.8 (1.7, 1.9)	10 824 (54.7%)	1.9 (1.8, 2.0)	231 (3.0%)	0.7 (0.4, 1.0)

aOR, adjusted odds ratio; 95% CI, 95% confidence interval

Higher risk of mortality among non-white patients

The risk for in-hospital COVID-19 death was increased in individuals of non-white race. Systematic reviews have confirmed the higher risk of mortality among black, Asian and minority ethnicities (BAME) even after adjusting for confounders such as age, sex and comorbidities.[6,8,9] Even in low- and middle-income countries (LMIC), non-white people with COVID-19 who were admitted to hospital had significantly higher risk of mortality.[22] This disparity in COVID-19 deaths by race was present in our study among all age groups, and even among younger individuals who have low risk of COVID-19 mortality overall, non-white individuals exhibited higher mortality rates than white individuals, similar to another study[23].

There is currently little evidence that genetics, immunology or blood groups explain the racial and ethnic disparities in COVID-19 infection and severity.[23] Angiotensin-converting enzyme 2 (ACE2) appears elevated in African Americans[23] and Asians[24], which could place them at higher risk for COVID-19 severe disease.

Higher prevalence of comorbid disease may play a role in the increased severity of COVID-19 among non-white individuals.[25,26] BAME populations have a disproportionate burden of diabetes, cardiovascular disease, asthma, HIV, morbid obesity, liver disease, and kidney disease.[19,23,26-29] The risk of comorbidities results from generations of exposure to racial inequities, environmental hazards, and social factors such as food insecurity, which result in changes in the microbiome and localised inflammation, and contribute to the development of long-term stress, which results in compromised immunity, thus increasing the risk for comorbidities and perpetuating adverse health outcomes.[19,20,23,30]

We found a sex differential in mortality rates, with incidence of mortality higher in female individuals <40 years and in male individuals ≥40 years. Increased oestrogen in female individuals is associated with

improved immune function and reduced risk of viral infections compared to male individuals.[24] Severe COVID-19 disease in male individuals could be explained by androgen regulation of expression of both ACE2 and TMPRSS2, an endothelial cell surface protein that is involved in the viral entry and spread of SARS-CoV-2.[23,24]

In other studies, the overall male to female mortality sex ratio was not equal at all ages[31] and in one study was significantly higher among women, particularly in the 40–49-year age group[32]. The observed sex differences are complex, and intersectional analyses are required to understand risk factors that change with both sex and age, including differences in occupation, lifestyle (including smoking and alcohol use), comorbidities and health seeking behaviour, amongst others.[24,31,32] We need to consider the impact of gender and its social and cultural characteristics rather than only the biology of sex.

In our study, even within race groups, the risk for mortality differed by age and sex. Race-specific risk estimates are likely not fixed in men and women or by age group, requiring statistical analysis stratified by effect modifiers rather than adjusting for them in regression models.[33] The gendered disparities in COVID-19 is another important point of consideration given the multiple intersecting layers of oppression and marginalisation amongst women, especially black African women. During the pandemic, women in South Africa, especially women of colour, struggled to find shelter as they tackled poverty, unemployment, gender-based violence and food insecurity. In the USA, 'non-white' women have borne the greatest burden of COVID-19 disease and the socio-economic consequences of the pandemic.[30]

Higher mortality in young in LMIC

The risk of mortality increased with age, but there were proportionately more COVID-19 deaths reported among young people in South Africa compared to those in high income countries (HIC). Globally, deaths in individuals younger than 70 years accounted for 13% of all deaths in HIC and 63% in LMIC.[34] In our analysis, 67% of deaths were in people younger than 70 years. The COVID-19 mortality rate for those aged 70–79 is 12.6 times the rate for those aged 50–59 in HIC, 3.5 times in LMIC and 1.8 times in our study. This pattern holds overall as well as separately for male and female mortality rates.[34] The probability of a COVID-19 patient dying at age 40–49 years in a developing country is statistically similar to dying at age 60–69 in a rich country.[35] This difference is only partly related to differences in population age structure. Poorer outcomes in developing countries are driven by a higher prevalence of comorbid conditions, and by challenges in access to hospitals and critical care.[35]

Socio-economic status

Higher COVID-19 mortality in non-white groups may be attributable to increased risk of infection amongst these communities.[25,28] Our data revealed that most hospital admissions occurred amongst non-white people of working age – reflecting historical patterns of disadvantage that remain today. Admissions incidence was highest among working age individuals in non-white groups, and in older individuals among white people. Admissions were higher in female individuals in black and coloured groups, and higher in male individuals in Indian and white groups. A higher percentage of total admissions in the first wave were among black people, who may have been most severely hit in the early part of the pandemic due to employment in essential services, while other race groups were better able to shield and adopt measures for prevention and isolation, and access health services. In South African national blood service sero-surveys, sero-prevalence has been reported to be consistently higher among black African individuals.[36] Socio-economic factors among non-white groups – including poverty; unemployment; poor housing conditions; living in larger, multigenerational households; low level of education; as well as higher burden of underlying comorbidities; and poor access to health services – place them at increased risk for COVID-19 infection and death.[8,11,22,25,27,29,37] Frontline workers in South Africa are mostly women and mostly non-white and, as in other settings, have less opportunity to work from home, and have increased risk of exposure to SARS-CoV-2 through work and commuting using public transport.[25]

Healthcare access

Inequality in access to health care may also be driving increased COVID-19 infection and mortality rates.[9] Fewer black African people and more white people and those of Indian descent were admitted in the private sector, reflecting health insurance coverage by race group in South Africa, which was 10% in black, 17% in coloured, 52% in Indian and 73% in white groups.[38] In the USA, minorities are also less likely to have health insurance, resulting in reduced healthcare access.[28]

Almost half (47%) of all admissions were in the private sector, despite only 16% of the population having access to medical insurance and private health care. This might be due to lower thresholds for admission in the private sector and to limited bed availability in the public sector, but is unlikely to be due to patients in the public sector having lower risk of severe disease requiring hospitalisation.

A lower proportion of patients in the public sector were treated in ICU, ventilated or treated with supplemental oxygen, which reflects inequity of resources between the public and private sectors, including hospital beds, healthcare workers and equipment such as oxygen and ventilators. In South Africa, the average spend in the private sector was six times higher than that in the public sector.[39] Higher expenditure affords more healthcare specialists, hospitals, and expensive medicines and technology. A comparison of the quality of healthcare systems of 48 countries found that the South African private sector ranked sixth while the public sector ranked eighth from the bottom.[40]

There were also differences in treatment in ICU and ventilation by race and health sector. There was less inequality in treatment in the private sector where non-white groups with highest risk of mortality were most likely to be treated in ICU or ventilated. In the public sector, however, black African patients were less likely to have been treated in ICU and ventilated compared to white patients, despite having higher risk of mortality than white patients. The inequality could be due to black patients more likely accessing care in rural district hospitals that had no ICU or ventilators available. Of concern, this finding suggests possible rationing of care that unfairly disadvantaged black people in the public sector. In Brazil, ICU access was also considered to explain differences in mortality by ethnicity, with white patient more likely to be admitted to ICU than non-white patients.[22]

In South Africa, 47% of individuals in the 2018 general household survey reported facing constraints in access to health services, which showed bias towards the poor (63%) compared to the non-poor (36%).[41] Black South Africans, living in rural areas, with lower education levels, being unemployed and poor, were least likely to report access and experienced long distances to the nearest healthcare facilities.[41] The inequitable distribution of resources has an impact on 'the timeliness, range and quality of services provided to users' in public healthcare facilities.[41] Even in HICs like the USA, African Americans and Latin Americans had lower levels of access to a health provider[20], social and economic barriers to testing[42], varying medication prescriptions[28], and lower quality care for COVID-19[29].

Race and racism

Race and SES were important determinants of access to health care during apartheid when health systems were fragmented and discriminatory; but racial differences continue to impact access to health care today.[38] The consequences of structural inequality disproportionately affect vulnerable groups, who experience discrimination based on their race, gender, and SES. The pandemic has exposed pre-pandemic inequalities that illustrate multiple barriers to health care and historically disadvantaged groups remain most impacted by COVID-19.[30] In addition, the relationship between structural inequality and COVID-19 disease susceptibility and severity are bidirectional; the impact of the pandemic within these communities has worsened inequities in education, housing, employment, income, and access to quality health care.[43]

Some argue that 'racism, not race, drives inequity' in COVID-19 infection and outcomes.[43] The biomedical risk factors and social determinants that disproportionately influence COVID-19 morbidity and mortality

within BAME communities, are linked partly to structural racism.[29,37,44] 'These processes are complex and systemic, underpinned by unequal power relations and beliefs, and operating at individual, community, and organisational levels, resulting in stigmatisation, discrimination, and marginalisation of ethnic minorities'[6].

Limitations

This analysis had several limitations. Firstly, data quality in a surveillance system is dependent on the information submitted by healthcare facilities. Fields with the highest proportion of incomplete data included race (36%) and comorbidities (25–32%). The proportion with missing race information was similar to the 39% reported in a study in Brazil[22], and the 26% in a large UK data set[42]. Analysis was restricted to those with complete data. It is possible that there were differences amongst those who were excluded with unknown race. Secondly, DATCOV does not collect socio-economic data on income, education, occupation, household size, etc. and so we were limited to examining SES using health sector of admissions as a proxy. We were therefore unable to take a nuanced approach to inferring associations of COVID-19 mortality with inequality. It is also possible that some patients with medical aid were admitted in the public sector and some without medical aid were admitted in the private sector; however, these are likely to be small numbers and should not affect analysis. Therefore, sector of admission is likely to be a robust proxy for SES. In addition, race in this analysis may serve as a proxy for SES rather than as a risk factor in itself. Thirdly, the hospital surveillance system has incomplete data on reason for admission and includes patients with COVID-19 symptoms and those who tested positive for SARS-CoV-2 incidentally when admitted for other reasons. There could have been changes over time in the criteria and thresholds for hospitalisation which could have influenced the analysis of treatment in ICU or with ventilation, but it is likely that these changes over time were similar across race groups. Fourthly, our analysis did not include out-of-hospital mortality, which probably underestimates the true impact of COVID-19, as healthcare access would likely be more constrained among patients who are not hospitalised, as was demonstrated in Brazil.[22]

Conclusion

This study adds to the evidence of inequalities in South Africa, revealing how different intersecting systems (age, sex, race, SES) influence healthcare utilisation and health outcomes for people with COVID-19. These findings demonstrate the importance of collecting and analysing data on SES alongside race data.[45] This will ensure that disease control measures address the most marginalised groups affected by COVID-19.[32] Public health efforts should be targeted towards vulnerable populations, taking into consideration the pre-existing inequities that predispose them to have poor disease outcomes and yet have more limited access to health interventions.[44] The findings should also inform government efforts to provide inclusive non-discriminatory health services, and urgently improve access to ICU, ventilation and oxygen in the public sector.

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Competing interests

We have no competing interests to declare.

Authors' contributions

W.J. and S.M. contributed to the literature search. W.J., L.B., C.C., L.O. and C.M. contributed to study design and refining methods of analysis. L.O., W.J. and R.W. contributed to data analysis, and creation of tables and figures. W.J., L.O. and S.M. contributed to data interpretation and writing the initial draft. W.J. drafted the initial manuscript and all other co-authors contributed scientific inputs equally towards the interpretation of the findings and the final draft of the manuscript. W.J., L.O., R.W. and C.M. verified the underlying data.

References

1. South African Department of Health. COVID-19 statistics in SA [webpage on the Internet]. No date [cited 2022 Feb 14]. Available from: https://www.health.gov.za/covid19/index.html
2. Madhi SA, Kwatra G, Myers JE, Jassat W, Dhar N, Mukendi CK, et al. South African population immunity and severe Covid-19 with Omicron variant [preprint]. medRxiv. 2021.12.20.21268096. https://doi.org/10.1101/2021.12.20.21268096
3. South African Department of Health. COVID-19 statistics in SA [webpage on the Internet]. No date [updated 2021 Nov 25; cited 2022 Feb 14]. Available from: https://sacoronavirus.co.za/2021/11/25/update-on-covid-19-thursday-25-november-2021/
4. South African Medical Research Council. Estimated number of excess natural deaths and death rates by province and metro, South Africa 2020/2021 (all ages) [webpage on the Internet]. No date [cited 2022 Feb 14]. Available from: https://www.samrc.ac.za./reports/report-weekly-deaths-south-africa
5. Nguyen NT, Chinn J, Ferrante MD, Kirby KA, Hohmann SF, Amin A. Male gender is a predictor of higher mortality in hospitalized adults with COVID-19. PLoS ONE. 2021;16, e0254066. https://doi.org/10.1371/journal.pone.0254066
6. Sze S, Pan D, Nevill CR, Gray LJ, Martin CA, Nazareth J, et al. Ethnicity and clinical outcomes in COVID-19: A systematic review and meta-analysis. eClinicalMedicine. 2020;29, Art. #100630. https://doi.org/10.1016/j.eclinm.2020.100630
7. Sasson I. Age and COVID-19 mortality: A comparison of Gompertz doubling time across countries and causes of death. Demogr Res. 2021;44:379–396. https://doi.org/10.4054/DemRes.2021.44.16
8. Khanijahani A, Iezadi S, Gholipour K, Azami Aghdash S, Naghibi D. A systematic review of racial/ethnic and socioeconomic disparities in COVID-19. Int J Equity Health. 2021;20:248. https://doi.org/10.1186/s12939-021-01582-4
9. Mackey K, Ayers CK, Kondo KK, Saha S, Advani SM, Young S, et al. Racial and ethnic disparities in COVID-19-related infections, hospitalizations, and deaths: A systematic review. Ann Intern Med. 2021;174(3):362–373. https://doi.org/10.7326/M20-6306
10. Gershengorn HB, Patel S, Shukla B, Warde PR, Bhatia M, Parekh D, et al. Association of race and ethnicity with COVID-19 test positivity and hospitalization is mediated by socioeconomic factors. Ann Am Thorac Soc. 2021;18(8):1326–1334. https://doi.org/10.1513/AnnalsATS.202011-1448OC
11. Jassat W, Cohen C, Tempia S, Masha M, Goldstein S, Kufa T, et al. Risk factors for COVID-19-related in-hospital mortality in a high HIV and tuberculosis prevalence setting in South Africa: A cohort study. Lancet HIV. 2021;8:e554-e567. https://doi.org/10.1016/S2352-3018(21)00151-X
12. Statistics South Africa. Inequality trends in South Africa: A multidimensional diagnostic of inequality. Pretoria: Statistics South Africa, 2019. Available from: https://www.statssa.gov.za/publications/Report-03-10-19/Report-03-10-192017.pdf
13. Morudu P, Kollamparambil U. Health shocks, medical insurance and household vulnerability: Evidence from South Africa. PLoS ONE. 2020;15, e0228034. https://doi.org/10.1371/journal.pone.0228034
14. Statistics South Africa. Mid-year population estimates, 2020. Statistical release P0302. Pretoria: Statistics South Africa; 2021. Available from: http://www.statssa.gov.za/publications/P0302/P03022020.pdf
15. De Glanville WA, Thomas LF, Cook EAJ, De C. Bronsvoort BM, Wamae NC, Kariuki S, et al. Household socio-economic position and individual infectious disease risk in rural Kenya. Sci Rep. 2019;9:2972. https://doi.org/10.1038/s41598-019-39375-z
16. Marmot M. Social determinants of health inequalities. Lancet. 2005;365(9464):1099–1104. https://doi.org/10.1016/S0140-6736(05)71146-6

17. Coovadia H, Jewkes R, Barron P, Sanders D, McIntyre D. The health and health system of South Africa: Historical roots of current public health challenges. Lancet. 2009;374:817–834. https://doi.org/10.1016/S0140-6736(09)60951-X

18. National Institute for Communicable Diseases (NICD). Proposed definition of COVID-19 wave in South Africa. Communicable Diseases Communiqué. 2021 Nov;20(11). Available from: https://www.nicd.ac.za/wp-content/uploads/2021/11/Proposed-definition-of-COVID-19-wave-in-South-Africa.pdf

19. Raine S, Liu A, Mintz J, Wahood W, Huntley K, Hazulla F. Racial and ethnic disparities in COVID-19 outcomes: Social determination of health. Int J Environ Res Public Health. 2020;17:8115. https://doi.org/10.3390/ijerph17218115

20. Ruprecht MM, Wang X, Johnson AK, Xu J, Felt D. Evidence of social and structural COVID-19 disparities by sexual orientation, gender identity, and race/ethnicity in an urban environment. J Urban Health. 2021;98:27–40. https://doi.org/10.1007/s11524-020-00497-9

21. World Health Organization (WHO). COVID-19 and the social determinants of health and health equity: Evidence brief. Geneva: WHO; 2021. Available from: https://www.who.int/publications/i/item/9789240038387

22. Baqui P, Bica I, Marra V, Ercole A, Van der Schaar M. Ethnic and regional variations in hospital mortality from COVID-19 in Brazil: A cross-sectional observational study. Lancet Glob Health. 2020;8, e1018-26. https://doi.org/10.1016/S2214-109X(20)30285-0

23. Carethers JM. Insights into disparities observed with COVID-19. J Internal Med. 2021;289:463–473. https://doi.org/10.1111/joim.13199

24. Kopel J, Perisetti A, Roghani A, Aziz M, Gajendran M, Goyal H. Racial and gender-based differences in COVID-19. Front Public Health. 2020;8:418. https://doi.org/10.3389/fpubh.2020.00418

25. Acosta AM, Garg S, Pham H, Whitaker M, Anglin O, O'Halloran A, et al. Racial and ethnic disparities in rates of COVID-19-associated hospitalization, intensive care unit admission, and in-hospital death in the United States from March 2020 to February 2021. JAMA Netw Open. 2021;1;4(10), e2130479. https://doi.org/10.1001/jamanetworkopen.2021.30479

26. Laurencin CT, McClinton A. The COVID-19 pandemic: A call to action to identify and address racial and ethnic disparities. J Racial Ethn Health Disparities. 2020;7(3):398–402. https://doi.org/10.1007/s40615-020-00756-0

27. Hooper MW, Nápoles AM, Pérez-Stable EJ. COVID-19 and racial/ethnic disparities. JAMA. 2020;323(24):2466–2467. https://doi.org/10.1001/jama.2020.8598

28. Bhala N, Curry G, Martineau AR, Agyemang C, Bhopal R. Sharpening the global focus on ethnicity and race in the time of COVID-19. Lancet. 2020;395(10238):1673–1676. https://doi.org/10.1016/S0140-6736(20)31102-8

29. Tai DBG, Shah A, Doubeni CA, Sia IG, Wieland ML. The disproportionate impact of COVID-19 on racial and ethnic minorities in the United States. Clin Infect Dis. 2021;72(4):703–706. https://doi.org/10.1093/cid/ciaa815

30. Obinna DN. Confronting disparities: Race, ethnicity, and immigrant status as intersectional determinants in the COVID-19 era. Health Educ Behav. 2021;48(4):397–403. https://doi.org/10.1177/10901981211011581

31. Bhopal S, Bhopal R. Sex differential in COVID-19 mortality varies markedly by age. Lancet. 2020;396:532–533. https://doi.org/10.1016/S0140-6736(20)31748-7

32. Dehingia N, Raj A. Sex differences in COVID-19 case fatality: Do we know enough? Lancet Glob Health. 2021;9(1):e14–e15. https://doi.org/10.1016/S2214-109X(20)30464-2

33. Islam N, Khunti K, Dambha-Miller H, Kawachi I, Marmot M. COVID-19 mortality: A complex interplay of sex, gender, and ethnicity. Eur J Public Health. 2020;30(5):847–848. https://doi.org/10.1093/eurpub/ckaa150

34. Demombynes G. COVID-19 Age-mortality curves are flatter in developing countries. Policy research working paper 9313. Washington DC: World Bank Group; 2020. https://doi.org/10.1596/1813-9450-9313

35. Chauvin JP, Fowler A, Herrera LN. The younger age profile of COVID-19 deaths in developing countries. IDB Working Paper Series IDP-WP-1154. Washington DC: Inter-American Development Bank; 2020. http://dx.doi.org/10.18235/0002879

36. Sykes W, Mhlanga L, Swanevelder R, Glatt TN, Grebe E, Coleman C, et al. Prevalence of anti-SARS-CoV-2 antibodies among blood donors in Northern Cape, KwaZulu-Natal, Eastern Cape, and Free State provinces of South Africa in January 2021 [preprint]. Research Square. 2021 Feb 12:rs.3.rs-233375. https://doi.org/10.21203/rs.3.rs-233375/v1

37. Figueroa JF, Wadhera RK, Mehtsun WT, Riley K, Phelan J, Jha AK. Association of race, ethnicity, and community-level factors with COVID-19 cases and deaths across U.S. counties. Healthcare. 2021;9:100495. https://doi.org/10.1016/j.hjdsi.2020.100495

38. Mhlanga D, Garidzirai R. The influence of racial differences in the demand for healthcare in South Africa: A case of public healthcare. Int J Environ Res Public Health. 2020;17,5043. https://doi.org/10.3390/ijerph17145043

39. McIntyre D, Doherty J, Ataguba J. Healthcare financing and expenditure: Post-1994 progress and remaining challenges. In: Van Rensburg H, editor. Health and healthcare in South Africa. Pretoria: Van Schaik; 2012. p. 433–482.

40. Monitor Group. Health Systems Comparison Project. Cambridge: Mimeo; 2008.

41. Burger R, Christian C. Access to health care in post-apartheid South Africa: Availability, affordability, acceptability. Health Econ Policy Law. 2020;15:43–55. https://doi.org/10.1017/S1744133118000300

42. Mathur R, Rentsch CT, Morton CE, Hulme WJ, Schultze A, OpenSAFELY Collaborative. Ethnic differences in SARS-CoV-2 infection and COVID-19-related hospitalisation, intensive care unit admission, and death in 17 million adults in England: An observational cohort study using the OpenSAFELY platform [with erratum 2021 May 6]. Lancet. 2021;397(10286):1711–1724. https://doi.org/10.1016/S0140-6736(21)00634-6

43. Khazanchi R, Evans CT, Marcelin JR. Racism, not race, drives inequity across the COVID-19 continuum. JAMA Netw Open. 2020;3(9), e2019933. https://doi.org/10.1001/jamanetworkopen.2020.19933

44. Ford CL. Commentary: Addressing inequities in the era of COVID-19. The pandemic and the urgent need for critical race theory. Family Commun Health. 2020;43(3):184–186. https://doi.org/10.1097/FCH.0000000000000266

45. Chowkwanyun M, Reed AL. Racial health disparities and COVID-19 – Caution and context. N Engl J Med. 2021;383(3):201–203. https://doi.org/10.1056/NEJMp2012910

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Pandemic governance: Developing a politics of informality

South Africa had the privilege of learning from how other countries responded to the crisis engendered by the COVID-19 pandemic. However, this opportunity seems to have been lost as the South African government made the mistake of transposing a developed-world preventive response onto a largely developing-world populace. The government failed to map out how factors such as South Africa's demographic composition, spatial architecture, the incidence of poverty and informality, and competing epidemics would interact synergistically and shape epidemiological outcomes. In this article shaped by sociological insights, we show how the application of governance systems can give rise to many unintended social consequences when the knowledge forms upon which they are based are not suitably tailored to meet the needs of the specific local context. We highlight how informality can play a valuable role in fighting the COVID crisis and suggest that, to truly succeed, the government should include rather than override informal principles of governance.

Significance:

We present a brief comparative analysis of the responses of different nation states to the COVID-19 pandemic. The insights contribute to the sociological literature as well as to other disciplines, highlighting how local contextual factors are (re)shaping the form of policy responses as well as their associated consequences. More specifically, we focus on the importance of adopting a political economy approach in the analysis of informality and motivate how and why this may be useful for consideration in areas related to policy development and governance more broadly.

Introduction

On 28 March 2020, John Sparks, the Africa correspondent for *Sky News* posted an eyewitness account describing the conditions in Alexandra Township (forming part of the City of Johannesburg Metropolitan municipality and located adjacent to the affluent suburb of Sandton). In this report, Sparks[1] purportedly provides an objective account regarding the immediate failings of the government's lockdown. After brief and perfunctory admissions that Alexandra is overcrowded, that people need to eat, and that the average of six people sharing a single-bedroom shack would be reluctant to remain indoors for the entire day, the real message of the report is revealed. For Sparks[1], the problem with getting township residents to stay in their homes is that they invariably outnumber the South African National Defence Force troops meant to police them. He thereafter concludes that 'this township and many others cannot be policed, and its residents *will* not self-isolate'[1]. This framing is problematic as it finds less fault with the lockdown mandates and principles of governance than it does the people being governed – who are portrayed as illiterate, irresponsible, and ungovernable.

Ultimately, the application of governance systems has been shaped by what many have termed 'pandemic politics': the political, social, economic, and legal issues shaping COVID-19's impact on various societal domains.[2-4] Sociology can provide insights into 'pandemic politics' as it is a discipline concerned with the study of social change, the structure of society, and how shared beliefs cohere to give rise to various institutions and behavioural practices. While not claiming complete objectivity itself, the deployment of a poststructuralist method with its emphasis on the fluidity of meaning allows for concepts like governance and 'the science' to be seen not as fixed and value-free entities, but rather as things that may be ideologically laden and shaped by power relations.

In this article, we first contextualise the COVID-19 global pandemic to show how the epidemiological outcomes of the virus were shaped by local contextual factors. Then we focus more closely on the state's response by using sociological insights gleaned from the field of governmentality studies to demonstrate how formal principles of governance are deleterious when they override rather than include informal logics. Finally, we motivate by imagining a 'new normal' that heeds the lessons learned surrounding the governance of informality.

Contextualising COVID-19: The glocalisation of a pandemic

For all the talk of a 'new normal', our experiences of life under COVID are just as diverse and varied as they were before the pandemic even began. A primary reason for this observation is that we have been privy to the pandemic's glocalisation. The latter is a sociological concept that can be used to explain how global universalising forces display particularising tendencies in that they frequently adapt in line with local conditions.[5] On the one hand, the COVID-19 pandemic was global in that it resulted in the disarticulation and reconfiguration of global supply chains[6]; it occasioned worldwide economic downturn[6]; and the more globally connected cities experienced higher rates of morbidity and mortality[7]. On the other hand, the COVID-19 pandemic was a local phenomenon as the public health crises that ensued in respective nation states around the world reflected both regional state capacities and internal political choices.[6]

Therefore, when the World Health Organization (WHO) declared the coronavirus outbreak a global pandemic on 11 March 2020, what followed was a mass socio-political experiment in the management of people and crisis situations. In drafting policy responses to the pandemic, nation states measured the cost to human life against the

value of their democratic principles and the health of their economies, and in turn, created interesting policy blends drawn off the axes of libertarianism–authoritarianism and social democracy–neoliberalism.[8]

For instance, following an initial denial of the severity of the pandemic, countries with obstinately right-wing neoliberal administrations such as Brazil, the USA and the UK were demonstrably more laissez-faire in their response measures.[6] In espousing the liberal doctrine of letting the pandemic run its natural course[9], they opted for the strategy of herd immunity and prioritised individual freedom and the protection of profit over the preservation of public health[6]. On the other end of the extreme, China took a much stronger interventionist approach with its 'zero-tolerance for COVID policy' and demonstrated the allure of a dictatorship in containing the spread of the virus.[10] In an impressive feat of mobilising resources, they constructed two fully furnished specialty field hospitals in under two weeks.[11] As infectious disease hospitals, they were constructed keeping the transmission dynamics of the novel virus in mind.[11]

The above observations demonstrate that science – an invariably unfinished project – is not neutral, especially when applied towards political ends. With the pandemic's immanent yet progressive politicisation, a myriad of divergent policy responses all around the world were shuffled in and were similarly justified in that they were 'following the science'[12]. Far from being objective, 'pandemic science' has been open to interpretation and it is the perceived severity of the problem of COVID-19 as well as how it has been legally defined that has determined the robustness of how nation states responded. For example, nation states such as Bulgaria, Italy, Portugal, and Spain were all able to declare a state of emergency.[13] Alternately, countries like Albania[13], Bosnia[13], and South Africa may have had either higher constitutional thresholds to meet or they simply could not legally declare a state of emergency, instead leaving them to settle for declaring a national state of disaster.

Another example is the case of Ireland which responded to the COVID-19 crisis through the *Health Act of 2020* and the *Emergency Act of 2020* as they could only evoke their constitutional powers and declare a state of emergency in conditions characterised by political violence[14] and which might pose a threat to state sovereignty. This is significant because the constitutional provisions[13] and legislative frameworks of different countries dictate which emergency response mechanisms are permissible or ideal. This in turn determines how much power is transferred to the executive governing body, how many resources may be released or redirected, which crisis measures may be adopted, and consequently which civil liberties may be suspended or curtailed.

Even then, once countries get the legal go-ahead to implement certain public health interventions, there is still the issue of certain politicians both knowledgeable and lacking in a scientific background that are charged with (in)directly undermining the efforts and policy recommendations made by their respective scientific advisory boards. An illustrative example of this is how Jair Bolsonaro, President of Brazil, fired his health minister for publicly recommending that Brazil make use of physical distancing and a lockdown.[15] Similarly, Richard Bright – director of the US Biomedical Advanced Research and Development Authority – was demoted after publicly raising concerns regarding former President Donald Trump's overly enthusiastic endorsement of hydroxychloroquine as a potential treatment for COVID-19.[16] But while populist leaders like Boris Johnson (UK), Narendra Modi (India), Donald Trump (USA) and Jair Bolsonaro (Brazil) manufactured good news to fuel their politics by downplaying the pandemic and rejecting or distorting the science[17], South Africa was facing an unseen threat of a much different kind.

COVID's challenge to South Africa and a polemic against performative scientism

As per the WHO's[18] guidelines, in a situation where vaccines are unavailable, behaviour modification and non-pharmaceutical interventions like social distancing, mask wearing, the self-isolation of those at risk of exposure, quarantining of positive cases, handwashing and sanitising, and restrictions on public gatherings all become the order of the day. The South African government was quick to adopt these measures following President Ramaphosa's National Address on 15 March 2020. In that same address, Mr Ramaphosa announced the establishment of the National Coronavirus Command Council which would allow for intergovernmental coordination in response to the pandemic.[19] On 26 March 2020 – 11 days after President Ramaphosa first evoked his constitutional powers and declared a national state of disaster – a 'hard lockdown' was imposed. This risk-adjusted strategy – which began with the status of Alert Level 5 – was seen as the most restrictive lockdown response on the continent[20], and among the most stringent in the world[8,21]. With the exception of those sectors involved in the performing of essential services or that dealt in the trading of essential goods, the early lockdown entailed a complete economic shutdown and a ban on inter-provincial travel.[8] Under the threat of hefty fines and imprisonment, people would be allowed to leave their homes only to buy groceries and access medical services or if they worked in essential services.[21]

South Africa was initially praised for demonstrating good governance in taking decisive action and swiftly implementing the hard lockdown.[8] South Africa's science-based approach is partly why it was initially seen as so successful[22], garnering the praise of international organisations like the WHO[23]. For instance, the Ministerial Advisory Committee (MAC) on COVID-19 was established on 30 March 2020. It consisted of researchers, clinicians, pathologists, laboratory practitioners, and public health practitioners and they performed the function of regularly advising the government on its various interventions.[24] This approach stood in stark contrast with the anti-scientific sentiments of former President Mbeki's administration where the ideology of AIDS-denialism, bogus AIDS cures[25], and delay in providing affected groups with anti-retroviral drugs resulted in at least 330 000 unnecessary AIDS-related deaths[26].

At the International Aids Conference held in South Africa in 2000, former Minister of Health Dr Tshabalala-Msimang called renowned infectious disease epidemiologist Prof. Abdool Karim a traitor and she saw it as treasonous that he and his colleagues were advocating for the government to provide access to anti-retroviral treatment.[27] Now, in the current era defined by COVID-19, for the duration of 2020, Prof. Abdool Karim served as Co-Chair on the MAC on COVID-19 which provided scientific advice to the President and Health Minister on how to proceed in handling the pandemic.[25] Although the South African government was definitely 'following the science'[25] in developing an epidemic response, it is important to consider how well-suited the policy responses – informed by 'the science' – were in helping overcome specific challenges posed by South Africa's local context, as well as how closely the government followed the recommendations. As a complete analysis of the second consideration is beyond the scope of this article, we will mainly focus our attention on the first consideration, which essentially deals with COVID's challenge to South Africa.

While South Africa may be formally classified as a middle-income country, there are many realities that cast doubt on this status. South Africa has been dubbed the most unequal society in the world, a title that has been seemingly unchallenged for the past 16 years.[28] Reflective of South Africa's segregationist history, income distribution and wealth distribution remain heavily racialised.[29] In a further demonstration of inequality, South Africa spends 42–44% of its total health expenditure on voluntary private health insurance – popularly referred to as 'medical aid' – for a scheme that covers roughly 16% of the population.[30,31]

Before the scourge of the COVID-19 pandemic even began, the South African health system was battling its quadruple disease burden the confluence of communicable diseases such as HIV and tuberculosis (TB); non-communicable diseases like diabetes, hypertension, cardiovascular diseases, cancer, and chronic lung disease; maternal and child mortality; and trauma and violence.[32] This means that by the time the pandemic hit, the response was to be shouldered by an already overburdened, under-resourced, and poorly administered public health system.[33]

Moreover, instead of taking a strictly biomedical approach to tackling the COVID-19 pandemic, the necessity of adopting a syndemic approach should have been apparent early on. Viewing the syndemic impact of

COVID-19 means being attuned to how the co-occurrence of epidemics and various social factors routinely interact to produce complicated public health outcomes to which the state must actively respond. In other words, South Africa had to prepare for how biological factors – such as competing epidemics and comorbidities – would interact synergistically with socioecological factors – such as poverty, food insecurity, gender-based violence, and widespread housing insecurity – and make the disease and negative impacts thereof more likely to cluster among socially disadvantaged groups.[34,35]

However, it must be added that in a controversial turn of events, in September 2020, it was a stated awareness of the syndemic nature of COVID-19 that served as justification for the reconfiguration of the original MAC on COVID-19.[24] What is at issue is that some of the scientists who were being relieved of their duties were among the most respected in their fields and they were publicly known for having been critical of various elements of the government's occasionally 'unscientific' handling of the pandemic.[36,37] Examples of such persons are Prof. Francois Venter, Prof. Glenda Gray – the president of the South African Medical Research Council – and Prof. Shabir Madhi – who spearheaded Oxford University's COVID-19 vaccine trials in South Africa.[36,37] Nevertheless, the Department of Health has maintained that the MAC was augmented to strengthen it by including other experts such as social scientists, community leaders, and specialists in ethics. Furthermore, they proclaimed that[24]:

> *the Minister accepted and implemented almost all (more than 95%) of the advisories from the MAC on COVID-19 . . . Those who persist that government has not heeded the advices from the MAC on COVID-19 are dishonest and intent on misleading he* [sic] *public.*

To return to the issue of how well-suited the policy responses were in addressing the specific challenges posed by South Africa's context, the answer remains murky at best. Despite the fact that, at the start of 2020, the South African government had limited fiscal space[7] and the South African economy was experiencing a technical recession[26], the government got off to a promising start, leveraging its existing infrastructure and experience in dealing with the HIV and TB epidemics[22]. In April 2020, around 28 000 health workers – representing capacities that were developed in response to the aforementioned epidemics[26] – and 67 mobile testing units were deployed during the lockdown to conduct door-to-door symptom 'screening' in at-risk communities[7,26].

However, things began to unravel rapidly as the government neither had the necessary infrastructure and resources to properly see their public health interventions through nor were they capable of dealing with the lockdown's unintended social and economic consequences. For instance, in regard to the community screening and testing programme, contact tracing became unfeasible as the turnaround time for test results had increased from 12–48 hours to 5–14 days.[7,26,38,39] This means that by the time someone got their positive result, they would have likely exposed someone else to the virus. It is also the case that the government had to ensure that by attempting to follow up on COVID-19 so rigorously that they did not lose sight of the other previous health challenges that they were battling.[32] For example, the lockdown-induced reduction in earnings and the limitations placed on movement created difficulties for people in terms of accessing public transport. Consequently, the National Institute for Communicable Diseases reported that with the COVID-19 level 5 restrictions, the first five weeks of the lockdown saw an average 48% weekly decrease in testing for TB and a 33% decline in newly diagnosed cases.[23,32,38]

While other countries were facing threats like populism with its concomitant anti-science and anti-establishmentarian politics – South Africa was facing an unseen threat in the form of what Muller[23] calls 'performative scientism'. In the sociological and philosophical literature, scientism can refer to a particular methodological and epistemological stance which regards scientific knowledge as the purest form of knowledge and one that is incapable of being contaminated by other knowledge forms.[40] Scientism is sometimes used pejoratively[40] to describe:

> *an exaggerated kind of deference towards science, an excessive readiness to accept as authoritative any claim made by the sciences, and to dismiss every kind of criticism of science or its practitioners as anti-scientific prejudice.*[41(p.17-18)]

'The science' became both a shield and a general selling point to boost the legitimacy of the government's policy interventions. It is the opaqueness characteristic of the government's decision-making processes regarding its handling of the pandemic which is said to have caused confusion about when the government showed deviations from the scientific expertise.[37] An example of such performative scientism or 'COVID theatre'[42] can be seen in things like the tobacco ban[43] which had very little scientific merit as well other irrational measures like the 12–4 a.m. curfew[42] or the ban on the sale of open toe shoes.

Even though we have demonstrated the complicated relationship between politics and 'the science', to fully understand the consequences of the lockdown it is important to note how governance systems have differential impacts when exercised on various population groups. In the next section, we engage how the governance systems represented by the pandemic response were ill-suited to helping those individuals living in contexts defined by informality.[44]

Governing the informal: A people without a safety net

An informal settlement may be described as a dense settlement in an urban area where residents have occupied land and have made makeshift housing using resources and construction methods that are not wholly compliant with formal urban planning methods and building regulations.[44] Informal settlements are typically characterised by overcrowding[45], insecure tenure[46], inadequate access to clean water[45] and formalised sanitation infrastructure[44], poverty[46,47], and a lack of access to basic service delivery[45].

In 2015, it was estimated that around 25% of the world's population (1 billion people) were living in informal settlements, and that within 15 years that percentage would double.[48] In South Africa, as many as 1.2 million households live in informal settlements.[49] It is important to be sensitive in terms of how we speak about informality and informal settlements. We should avoid sentiments that needlessly pathologise the conditions that many people involuntarily live in. And, in recognising the ingenuity, resourcefulness, and adaptability that the people living in informality often display, we should similarly avoid the indirect naturalisation of these very conditions.

Informality may be understood as a social existence outside of formal regulations and one that is further removed from the provisions of the state. Within the literature, there has been a tendency to approach informality as: a *sector* – like the labour market; a *setting* – like informal settlements; or as an *outcome* – regarding the legal status of various practices.[50] Furthermore, in conceptualising informality, there have historically been three traditional schools of thought, namely: *dualism* – the informal economy encompasses low-income and marginal economic activities that are distinct from the formal, modern capitalist sector; *structuralism* – a neo-Marxist approach wherein informal economies are exploited and subsumed by formal economies; and *legalism* – a neoliberal approach wherein informal activities are framed as a rational response to the costs and overregulation accompanying bureaucracy.[50]

However, all the above approaches have been critiqued on account of their static categorisations of informality and their subsequent neglect of a thorough political economy analysis.[50] In other words, 'informality is not confined to the urban poor'[50], but also includes those political and economic elites that have privileged themselves through informal networks. An example is how the tobacco ban, which may have been politically motivated, created lucrative opportunities for illicit tobacco traders.[23]

Moreover, the state itself can in many instances be extremely deregulated (through bureaucratic inefficiencies, corruption, and the outsourcing of informal labour), whereas the informal sector can appear to be highly organised and regulated, albeit not by a state body. This article therefore draws on Roy's poststructuralist framing of urban informality as 'organising logic, a system of norms that governs the process of urban transformation'[51]. This allows us to treat informality as a critical and multi-scalar category of analysis wherein informal networks and circuits of exchange continuously give rise to new 'winners and losers' in urban development.[50]

A 'politics of informality' is a 'strategy for elite and subaltern groups'[50], largely perceived as a response to the shortcomings and inefficiencies of the state. Therefore, things like collective mobilisation and protests are also included under the rubric of a 'politics of informality'. Informality thus plays a very important role in sustaining people's lives and helping them enact citizenship[52], and informal governance only constitutes an oxymoron if one maintains that the formal and informal are mutually exclusive entities.

Informal settlements propel the city's development and stimulate the local economy as they provide low-income groups with affordable housing.[48] As a function of their location, informal settlements help people actualise their right to the city as it enables easier access to services and resources within the city. For instance, informal settlements can help the urban poor find jobs and gain access to schools, healthcare facilities, and other public amenities.[49] The informal sector provides a viable food source for around 70% of poorer households and informal food vendors are convenient outlets because of their operating hours, because they can sell food items in flexible quantities, because they are more affordable, and because they sometimes offer credit to regular customers.[53]

Now that we can see how essential the informal sector is to maintaining life, we could imagine how much suffering was caused by the initial hard lockdown. Between April and June 2020, more than 2 million jobs were shed from the labour market[54], and statistics from February 2021 suggest that of the initial 2.2 million jobs lost, only 40% had been recovered[55]. These job losses were concentrated among the already socially disadvantaged, with rates of job loss in the informal sector twice as high as that in the formal sector.[54] Informal workers were effectively left without a safety net as they did not qualify for the Unemployment Insurance Fund, and the meagre COVID-19 Social Relief of Distress grant to the value of ZAR350 per month was only introduced on 21 April 2020.[7]

The loss of and reduction in average household income exacerbated food insecurity in South Africa. Prior to the lockdown, around 9 million children were receiving a free meal at school every day – an important feeding programme that fell away with the closure of schools.[26,29] Furthermore, it did not help that informal food vendors and spaza shops were not allowed to operate as they were not classified as essential retailers.[56] Two weeks into the lockdown, informal food vendors were finally allowed to open for business. However, they were only allowed to serve uncooked foods and they had to have a pre-existing municipal permit in order to function.[56]

In writing on South Africa's lockdown-induced food insecurity ordeal, Battersby[56] suggests that the government's regulations show a very limited understanding of how poor people routinely access food. The bias towards larger formal food providers is said to instead reflect a bias against informality.[56] This is an argument that has been extended in other forms. For instance, Friedman[25] references South Africa's high inequality and sees the country as divided into a 'First World' and a 'Third World'. He then asks why South Africa performed worse than other African countries when it had the most sophisticated medical infrastructure.[25] In supplying an answer, he suggests that perhaps it was the sophisticated medical infrastructure itself that contributed to the severity of the outbreak.[25] Here Friedman alludes to the increase in turnaround time for COVID-19 tests and further intimates that South Africa reflected a 'First World' bias in that it attempted to emulate 'the science' of Northern countries and it invested all of 'its eggs' in the contact tracing basket even when it still clearly lacked the necessary infrastructure to make it worthwhile.[25]

Whether we discuss the government's bias against informality – in the case of Battersby[56] – or the government's 'First World bias' – in the case of Friedman[25] – or the Alexandra township residents' unwillingness to self-isolate – in the case of Sparks[1] – the governance systems which comprised the government's epidemic response clearly had differential impacts on various population groups.

In the field of governmentality studies – which finds inspiration in the work of Michel Foucault – governance refers to the particular political rationality that is adopted by a given regulatory body which outlines how power is to be exercised in the management of a specific target, such as a population or a company.[9] With governmentality being a neologism of government and rationality, the state is not just an overseer and service provider. Instead, they exercise power through contributing to the formation of political subjects which conduct themselves according to specified means.

So, for example, in neoliberal regimes, less government does not mean that there is less governance.[57] Instead, neoliberal governance uses notions of rights and freedoms to frame what it means to be a citizen in that particular context. These notions of citizenship are then imbibed in people and thus people begin to govern and conduct themselves accordingly. This allows for the government to govern at a distance, and it shifts some responsibility on to the individual.

Additionally, the neoliberal ideology that the market is the most efficient and legitimate distributor of wealth functions to hold individuals accountable for their own social standing, irrespective of institutional and economic barriers. Another timely example of such governance would be how we have been conditioned into identifying certain behaviours as COVID-friendly etiquette and have modified our behaviours accordingly in the favour of public interest. If everyone adopted these modes of self-conduct, it would reduce the pressure experienced by the public health system. Unfortunately, due to economic, spatial, and infrastructural inequalities, people in informal settlements cannot be effectively governed using the same principles as those applied in the suburbs.

To this point, in a study on two informal settlements in Cape Town (Masiphumelele and Klipfontein Glebe) geographic information system (GIS) software (ArcGIS 10.5.1 (Esri)) was used to examine the feasibility of social distancing as an effective method to prevent the spread of COVID-19.[45] The researchers calculated the distance between the dwellings to get a sense of the relative density of the informal settlement, and they compared the results with the UK guidelines on social distancing which recommends a minimum distance of 2 metres when meeting another person outside[44] – a distance that South Africa then adopted. At the time that the associated authors were writing (April 2020) they reported that there were no other similar GIS studies juxtaposing the spatial arrangement of informal settlements and the social distancing guidelines.[44] Instead, the prevailing uses of GIS were studies that either determined caseloads and fatalities within specific areas, or were linked to general vulnerability mapping, whereby census data such as poverty indicators and population density were used to ascertain which population groups would be more susceptible to COVID-19.[44]

They found that to effectively maintain social distancing, the residents would still have to remain indoors.[44] This was unfeasible as many shacks are overcrowded and poorly ventilated[10], people share communal toilets which may be distant from their homes, and the lack of sanitation infrastructure may make them more susceptible to COVID[44]. Furthermore, people still need to leave their homes on a day-to-day basis as many township residents cannot store food, as they lack appliances like refrigerators.[45]

Conclusion: Developing a politics of informality

If the South African National Defence Force's excessive violence against civilians was any indication, the lockdown was an untenable condition to maintain. While the lockdown did buy time for the health system to prepare for an influx of patients, it was nothing to be desired. This is not to say that things could not have gone differently. Despite the apparent necessity of the situation, a major fault in the government's epidemic response was the failure to properly consult the people living in informal

settlements who would be most severely affected by the regulations.[33] Had they consulted with community leaders or researchers, they would have been able to modify their lockdown response accordingly.

For instance, rather than a national lockdown, a community lockdown might have made more sense, and instead of an entire township being cordoned off, clusters of dwellings could isolate together.[44] This would have made it easier to assess the relative risks and needs posed by various communities. Additionally, in full acknowledgement of the fact that social distancing is impossible in many informal settlements, the government should have launched mass construction and development campaigns in informal settlements across South Africa. The installation of things like temporary housing, water and sanitation infrastructure, and allotment gardens may have addressed several socio-economic challenges posed by the crisis and it would have provided a much-needed labour source for informal construction workers. More state resources and authority should have been conferred to the non-governmental organisations that already had a foothold in certain communities and which were filling a governance vacuum vis-à-vis the state.

The problems associated with the government allowing food vendors to operate on the condition that they had municipal permits showed us that with a 'politics of informality', the ultimate goal is not inclusion via formalisation, as the latter brings with it new barriers to entry. Not to be simply conflated with calls for more decentralised governance, a politics of informality – as a form of 'governmentality from below' – is about supplementing existing positive forms of governance and enhancing a people's ability to effectively conduct themselves, even if this goes against the neoliberal doctrine of investing in people materially. Alternatively, the government could have supplied informal food vendors with masks, latex gloves, and other equipment to safely prepare food, as well as things like industrial tape to demarcate physical distancing space and ensure the safe distribution of food to clients.

Nevertheless, this article has also demonstrated that treating informality as a critical category of analysis means being attuned to how political and economic elites may also use a 'politics of informality' to enrich themselves. Therefore, extra-governmental organisations should be approached or established prior to the launching of any fiscal response or development programme, in order to audit the awarding of contracts and funds.

This article has thus motivated the need to further develop the conceptual tool of a 'politics of informality', which begins with the acknowledgement that informality is not opposed to governance, but rather has the capacity to strengthen governance systems.[52] As opposed to governance systems which assume that top-down policy decisions will have uniform effects on various population groups, a 'politics of informality' can better inform policy as it is situational, contingent[52], and informed by the daily realities of the people thereby affected. Suffice it to say, social distancing in a shack was and is impossible because the prevailing governance systems deem it so.

Competing interests

We have no competing interests to declare.

Authors' contributions

Conceptualisation: D.T.v.W.; V.R. Methodology: V.R.; D.T.v.W. Data collection: D.T.v.W.; V.R. Data analysis: D.T.v.W.; V.R. Writing – the initial draft: D.T.v.W. Writing – revisions: V.R. Student supervision: V.R. Project leadership: D.T.v.W. Project management: V.R. Where both authors are mentioned, the first mentioned author played a more prominent role.

References

1. Sparks J. Coronavirus: The South African township where people just won't follow the lockdown rules. Sky News. 29 March 2020 [cited 2021 Dec 16]. Available from: https://news.sky.com/story/coronavirus-the-south-african-township-where-people-just-wont-follow-the-lockdown-rules-11965027
2. Kahl C, Wright TJ. Aftershocks: Pandemic politics and the end of the old international order. New York: St. Martin's Press; 2021.
3. Delanty G. Pandemics, politics, and society critical perspectives on the COVID-19 crisis. Berlin: De Gruyter; 2021. https://doi.org/10.1515/9783110713350
4. Boin A, McConnell A, Hart P't. Governing the pandemic: The politics of navigating a mega-crisis. Cham: Palgrave Macmillan; 2021. https://doi.org/10.1007/978-3-030-72680-5
5. Robertson R. Glocalization: Time-space and homogeneity-heterogeneity. In: Featherstone M, Lash S, Robertson R, editors. Global modernities. London: SAGE Publications Ltd; 1995. p. 25–55. https://doi.org/10.4135/9781446250563.n2
6. Saad-Filho A. From COVID-19 to the end of neoliberalism. Crit Sociol. 2020;46(4–5):477–485. https://doi.org/10.1177/0896920520929966
7. Visagie J, Turok I. Rural–urban inequalities amplified by COVID-19: Evidence from South Africa. Area Dev Policy. 2021;6(1):50–62. https://doi.org/10.1080/23792949.2020.1851143
8. Walby S. The COVID pandemic and social theory: Social democracy and public health in the crisis. EJST. 2020;14(1):22–43. https://doi.org/10.1177/1368431020970127
9. Gjerde LEL. From liberalism to biopolitics: Investigating the Norwegian government's two responses to Covid-19. Eur Soc. 2020;23(1):262–274. https://doi.org/10.1080/14616696.2020.1824003
10. Manderson L, Levine S. COVID-19, risk, fear, and fall-out. Med Anthropol. 2020;39(5):367–370. https://doi.org/10.1080/01459740.2020.1746301
11. Luo H, Liu J, Li C, Chen K, Zhang M. Ultra-rapid delivery of specialty field hospitals to combat COVID-19: Lessons learned from the Leishenshan hospital project in Wuhan. Autom Constr. 2020;119:1–10. https://doi.org/10.1016/j.autcon.2020.103345
12. Stevens A. Governments cannot just 'follow the science' on COVID-19. Nat Hum Behav. 2020;4:560. https://doi.org/10.1038/s41562-020-0894-x
13. Engler S, Brunner P, Loviat R, Abou-Chadi T, Leemann L, Glaser A, et al. Democracy in times of the pandemic: Explaining the variation of COVID-19 policies across European democracies. West Eur Polit. 2021;44(5-6):1077-1102. https://doi.org/10.1080/01402382.2021.1900669
14. Greene A. Ireland's response to the COVID-19 pandemic. Verfassungsblog. 11 April 2020 [cited 2022 Jan 08]. Available from: https://verfassungsblog.de/irelands-response-to-the-covid-19-pandemic/
15. Chowdhury AZ, Jomo KS. Responding to the COVID19 pandemic in developing countries: Lessons from selected countries of the Global South. Development (Rome). 2020;63:162–171. https://doi.org/10.1057/s41301-020-00256-y
16. Keown A. Bright settles dismissal complaint while whistleblower case continues. BioSpace. 10 August 2021 [cited 2022 Jan 08]. Available from: https://www.biospace.com/article/vaccine-expert-dismissed-by-trump-administration-settles-complaint-with-hhs-whistleblower-complaint-ongoing/
17. Gonsalves G, Yamey G. Populist leaders like Trump, Bolsonaro, Modi, and Johnson view scientists as their opponents. BMJ. 2020;371, m3878. https://doi.org/10.1136/bmj.m3878
18. World Health Organization (WHO). Advice on the use of masks in the community, during home care and in health care settings in the context of the novel coronavirus (2019-nCoV) outbreak: Interim guidance [document on the Internet]. c2020 [cited 2022 Jan 08]. Available from: WHO-nCov-IPC_Masks-2020.1-eng.pdf
19. Pietersen JM. The nexus between public administration and disaster management: A case of Covid-19 in South Africa. Afr J Public Sector Develop Govern. 2020;3(1):40–60. https://doi.org/10.10520/ejc-ajpsdg-v3-n1-a2
20. Stiegler N, Bouchard JP. South Africa: Challenges and successes of the COVID-19 lockdown. Ann Méd-Psychol. 2020;178:695–698. https://doi.org/10.1016/j.amp.2020.05.006
21. Bulled N, Singer M. In the shadow of HIV & TB: A commentary on the COVID epidemic in South Africa. Glob Public Health. 2020;15(8):1231–1243. https://doi.org/10.1080/17441692.2020.1775275
22. Devermont J, Mukulu T. South Africa's bold response to the Covid-19 pandemic [webpage on the Internet]. c2020 [cited 2021 Dec 28]. Available from: https://www.csis.org/analysis/south-africas-bold-response-covid-19-pandemic

23. Muller SM. The dangers of performative scientism as the alternative to anti-scientific policymaking: A critical, preliminary assessment of South Africa's Covid-19 response and its consequences. World Dev. 2021;140:1–14. https://doi.org/10.1016/j.worlddev.2020.105290

24. South African Department of Health. Minister Zweli Mkhize confirms total of 671 669 cases of coronavirus COVID-19 [media release]. 28 September 2020. Available from: https://www.gov.za/speeches/minister-zweli-mkhize-confirms-total-671-669-cases-coronavirus-covid-19-28-sep-2020-0000

25. Friedman S. In, but not of, Africa: A divided South Africa faces COVID-19. The Round Table. 2021;110(1):16–30. https://doi.org/10.1080/00358533.2021.1875678

26. Seekings J, Nattrass N. Covid vs. Democracy: South Africa's lockdown misfire. J Democr. 2020;31(4):106–121. https://doi.org/10.1353/jod.2020.0059

27. Malan M. Comparing the government responses to #Covid19 under Ramaphosa and #HIV under Mbeki. Daily Maverick. 25 March 2020. Available from: https://www.dailymaverick.co.za/article/2020-03-25-comparing-the-government-responses-to-covid19-under-ramaphosa-and-hiv-under-mbeki/

28. Baldwin-Ragaven L. Social dimensions of COVID-19 in South Africa: A neglected element of the treatment plan. Wits J Clin Med. 2020;2(SI):33–38. https://doi.org/10.18772/26180197.2020.v2nSIa6

29. Jamieson L, Van Blerk L. Responding to COVID-19 in South Africa – social solidarity and social assistance. Child Geogr. 2021:1–10. https://doi.org/10.1080/14733285.2021.1924359

30. Barber SL, Kumar A, Roubal T, Colombo F, Lorenzoni L. Harnessing the private health sector by using prices as a policy instrument: Lessons learned from South Africa. Health Policy. 2018;122(5):558–564. https://doi.org/10.1016/j.healthpol.2018.03.018

31. Sehoole TJ. COVID-19: Pandemic burden in sub-Saharan Africa and the right to health – The need for advocacy in the face of growing privatisation. Afr J Prm Health Care Fam Med. 2020;12(1), a2476. https://doi.org/10.4102/phcfm.v12i1.2476

32. Shabir M, Hofman K. The unanticipated costs of COVID-19 to South Africa's quadruple disease burden. S Afr Med J. 2020;110(8):698–699. https://doi.org/10.7196/SAMJ.2020.v110i8.15125

33. Staunton C, Swanepoel C, Labuschaigne M. Between a rock and a hard place: COVID-19 and South Africa's response. J Law Biosci. 2020;7(1):1–12. https://doi.org/10.1093/jlb/lsaa052

34. Yadav UN, Rayamajhee B, Mistry SK, Parsekar SS, Mishra SK. A syndemic perspective on the management of non-communicable diseases amid the COVID-19 pandemic in low- and middle-income countries. Front Public Health. 2020;8:508. https://doi.org/10.3389/fpubh.2020.00508

35. Schmidt-Sane M, Leach M, MacGregor H, Meeker J, Wilkinson A. Local Covid-19 syndemics and the need for an integrated response. Inst Dev Stud Bull. 2021;13(3–5):1–8. http://dx.doi.org/10.19088/1968-2021.103

36. Cowan K, Karrim A. Mkhize disbands Ministerial Advisory Committee on Covid-19 'out of the blue'. News24. 25 September 2020 [cited 2022 Jan 11]. Available from: https://www.news24.com/news24/southafrica/investigations/mkhize-disbands-ministerial-advisory-committee-on-covid-19-out-of-the-blue-20200925

37. Paterson M. Politicised COVID-19 responses undermine trust in science. University World News. 6 January 2021 [cited 2022 Jan 14]. Available from: https://www.universityworldnews.com/post.php?story=20210106135416792

38. South African National Institute for Communicable Diseases. Impact of COVID-19 intervention on TB testing in South Africa [document on the Internet]. c2020 [cited 2022 Jan 12]. Available from: Impact-of-Covid-19-interventions-on-TB-testing-in-South-Africa-10-May-2020.pdf (nicd.ac.za)

39. Mendelson M, Madhi S. South Africa's coronavirus testing strategy is broken and not fit for purpose: It's time for a change. S Afr Med J. 2020;110(6):429-431. https://doi.org/10.7196/SAMJ.2020.v110i6.14902

40. Gaj N, Lo Dico G. Science, scientism, and the disunity of science: Popular science during the COVID-19 pandemic. Argumenta. 2021;7(1):179–194. https://doi.org/10.14275/2465-2334/202113.gaj

41. Haack S. Evidence and inquiry. A pragmatist reconstruction of epistemology. 2nd ed. Amherst: Prometheus Books; 2009.

42. Farber T, Keeton C, Hosken G. 'The govt has blood on its hands': State blamed for 'ineptitude' on Covid-19. Sunday Times. 11 July 2021 [cited 2022 Jan 03]. Available from: https://www.timeslive.co.za/sunday-times/news/2021-07-04-the-govt-has-blood-on-its-hands-state-blamed-for-ineptitude-on-covid-19/

43. Maphanga C. 'There isn't much merit from a scientific perspective in banning smoking' – top scientist. News 24. 25 June 2020 [cited 2021 Dec 28]. Available from: https://www.news24.com/news24/southafrica/news/there-isnt-much-merit-from-a-scientific-perspective-in-banning-smoking-top-scientist-20200625

44. Gibson L, Rush D. Novel coronavirus in Cape Town informal settlements: Feasibility of using informal dwelling outlines to identify high risk areas for COVID-19 transmission from a social distancing perspective. JMIR Public Health Surveill. 2020;6(2), e18844. https://doi.org/10.2196/18844

45. Ntsebeza L. COVID-19 and its implications for South Africa's democracy. ASCL Africanist Blog. 09 April 2020 [cited 2021 Dec 20]. Available from: https://www.ascleiden.nl/content/ascl-blogs/covid-19-and-its-implications-south-africas-democracy

46. Pietrus MF. The right to the city in the informal sector: Claiming rights or gaining access in Kampala, Uganda? Geogr Bull. 2015;56(1):3–26. Available from: https://www.researchgate.net/publication/282381446_The_right_to_the_city_in_the_informal_sector_Claiming_rights_or_gaining_access_in_Kampala_Uganda

47. Gunter A, Massey R. Renting shacks: Tenancy in the informal housing sector of the Gauteng Province, South Africa. BGSS. 2017;37:25–34. https://doi.org/10.1515/bog-2017-0021

48. Jones P. Distance and proximity matters: Understanding housing transformation through micro-morphology in informal settlements. Int J Hous Policy. 2021;21(2):169–195. https://doi.org/10.1080/19491247.2020.1818052

49. Visagie J, Turok I, Misselhorn M. Upgrading dense informal settlements by building upwards: Lessons from an informal settlement in Durban, South Africa. HSRC Policy Brief 01. May 2020. http://hdl.handle.net/20.500.11910/15420

50. Banks N, Lombard M, Mitlin D. Urban informality as a site of critical analysis. J Dev Stud. 2020;56(2):223–238. https://doi.org/10.1080/00220388.2019.1577384

51. Roy A. Urban informality: Toward an epistemology of planning. J Am Plan. 2005;71(2):147–158. https://doi.org/10.1080/01944360508976689

52. Davis DE. Reflections on the politics of informality: what we know, how we got there, and where we might head next. St Comp Int Dev. 2018;53(3):365-378. https://doi.org/10.1007/s12116-018-9273-2

53. Wegerif MCA. "Informal" food traders and food security: Experiences from the Covid-19 response in South Africa. Food Secur. 2020;12:797–800. https://doi.org/10.1007/s12571-020-01078-z

54. Spaull N, Oyenubi A, Kerr A, Maughan-Brown B, Ardington C, Christian C, et al. NIDS-CRAM Wave 2 Synthesis Findings. The National Income Dynamics Study – Coronavirus Rapid Mobile (NIDS CRAM) Survey. c2020 [cited 2021 Nov 22]. Available from: https://cramsurvey.org/wp-content/uploads/2020/09/1.-Spaull-et-al.-NIDS-CRAM-Wave-2-Synthesis-Findings..pdf

55. Staff writer. South Africa is seeing a lockdown recovery – but the jobs aren't coming back. Business Tech. 10 March 2021 [cited 2022 Jan 06]. Available from: https://businesstech.co.za/news/business/474662/south-africa-is-seeing-a-lockdown-recovery-but-the-jobs-arent-coming-back/

56. Battersby J. South Africa's lockdown regulations and the reinforcement of anti-informality bias. Agric Hum Values. 2020;37:543–544. https://doi.org/10.1007/s10460-020-10078-w

57. Larner W. Neo-liberalism: Policy, ideology, governmentality. Stud Polit Econ. 2000;63(1):5–25. https://doi.org/10.1080/19187033.2000.11675231

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Economic vulnerability and poor service delivery made it more difficult for shack-dwellers to comply with COVID-19 restrictions

In South Africa, demand for housing close to viable/sustained sources of employment has far outstripped supply; and the size of the population living in temporary structures/shacks (and in poorly serviced informal settlements) has continued to increase. While such dwellings and settlements pose a number of established risks to the health of their residents, the present study aimed to explore whether they might also undermine the potential impact of regulations intended to safeguard public health, such as the stringent lockdown restrictions imposed to curb the spread of COVID-19 in 2020 and 2021. Using a representative sample of 1381 South African households surveyed in May–June 2021, the present study found that respondents in temporary structures/shacks were more likely to report non-compliance (or difficulty in complying) with lockdown restrictions when compared to those living in traditional/formal houses/flats/rooms/hostels (OR: 1.61; 95% CI: 1.06, 2.45). However, this finding was substantially attenuated and lost precision following adjustment for preceding socio-demographic and economic determinants of housing quality (adjusted OR: 1.20; 95% CI: 0.78, 1.87). Instead, respondents were far more likely to report non-compliance (or difficulty in complying) with COVID-19 lockdown restrictions if their dwellings lacked private/indoor toilet facilities (adjusted OR: 1.56; 95% CI: 1.08, 2.22) or if they were 'Black/African', young, poorly educated and under-employed (regardless of their socio-economic position, or whether they resided in temporary structures/shacks, respectively). Restrictions imposed to safeguard public health need to be more sensitively designed to accommodate the critical roles that poverty and inadequate service delivery play in limiting the ability of residents living in temporary structures/shacks and inadequately serviced dwellings/settlements to comply.

Significance:

- South Africans living in temporary structures/shacks are more likely to be poorly educated and under-employed, with fewer assets and limited access to basic household services.
- Poverty and inadequate service delivery were more important determinants of compliance with COVID-19 restrictions than housing quality.
- In the absence of improvements in economic circumstances and the delivery of basic household services, restrictions imposed to safeguard public health need to be more sensitively designed to take account of the structural barriers to compliance experienced by households where poverty and/or inadequate service delivery limit their ability to stay at home; maintain hygiene; and/or practise social distancing.

> *This idea of the 'humbling pandemic'[1] does not hold for people whose lives depend on informal economy and movement in the face of heavy restrictions on their respective activities such as… street hustle and domestic work. Therefore, the pandemic response – which employs tactics that come to determine how lives are to be lived – can be seen as an exacerbator of inequalities, by the hands of which precarious circumstances of living are a larger threat than the risk of infection.*[2]
>
> Stefan Ogedengbe[3]

Introduction

It is important not to overlook the role that temporary structures/shacks can play in accommodating the needs, aspirations and agency of citizens when public policies fail to provide affordable housing.[4-8] Nor should we dismiss the role that shared adversity can play in the formation of grassroots social and political movements capable of delivering tangible benefits to the communities involved.[9-12] Yet while necessity might well be the 'mother of invention', there can be little doubt that such dwellings pose multiple challenges to the health and well-being of their residents[13,14]; and that disadvantage, poverty and despair are what more commonly lie behind the 'necessity' to take shelter in (or, indeed, to *make* shelters from) temporary structures that: provide inadequate and substandard accommodation; offer limited protection from the elements; face an increased risk of catastrophic events (such as fires, floods and storms); and provide little security for residents or their possessions[15]. Unsurprisingly, researchers who have explored the many substantive and subtle, direct and indirect contributions that housing can make to health[16] are scathing in their assessments of temporary structures/shacks, pointing out that the 'physical and socio-economic conditions found in informal settlements are generally hazardous to health and tend to exacerbate the severe socio-economic conditions of the urban poor'[14] and contain 'all [of] the conditions [required] for [the] rapid spread [of infectious disease]: very high population density, scant access to water and sanitation, widespread poverty and inadequate health infrastructure…'[10].

For these reasons, the predominant focus of research into the health and well-being of households living in temporary structures/shacks – both within the backyards of more permanent/formal dwellings[7,8,17] and in emerging/established 'informal settlements'[18,19] – has been on their social, political and structural determinants, correlates and consequences[7,13]. Such research has had an important role to play in documenting the scale of the problems facing rapidly urbanising populations, and wherever internal and international migration, population growth, social change, weak governance and limited resources all conspire to create demand for housing that far outstrips supply.[6,20] In South Africa, these challenges also reflect the enduring legacy of apartheid policies that allocated residential rights on the basis of racialised 'population group' classifications[21], and tightly controlled access to formal housing that was close to viable and sustained sources of employment (particularly where these were also close to areas reserved for those classified as 'White/European')[20]. The abolition of these 'influx control' statutes in 1986[22] (and the subsequent repeal of the last of the *Group Areas Acts [No.36 of 1966]* in 1990) has both accentuated and accelerated the ongoing depopulation of South Africa's more rural provinces as people have sought work and better livelihoods in the country's urban and industrial centres[23]. At the same time, the end of apartheid also saw a substantial increase in migration from Africa (and beyond), as migrants sought opportunities in one of the continent's strongest economies.[24]

Despite these seemingly inexorable trends, and the importance afforded the right to housing in South Africa's 1996 constitution[25-27], a raft of successive government policies and commitments to address the need for additional, affordable housing have demonstrably failed to deliver the quantity and quality required to accommodate the shortfall in housing generated by the rapid rate of urbanisation[8,12,20,23,27-30]. As a result, the proportion of South Africa's population living in temporary structures/shacks remains high (at ~10–15%) and shows no sign of abating, while any short-term benefits of relocating close(r) to sources of employment[23] (and any associated benefits in terms of the 'health selection' of those involved)[31,32] are likely to dissipate whenever the economy falters or competition for employment makes wages stagnate, or work opportunities dry up. Indeed, the inherent vulnerability of impoverished households living in temporary structures/shacks places them at greater risk of being trapped in a worsening cycle of poverty, leading to a steady decline in the social and material fabric of communities containing large numbers of such dwellings (and particularly those 'informal settlements' where temporary structures/shacks predominate).[17] These add further, *communal* risks to the physical and mental health problems such communities face, particularly wherever: inadequate water and sanitation services facilitate the spread of infectious disease[17,19]; the absence of mains electricity makes households reliant on less efficient and more dangerous sources of heat and light[33]; and social unrest and criminality pose tangible threats to the safety and security of individuals and marginalised groups[34]. Such factors further accentuate the vulnerability of both households and communities, and further undermine their resilience to cope with or mitigate structural and systemic changes beyond their control.[35,36]

Although these challenges and realities have been well documented and are widely recognised[23], they are often framed in ways that ensure they are simply accepted as an inevitable (or at least an intractable) consequence of external forces over which local authorities, governments and nation states have limited influence (such as 'market forces' and 'globalisation')[10,12,20,27,37]. When overlooked or dismissed in this way it is not surprising that policymakers fail to acknowledge or accommodate the very particular needs of these communities, and resort to imposing policies with which they are ill-equipped or simply unable to comply.[38] In the process, it is commonplace for policymakers (and commentators) to mistake shack-dwellers' *inability* to comply as an *unwillingness to conform* – whether that be to land ownership statutes, building regulations, health and safety guidance, or the emergency lockdown restrictions imposed following the onset of the COVID-19 pandemic.[23] For this reason, the aim of the present study was to examine the determinants, correlates and consequences of residence in a temporary structure/shack 12 months into the COVID-19 pandemic, to better understand the role that disadvantage, poverty and inadequate service delivery might play in the ability of residents to comply with COVID-19 lockdown restrictions.

Methods

Data collection

The present study used South African data generated during Round 8 of Afrobarometer (AB-R8; https://afrobarometer.org/) – a series of cross-national surveys which began in 1999 and currently covers 34 African countries. The South African arm of the AB-R8 survey was undertaken by Plus 94 Research (PTY) Ltd (https://plus94.co.za/) between 2 May and 12 June 2021, and involved trained fieldworkers conducting interviews (in-person and in the language chosen by each respondent) with a nationally representative, random, stratified probability sample of 1600 adult South Africans.[39] The sampling units/enumeration areas used followed the sampling frame developed for Statistics South Africa's 2011 Population and Housing Census[40], stratified by: province; rural/urban locale; and dominant quasi-racial 'population group' – with the distribution of these strata updated in line with Statistics South Africa's 2016 Community Survey[41]. This involved a total of 400 enumeration areas randomly selected with probabilities proportionate to the sample size. Within each selected area, four households were selected using pre-set walk patterns originating from randomly selected start points; and within each household, one resident adult (aged ≥18 years) was then randomly selected for interview, yielding an overall sample of 1600 respondents.

Analytical design

To examine the putative causal relationships between socio-demographic, economic, household and COVID-19 related determinants, correlates and consequences of residence in a temporary structure/shack and ease of compliance with COVID-19 lockdown restrictions, we designed our analyses around a hypothesised causal path diagram (in the form of a directed acyclic graph; see Figure 1). This diagram used temporal logic to identify those (socio-demographic, economic, household and COVID-19 related) features considered likely to have preceded one another in a theoretical temporal sequence/cascade of (time-invariant) 'events' (such as respondent gender or 'population group' classification) and 'crystallised' (time-variant) characteristics (such as employment status or respondent/household assets), whose position within this sequence will have been determined by the timing of, and the specific items included in, the AB-R8 survey questionnaire (as well as by the contexts and circumstances under which this questionnaire was answered by survey participants).[42] In the absence of substantive evidence to the contrary, any variables considered likely to have occurred (or 'crystallised') before any given exposure variable were assumed to act as potential (or, at the very least, 'candidate') confounders, as these can be considered *probabilistic* causes of *both* the specified exposure *and* its subsequent (specified) outcome(s). All such confounders require conditioning (through sampling, stratification or – as here – statistical adjustment) to deliver estimates of 'total causal effects' in which the risk of confounding bias has been mitigated.[42]

While this approach to causal inference using observational (i.e. non-experimental) data helps to reduce the impact of bias from *measured* confounders (by ensuring analyses are conditioned thereon), the estimates generated are still likely to be biased[43], not least as a result of residual confounding (associated with non-random measurement error and imprecision in the ascertainment of the variables concerned); unacknowledged/unadjusted confounding (caused by a failure to adjust for unknown/unmeasured/latent confounders); and collider bias (resulting from endogenous selection bias[44-46] or inappropriate conditioning on mediators and/or consequences of the outcome – often as a result of their misclassification as potential/candidate confounders[42]).

In an effort to reduce residual confounding, we carefully examined the responses provided to each of the items available for consideration as potential/candidate confounders to eliminate any sampling/measurement-related error generated by respondents with missing data values, and by overlapping/indiscrete answer options/categories – the first through case-wise deletion of respondents with missing data and

the second through re-categorisation (although both of these steps would have nonetheless introduced alternative sources of bias and imprecision, particularly through selection bias and a loss of information, respectively).

There was less scope to address unadjusted confounding in the design of our analyses, not least given the finite number of items in the AB-R8 survey instrument and its emphasis on self-reported items (and the predominance of opinion-based items) that can be challenging, if not impossible, to interpret as phenomenological events (or crystallising processes) amenable to temporal positioning with respect to any given exposure-outcome dyad. Nonetheless, to acknowledge the potential role that such characteristics might play as unacknowledged or unmeasured confounders, we included three of the innumerable possible sets of unmeasured confounders within our theoretical causal path diagram (Figure 1) to emphasise the (unadjusted confounding) bias they might impose on any estimates of the causal relationships examined in the present study.

Finally, because some of the potential/candidate confounders selected for adjustment comprised features of respondents or households that were subject to change over time (i.e. 'time-variant' variables), we sought to address uncertainty regarding precisely when these characteristics might have crystallised (as/when measured by the AB-R8 survey) by conducting sensitivity analyses with confounder/covariate adjustment sets containing potential/candidate confounders considered more vs. less likely to have themselves been affected by COVID-19. The former included respondent employment status and respondent/household assets, both of which might plausibly provide indicators of pre-, intra- or post-pandemic socio-economic vulnerability/mobility.

Notwithstanding our efforts to address these three potential sources of bias when estimating causal effects from observational/non-experimental data, it is important to stress that these efforts are very unlikely to have been completely successful.[42,44] Similarly, because incompletely representative/non-probabilistic sampling – which is common to most surveys involving relatively small samples of voluntary/consenting participants (such as the AB-R8 survey) – can invoke endogenous selection bias (another form of 'collider bias')[45,46], even carefully theorised causal path diagrams and the careful selection, measurement/parameterisation and statistical adjustment of potential/candidate confounders may not eliminate the risk of generating biased causal estimates from analyses of observational data. For these reasons, the findings generated by the present study remain speculative and warrant careful examination, replication and further exploration.

Selection of exposure, outcome and 'candidate' confounder variables

The two principal outcomes of interest examined in the present study were derived from an item situated in the final section of the original AB-R8 questionnaire containing fieldworker-generated observations and assessments; and an item included in the supplementary (COVID-19) module attached to the AB-R8 questionnaire in those countries where data collection had been suspended or postponed as a result of the COVID-19 pandemic, and was only resumed following the first (or subsequent) waves of infection (and associated lockdown restrictions). South Africa was one such country, where the AB-R8 survey was conducted between 2 May and 10 June 2021, when the country was in the process of moving from 'Alert Level 1' (which at that time included the closure of 33/53 land border crossings; an overnight curfew; the closure of nightclubs and specified opening/closing hours for public venues; limits on the size of public and private gatherings/events [and a ban on spectators at sporting events]; limits on the distances travelled for work or private purposes; working from home wherever possible; a ban on alcohol consumption in public places; social distancing; the provision of hand sanitisers in public venues; and the wearing of face masks in any 'public place')[47,48] to 'Alert Level 2' (in which, inter alia, the

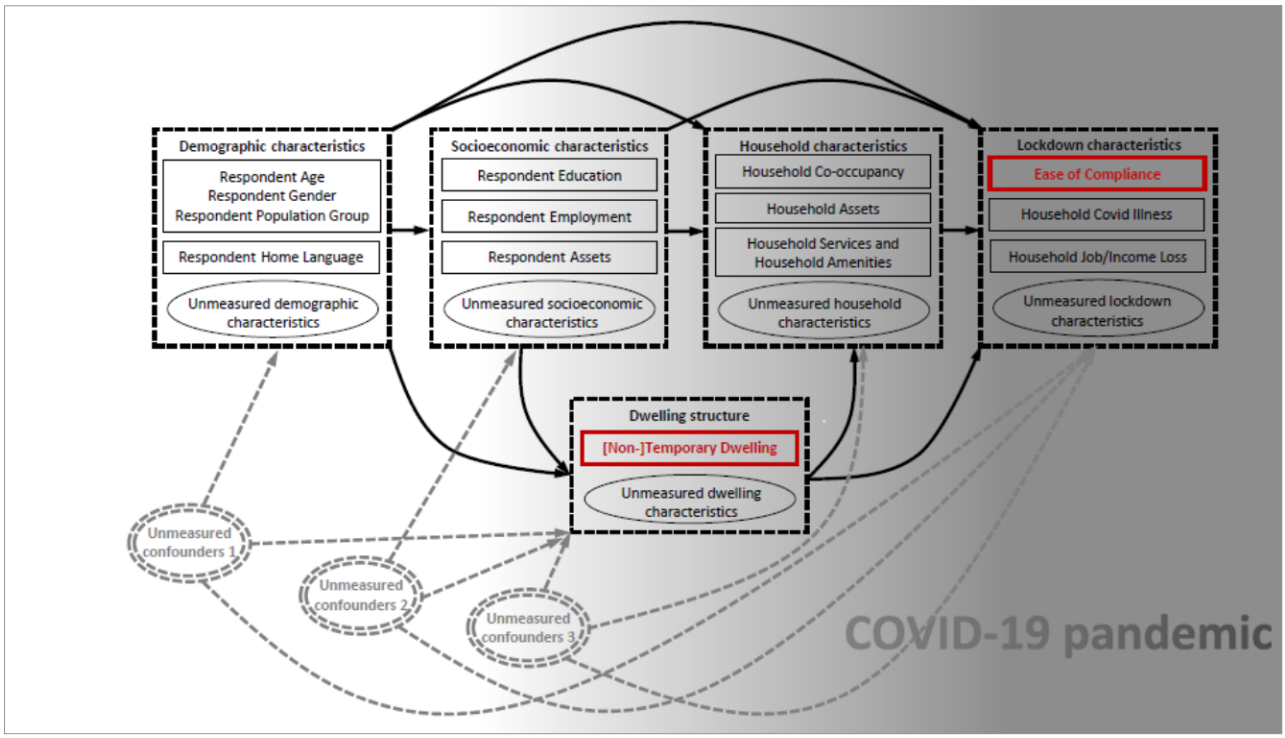

Figure 1: A theoretical causal path diagram, drawn in the form of a directed acyclic graph in which each of the measured (rectangles) and unmeasured (ellipses) sets of variables of relevance to the present study have been arranged in their hypothesised temporal sequence (from left to right), with each preceding variable assumed to act as a probabilistic cause of all subsequent variables. The two specified outcomes ('[Non-]Temporary Dwelling' and 'Ease of Compliance') have been indicated in red. Three examples of the many different unmeasured sets of covariates (indicated by ellipses with double outlines) likely to contribute confounder bias to estimates of the focal relationships examined in the present study, have been included to emphasise their potential impact.

limits on the size of public and private gatherings/events were further reduced)[49].

The first of these two AB-R8 items required the fieldworker to answer the question: 'In what type of shelter does the respondent live?' with seven pre-categorised answers, namely: 'Non-traditional/Formal house'; 'Traditional house/Hut'; 'Temporary structure/shack'; 'Flat in a block of flats'; 'Single room in a larger dwelling structure or backyard'; 'Hostel in an industrial compound or farming compound'; or 'Other'. The second item involved asking respondents (i.e. household key informants): 'How easy or difficult was it for you and your household to comply with the lockdown or curfew restrictions imposed by the government?', for which there were four explicit answers available ('Very easy'; 'Easy'; 'Difficult'; or 'Very difficult') and three implicit options used to code unprompted and less definitive answers ('Neither easy nor difficult'; 'I/we did not comply'; and 'Don't know'). The distribution of responses to each of these items was carefully examined to generate binary categorical variables that sought to balance the distribution of responses with the conceptual integrity of the answers that each provided (as described under 'Data preparation and statistical analyses'; see also Section 1 in the supplementary material).

The variables examined as putative determinants, correlates and consequences of these two outcomes – and as potential/candidate confounders when subsequent variables were specified as the exposure – were selected from amongst those items included in the AB-R8 survey instrument that focused primarily on phenomenological characteristics (i.e. socio-demographic, economic, household and COVID-19 related features that were least likely to be vulnerable to reporting bias or to have changed substantively [i.e. 're-crystallised'] as a result of illness or job/business/income loss during the pandemic). While this meant that a large proportion of the (more opinion-based) items included in the AB-R8 survey instrument had to be discounted as suitable for use as exposures (or potential/candidate confounders), there were a sizeable number of more phenomenological items (10 in all) considered relevant to the socio-demographic characteristics of respondents (age, gender, and 'population group' classification) and households (the primary language spoken in the home); and the socio-economic position of both respondents (educational attainment) and households (type of dwelling, number of adult residents and household utilities, services and amenities), that were considered unlikely to have changed in the 14–15 months from the onset of the COVID-19 pandemic (in March 2020) to when South Africa's AB-R8 survey took place (in May–June 2021). While responses to items on these characteristics were therefore considered 'time-invariant' (and to have occurred at discrete points before each of the present study's specified outcomes), there were a number of additional, *ostensibly* phenomenological, criteria (including respondent employment; 12 measures of discrete respondent/household assets; and 2 measures of COVID-19 related impacts on illness and job/business/income loss) that were likely to have been more susceptible to change during/following the onset of the pandemic, and were therefore considered 'time-variant' (and to have potentially crystallised – as/when measured – *after both* of the principal outcomes examined in the present study). To address the risk that these 14 variables might not constitute genuine confounders (but instead might act as colliders, whether as consequences of the outcome or mediators between each of the exposure-outcome dyads examined), we undertook the sensitivity analyses described earlier (see Supplementary tables 1 and 2) using confounder/covariate adjustment sets that excluded respondent employment status and respondent/household assets – viewing these instead as likely indicators of intra/post-pandemic fluidity in socio-economic position (as opposed to definitive measures of pre-pandemic employment/wealth). These analyses are examined in greater detail in the 'Results'.

Data preparation and statistical analyses

In preparation for our analyses, the distribution of responses to all 24 of the items selected as putative determinants, correlates and/or consequences of each of the two specified outcomes – or as potential/candidate confounders in any of the exposure-outcome dyads involved – was carefully examined to facilitate their re-categorisation into coherent analytical variables (see Section 1 in the Supplementary material). This included reducing each of the specified outcomes to binary variables for analysis using logistic regression analysis, in which the categories selected were determined at, or as close as possible to, the median value.

Standard descriptive statistics (frequencies with percentages) were used to summarise the responses obtained for each of the 26 variables (i.e. 24 covariates and 2 specified outcomes) examined in the present study. Respondents who were ineligible/unable/unwilling to answer (or did not know the answer to) any of the survey items required to generate these data were excluded from the (sub)sample of respondents subsequently included in the 'complete case analyses' that followed. These analyses involved univariable and multivariable logistic regression models designed with reference to the theoretical causal path diagram summarised in Figure 1, in which the postulated temporal sequence of, and probabilistic causal relationships between, each of these variables was used to select covariates likely to have acted as potential confounders for each of the exposure-outcome dyads examined. The results of these (unadjusted and confounder adjusted) models are presented as odds ratios (OR) with 95% confidence intervals in parentheses (95% CI).

Results

Sample characteristics

The re-categorised variables derived from each of the 26 AB-R8 items have been summarised in Table 1. Most respondents (1381; 86.3%) provided complete data on all 26 variables, while a modest number (219; 13.7%) provided responses to one or more of the survey items (e.g. 'Don't know', 'Refused', or 'Not applicable') that resulted in missing data values. Given the risk of endogenous selection bias in analyses that seek causal inference from unrepresentative samples[45] – a risk that can already be high in studies dependent on fallible and incompletely probabilistic sampling techniques (such as household surveys conducted under exigent circumstances)[49-51] – the distribution of responses obtained from participants providing complete data on all 26 variables was compared to those of participants who had not (Table 1). This comparison provided some reassurance that the former (the 'complete case [sub]sample') displayed socio-demographic and economic characteristics (at both the individual- and household-level) that were broadly comparable to the latter. In particular, it was reassuring that the proportion of respondents in each (sub)sample who were resident in non-temporary structures (i.e. houses/flats, rooms or hostels) was very similar (91.0% vs. 87.8%), as was the proportion of those who had found it 'Difficult' (or worse) to comply with lockdown restrictions (34.7% vs. 40.3%); and there was also little difference in the proportion of households who had experienced COVID-19 related illness (19.8% vs. 17.5%) or job/business/income loss (34.1% vs. 32.3%; see Table 1).

However, there were nonetheless some more substantive differences evident in the socio-demographic distribution of the complete case (sub)sample, with 10% more respondents classified as 'Black/African' (70.3% vs. 60.7%) and only half the proportion classified as 'South/East Asian' (4.7% vs. 8.7%) when compared to those with missing data. Given South Africa's enduring legacy of structural and socio-economic inequality along quasi-racialised 'population group' lines[21], these differences might explain the lower educational attainment of respondents in the complete case (sub)sample (e.g. 14.8% vs. 23.2% having completed at least some university/tertiary education) and the lower proportion of these respondents who owned all but one of the six personal assets (the exception being a mobile phone). Despite these trends, multiple co-occupancy was actually lower amongst households included in the complete case (sub)sample (with only 31.0% vs. 40.2% of these households occupied by more than two adults); and there was little evidence of any substantive differences in household asset ownership or in access to household services (the notable exception being the proportion of households with piped water inside their dwelling: 53.1% vs. 63.7%; see Table 1).

Notwithstanding these differences (and the potential risk of endogenous selection/collider bias they might pose)[45], the analyses that follow rely solely on those 1381 respondents for whom data were available on all

Table 1: The distribution of the 26 re-categorised items from the AB-R8 survey amongst: (1) the 1381 (86.3%) South African respondents who provided answers to all 26 items; and (2) the 219 respondents (13.7%) with missing data on one or more of these variables

Variable	Respondents with complete data ($n=1381$)		Respondents with incomplete data ($n\leq219$)	
	n	%	*n*	%
Respondent age				
18–25 years (3)	325	23.5	41	18.8
26–35 years (2)	377	27.3	68	31.2
36–50 years (1)	390	28.2	63	28.9
51–90 years (0)	289	20.9	46	21.1
Respondent gender				
Female (0)	697	50.5	104	47.5
Male (1)	684	49.5	115	52.5
Respondent 'population group' classification				
'Black/African' (0)	971	70.3	133	60.7
'White/European' (1)	139	10.1	29	13.2
'Coloured/mixed race' (2)	206	14.9	38	17.4
'South/East Asian' (3)	65	4.7	19	8.7
Respondent home language				
Non-European (1)	1051	76.1	164	74.9
European (0)	330	23.9	55	25.1
Respondent education				
Less than complete primary (4)	140	10.1	24	11.6
Complete primary but less than complete secondary (1)	397	28.8	55	26.6
Secondary complete (0)	489	35.4	56	27.1
Non-university post-secondary (3)	151	10.9	24	11.6
Some university or more (2)	204	14.8	48	23.2
Respondent employment				
No (looking) (0)	534	38.7	74	36.8
No (not looking (2)	334	24.2	47	23.4
Yes, part time (3)	173	12.5	24	11.9
Yes, full time (1)	340	24.6	56	27.9
Respondent assets				
Radio – Yes (1)	943	68.3	159	72.6
TV – Yes (1)	955	69.2	165	75.3
Motor Vehicle – Yes (1)	381	27.6	72	32.9
Computer – Yes (1)	480	34.8	102	46.5
Account – Yes (1)	1121	81.2	184	84.0
Mobile – Yes (1)	1263	91.5	189	86.3
Residence in [non-]temporary structure				
Formal house/flat (0)	1208	87.5	175	85.4
Temporary structure/shack (1)	125	9.1	25	12.2
Single room/hostel (2)	48	3.5	5	2.4
Household co-occupancy				
One adult in household (0)	599	43.4	81	37.0
Two adults in household (1)	354	25.6	50	22.8
More than two adults in household (2)	428	31.0	88	40.2
Household asset ownership				
Radio – Yes (1)	1174	85.0	186	84.9
TV – Yes (1)	1270	92.0	194	88.6
Motor vehicle – Yes (1)	652	47.2	111	50.7
Computer – Yes (1)	654	47.4	120	54.8
Account – Yes (1)	1244	90.1	198	90.4
Mobile – Yes (1)	1326	96.0	203	92.7
Household electricity supply				
Connected to grid (0)	1257	91.0	189	89.6
Not connected to grid (1)	124	9.0	22	10.4

Table 1 continues...

...Table 1 continued

Variable	Respondents with complete data (n=1381)		Respondents with incomplete data (n≤219)	
	n	%	*n*	%
Household water supply				
Water inside dwelling (0)	733	53.1	123	63.7
Water inside compound (1)	395	28.6	35	18.1
Water outside compound (2)	253	18.3	35	18.1
Household toilet access				
Private inside dwelling (0)	694	50.3	116	53.7
Private inside compound (1)	407	29.5	46	21.3
Outside compound (shared/none available) (2)	280	20.3	54	25.0
Household ease of lockdown compliance				
Less than 'Difficult' (0)	497	34.7	27	40.3
'Difficult' or worse (1)	902	65.3	40	59.7
Household COVID-19 related Illness				
Did not become ill (0)	1108	80.2	52	82.5
Became ill (1)	273	19.8	11	17.5
Household COVID-19 related job/business/income loss				
No loss (0)	910	65.9	44	67.7
Lost job/business/income (1)	471	34.1	21	32.3

Table 2: The socio-demographic and economic determinants of residence in a temporary structure/shack vs. a non-temporary or permanent structure (i.e. a house/flat, room or hostel) and the relationship between residence in a (non-)temporary structure/shack and a number of: household-level characteristics (including co-occupancy and household assets, services and amenities) and COVID-19 related phenomena (ease of lockdown compliance, illness and job/business income loss) – both before (Column 2.1) and after (Column 2.2) adjustment for any preceding potential/candidate confounders. All results are presented as odds ratios (ORs) with 95% confidence intervals in parentheses (95% CI).

Specified outcome:	Residence in a temporary structure/shack vs. a non-temporary/permanent structure (house/flat, room or hostel) – dichotomous
Outcome referent (0): Outcome contrast (1):	Non-temporary structure (house/flat, room or hostel) Temporary structure/shack

Specified exposures:	**Covariate adjustment set**	
	Column 2.1[a]	**Column 2.2[b]**
	None	Any preceding covariates
	OR (95% CI)	OR (95% CI)
Covariates considered likely to precede (and be potential determinants of) residence in a (non-)temporary structure:[c]		
Respondent age		
18–25 years (3)	**3.25 (1.62, 6.49)**	**3.23 (1.60, 6.50)**
26–35 years (2)	**3.17 (1.60, 6.27)**	**3.05 (1.54, 6.06)**
36–50 years (1)	**2.49 (1.24, 4.99)**	**2.76 (1.37, 5.55)**
51–90 years (0)	Referent	Referent
Respondent gender		
Female (0)	Referent	Referent
Male (1)	1.11 (0.77, 1.61)	1.11 (0.77, 1.61)
Respondent 'population group' classification		
'Black/African' (0)	Referent	Referent
'White/European' (1)	**0.12 (0.03, 0.49)**	**0.11 (0.03, 0.46)**
'Coloured/mixed race' (2)	0.79 (0.47, 1.33)	0.78 (0.46, 1.35)
'South/East Asian' (3)	1 (Empty)	1 (Empty)
Respondent home language		
Non-European (0)	Referent	Referent
European (1)	0.66 (0.41, 1.06)	1.09 (0.65, 1.82)

Table 2 continues...

...Table 2 continued

Specified exposures:	Covariate adjustment set	
	Column 2.1[a]	Column 2.2[b]
	None	Any preceding covariates
	OR (95% CI)	OR (95% CI)
Respondent education		
Less than complete primary (4)	1.19 (0.65, 2.16)	**2.01 (1.04, 3.88)**
Less than complete secondary (1)	1.35 (0.89, 2.06)	1.53 (0.99, 2.35)
Secondary complete (0)	Referent	Referent
Non-university post-secondary (3)	**0.38 (0.16, 0.91)**	**0.38 (0.16, 0.91)**
Some university of more (2)	**0.18 (0.07, 0.52)**	**0.24 (0.08, 0.67)**
Respondent employment		
No job (looking) (0)	Referent	Referent
No (not looking) (2)	**0.47 (0.29, 0.76)**	0.66 (0.39, 1.12)
Yes (part time) (3)	**0.47 (0.25, 0.89)**	0.57 (0.29, 1.09)
Yes (full time) (1)	**0.33 (0.19, 0.57)**	**0.54 (0.30, 0.96)**
Respondent radio		
Do not personally own (0)	Referent	Referent
Personally own (1)	**0.65 (0.44, 0.94)**	0.77 (0.51, 1.16)
Respondent television		
Do not personally own (0)	Referent	Referent
Personally own (1)	**0.45 (0.31, 0.65)**	**0.57 (0.38, 0.85)**
Respondent motor vehicle		
Do not personally own (0)	Referent	Referent
Personally own (1)	**0.26 (0.14, 0.47)**	**0.48 (0.25, 0.92)**
Respondent computer		
Do not personally own (0)	Referent	Referent
Personally own (1)	**0.35 (0.22, 0.57)**	**0.55 (0.32, 0.93)**
Respondent bank account		
Do not personally own (0)	Referent	Referent
Personally own (1)	0.87 (0.55, 1.37)	1.25 (0.76, 2.05)
Respondent mobile phone		
Do not personally own (0)	Referent	Referent
Personally own (1)	**0.41 (0.25, 0.69)**	**0.43 (0.25, 0.76)**
Covariates considered likely to be coterminous with (or determined by) residence in a [non-]temporary structure:		
Household co-occupancy		
One adult in household (0)	Referent	Referent
Two adults in household (1)	1.51 (0.95, 2.39)	**1.77 (1.09, 2.88)**
More than two adults in household (2)	1.52 (0.98, 2.35)	**1.87 (1.17, 3.00)**
Household radio		
No household member owns (0)	Referent	Referent
Household member owns (1)	**0.43 (0.28, 0.65)**	**0.32 (0.16, 0.62)**
Household television		
No household member owns (0)	Referent	Referent
Household member owns (1)	**0.21 (0.13, 0.33)**	**0.23 (0.12, 0.43)**
Household motor vehicle		
No household member owns (0)	Referent	Referent
Household member owns (1)	**0.24 (0.15, 0.38)**	**0.31 (0.16, 0.58)**
Household computer		
No household member owns (0)	Referent	Referent
Household member owns (1)	**0.38 (0.25, 0.58)**	0.62 (0.33, 1.18)
Household bank account		
No household member owns (0)	Referent	Referent
Household member owns (1)	0.67 (0.39, 1.16)	0.53 (0.22, 1.31)

Table 2 continues...

...Table 2 continued

Specified exposures:	Covariate adjustment set	
	Column 2.1[a]	**Column 2.2[b]**
	None	Any preceding covariates
	OR (95% CI)	OR (95% CI)
Household mobile phone		
No household member owns (0)	Referent	Referent
Household member owns (1)	**0.30 (0.16, 0.57)**	0.42 (0.15, 1.19)
Household electricity supply		
Connected to grid (0)	Referent	Referent
Not connected to grid (1)	**12.89 (8.40, 19.77)**	**11.80 (7.03, 19.81)**
Household water supply		
Water inside dwelling (0)	Referent	Referent
Water inside compound (1)	**3.12 (1.92, 5.06)**	**2.82 (1.67, 4.77)**
Water outside compound (2)	**6.13 (3.79, 9.92)**	**3.58 (2.09, 6.13)**
Household toilet access		
Private inside dwelling (0)	Referent	Referent
Private inside compound (1)	**6.48 (3.66, 11.49)**	**4.19 (2.22, 7.90)**
Outside compound (shared/none available) (2)	**10.36 (5.82, 18.44)**	**5.78 (3.01, 11.11)**
Household ease of lockdown compliance		
Less than 'Difficult' (0)	Referent	Referent
'Difficult' or worse (1)	**1.61 (1.06, 2.45)**	0.99 (0.60, 1.63)
Household COVID-19 related Illness		
Did not become ill (0)	Referent	Referent
Became ill (1)	0.61 (0.36, 1.04)	1.42 (0.75, 2.67)
Household COVID-19 related job/business/income loss		
No loss (0)	Referent	Referent
Lost job/business/income (1)	1.10 (0.75, 1.61)	1.34 (0.83, 2.17)

[a]Column 2.1: No adjustment for potential/preceding candidate confounding covariates.

[b]Column 2.2: Adjustment only for any preceding candidate/potential confounding covariates (and not for coterminous covariates in square parentheses – […]; with the exception of Respondent Age, Gender, 'Population Group' and Home Language), as listed in the following sequence: Respondent Age, Gender, 'Population Group', Home Language, Respondent Education; Respondent Employment; [Respondent Assets – Radio, Television, Motor Vehicle, Computer, Bank Account, Mobile Phone]; Household Occupancy; [Household Assets – Radio, Television, Motor Vehicle, Computer, Bank Account, Mobile Phone]; [Household Services and Amenities – Electricity, Water, Toilet]; [Lockdown Characteristics – Ease of Compliance, Household COVID-19 Illness, Job/Business/Income Loss].

[c]Alternating white/grey shading indicates groups of covariates considered coterminous (i.e. occurring or crystallising at around the same time, given the questions/items used to ascertain these within the AB-R8 survey).

26 of the variables examined. The results of these analyses therefore need to be interpreted with a degree of caution from a causal inference perspective[44,45,49]. This (sub)sample of adult respondents comprised a similar number of men and women, with a median age of 35 (range: 18–90), most of whom were classified as 'Black/African' (70.3%), and with far fewer classified as 'Coloured/mixed race' (14.9%), 'White/European' (10.1%) or 'South/East Asian' (4.7%). Most (76.1%) spoke non-European languages at home (the majority of which were indigenous South African languages; see Section 1 in the Supplementary material); and although 61.1% had completed secondary education (or above), only around a third (37.1%) reported they had current employment that paid a cash income, and around a third of these (12.5%) were employed only part-time. As such, the complete case (sub)sample of South African respondents included in the analyses that follow are characterised by high levels of under-employment, and this is likely to have a substantial bearing on the proportion who reported that they, or someone in their household, had (temporarily or permanently) lost their income/job/business as a result of COVID-19 (34.6%) – particularly if, as seems likely, a substantial proportion of those who reported that they were under-employed at the time the AB-R8 survey took place had lost employment/income *as a result of* COVID-19. Under such circumstances (and as described earlier), this employment variable (and its associated impact on the assets owned by respondents and their households) seems very likely to constitute a potential *consequence* of COVID-19 rather than always being a preceding *determinant* of either residence in a temporary structure/shack or ease of lockdown compliance.

Multivariable statistical analyses

To address the possibility that individual- and household-level socio-economic characteristics (i.e. respondent employment and individual/household assets) might constitute consequences (as opposed to determinants) of residence in a temporary structure/shack and/or ease of lockdown compliance – and might therefore act as mediators/colliders rather than genuine confounders in the socio-demographic patterning of either specified outcome – additional sensitivity analyses were undertaken in which employment and personal/household assets were removed from the covariate adjustment sets used to mitigate the effect of confounder bias (see Supplementary tables 1 and 2). These additional analyses mirrored the statistical models used to estimate the total causal effects of each of the remaining 25 (socio-demographic, economic, household and COVID-19 related) variables selected for examination as potential determinants, correlates or consequences of residence in a temporary structure/shack and/or ease of lockdown compliance (see Tables 2 and 3). The first of these sets of models (summarised in the first column of Tables 2 and 3) adjusted for none of the preceding (candidate) covariates considered potential confounders, while the second set (summarised in the second column of Tables 2 and 3) adjusted only for those individual- and household-level socio-demographic and economic

Table 3: The socio-demographic and economic determinants of ease of compliance with COVID-19 restrictions; and the relationship between ease of compliance and COVID-19 related illness and job/business/income loss – both before (Column 3.1) and after (Column 3.2) adjustment for any preceding potential/candidate confounders. All results are presented as odds ratios (ORs) with 95% confidence intervals in parentheses (95% CI).

Specified outcome:	Self-reported ease of compliance with lockdown restrictions – dichotomous
Outcome referent (0): Outcome contrast (1):	Less than 'Difficult' 'Difficult' or worse

Specified exposures:	**Covariate adjustment set**	
	Column 3.1[a]	**Column 3.2**[b]
	None	Any preceding covariates
	OR (95% CI)	OR (95% CI)
Covariates considered likely to precede (and be potential determinants of) ease of compliance with lockdown:[c]		
Respondent age		
18–25 years (3)	1.35 (0.97, 1.87)	1.35 (0.97, 1.89)
26–35 years (2)	**1.57 (1.14, 2.16)**	**1.55 (1.12, 2.15)**
36–50 years (1)	1.23 (0.90, 1.68)	1.32 (0.96, 1.81)
51–90 years (0)	Referent	Referent
Respondent gender		
Female (0)	Referent	Referent
Male (1)	1.11 (0.89, 1.39)	1.13 (0.90, 1.41)
Respondent 'population group' classification		
'Black/African' (0)	Referent	Referent
'White/European' (1)	**0.46 (0.32, 0.66)**	**0.45 (0.30, 0.67)**
'Coloured/mixed race' (2)	0.78 (0.57, 1.07)	0.78 (0.57, 1.08)
'South/East Asian' (3)	**0.53 (0.32, 0.88)**	**0.55 (0.30, 0.98)**
Respondent home language		
Non-European (0)	Referent	Referent
European (1)	**0.76 (0.59, 0.99)**	1.02 (0.74, 1.40)
Respondent education		
Less than complete primary (4)	0.98 (0.66, 1.47)	1.17 (0.76, 1.81)
Less than complete secondary (1)	1.14 (0.86, 1.52)	1.20 (0.89, 1.61)
Secondary complete (0)	Referent	Referent
Non-university post-secondary (3)	0.71 (0.49, 1.04)	0.72 (0.49, 1.05)
Some university of more (2)	**0.55 (0.40, 0.77)**	**0.62 (0.44, 0.87)**
Respondent employment		
No job (looking) (0)	Referent	Referent
No (not looking) (2)	**0.63 (0.47, 0.85)**	0.75 (0.55, 1.03)
Yes (part time) (3)	**0.62 (0.43, 0.89)**	0.69 (0.48, 1.01)
Yes (full time) (1)	**0.55 (0.42, 0.74)**	**0.72 (0.52, 0.99)**
Respondent radio		
Do not personally own (0)	Referent	Referent
Personally own (1)	0.85 (0.67, 1.08)	0.94 (0.73, 1.22)
Respondent television		
Do not personally own (0)	Referent	Referent
Personally own (1)	0.92 (0.72, 1.17)	1.10 (0.84, 1.42)
Respondent motor vehicle		
Do not personally own (0)	Referent	Referent
Personally own (1)	**0.56 (0.44, 0.72)**	0.76 (0.57, 1.02)
Respondent computer		
Do not personally own (0)	Referent	Referent
Personally own (1)	**0.59 (0.47, 0.74)**	**0.71 (0.54, 0.93)**
Respondent bank account		
Do not personally own (0)	Referent	Referent
Personally own (1)	0.86 (0.64, 1.15)	0.99 (0.72, 1.37)
Respondent mobile phone		
Do not personally own (0)	Referent	Referent
Personally own (1)	1.32 (0.90, 1.95)	1.46 (0.98, 2.19)

Table 3 continues...

...Table 3 continued

Specified exposures:	Covariate adjustment set	
	Column 3.1[a]	**Column 3.2**[b]
	None	Any preceding covariates
	OR (95% CI)	OR (95% CI)
Residence in a temporary/non-temporary structure		
House/flat (0)	Referent	Referent
Temporary structure/shack (1)	**1.61 (1.06, 2.45)**	1.20 (0.78, 1.87)
Single room/hostel (2)	1.11 (0.60, 2.04)	0.88 (0.47, 1.66)
Household co-occupancy		
One adult in household (0)	Referent	Referent
Two adults in household (1)	0.88 (0.66, 1.15)	0.92 (0.69, 1.22)
More than two adults in household (2)	0.86 (0.67, 1.12)	0.90 (0.67, 1.18)
Household radio		
No household member owns (0)	Referent	Referent
Household member owns (1)	0.84 (0.61, 1.15)	1.00 (0.65, 1.54)
Household television		
No household member owns (0)	Referent	Referent
Household member owns (1)	1.16 (0.78, 1.73)	1.38 (0.85, 2.24)
Household motor vehicle		
No household member owns (0)	Referent	Referent
Household member owns (1)	**0.60 (0.48, 0.75)**	0.81 (0.60, 1.11)
Household computer		
No household member owns (0)	Referent	Referent
household member owns (1)	**0.60 (0.48, 0.76)**	0.86 (0.60, 1.24)
Household bank account		
No household member owns (0)	Referent	Referent
Household member owns (1)	1.13 (0.78, 1.63)	1.55 (0.89, 2.69)
Household mobile phone		
No household member owns (0)	Referent	Referent
Household member owns (1)	1.08 (0.62, 1.89)	0.77 (0.36, 1.65)
Household electricity supply		
Connected to grid (0)	Referent	Referent
Not connected to grid (1)	1.39 (0.92, 2.09)	1.29 (0.81, 2.03)
Household water supply		
Water inside dwelling (0)	Referent	Referent
Water inside compound (1)	**1.30 (1.00, 1.68)**	1.08 (0.82, 1.43)
Water outside compound (2)	**1.63 (1.19, 2.22)**	1.28 (0.90, 1.81)
Household toilet access		
Private inside dwelling (0)	Referent	Referent
Private inside compound (1)	**1.37 (1.06, 1.77)**	1.02 (0.76, 1.38)
Outside compound (shared/none available) (2)	**2.18 (1.59, 2.99)**	**1.55 (1.08, 2.24)**
Covariates considered likely to be coterminous with (or consequences of) ease of lockdown compliance:[b]		
Household COVID-19 related illness		
Did not become ill (0)	Referent	Referent
Became ill (1)	0.83 (0.63, 1.09)	1.05 (0.79, 1.41)
Household COVID-19 related job/business/income loss		
No loss (0)	Referent	Referent
Lost job/business/income (1)	**1.88 (1.47, 2.40)**	**1.87 (1.44, 2.43)**

[a]*Column 3.1: No adjustment for potential/preceding candidate confounding covariates.*

[b]*Column 3.2: Adjustment only for any preceding candidate/potential confounding covariates (and not for coterminous covariates in square parentheses – […]; with the exception of Respondent Age, Gender, 'Population Group' and Home Language), as listed in the following sequence: Respondent Age, Gender, 'Population Group', Home Language, Respondent Education; Respondent Employment; [Respondent Assets – Radio, Television, Motor Vehicle, Computer, Bank Account, Mobile Phone]; [Residence in a (Non-)Temporary Structure, Household Occupancy]; [Household Assets – Radio, Television, Motor Vehicle, Computer, Bank Account, Mobile Phone]; [Household Services and Amenities – Electricity, Water, Toilet]; [Lockdown Characteristics – Household COVID-19 Illness, Job/Business/Income Loss].*

[c]*Alternating white/grey shading indicates groups of covariates considered coterminous (i.e. occurring or crystallising at around the same time, given the questions/items used to ascertain these within the AB-R8 survey).*

covariates considered likely to have occurred (or crystallised) *before* the specified outcome.

Determinants, correlates and consequences of residence in a (non-)temporary structure/shack

Table 2 summarises both the socio-demographic and economic determinants of residence in a temporary structure/shack (as compared to a non-temporary or permanent structure, such as a house/flat, room or hostel); and the relationships evident between residence in a temporary structure/shack and a number of household-level characteristics (including co-occupancy and household assets, services and amenities) and COVID-19 related phenomena (ease of lockdown compliance, illness and job/business income loss). These analyses confirm that residence in a temporary structure/shack was far more common amongst respondents aged 50 years or younger (when compared to those aged 51–90), but was far less common amongst respondents classified as 'White/European' or 'South/East Asian' (none of whom lived in a temporary structure/shack) than those classified as 'Black/African'.

Residence in a temporary structure/shack was also far less common amongst respondents who were better educated (and particularly those who had completed some university/tertiary education), and amongst those who were in full- or part-time employment. Moreover, even those who were unemployed but not looking for work were less likely to live in a temporary structure/shack than those who were looking for work – presumably because the former were able to rely on another source of income (such as a pension, grant, private income or a wealthy/working partner/family member) that was sufficient to cover the cost of living in a non-temporary or permanent dwelling (i.e. a house/flat, room or hostel).

These socio-economic patterns were also evident in the much lower odds of residence in a temporary structure/shack amongst those respondents who had the means to own material assets (particularly a television, motor vehicle or computer), even after adjustment for employment status. Meanwhile, *households* that lacked key material assets (particularly a television, motor vehicle or computer) were also far more likely to reside in a temporary structure/shack, as were households that were not connected to the electricity grid, or did not have piped water or private toilet facilities within their own dwelling.

To a large extent, these relationships were only modestly attenuated following adjustment for potential confounders (see Table 2); and excluding respondent employment and respondent/household assets from the confounder adjustment sets in the sensitivity analyses summarised in Supplementary table 1 indicated that non/adjustment for these (*potentially* time-variant) markers of socio-economic status had little effect on the relationships observed amongst the putative determinants, correlates and consequences of residence in a temporary structure/shack. Taken together, these analyses indicate that residence in informal structures/shacks is consistently associated with socio-demographic and economic indicators of disadvantage and poverty, and that such dwellings have fewer of the material assets, services and amenities that might otherwise help mitigate the impact of disadvantage and poverty on health, and the vulnerability of their residents to COVID-19 related illness and job/business/income loss (although these relationships lacked precision both before and after adjustment for potential confounders).

Determinants, correlates and consequences of ease of compliance with lockdown restrictions

Table 3 summarises both the socio-demographic and economic determinants of ease of compliance with COVID-19 restrictions and the relationship between ease of compliance and COVID-19 related illness and job/business/income loss. These analyses reveal that respondents whose households had found it 'Difficult' or 'Very difficult' to comply with lockdown restrictions (or had been unable to comply with these) were very similar to those who were more likely to reside in temporary structures/shacks (see Table 2). For example, younger respondents were more likely to live in households that found it 'Difficult' (or worse) to comply with lockdown restrictions, while those who were classified as 'White/European' or 'South/East Asian', and those with some university education, who were employed (full or part time), or who owned substantive assets (particularly a motor vehicle or a computer) were far *less* likely to have found it 'Difficult' (or harder still) to comply with lockdown restrictions.

For these reasons it may not be surprising that respondents who were residents of temporary structures/shacks were more likely to report that their household had found it 'Difficult' (or worse) to comply with lockdown restrictions (OR: 1.61; 95% CI: 1.06, 2.45). However, this relationship was substantially attenuated and lost precision following adjustment for preceding (individual-level) socio-demographic and economic confounders (OR: 1.21; 95% CI: 0.78, 1.87). Instead, ease of compliance with lockdown was most strongly associated with individual-level socio-demographic/economic characteristics (as summarised above), and with household-level characteristics that were more commonly (although not exclusively) observed amongst residents in a non-temporary or permanent structure (such as household ownership of a motor vehicle, and/or computer; and piped water/private toilet facilities within the dwelling).

While many of the relationships observed between respondent- and household-level characteristics and ease of compliance with lockdown restrictions were substantively attenuated following adjustment for potential confounders, those for age, 'population group', education, employment and at least one key personal asset (a computer) retained precision; as did the association with household toilet facilities – where respondents in households lacking a private toilet within their dwelling were far more likely to report that complying with lockdown restrictions had been 'Difficult' (or worse), even after adjustment for all 20 preceding variables considered potential confounders (OR: 1.55; 95% CI: 1.08, 2.24). Furthermore, the strength and precision of these (confounder adjusted) relationships was largely unaffected when respondent employment and respondent/household assets were excluded from the confounder adjustment sets used in the sensitivity analyses summarised in Supplementary table 2 – indicating that non/adjustment for these (*potentially* time-variant) markers of socio-economic status had little effect on the relationships observed amongst the putative determinants, correlates and consequences of ease of compliance with COVID-19 lockdown restrictions.

These relationships therefore reveal that many of the determinants and characteristics of residence in a temporary structure/shack also have a substantive impact on the ease of compliance with South Africa's COVID-19 lockdown restrictions. As such, the health risks that residents in these households face as a result of their disadvantage and poverty will have been amplified not only by the additional risks, limited assets and inferior services that living in such structures affords, but also by their limited ability to comply with measures intended to reduce the transmission of COVID-19 (i.e. stay at home, maintain personal hygiene and practise social distancing). Indeed, while there was some evidence within the data set examined in the present study that households who had experienced COVID-19 related illness, or had lost a job, a business or income as a result of the pandemic, were *more* likely to reside in temporary structures/shacks (see Table 2), both of these relationships appeared prone to substantial bias from confounding, and both lacked precision (illness – adjusted OR: 1.42; 95% CI: 0.75, 2.67; job/business/income loss – adjusted OR: 1.34; 95% CI: 0.83, 2.17). Nonetheless, the heightened vulnerability of such households to the ill-effects of COVID-19 and associated lockdown restrictions is evident amongst those that experienced COVID-19 related job/business/income loss who – like respondents who were looking for work – were far more likely to find it 'Difficult' (or worse) to comply with lockdown restrictions (even after adjustment for all 23 preceding variables; OR: 1.87; 95% CI: 1.44, 2.43; see Table 3).

Discussion

Our analyses confirm the unequal distribution of socio-demographic and economic circumstances amongst South African households living in temporary structures/shacks.[52,53] Setting aside the agency and determination evident wherever the poor and underserved have taken the

initiative to 'house themselves' (as some believe policymakers implicitly concede they must)[6,7,14,23], the evidence is clear that the residents of these households tend to: come from South Africa's most disadvantaged 'population group' (i.e. those classified as 'Black/African'); have lower educational attainment and fewer personal (and household) assets; be under-employed/looking for work; and have to share water and toilet facilities, while often coping without access to mains electricity[19,27]. These same factors are also strong determinants, correlates and consequences of compliance with the COVID-19 lockdown restrictions introduced in 2020 (and still in place, although presently at a much lower 'tier' than initially implemented). Unsurprisingly, survey respondents living in temporary structures/shacks were much more likely to report that they had not been able to comply with these restrictions (or had found it 'Difficult' or 'Very difficult' to do so). However, this relationship was substantially attenuated (and lost precision) following adjustment for preceding, individual-level, socio-demographic and economic determinants of residence in a temporary structure/shack – indicating that poverty was likely to be a far more important barrier to lockdown compliance than informal/temporary housing per se. Nonetheless, the fact remains that two of the personal assets/household services least commonly reported by respondents resident in temporary structures/shacks (a computer and a private/indoor toilet) are also those that are likely to have *directly* undermined these households' ability to comply with lockdown restrictions by limiting opportunities for 'working (virtually) from home' and requiring residents to leave their home to use the toilet/dispose of human waste.[52-54] Indeed, a post hoc examination of two items in the AB-R8 survey (in which all respondents were asked how often they used the Internet, and those 1255/1381 [90.9%] who personally owned a mobile phone were asked whether these had access to the Internet) reveal that those living in temporary structures/shacks were far less likely to access the Internet 'Every day' (OR: 0.61; 95% CI: 0.41, 0.89), and were also less likely to have access to the Internet on their mobile phones (OR: 0.82; 95% CI: 0.53, 1.27), when compared to those living in traditional/formal houses/flats/rooms/hostels (although the second of these associations lacked precision; see Supplementary table 3).

These findings are not entirely unanticipated and, given the wealth of research on the socio-economic circumstances and living conditions of South African households resident in temporary structures/shacks[17,27], it is frankly astonishing that the constraints these households face were overlooked (and continue to be overlooked) by those responsible for the country's multi-tiered COVID-19 restrictions[18,55]. Imposing such restrictions on individuals/households lacking the means to comply not only compounds the existing risks and challenges they face, but also undermines their ability to support and protect themselves (while making them appear responsible for not doing so).[2,52,53] These residents and communities are not without insight, determination or agency[4,5,7,8,12] – yet there is little evidence that the South African authorities sought to work with them to develop alternatives to lockdown restrictions that are, at best, impracticable[2,53] and, at worst, punitive for those who rely on casual, flexible, informal and opportunistic sources of 'in-person' (as opposed to 'virtual' or 'online') work[2,56], and those living in contexts where space is at a premium, and where access to clean water, toilet facilities and food necessitate levels of social interaction that require them to breach such restrictions[18,19,57].

The extraordinary disconnect between what policymakers expect and what shack-dwellers can achieve has led to withering attacks on South Africa's emergency response to the COVID-19 pandemic.[2,52,53,57,58] These extend comparable critiques emanating across the globe from analysts and commentators who questioned the feasibility and merits of prolonged lockdowns introduced to reduce the transmission of SARS-CoV2, 'flatten the curve' and ensure that health services were not overwhelmed.[48,59,60-63] Amongst these critics were those who acknowledged the need to impose short-term emergency measures to delay the spread of disease, but who argued that these should only be used to buy the time required to better understand the biology and epidemiology of this new disease; and to better calibrate the costs and benefits of the more extreme and expensive non-pharmaceutical interventions (such as border closures, travel bans, curfews, 'stay at home' orders, enforced quarantine and rigorous contact-tracing). While emergency measures were arguably necessary to address the uncertain (and potentially devastating) threat to life posed by a 'newly emergent disease with pandemic potential'[64], by the time most countries across the world were experiencing community transmission of SARS-CoV2, evidence from China[65] and elsewhere[66] already provided much needed reassurance that the vast majority of young and healthy people were at low (or very low) risk of 'serious' disease (i.e. a level of disease posing a significant threat to life, or warranting professional clinical care). Although there remained extensive uncertainty regarding the transmissibility and longer-term health effects of non-fatal infection[67] – and even though the promise of effective therapies and vaccines was tainted by academic hubris[44], pseudoscience and 'fake news'[61] – calls to end lockdown restrictions gained ground and continue to pose a growing challenge to the authority of governments and their scientific advisors.

Amongst these critics were clinicians, epidemiologists and other scholars who questioned the very basis of non-pharmaceutical interventions on two specific grounds: first, because the much vaunted benefits of these interventions often overlooked or discounted their economic and social costs (including their direct and indirect effects on health and health care)[59-61,68]; and second, because the widespread adoption of universal/blanket (or 'one-size-fits-all')[58] restrictions failed to recognise the unequal distribution of their potential costs (and likely benefits) to different sectors of the population, and instead assumed that everyone had access to the resources required to comply)[2,60]. To these we are tempted to add a third, namely that 'flattening the curve' to protect finite health services makes little sense (and may even be inequitable) in contexts (or to communities) where these services were already inaccessible or had little to offer *before* the pandemic struck.[20,69,70] Yet evidence for this proposition (based on data from two further items within the AB-R8 survey) is somewhat equivocal. The first of these required the fieldworker to answer the question 'Are the following facilities present in the primary sampling unit/enumeration area or in easy walking distance?' – for which one of the facilities listed was 'Health clinic (private or public or both)'; while the second asked all respondents 'How well or badly would you say the current government is handling the following matters, or haven't you heard enough to say?' – for which one of the 'matters' included was 'Improving basic health services' and the five pre-categorised answers were 'Very badly', 'Fairly badly', 'Fairly Well', 'Very well' and 'Don't know/Haven't heard enough'. Post hoc analyses of these variables reveal that respondents living in temporary structures/shacks were *less* likely to have been located in primary sampling units/enumeration areas within easy walking distance of a health clinic (OR: 0.71; 95% CI: 0.49, 1.03), but somewhat *more* likely to say that improving basic health services had been handled well by the current government (OR: 1.40; 95% CI: 0.96, 2.03), when compared to those living in traditional/formal houses/flats/rooms/hostels (although both of these associations lacked precision, and the latter is likely to be substantially confounded by the political affiliation of the respondents involved; see Supplementary table 4).

Hindsight is a cruel teacher, and it is all too easy to forget the uncertainty, anxiety, confusion and wild speculation that accompanied the onset of the COVID-19 pandemic a little over two years ago. Under these circumstances, policymakers might be forgiven for focusing on the risks posed by a potentially devastating new disease, and for overlooking the direct and indirect health effects of lockdown restrictions.[68] They might also be forgiven for adopting a 'one-size-fits-all' approach if only to facilitate public understanding, acceptance and compliance. And no one doubts the pressure they faced to protect health services, particularly where these are a scarce and precious resource. Indeed, some might argue that contemporary criticisms of these decisions can be dismissed on this basis alone, or by pointing out that it is easy to be 'wise after the event'. Yet many of these concerns were raised at the very time policymakers were adopting draconian measures while candidly admitting an astonishing degree of uncertainty.[2,57] And none of these explanations justify the failure of governments across the world to consider the unintended consequences of their decisions, or to apply the established tenets of evidence-informed decision-making in which any intervention (however well-intentioned or ostensibly beneficial)

merits careful pre- and post-implementation scrutiny to guard against any known and unknown ill-effects, respectively. Instead, their failure offers perhaps the clearest insight yet into the hegemony of different sources and forms of knowledge; the dominance of curative medicine over preventative measures/public health; and the limited awareness and understanding of those in authority/power concerning the day-to-day lives, most pressing needs and legitimate concerns of 'ordinary' people.

Our study focused on the last of these concerns, and while we hope to have demonstrated the futility of the second, we were unable to address the first as we relied upon quantitative techniques that offer more acceptable, manageable and comfortable 'evidence' for policymakers than those generated through qualitative, naturalistic and democratic forms of enquiry. While our analyses nonetheless paint a stark picture of the challenges that households living in temporary structures/shacks face – and the cumulative risks to their health of poverty, under-employment, poor housing and inadequate service provision[2,13] – a fuller understanding of the lived experiences of these households will require further research to challenge and stretch the rather limited insights that our data and techniques permit, and add nuance, tone and hue to the rather sketchy quantitative picture these provide. In particular, additional studies will be required to establish *which* of the multifaceted components of South Africa's lockdown restrictions were least/most challenging for residents of temporary structures/shacks to adopt, and *why* – detail that was unavailable in the items included in the AB-R8 questionnaire.

Conclusion

There can be little doubt that South African households living in temporary structures/shacks face a number of direct and indirect threats to health, not only as a result of the inadequate protection such dwellings provide (and the additional risks that informal structures and settlements entail), but also as a consequence of the dire social and economic circumstances that forced/led these households to seek shelter therein. These threats to health are compounded whenever ignorance, incompetence, ineptitude or indifference undermine the equitable allocation of resources to ensure these households have access to public services and amenities – including regulations intended to safeguard public health during ordinary, and extraordinary, circumstances.

We are not the first to argue that the adoption of a universal/blanket approach to the non-pharmaceutical interventions implemented during South Africa's response to the COVID-19 pandemic failed to acknowledge the unequal distribution of their impracticability, costs and consequences in one of the world's most unequal societies. However, our analyses provide robust, quantitative evidence that poverty and inadequate household services are likely to be more important determinants of compliance with non-pharmaceutical interventions than informal/temporary housing per se. These findings have a number of potential implications for the development of practical, effective and equitable policies that aim to address the collective risks that affect us all, both now and in the future. These implications are particularly important for those risks/policies that impose restrictions on the freedoms we require to survive and thrive – restrictions that can only be justifiable if they are practicable for all, while universal in their benefits, and equitable in their costs and consequences.

- First: universal/blanket policies can only be equitable when these do not impose impracticable constraints or untenable consequences on those who lack the means to comply (or to prevail thereafter).
- Second: stratified policies (such as those that are 'means-tested') may often be the only way to ensure that those with limited capacity to cope with restrictive regulations are subject to (less draconian) constraints/sanctions or receive additional support to ensure they can comply.
- Third: ongoing research will be required to ensure that policymakers not only know *which* components of the restrictive regulations available to them might be particularly challenging or impossible for specific households/communities to adopt, but also *how* compliance might be strengthened through stratification or the provision of additional services and support.
- Fourth: regardless of the formal evidence available to them, policymakers and their specialist technical advisers must draw on the insight of communities most likely to be disproportionately affected by, or least able to comply with, any restrictive regulations to ensure they have access to the first-hand, experiential expertise required to assess whether (and how) these communities might be able to comply.
- Fifth: in the absence of formal evidence or experiential expertise, policymakers might best *assume* that the most disadvantaged members of society will be unable to comply with any regulations that restrict their ability to seek informal/casual/opportunistic sources of work, or access essential goods, services and amenities beyond the confines of their dwellings or underserved communities.

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Competing interests

We have no competing interests to declare.

Authors' contributions

G.T.H.E.: Conceptualisation, methodology, data analysis, writing – initial draft and revisions, project management and leadership, student supervision. R.B.M.: Conceptualisation, data collection, data analysis, writing – revisions. H.R.: Conceptualisation, methodology, data analysis, writing – revisions. T.d.W.: Conceptualisation, data analysis, writing – revisions.

References

1. Nyamnjoh BA. Covid-19: The humbling and humbled virus. Corona Times. 20 April 2020. Available from: https://www.coronatimes.net/covid-19-humbling-humbled-virus/
2. Manderson L, Levine S. COVID-19, risk, fear, and fall-out. Med Anthropol. 2020;39:367–370. https://doi.org/10.1080/01459740.2020.1746301
3. Ogedengbe SS. Life of the urban poor during the COVID-19 pandemic in South Africa [MA thesis]. Bergen: University of Bergen; 2021. https://bora.uib.no/bora-xmlui/bitstream/handle/11250/2838071/Thesisbare-life-Stefan.pdf?sequence=1&isAllowed=y
4. De Soto H. The mystery of capital. New York: Basic Books; 2000.
5. Bank L. The rhythms of the yards: Urbanism, backyards and housing policy in South Africa. J Contemp Afr Stud. 2007;25:205–228. https://doi.org/10.1080/02589000701396298
6. Richards R, O'Leary B, Mutsonziwa K. Measuring quality of life in informal settlements in South Africa. Soc Indic Res. 2007;81:375–388. https://doi.org/10.1007/s11205-006-9014-1
7. Lemanski C. Augmented informality: South Africa's backyard dwellings as a by-product of formal housing policies. Habitat Int. 2009;33:472–484. https://doi.org/10.1016/j.habitatint.2009.03.002
8. Hunter M, Posel D. Here to work: The socioeconomic characteristics of informal dwellers in post-apartheid South Africa. Environ Urban. 2012;24:285–304. https://doi.org/10.1177/0956247811433537

9. Pithouse R. A progressive policy without progressive politics: Lessons from the failure to implement 'Breaking New Ground'. Town Reg Plan. 2009;54:1-4. https://hdl.handle.net/10520/EJC108694

10. Van Belle S, Affun-Adegbulu C, Soors W, Srinivas PN, Hegel G, Van Damme W, et al. COVID-19 and informal settlements: An urgent call to rethink urban governance. Int J Equity Health. 2020;19:1–2. https://doi.org/10.1186/s12939-020-01198-0

11. Maggott T. Review of: Ngwane T Amakomiti 'Grassroots Democracy in South African Shack Settlements'. Notebooks: J Stud Power. 2021;1:209–211. https://doi.org/10.1163/26667185-010D1o0w0n1l4o

12. Fieuw W, Mitlin D. What the experiences of South Africa's mass housing programme teach us about the contribution of civil society to policy and programme reform. Environ Urban. 2018;30:215–232. https://doi.org/10.1177/0956247817735768

13. Shortt NK, Hammett D. Housing and health in an informal settlement upgrade in Cape Town, South Africa. J Hous Built Environ. 2013;28:615–627. https://doi.org/10.1007/S10901-013-9347-4

14. Wekesa BW, Steyn GS, Otieno FF. A review of physical and socio-economic characteristics and intervention approaches of informal settlements. Habitat Int. 2011;35:238–245. https://doi.org/10.1016/j.habitatint.2010.09.006

15. Steyn G. Sustainable African settlement: Profiling a vision. Pretoria: Tshwane University of Technology; 2003.

16. Shaw M. Housing and public health. Annu Rev Public Health. 2004;25:397-418. https://doi.org/10.1146/annurev.publhealth.25.101802.123036

17. Govender T, Barnes JM, Pieper CH. Living in low-cost housing settlements in Cape Town, South Africa – the epidemiological characteristics associated with increased health vulnerability. J Urban Health. 2010;87:899–911. https://doi.org/10.1007/s11524-010-9502-0

18. Corburn J, Vlahov D, Mberu B, Riley L, Caiaffa WT, Rashid SF, et al. Slum health: Arresting COVID-19 and improving well-being in urban informal settlements. J Urban Health. 2020;97:348–357. https://doi.org/10.1007/s11524-020-00438-6

19. Chetty K. The case of South Africa: The societal impact of COVID-19. Int J Soc Qual. 2021;11:85–110. https://doi.org/10.3167/IJSQ.2021.11010207

20. Adebayo P. Housing policy and the post-apartheid city: A tale of urban exclusion through housing delivery. In: Magidimisha-Chipungu HH, Chipungu L, editors. Urban inclusivity in southern Africa. The Urban Book Series. Cham: Springer; 2021. p. 251–272. https://doi.org/10.1007/978-3-030-81511-0_13

21. Ellison GTH, De Wet T. The classification of South Africa's mixed-heritage peoples 1910–2011: A century of conflation, contradiction, containment, and contention. In: Rocha ZL, Aspinall PJ, editors. The Palgrave international handbook of mixed racial and ethnic classification. Cham: Palgrave Macmillan; 2020. p. 425–455. https://link.springer.com/chapter/10.1007/978-3-030-22874-3_23

22. Perkins P. The legacy of influx control. Reality. 1987;19:10–13.

23. Marutlulle NK. A critical analysis of housing inadequacy in South Africa and its ramifications. Afr Public Service Delivery Perform Rev. 2021;9(1):16. https://doi.org/10.4102/apsdpr.v9i1.372

24. Ellison GTH, De Wet T. Poverty, disability and self-reported health amongst residents and migrants in Gauteng, South Africa. Ann Hum Biol. 2016;43:131-143. https://doi.org/10.3109/03014460.2016.1147597

25. Wilson S. Breaking the tie: Evictions from private land, homelessness and a new normality. S Afr Law J. 2009;126:270–290. https://hdl.handle.net/10520/EJC53872

26. Kornienko K. Waiting, hope, democracy, and space: How expectations and socio-economic rights shape two South African urban informal communities. J Asian Afr Stud. 2017;52:34–49. https://doi.org/10.1177/0021909614560243

27. Socio-Economic Rights Institute of South Africa (SERISA). Informal settlements and human rights in South Africa [document on the Internet]. c2018 [cited 2022 Mar 27]. Available from: https://www.ohchr.org/Documents/Issues/Housing/InformalSettlements/SERI.pdf

28. Tomlinson MR. South Africa's housing policy: Lessons from four years of the new housing subsidy scheme. Third World Plan Rev. 1999;21:283. https://doi.org/10.3828/TWPR.21.3.N72W4P14881V7221

29. Lemanski C. Moving up the ladder or stuck on the bottom rung? Homeownership as a solution to poverty in urban South Africa. Int J Urb Reg Res. 2011;35:57–77. https://doi.org/10.1111/j.1468-2427.2010.00945.x

30. Phago K. The development of housing policy in South Africa. Politeia. 2010;29:88–106.

31. Ellison GTH, De Wet T. Johannesburg's 'poor housing, good health' paradox: The role of health status assessment, statistical modelling, residential context and migrant status. Public Health. 2020;186:257–264. https://doi.org/10.1016/j.puhe.2020.04.039

32. Cramm JM, Nieboer AP. The influence of social capital and socio-economic conditions on self-rated health among residents of an economically and health-deprived South African township. Int J Equity Health. 2011;10:1–7. https://doi.org/10.1186/1475-9276-10-51

33. Musango JK. Household electricity access and consumption behaviour in an urban environment: The case of Gauteng in South Africa. Energy Sustain Dev. 2014;23:305–316. https://doi.org/10.1016/j.esd.2014.06.003

34. Meth P. Informal housing, gender, crime and violence: The role of design in urban South Africa. Br J Criminol. 2017;57:402–421. https://doi.org/10.1093/bjc/azv125

35. Mattes RB, Logan C, Gyimah-Boadi E, Ellison GTH. Covid-19 in Africa: Vulnerabilities and assets. Afrobarometer Policy Paper 67 [document on the Internet]. c2020 [cited 2022 Mar 27]. Available from: https://afrobarometer.org/publications/pp67-covid-19-africa-vulnerabilities-and-assets-effective-response

36. Posel D, Oyenubi A, Kollamparambil U. Job loss and mental health during the COVID-19 lockdown: Evidence from South Africa. PLoS ONE. 2021;16, e0249352. https://doi.org/10.1371/journal.pone.0249352

37. Mashiane K, Odeku KO. Analysis of the impediments to the realisation of the right to access to adequate housing in South Africa. J Soc Dev Afr. 2021;36:149-176. https://www.ajol.info/index.php/jsda/article/view/215980/203686

38. Jiusto S, Hersh R. Proper homes, toilets, water and jobs: A new approach to meeting the modest hopes of shackdwellers in Cape Town, South Africa. WIT Trans Ecology Environ. 2009;120:743–757. https://doi.org/10.1177/0956247811433537

39. Afrobarometer. Afrobarometer Round 8 survey: South Africa, 2021 – Summary of Results and Technical Information [document on the Internet]. c2021 [cited 2022 Mar 27]. Available from: https://afrobarometer.org/sites/default/files/publications/Summary%20of%20results/summary_of_results-south_africa_r8_26nov21.pdf

40. Statistics South Africa (StatsSA). Census 2011 Statistical Release (revised) P0301.4. Pretoria: StatsSA; 2012. Available from: https://www.statssa.gov.za/publications/P03014/P030142011.pdf

41. Statistics South Africa (StatsSA). Community Survey 2016 Statistical Release P0301. Pretoria: StatsSA; 2016. Available from: http://cs2016.statssa.gov.za/wp-content/uploads/2016/07/NT-30-06-2016-RELEASE-for-CS-2016-_Statistical-releas_1-July-2016.pdf

42. Ellison GTH. Might temporal logic improve the specification of directed acyclic graphs (DAGs)? J Stat Data Sci Educ. 2021;29:202–213. https://doi.org/10.1080/26939169.2021.1936311

43. Box GEP. Science and statistics. J Am Stat Assoc. 1976;71:791–799. https://doi.org/10.1080/01621459.1976.10480949

44. Ellison GTH. COVID-19 and the epistemology of epidemiological models at the dawn of AI. Ann Hum Biol. 2020;47:506–513. https://doi.org/10.1080/03014460.2020.1839132

45. Elwert F, Winship C. Endogenous selection bias: The problem of conditioning on a collider variable. Ann Rev Sociol. 2014;40:31–53. https://doi.org/10.1146/annurev-soc-071913-043455

46. Munafò MR, Tilling K, Taylor AE, Evans DM, Davey Smith G. Collider scope: When selection bias can substantially influence observed associations. Int J Epidemiol. 2018;47:226–235.

47. Disaster Management Act (DMA), Republic of South Africa. Regulations to address, prevent and combat the spread of coronavirus COVID-19. Adjusted alert level 1. Government Gazette. 2021;44201:4–17. Available from: https://www.gov.za/sites/default/files/gcis_document/202103/44201rg11246gon152.pdf

48. Bhorat H, Köhler T, Oosthuizen M, Stanwix B, Steenkamp F, Thornton A. The economics of COVID-19 in South Africa: Early impressions. DPRU Working Paper 202004. Cape Town: Development Policy Research Unit (DPRU), University of Cape Town; 2020. https://media.africaportal.org/documents/The_economics_of_COVID-19_in_SA_1.pdf

49. Disaster Management Act (DMA), Republic of South Africa. Regulations to address, prevent and combat the spread of Coronavirus COVID-19. Adjusted alert level 2. Government Gazette. 2021;45156:4–20. Available from: https://www.gov.za/sites/default/files/gcis_document/202109/45156rg11337gon869s.pdf

50. Mercer AW. Selection bias in nonprobability surveys: A causal inference approach [PhD thesis]. College Park, MD: University of Maryland; 2018. https://www.proquest.com/openview/8a9382624a5f2be1da4074bad317a633/1?pq-origsite=gscholar&cbl=18750

51. Cepal NU. Recommendations for eliminating selection bias in household surveys during the coronavirus disease (COVID-19) pandemic. Mexico City: Statistics Division, Economic Commission for Latin America and the Caribbean (ECLAC); 2020. http://hdl.handle.net/11362/45553

52. Turok I, Visagie J. The Covid-19 crisis has amplified spatial inequalities. Econ3x3. 01 October 2020. Available from: https://www.econ3x3.org/article/covid-19-crisis-has-amplified-spatial-inequalities

53. Turok I, Visagie J. COVID-19 amplifies urban inequalities. S Afr J Sci. 2021;117, Art. #8939. https://doi.org/10.17159/sajs.2021/8939

54. Nyashanu M, Simbanegavi P, Gibson L. Exploring the impact of COVID-19 pandemic lockdown on informal settlements in Tshwane Gauteng Province, South Africa. Glob Public Health. 2020;15:1443–1453. https://doi.org/10.1080/17441692.2020.1805787

55. Nwosu CO, Oyenubi A. Income-related health inequalities associated with the coronavirus pandemic in South Africa: A decomposition analysis. Int J Equity Health 2021;20, Art. #21. https://doi.org/10.1186/s12939-020-01361-7

56. Ogunkola IO, Imo UF, Obia HJ, Okolie EA, Lucero-Prisno III DE. While flattening the curve and raising the line, Africa should not forget street vending practices. Health Promotion Perspect. 2021;11:32–35. http://doi.org/10.34172/hpp.2021.05

57. Friedman S. In, but not of, Africa: A divided South Africa faces COVID-19. The Round Table. 2021;110:16–30. https://doi.org/10.1080/00358533.2021.1875678

58. Broadbent A, Smart BT. Why a one-size-fits-all approach to COVID-19 could have lethal consequences. In: Schwartz MC, editor. The ethics of pandemics. p. 78–81. Ontario: Broadview Press; 2020. Available from: https://broadviewpress.com/product/the-ethics-of-pandemics/#tab-description

59. Van Bruwaene L, Mustafa F, Cloete J, Goga A, Green RJ. What are we doing to the children of South Africa under the guise of COVID-19 lockdown? S Afr Med J. 2020;110:574–575. https://doi.org/10.7196/SAMJ.2020.v110i7.14932

60. Joska JA, Andersen L, Rabie S, Marais A, Ndwandwa E-S, Wilson P, et al. COVID-19: Increased risk to the mental health and safety of women living with HIV in South Africa. AIDS Behav. 2020;24:2751–2753. https://doi.org/10.1007/s10461-020-02897-z

61. Ioannidis JPA. Coronavirus disease 2019: The harms of exaggerated information and non-evidence-based measures. Eur J Clin Invest. 2020;50, e13222. https://doi.org/10.1111/eci.13222

62. Kulldorff M, Gupta S, Bhattacharya J. Great Barrington Declaration [webpage on the Internet]. c2020 [cited 2022 Mar 27]. Available from: https://gbdeclaration.org

63. McKeigue PM, Colhoun HM. Evaluation of "stratify and shield" as a policy option for ending the COVID-19 lockdown in the UK [preprint]. MedRxiv. 2020.04.25.20079913. https://doi.org/10.1101/2020.04.25.20079913

64. Madhav N, Oppenheim B, Gallivan M, Mulembakani P, Rubin E, Wolfe N. Pandemics: Risks, impacts, and mitigation. In: Disease control priorities: Improving health and reducing poverty. 3rd ed. Washington DC: The International Bank for Reconstruction and Development/The World Bank; 2017.

65. Wang W, Tang J, Wei F. Updated understanding of the outbreak of 2019 novel coronavirus (2019-nCoV) in Wuhan, China. J Med Virol. 2020;92:441–447. https://doi.org/10.1002/jmv.25689

66. Nishiura H, Kobayashi T, Miyama T, Suzuki A, Jung SM, Hayashi K, et al. Estimation of the asymptomatic ratio of novel coronavirus infections (COVID-19). Int J Infect Dis. 2020;94:154–155. https://doi.org/10.1016/j.ijid.2020.03.020

67. Mahase E. Covid-19: What do we know about "long covid"? Br Med J. 2020;370, m2815. https://doi.org/10.1136/bmj.m2815

68. Smart B, Combrink H, Broadbent A, Streicher P. Direct and indirect health effects of lockdown in South Africa. Working Paper 572. Washington DC: Center for Global Development; 2021. Available from: https://www.cgdev.org/sites/default/files/WP572-Smart-South-Africa-Indirect-Health-Effects.pdf

69. Masiya T, Davids YD, Mangai MS. Assessing service delivery. Theor Empir Res Urban Manag. 2019;14:20–40. http://hdl.handle.net/20.500.11910/13960

70. Mataboge MLS, Beukes S, Nolte AGW. The experiences of clients and healthcare providers regarding the provision of reproductive health services including the prevention of HIV and AIDS in an informal settlement in Tshwane. Health SA. 2016;21:67–76. http://dx.doi.org/10.1016/j.hsag.2015.05.002

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The inhibitors and enablers of emerging adult COVID-19 mitigation compliance in a township context

Young adults are often scapegoated for not complying with COVID-19 mitigation strategies. While studies have investigated what predicts this population's compliance and non-compliance, they have largely excluded the insights of African young people living in South African townships. Given this, it is unclear what places young adult South African township dwellers at risk for not complying with physical distancing, face masking and handwashing, or what enables resilience to those risks. To remedy this uncertainty, the current article reports a secondary analysis of transcripts (n=119) that document telephonic interviews in June and October 2020 with 24 emerging adults (average age: 20 years) who participated in the Resilient Youth in Stressed Environments (RYSE) study. The secondary analysis, which was inductively thematic, pointed to compliance being threatened by forgetfulness; preventive measures conflicting with personal/collective style; and structural constraints. Resilience to these compliance risks lay in young people's capacity to regulate their behaviour and in the immediate social ecology's capacity to co-regulate young people's health behaviours. These findings discourage health interventions that are focused on the individual. More optimal public health initiatives will be responsive to the risks and resilience-enablers associated with young people and the social, institutional, and physical ecologies to which young people are connected.

Significance:

- Emerging adult compliance with COVID-19 mitigation strategies is threatened by risks across multiple systems (i.e. young people themselves; the social ecology; the physical ecology).
- Emerging adult resilience to compliance challenges is co-facilitated by young people and their social ecologies.
- Responding adaptively to COVID-19 contagion threats will require multisystem mobilisation that is collaborative and transformative in its redress of risk and co-championship of resilience-enablers.

Introduction

To manage the health impacts of Coronavirus Disease 2019 (COVID-19), the South African government instituted a national state of disaster on 15 March 2020.[1] At the time of writing, this state and its related disease mitigation strategies – including physical distancing, face masking and hand sanitising – were ongoing. Vaccination rollout and uptake did not alter directives enforcing these public health measures in South African public spaces, particularly indoor ones. Public adherence to these mitigation strategies was mixed, with emerging adults (young people aged 18–29[2]) – both in South Africa and elsewhere[3] – often portrayed as the least compliant.

Although some studies have considered the complexities of eliciting and sustaining the public's compliance with these strategies in South Africa[4-6], and elsewhere[7,8], they seldom foreground or detail the insights of emerging adults. When young people's insights are foregrounded[3,9,10], they typically exclude the voices of those living in structurally disadvantaged communities – such as South African townships – where compliance with disease mitigation strategies is arguably harder[4,11]. The current article redresses that oversight with a particular emphasis on what supported emerging adult resilience to compliance threats.

In South Africa, attention to emerging adult resilience to compliance threats is imperative, especially in structurally disadvantaged contexts. This population group is sizeable (18- to 34-year-olds constitute a third of South Africa's population) and vulnerable (the majority have first-hand, chronic experience of hardship; structural disadvantage jeopardises compliance with public health strategies).[4,11,12] Furthermore, this population group has been poorly responsive to vaccination roll-out in South Africa and so supporting their compliance with other COVID-19 mitigation strategies is critical.[13]

To better understand emerging adult resilience to compliance threats, this article is framed by social-ecological or multisystemic theories of resilience. While earlier theories of resilience emphasised personal strengths in accounts of what supported young people to adjust well to significant stressors[14], current theories explain young people's capacity for positive adjustment as a process that is co-facilitated by young people and their social and physical ecologies[14-17]. Said differently, resilience requires personal resources (e.g. good health or psychological agency) as well as social (e.g. a supportive family or enabling community), institutional (e.g. meaningful mental health services or quality schools), and environmental ones (e.g. safe spaces to relax or exercise) that work in concert to support positive adjustment to significant stress. Further, depending on a given situational or cultural context at a given point in time, certain resources might be differentially valuable (i.e. have greater or lesser impact on young people's positive outcomes).[18] Hence, it is important to understand resilience in context.[17] To illustrate, family members are prominent sources of social support in studies investigating young people's resilience to COVID-

related stressors[19-21], possibly because socio-economic challenges have necessitated that many emerging adults live with their parents[22], particularly during the pandemic[23].

As briefly detailed next, the pre-existing studies that have considered emerging adult resilience to the threats to COVID-19 mitigation compliance, typically underplay social and ecological supports.

Compliance and emerging adult resilience to COVID-19 stressors

While compliance with COVID-19 mitigation strategies is important for physical health, there are concerns that compliance could come at a cost to youth well-being given young people's need to be socially active.[24] Reduced social interaction threatens fulfilment of the key developmental tasks of emerging adulthood (i.e. school completion and career engagement; economic and functional independence; a long-term romantic partnership).[2] Consequently, there are widespread assumptions that young people will show less resilience to COVID-related lifestyle demands and disruptions, including compliance with COVID-19 mitigation strategies.[3,24]

Contrary to the growing understanding that resilience is contingent on more than personal factors, studies of what enabled emerging adult compliance with COVID-19 mitigation measures typically report personal factors. For instance, a study with 263 Dutch youth (mean age: 21) associated compliance with personal mental health and active coping styles.[25] Similarly, a study with 2315 Polish emerging adults (mean age: 20) showed that adherence to face masking was motivated by awareness of personal health risk.[9] A study with a sample of Swiss youth ($n=737$; mean age: 22) reported that antisocial personality traits and low trust in authority figures/government were associated with lower compliance.[26] A large adult study ($n=8317$; mean age: 27) found that personal beliefs (i.e. believing in the efficacy of disease mitigation strategies; valuing personal health) predicted compliance across 70 countries.[8]

Despite the emphasis on the role of personal factors in emerging adult compliance with COVID-19 mitigation strategies, some studies do report social or ecological factors that facilitate compliance. For instance, Koning and colleagues found that compliance among the Dutch youth in their study was higher for those who reported a mentoring relationship with an adult in their community (e.g. a teacher, neighbour, or non-parent relative).[25] Similarly, a study with 720 emerging adults from Minnesota (USA) found an association between emerging adult compliance with COVID-19 distancing regulations, their living arrangements, and their cultural roots.[3] Those who lived with a parent and self-identified as Asian were more likely to comply; those who were more compliant, showed greater resilience to COVID-19 stressors (i.e. better mental health outcomes). Although the study did not account for these associations, it is possible that parents encouraged compliance or that young people complied in order not to jeopardise the health of the parent/s they were living with. Similarly, Asian cultures are traditionally associated with harmonious interdependence and respect for the well-being of others.[27]

Human behaviour theory has offered some insight into these diverse patterns to compliance/non-compliance of emerging adults during the pandemic. In their critical reviews, Demirtaş-Madran[28] and Taylor[29] reflect that – alongside the applicability of the Extended Parallel Process Model, Protection-Motivation Theory, Fear-Drive Theory, Terror Management Theory, and the Health Belief Model – personal factors still play a deciding role in the multiple systems interacting to drive compliance. Even in studies that indicate that people who are more fearful of COVID-19 are more likely to comply with mandated health behaviours (e.g. Anaki and Sergay[30]; Harper et al.[31]), the protective importance of other factors, such as cultural tightness or looseness, still predicts both fear of and compliance with protective behaviours.[32]

The current study

Social-ecological or multisystemic resilience theories discourage a one-size-fits-all understanding of resilience. Instead, systems thinking urges attention to the variability of human resilience relative to a specific risk, developmental stage, or situational/cultural context.[14-18] While personal strengths and social connections have been reported in studies of South African emerging adults' experiences of COVID-19-related challenges and their resilience to those challenges[33,34], it is unclear what role – if any – these or other multisystemic resources play in South African emerging adults' compliance with physical distancing, face masking and hand sanitising in township contexts. Hence, the purpose of the current study was to explore the lived experiences of 24 emerging adults from eMbalenhle township in Mpumalanga Province to better understand what inhibited and what enabled their compliance with public health measures in this township context. This purpose translated into two questions: How do emerging adults living in a township context account for non-compliance with physical distancing, face masking and handwashing? How do these young people explain their resilience to compliance inhibitors?

Mbunge and colleagues have theorised that the stressors that recur across Africa (e.g. resource-constrained settlements, ineffective COVID-19 relief aid, political and social instability, extended households, reliance on public transport) are likely to compromise compliance with typical COVID-19 mitigation strategies.[6] These stressors are pronounced in South African townships, which are typically 'low income and densely populated' and do not allow people to 'withdraw from social interactions in a single home, work remotely, buy large quantities of supplies to avoid regular visits to the shops, or drive alone in a car to secure supplies'[4(p.261)]. Accordingly, we assumed that similar challenges would inhibit emerging adult compliance with COVID-19 mitigation strategies in the context of eMbalenhle (a densely populated, resource-constrained township). Our long-term involvement in resilience studies in eMbalenhle and other South African townships led us to believe that emerging adult resilience to these compliance threats would be a process that was co-facilitated by young people's social ecology.

Methods

To answer our research questions, we conducted a secondary analysis of 119 transcripts that documented semi-structured interviews with 24 emerging adults participating in a sub-study of the Resilient Youth in Stressed Environments (RYSE) study. Two of the authors (L.T. and M.U.) co-lead the RYSE study and all authors were co-principal investigators in the RYSE sub-study in which the transcripts were generated. This sub-study was focused on understanding the risks of COVID-related lockdown to the well-being of emerging adults in a township context and resilience to those risks. The primary analysis of the sub-study's data had the same focus.[33] While compliance and non-compliance played into those risks and resilience, they were not the focus of the primary analysis. Secondary analyses are appropriate when they extend or supplement a pre-existing analysis.[35]

The primary sub-study: A synopsis of its methodology

The methodology of the primary sub-study, which followed a phenomenological design and subscribed to social constructivist principles, is comprehensively detailed elsewhere.[33] As in other secondary analyses[35], what follows is a summary of that methodology.

Contextualisation

eMbalenhle, a township located in the Govan Mbeki municipality in Mpumalanga Province, is challenged by ongoing air quality and health issues relating to the nearby petrochemical industry, fumes from fuels, dust and meteorological factors.[36] In this regard, COVID-19 represented an additional layer of public health risk. Further, like many other South African townships, eMbalenhle is densely populated (6050 persons/km^2); challenged by structural disadvantage (including poor quality housing and crowded living conditions) and widespread poverty; and under-serviced.[37] As in other parts of South Africa[38], eMbalenhle residents are frequently involved in violent protests over poor service delivery and local government corruption[39].

The sub-study's temporal context is also important. It took place during the first wave of the COVID-19 pandemic in South Africa (specifically, June and October 2020). The first wave peaked in June and July 2020.[40]

Participants

RYSE was supported by a Community Advisory Panel (CAP) that was trained to recruit eligible participants ethically.[41] This Panel facilitated participant recruitment to the sub-study too. Young people were eligible for the sub-study if they were 18–29 years old; lived in eMbalenhle; and were willing to share their lived experiences of the COVID-related lockdown. A total of 24 emerging adults (14 young women; 10 young men) participated. Their average age was 20 and the majority spoke Zulu. Of the 24 participants, 9 were studying at a tertiary education institution; 7 were neither employed nor in education/training (NEET); 6 were completing high school; and 2 reported formal employment. At the time of the study, participants' household size ranged from 1 to 14 (most reported 5–7 household members).

Ethics

Participants consented in writing. They chose to be identified by their first name or a preferred name and gave permission to be identified by their chosen name in publications. Their consent included permission for secondary analyses of the data. The research ethics committees of the Faculties of Health Sciences and Education at the University of Pretoria provided ethical clearance [UP17/05/01] as did the Social Sciences Research Ethics Committee at the University of Leicester [26759]. Clearance included permission to compensate participants modestly for their time (i.e. participants received a ZAR300 supermarket voucher) and data/airtime expenses relating to participation (ZAR25/week).

Data generation methods and procedure

All 24 participants engaged in weekly telephonic interviews during June 2020 (total interviews: 96) and provided weekly digital diary entries (typically via WhatsApp™) using their personal cell phones. Most participants ($n=23$) were available for a single follow-up interview in October 2020 and an additional set of digital diary entries. The diary entries and interviews were directed by three primary questions: (1) What COVID-19-related challenges or stresses did you experience in the past 2 or 3 days? (2) How did you manage these challenges or stresses? (3) Who or what helped you to manage these challenges or stresses?

A research assistant, who was completing a master's degree in educational psychology at the time and is fluent in English and Zulu, conducted and transcribed the interviews. The translated parts of the interviews were independently verified. Interviews were typically about 30 minutes long. The research assistant also set up a study-dedicated telephone number (and associated WhatsApp™ account) on a password-protected cell phone and managed receipt of all diary entries.

Primary data analysis

The data were analysed using inductive thematic analysis. The analysis, which was framed by multisystemic resilience theory[15-17], focused on understanding what supported young people's resilience to COVID-19-related stressors. Rigour was advanced by multiple coders reaching consensus and by the Community Advisory Panel endorsing the findings.[33]

The secondary analysis

Because the content of the digital diaries and interviews overlapped and because the latter were more detailed[27], the secondary analysis included only the 119 interview transcripts. The secondary analysis utilised an inductive thematic approach[42]. Using ATLAS.ti.9 software to manage the secondary analysis, the first author identified data specific to physical distancing, face masking, and handwashing/sanitising. The search for data specific to these foci related to the first research question (i.e. How do emerging adults living in a township context account for non-compliance with physical distancing, face masking and handwashing?) directing the secondary analysis. As is typical in an inductive approach, the first author identified phrases/segments in the data that revealed constraints to compliance with these three protective measures and labelled them accordingly. In line with the second research question (i.e. How do young people explain their resilience to compliance inhibitors?), she also identified phrases/segments in the data that revealed what/who supported young people's resilience to those constraints and labelled them accordingly. Following Braun and Clarke[42], she considered which labels cohered thematically, grouped them, and used their commonality to provide a summative, thematic label. To advance rigour, the co-authors critically considered the identified themes. No substantive changes were recommended.

Rigour

In addition to the co-authors critically examining the identified themes, we advanced the credibility of the findings by including multiple excerpts from the transcripts. In so doing we also respected the centrality of participant voice, as it were, to the quality of research findings.[43] Further, as advised in the *American Psychological Association* standards for qualitative reporting[44], and with the participants' consent, we have described the context and participants in some detail to support reader decisions about the transferability of the findings to young people in similarly resource-constrained contexts. We have also been transparent about the assumptions that we held at the outset of the study.[42]

Findings

As summarised in Figure 1, non-compliance with physical distancing, face masking and handwashing was fuelled by forgetfulness; perceptions of dissonance (i.e. experiencing that health measures conflicted with typical ways-of-being and -doing); and structural constraints. Resilience to these compliance risks was partly facilitated by young people's capacity to regulate their behaviour. Importantly, this resilience was co-facilitated by young people's immediate social ecology co-regulating compliance. Each is detailed next.

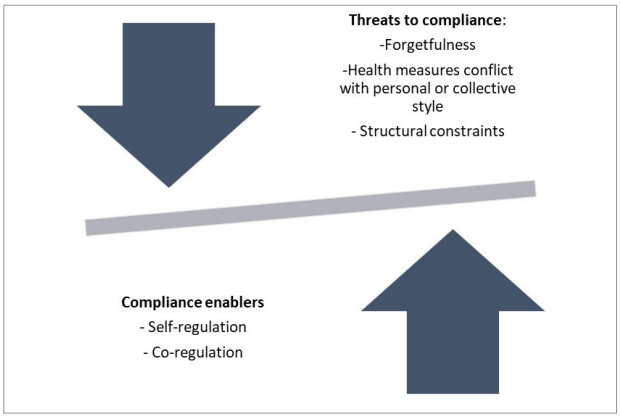

Figure 1: Summary of findings.

Risks to compliance

Not surprisingly, compliance was often jeopardised by young people forgetting their masks at home, forgetting to maintain physical distancing, or forgetting to sanitise their hands before entering a public space. For instance, Sibusiso said, 'I had forgotten my mask and I wasn't allowed inside the mall because the guard said to me, I'm a threat without a mask' (June_Week[W]4). Likewise, Mikateko recounted, 'I forgot my mask… I was ready to go back home and fetch it' (June_W2). In reference to physical distancing, Tinyiko (October) said that when she and her friends were together, 'we just forget'. Happiness1 commented, 'If there were no markers about distance and also the sanitizers and washing hands thoroughly, we would totally forget'. In addition, and as detailed below, compliance was threatened by the structural constraints that typify townships and/or when people perceived COVID-19 mitigation strategies to be alien to their personal or collective ways-of-doing.

Health measures conflict with personal or collective style

There was frequent reference to COVID-19 regulations conflicting with typical ways of being and doing. Some young people ascribed this challenge to personal preferences; some ascribed it to their gender.

Many linked non-compliance to people in their community being inclined to disregard rules and/or disbelieve official information.

> *I am a hugger … so, it's kind of hard for me to adapt to people when I see them and I have to remember that, no, we do not hug each other anymore* (Happiness2 June_W1)

> *They don't even wear masks …they hug each other, they throw parties … they really don't believe that this thing exists, they don't* (Keletso, June_W1)

> *They're not wearing any masks; they are just living; they don't do social distancing; they keep touching each other, and others are still hugging each other…I can say that they need someone who would explain to them about this thing, because now they're not taking it seriously … it affects me because it might happen that one of them gets it and then it might end up being around here, very close to us, and then everyone else is infected fast* (Nkosinathi, June_W1)

> *I have friends, we eat together, we go together... you know girls: we talk and laugh and touch each other and we are not supposed to. It is wrong. We are not supposed to hug each other, but we do* (Tinyiko, October)

> *It's this distance. You don't get used to it. You don't get used to the fact that a person is going to stand certain metres away from you. You're not used to that, that you're unable to talk... that is what makes it hard. You feel like this person is too far away from you* (Mamello, October)

> *So, you understand that this is the township, you see. So, there are people here who don't care about that* [rules]. *They are always at the corner – even now they are relaxed and chilling at the corner, smoking weed … those hardcore township guys, just like me, they see those that are following the rules as though it's people who think highly of themselves … so if you're going to wear a face mask going to the tuck shop… people* [will] *define you as someone who thinks highly of themselves, like someone who thinks they are better than the rest…*(Lungelo, June_W1,2; October)

Structural constraints

Like most townships, eMbalenhle is densely populated and poorly serviced. These constraints translated into crowded public spaces and queues often being unavoidable, as well as hygiene threats and service delivery protests. Spaces that were typically packed were taxi ranks, mini-bus taxis, and local shops; mostly, these spaces were not conducive to physical distancing and often included people who eschewed face masking. The latter were also associated with service delivery protests.

> *Some were wearing masks, but they were hanging over their chins; others were too close to each other, touching each other, so many things … I was there to collect the food parcel… it was too overcrowded …* (Willington, June_W2)

> *There are a lot of people in the taxi that don't follow the rules of wearing their masks, they don't want to sanitize inside the taxi, even though the taxis have a sanitizer available… So, with that, a lot of people will be affected because if one infected person goes into the taxi, that means everyone in the taxi will also have it* (Sipho, June_W3)

> *We are many in the stores ... so, there's a lot of us in the queue. And also, on the shelves, we are touching groceries. And then people are not complying, they're not wearing their masks, there's no social distance check. And then somebody coughed on the side and we are all in the same queue and he's touching something that I'm also going to touch. So, it's very stressful* (Happiness1, October)

> *Let me just start with the water issue. At some point people were about to protest here … according to the regulations, I have to wash my hands every time. So, not having water, we can't wash our hands* (Tshegofatso, June_W2)

> *There was a strike in our area. I did not join the strike, but this thing stressed me because people don't care. They were not wearing masks* (Naledi2, June_W2)

> *There were many people there and they were protesting… I think only 10% were wearing masks and the rest were not … A lot of them were not doing any social distancing, and some did not care about the fact that there's COVID, all they cared about was the food parcel whereabouts … a lot of people that were there are our neighbours, like some of them live on our street… so, my stress was … they were breaking all the regulations that were put in place… I'm happy that my parents didn't attend, but I was scared that the neighbours are the ones that went. And what I've noticed about our neighbours is …they still do the whole thing of coming and knocking on our door to ask for something they need. And when people come, they don't wear a mask* (Minky, June_W2)

Most participants reported that compliance in crowded spaces, including taxis, waned during less stringent lockdown periods (i.e. Lockdown levels 1 and 2):

> *Social distancing – it is* [lockdown] *Level 1 now, my sister – just forget about it … events have been opened, everything is opened. You cannot reprimand a drunk person to observe the 1.5 metres* (Thabo, October)

> *In most shops, people are forgetting the 1.5-metre marker. They stand close to each other. No one cares about COVID anymore because they say COVID is no longer there* (Thabang, October)

> *When we were in Level 5, it was a lot better because we practised social distance in the taxis …but now taxis are fully packed, so a 14-seater taxi will carry 14 passengers, and people are no longer wearing their masks … sometimes you are the only one that is wearing a mask … I will not tell the driver, 'Can I have the seat next to me be kept empty?'. That driver will tell me, 'If you are going to pay for that seat, then it's fine', which means that he's now charging you double* (Minky, October)

Self- and co-regulation support compliance resilience

Although there were significant challenges to complying with COVID-19 mitigation strategies, young people spoke often of their personal efforts to regulate their behaviour and comply with physical distancing, face masking, and hand sanitising. Essentially, they described this self-regulation as important but effortful (e.g. 'me being very disciplined' [Thabang, June_W2]; 'making sure I comply' [Naledi1, June_W1]; 'hard to manage … it's like you're in jail' [Happiness1, June_W2]; 'I control

myself' [Happiness2, October]). However, when others co-regulated compliance, such effort was easier.

References to formal co-regulation (e.g. by the police) were scant. There was some participant acknowledgement that they were less likely to forget about physical distancing or hand sanitising because these were formally regulated (e.g. 'if you get into the mall they sanitise you, when you get into a shop they sanitise you, when you go to the toilet they sanitise you, wherever you go you are sanitised' [Thabang_October]; 'there are signs that have been placed that you have to stand here and here and here' [Lungelo_W1]).

For the most part, co-regulation was informally facilitated by young people's immediate social ecologies (e.g. households, families, peer networks, neighbours, education institutions). These social ecologies committed to COVID-19 mitigation strategies and held young people accountable to do the same; mothers were frequently mentioned as the person holding young people accountable. Young people experienced co-regulating social ecologies as caring and enabling:

> *My mum, she knows that this thing is out there… she helps me and reminds me not to forget to sanitise, don't forget to do this, you know ... the fact that she constantly reminds me …that's driving me … giving me the urge to continue* [to comply] *all the time* (Sibusiso, June_W1)

> *Since I'm back in school, we have been told many times to always wear a mask. Yeah, so I don't forget that much* (Siyabonga, June_W1)

> *My mom …this week she was like, 'remember, have your sanitiser in your bag, always wear your mask, and don't ever forget in everything that you touch, you must sanitise. Distance yourself so that there are no close contacts that will make you to be close with someone'* (Khumotso, June_W2)

> *We are able to advise each other; even when I leave and maybe I forgot my face mask, they remind me, 'Hey, take your face mask!'* (Siphiwe, June_W2)

> *Everyone is doing it. You know, something is better when everyone is doing it rather than when you are doing it alone. You can't think you can defeat corona alone* (Tinyiko, June_W2)

> *It shows that you are not the only person who's fighting this thing. At least then you know that it's you and your whole community. Obviously if I was protecting myself as much as I can, if Corona will fill our community, then it means in the end I will also get infected. So, if my community is also keeping safe, it means that they're keeping me safe as well. It means they care about me as much as I care about them by showing them that I should follow things the way I am supposed to* (Tshegofatso, June_W3)

> *The people I live with also do these things. They remind each other as well. Even at school, it is a must that you do it. So, that is what makes it easy to get used to doing these things, because the people I live with also do it. It would've been hard if they were not doing it because then who would remind me to do it?* (Keletso, June_W3)

> *Here at home they know that if one person leaves, as soon as they come back, they have to sanitise. They are always reminding us, like, 'Wear your masks! Sipho, don't forget your mask!'* (Sipho, October)

Interestingly, lived experience of COVID-19 infection increased participants' efforts to comply with COVID-19 mitigation strategies and social ecologies' inclination to enact and co-regulate these strategies:

> *At first, I did not believe it's real … but as time went, I saw that this thing is there and it's real. I kept watching the news, reading in the media, there's a lot of things happening, people are dying… even in social media, we come across videoclips whereby a person is positive; he or she is urging people, like, 'Guys, this thing is there, it's killing, it's real. Let us adhere to the rules to stop the virus'* (Ayanda, June_W1)

> *Now that I have witnessed someone, I can actually see …like it's serious and it's near me. So, I'm adjusting by practising extra social distancing* (Thabang, June_W2)

> *So, now that they* [neighbours] *have experienced the COVID-19, seeing people coming to disinfect the place, it put people on the spot. People were shocked; people did not think that this will happen in our neighbourhood – my neighbourhood is not busy like other neighbourhoods… so seeing them now doing the social distancing … we have to do this …* (Mamello, June_W2)

Young people were not passive recipients of co-regulation. Many reported encouraging or prompting their family, peers, and community members to comply with COVID-19 mitigation strategies. Their initiative was reinforced when those with more authority (e.g. taxi drivers; security guards) and without authority (e.g. fellow passengers, fellow shoppers) repeated the compliance messaging:

> *They (household members) are protecting themselves because I've also told them that this thing is like Ebola, it can spread in the air, so now they have to be very alert and protect themselves* (Nkosinathi, June_W1)

> *My mother is a bit old now, you know, so I do speak to her. If she has forgotten, I remind her that she must remember to sanitise…stay safe, remember that this thing has no friend and has no age* (Tebogo, June_W1)

> *We firstly complained in the taxi, to the driver, and then people had to be turned down, like they had to get off since they didn't want to comply…it was helpful because if you don't want to comply by the rules, it is better that we leave you behind… instead of you making us all sick* (Happiness1, June_W2)

As the extracts demonstrate, the data suggest that co-regulated compliance might be dialogic, and hence multi-directional across the resilience systems at play. Put differently, in almost all participants' accounts, co-regulated compliance required verbal communication, and by extrapolation, a sense of agency that either enabled individual action or co-action (e.g. others stepping in and verbally supporting the action):

> *I was in a taxi and this other lady was busy talking and sneezing at the same time, and she didn't put her mask on. So, I was getting annoyed because she's sneezing and her mask is not on. So, I asked her, 'Can you please put on your mask'. Then she shouted at me. She said, 'Do you think I have corona? Do I look like someone who has corona?'' So, she started drama in the taxi. So, this other guy said to her, 'No, don't shout at her, she was asking you to put it on…' And then she just put it on.* (Mikateko, June_W4)

Discussion

The purpose of this article was to report on what inhibited and what enabled emerging adult compliance to physical distancing, face masking and hand sanitising in a township context. To that end, we conducted a secondary thematic analysis of 119 interview transcripts generated during a RYSE sub-study that sought to understand emerging adult resilience to COVID-19-related stressors. The transcripts documented semi-structured, weekly interviews during June 2020 with 24 emerging adults from a single township (i.e. eMbalenhle) and again in the first week of October 2020. Two questions directed the secondary analysis: How do emerging adults living in a township context account for non-compliance with physical distancing, face masking and handwashing? and How do these young people explain their resilience to compliance inhibitors? In what follows, these questions are considered in succession and the findings related to relevant resilience and COVID-19 literature.

Inhibitors of emerging adult compliance to physical distancing, face masking and hand sanitising

The participants' accounts of the challenges to their compliance with COVID mitigation strategies compel attention to the compound nature of risk and its rootedness in individual, social, and ecological factors.[15,16] This finding fits with those of others[4-6]. As presaged by these pre-existing studies, the contextual constraints that recur across Africa challenged the capacity of emerging adults in the RYSE sub-study to comply with government-directed mitigation strategies. In particular, reliance on public transport; exposure to queues and crowded local shops; disruptions to basic services and related service-delivery protests; and inequitable distribution of COVID relief aid and related protests obligated physical proximity and/or contact with locals who had been in close contact with crowds. Water supply disruptions put pay to handwashing. Essentially, young people's physical ecology jeopardised compliance and heightened their vulnerability to contracting COVID. While government directives aimed at COVID-19 mitigation were well intentioned, how they played out in the risk-saturated context of eMbalenhle flags the inadequacy of disease mitigation measures in the absence of structural redress and reliable service delivery.

Compliance was also challenged when mitigation strategies conflicted with preferred or typical ways-of-being and -doing at the level of the individual and the community (e.g. personal preference for close social contact; a culture of disbelief in official information and disregard for rules). While these factors probably relate to the developmental stage of emerging adulthood (e.g. risk-taking is typical of the transition to adulthood[2]) and/or many young South African adults' disillusionments with government and convention[45], they also echo previous findings that not all young people are compliant and that distrust and anti-social tendencies fuel non-compliance[3,26]. Still, recognising that personal and shared ways-of-being and -doing play into compliance reinforces the importance of bespoke public-health messaging. Put differently, they are a reminder of the importance of adapting public health messaging for specific groups of young people (e.g. youth who are less risk-aversive; youth with high distrust in government). They also call for bottom-up initiatives to animate health promotion in ways that resonate with local realities[46], both historical and current.

Emerging adult resilience to compliance inhibitors

Like the multifaceted nature of what inhibited compliance, emerging adult resilience to those inhibitors was complex and rooted in young people's personal capacity to regulate their behaviours *and* their social ecology's co-regulation of those behaviours. While COVID-related studies have acknowledged the role of the social ecology (especially the family[19-21]) to emerging adult resilience, there has been less attention to the social ecology's role in supporting compliance with COVID mitigation strategies.[3,25] The importance of the self and others sharing in the regulation of health promoting behaviours reinforces the understanding that resilience is not a mono-systemic capacity[14-17], and that processes which have traditionally been conceptualised as individual-driven (e.g. behaviour regulation) may be more communal/co-driven than assumed. In a community, like eMbalenhle, where young people may experience peer group censure for rule-respecting behaviours, the value of supportive co-regulation to compliance also illustrates the contextual responsivity of resilience-enabling resources.[17]

Co-regulation by others – in the case of our study, often caregivers and other adults – might seem counterintuitive to the developmental stage of emerging adulthood and its emphasis on functional independence.[2] Still, this fits with Koning and colleagues' finding that Dutch emerging adults were more likely to be compliant when they had access to a natural mentor.[25] Similarly, Berge and colleagues found that residence with a parent prompted emerging adults to observe physical distance regulations.[3] Social ecological theories of resilience have shown that resources can have a differential protective impact when they are contextually meaningful[18]; in the face of COVID-19, co-regulating others were probably situationally congruent resources[17].

The quantitative studies by Koning et al.[25] and Berge et al.[3] could not explain how adults supported emerging adult compliance with COVID-19 mitigation. Like other resilience studies that have noted the enabling value of role models and opportunities for dialogue[14,47], the qualitative design of our study yields detail suggesting that others inspired compliance by modelling it themselves and/or dialoguing about compliance. Some discursive prompts were timeous (e.g. as young people were about to leave home); others were recurring and therefore hard to dismiss. A take-away for future public health campaigns aimed at encouraging emerging adult compliance with disease mitigation strategies is that such campaigns should include people in young people's immediate social ecology, including adult relatives and non-relatives, and animate dialogue.

While our study's limited number of participants was too small to draw definitive conclusions, it is possible that the emerging adult participants (who self-identified as African and reported an appreciation of ubuntu values[33]) were receptive of co-regulation because of its fit with traditional African valuing of interdependence and young people's socialisation to respect their elders.[48] Certainly, their appreciation of others' compliance, and interpretation of collective compliance as an expression of care, fit with the interconnected ways-of-being that have been associated with African youth resilience.[49] Resilience science is mindful that effective enablement of the resilience of specific groups of young people lies in resources that are culturally congruent.[14-18] Importantly, the possibility that an appreciation for interdependent ways-of-being and -doing supported compliance in our study, encourages further consideration of how public health messaging and COVID mitigation strategies could benefit from collectivist values.[7,32,50] In contexts, like eMbalenhle, where there is some appreciation for non-conformity and risk-taking, public health campaigns will necessarily have to encourage locals to enact an ethic of care (e.g. remind young people and others to protect their health, and model health-promoting behaviours).

As in previous studies that have documented an association between contagion fears with emerging adult compliance with physical distancing and face masking[8,9], the findings nudge attention to the role of fear in compliance and how compliance declines as COVID cases decrease and restrictions are relaxed. While leveraging contagion fears could potentially coerce compliance with disease mitigation strategies, the ethics of doing so should be questioned, particularly when a physical ecology sets people up for non-compliance. It is in this context that our findings (and those in the wider behaviour theory literature[31]) relating to the importance of the personal ecosystem become central; as a society we need to establish public health messages and measures that carefully calibrate the effectiveness of compliance originating in fear, with compliance originating in personal context and resilience across systems. Without this calibration, we risk poor outcomes for specific – often already marginalised – groups.

Limitations

As reported previously[33], the purposive recruitment of the participants in the primary sub-study by the RYSE Community Advisory Panel limited the transferability of the sub-study's findings. It is possible that recruitment via public platforms (e.g. social media) could have

encouraged more diverse insights. Further, although eMbalenhle has much in common with other structurally disadvantaged communities in South Africa, we acknowledge that risk and resilience are highly sensitive to situational determinants.[17,18] Similarly, the cultural context is likely to shape which resources are differentially protective.[17,18] Although we theorised how situational and cultural context inhibited and/or enabled the COVID-19 mitigation compliance of the emerging adults in our study, sampling limitations (i.e. 24 young people from a single, structurally disadvantaged township) preclude definitive conclusions. A follow-up study with randomly recruited emerging adults from similar and dissimilar communities (e.g. structurally advantaged) could redress these sampling limitations. Finally, it is possible that the timing of our study (at the peak of the first wave and then toward the end of the first wave when incidence was resurging) played into personal and collective inclination to comply with COVID-19 mitigation strategies and related accounts of compliance inhibitors and enablers.

Conclusion

Notwithstanding the limitations that we have reported, our study is rare in its attention to the multisystemic complexity of what inhibited and enabled emerging adult compliance to physical distancing, face masking, and hand sanitising in a township context. Our findings suggest that to understand youth response to public health measures, we will need to understand better the context in which they make decisions. Even with the desire to demonstrate self-regulation and compliance, they are particularly susceptible to changing conditions around them as they, more than other age groups, are forced to be out in the world. Future public health initiatives will need to acknowledge these challenges and better facilitate ways for emerging adults to maintain social cohesion but still comply with public health measures. For example, better access to online social networks, or help with maintaining employment and educational paths may cushion the impact of a pandemic on young adults. We believe young people themselves may have the answers to these challenges if given the opportunity to influence the discourse regarding effective public health initiatives.

Indeed, this rich work showed that multiple systems – the individual emerging adult; their social ecology; their service ecology; their physical ecology – co-jeopardise emerging adult compliance with physical distancing, face masking, and handwashing. Similarly, emerging adult resilience to these compound compliance risks is informed by more than young people themselves. Instead, young people's capacity for compliance is co-facilitated by their personal capacity to adjust their behaviour and the capacity of their immediate social ecology to animate and sustain behaviour adjustments that are likely to limit COVID-19 contagion threats.

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Competing interests

We have no competing interests to declare.

Authors' contributions

L.T., D.L. and M.U. co-conceived and co-supervised the study. L.T. led field data collection. L.T. led the analyses with input from D.L. and M.U. L.T. drafted the original manuscript with input from D.L. and M.U. All authors contributed to the revision of the manuscript.

References

1. Wiysonge CS. South Africa's war on COVID-19. ThinkGlobalHealth. 2020 April 20 [cited 2022 Jan 27]. Available from: https://www.thinkglobalhealth.org/article/south-africas-war-covid-19
2. Arnett JJ. Emerging adulthood: A theory of development from the late teens through the twenties. Am Psychol. 2000;55(5):469. https://doi.org/10.1037/0003-066X.55.5.469
3. Berge JM, Larson N, Neumark-Sztainer D. Emerging adults and social distancing during COVID-19: Who was more likely to follow guidelines and what were the correlates with well-being and weight-related behaviors? Emerg Adulthood. 2021;9(6):670–678. https://doi.org/10.1177/21676968211051482
4. De Groot J, Lemanski C. COVID-19 responses: Infrastructure inequality and privileged capacity to transform everyday life in South Africa. Environ Urban. 2021;33(1):255–272. https://doi.org/10.1177/0956247820970094
5. Kollamparambil U, Oyenubi A. Behavioural response to the Covid-19 pandemic in South Africa. PLoS ONE. 2021;16(4), e0250269. https://doi.org/10.1371/journal.pone.0250269
6. Mbunge E, Fashoto S, Akinnuwesi B, Gurajena C, Metfula A. Challenges of social distancing and self-isolation during COVID-19 pandemic in Africa: A critical review [preprint]. SSRN. 2020 Nov 30. http://dx.doi.org/10.2139/ssrn.3740202
7. Cheng KK, Lam TH, Leung CC. Wearing face masks in the community during the COVID-19 pandemic: Altruism and solidarity. Lancet. Forthcoming 2020. https://doi.org/10.1016/S0140-6736(20)30918-1
8. Clark C, Davila A, Regis M, Kraus S. Predictors of COVID-19 voluntary compliance behaviors: An international investigation. Global Transit. 2020;2:76–82. https://doi.org/10.1016/j.glt.2020.06.003
9. Matusiak Ł, Szepietowska M, Krajewski PK, Białynicki-Birula R, Szepietowski JC. The use of face masks during the COVID-19 pandemic in Poland: A survey study of 2315 young adults. Dermatol Ther. 2020;33(6), e13909. https://doi.org/10.1111/dth.13909
10. Szepietowska M, Krajewski PK, Matusiak Ł, Białynicki-Birula R, Szepietowski JC. Do university students adhere to WHO guidelines on proper use of face masks during the COVID-19 pandemic? – Analysis and comparison of medical and non-medical students. Appl Sci. 2021;11(10):4536. https://doi.org/10.3390/app11104536
11. Turok I, Visagie J. COVID-19 amplifies urban inequalities. S Afr J Sci. 2021;117(3/4), Art. #8939. http://dx.doi.org/10.17159/sajs.2021/8939
12. Stats SA. SA population reaches 58,8 million [webpage on the Internet]. c2019 [cited 2022 Jan 27]. Available from: http://www.statssa.gov.za/?p=12362
13. South African Department of Health. COVID-19 online resource and news portal [updated 2022; cited 2022 Jan 28]. Available from: https://sacoronavirus.co.za/latest-vaccine-statistics/
14. Masten AS. Ordinary magic: Resilience in development. New York: Guilford Publications; 2015.
15. Masten AS, Lucke CM, Nelson KM, Stallworthy IC. Resilience in development and psychopathology: Multisystem perspectives. Annu Rev Clin Psychol. 2021;17:521–549. https://doi.org/10.1146/annurev-clinpsy-081219-120307
16. Masten AS, Motti-Stefanidi F. Multisystem resilience for children and youth in disaster: Reflections in the context of COVID-19. Advers Resil Sci. 2020;1(2):95–106. https://doi.org/10.1007/s42844-020-00010-w
17. Ungar M, Theron L. Resilience and mental health: How multisystemic processes contribute to positive outcomes. Lancet Psychiatry. 2020;7(5):441–448. https://doi.org/10.1016/S2215-0366(19)30434-1
18. Ungar M. Which counts more: Differential impact of the environment or differential susceptibility of the individual? Br J Soc Work. 2017;47(5):1279-1289. https://doi.org/10.1093/bjsw/bcw109
19. Li F, Luo S, Mu W, Li Y, Ye L, Zheng X, et al. Effects of sources of social support and resilience on the mental health of different age groups during the COVID-19 pandemic. BMC Psychiatry. 2021;21(1):1–4. https://doi.org/10.1186/s12888-020-03012-1
20. Liu CH, Zhang E, Wong GT, Hyun S. Factors associated with depression, anxiety, and PTSD symptomatology during the COVID-19 pandemic: Clinical implications for US young adult mental health. Psychiatry Res. 2020;290:113172. https://doi.org/10.1016/j.psychres.2020.113172
21. Marchini S, Zaurino E, Bouziotis J, Brondino N, Delvenne V, Delhaye M. Study of resilience and loneliness in youth (18–25 years old) during the COVID-19 pandemic lockdown measures. J Community Psychol. 2021;49(2):468–480. https://doi.org/10.1002/jcop.22473

22. Sawyer SM, Azzopardi PS, Wickremarathne D, Patton GC. The age of adolescence. The Lancet Child Adolesc Health. 2018;2(3):223–228. https://doi.org/10.1016/S2352-4642(18)30022-1

23. Hall SS, Zygmunt E. 'I hate it here': Mental health changes of college students living with parents during the COVID-19 quarantine. Emerg Adulthood. 2021;9(5):449–461. https://doi.org/10.1177/21676968211000494

24. Organization for Economic Co-operation and Development (OECD). Youth and COVID-19: Response, recovery and resilience. Paris: OECD; 2020. Available from: https://www.oecd.org/coronavirus/policy-responses/youth-and-covid-19-response-recovery-and-resilience-c40e61c6/

25. Koning N, Hagedoorn N, Stams GJ, Assink M, Van Dam L. What makes Dutch youth comply with preventive COVID‐19 measures? An explorative study. J Community Psychol. 2022;50:653–665. https://doi.org/10.1002/jcop.22651

26. Nivette A, Ribeaud D, Murray A, Steinhoff A, Bechtiger L, Hepp U, et al. Non-compliance with COVID-19-related public health measures among young adults in Switzerland: Insights from a longitudinal cohort study. Soc Sci Med. 2021;268:113370. https://doi.org/10.1016/j.socscimed.2020.113370

27. Tian G, Wang X. Cultural pathways to resilience: Informal social support of at-risk youth in China. In: Theron LC, Liebenberg L, Ungar M, editors. Youth resilience and culture. Dordrecht: Springer; 2015. p. 93–104. https://doi.org/10.1007/978-94-017-9415-2_7

28. Demirtaş-Madran HA. Accepting restrictions and compliance with recommended preventive behaviors for COVID-19: A discussion based on the key approaches and current research on fear appeals. Front Psychol. 2021;12, 558437. https://doi.org/10.3389/fpsyg.2021.558437

29. Taylor S. The psychology of pandemics: Preparing for the next global outbreak of infectious disease. Newcastle upon Tyne: Cambridge Scholars Publishing; 2019.

30. Anaki D, Sergay J. Predicting health behavior in response to the coronavirus disease (COVID-19): Worldwide survey results from early March 2020. PLoS ONE. 2021;16(1), e0244534. https://doi.org/10.1371/journal.pone.0244534

31. Harper CA, Satchell LP, Fido D, Latzman RD. Functional fear predicts public health compliance in the COVID-19 pandemic. Int J Ment Health Addict. 2021;19(5):1875–1888. https://doi.org/10.1007/s11469-020-00281-5

32. Dong D, Chen Z, Zong M, Zhang P, Gu W, Feng Y, Qiao Z. What protects us against the COVID-19 threat? Cultural tightness matters. BMC public health. 2021;21, Art. #2139. https://doi.org/10.1186/s12889-021-12161-1

33. Theron L, Levine D, Ungar M. Resilience to COVID-19-related stressors: Insights from emerging adults in a South African township. PLoS ONE. 2021;16(12), e0260613. https://doi.org/10.1371/journal.pone.0260613

34. Gittings L, Toska E, Medley S, Cluver L, Logie CH, Ralayo N, et al. 'Now my life is stuck!': Experiences of adolescents and young people during COVID-19 lockdown in South Africa. Glob Public Health. 2021;16(6):947–963. https://doi.org/10.1080/17441692.2021.1899262

35. Ruggiano N, Perry TE. Conducting secondary analysis of qualitative data: Should we, can we, and how? Qual Soc Work. 2019;18(1):81–97. https://doi.org/10.1177/1473325017700701

36. Walton NM, Piketh SJ, Van Zyl P, Maenhaut W, Burger R, Formenti P. Source apportionment of ambient fine and coarse aerosols in Embalenhle and Kinross, South Africa. Clean Air J. 2021;31(2), Art. #11980. https://doi.org/10.17159/caj/2021/31/2.11980

37. Statistics South Africa. Govan Mbeki, Mpumalanga: 2011 Census [webpage on the Internet]. c2011 [cited 2020 Sep 01]. Available from: http://www.statssa.gov.za/?page_id=993&id=govan-mbeki-municipality

38. Canham H. Theorising community rage for decolonial action. S Afr J Psychol. 2018;48(3):319–330. https://doi.org/10.1177/0081246318787682

39. Mathebula S. Protesters burn down Mpumalanga mall. The Citizen. 2018 June 26. Available from: https://www.citizen.co.za/news/south-africa/1963615/protesters-burn-down-mpumalanga-mall/

40. Centre for Respiratory Diseases and Meningitis, NICD-NHLS. An update on COVID-19 outbreak in South Africa: The first and the second wave of COVID-19 cases in South Africa [document on the Internet]. c2021 [cited 2022 Jan 26]. Available from: https://www.nicd.ac.za/wp-content/uploads/2021/01/An-update-on-COVID-19-outbreak-in-South-Africa_The-first-and-second-wave.pdf

41. Ungar M, Theron L, Murphy K, Jefferies P. Researching multisystemic resilience: A sample methodology. Front Psychol. 2021;11:3808. https://doi/10.3389/fpsyg.2020.607994

42. Braun V, Clarke V. Conceptual and design thinking for thematic analysis. Qual Psychol. 2022;9(1):3–26. https://doi.org/10.1037/qup0000196

43. Morse JM. Critical analysis of strategies for determining rigor in qualitative inquiry. Qual Health Res. 2015;25(9):1212–1222. https://doi.org/10.1177/1049732315588501

44. Levitt HM, Bamberg M, Creswell JW, Frost DM, Josselson R, Suárez-Orozco C. Journal article reporting standards for qualitative primary, qualitative meta-analytic, and mixed methods research in psychology: The APA Publications and Communications Board task force report. Am Psychol. 2018;73(1):26. https://doi.org/10.1037/amp0000151

45. Long W. Nation on the couch: Inside South Africa's mind. Cape Town: Melinda Ferguson Books; 2021.

46. Ikemura Amaral A, Jones GA, Nogueira M. Brazil's so-called invisibles will need more than resilience to redress the unequal impacts of COVID-19. LSE Latin America and Caribbean Blog. 2020 May 14. Available from: https://blogs.lse.ac.uk/latamcaribbean/2020/05/14/brazils-so-called-invisibles-will-need-more-than-resilience-to-redress-the-unequal-impacts-of-covid-19/

47. Van Breda AD, Theron LC. A critical review of South African child and youth resilience studies, 2009–2017. Child Youth Serv Rev. 2018;91:237–247. https://doi.org/10.1016/j.childyouth.2018.06.022

48. Mhlongo N. Black tax: Burden or ubuntu? Johannesburg: Jonathan Ball Publishers; 2019.

49. Phasha TN. Educational resilience among African survivors of child sexual abuse in South Africa. J Black Stud. 2010;40(6):1234–1253. https://doi.org/10.1177/0021934708327693

50. Courtney EP, Felig RN, Goldenberg JL. Together we can slow the spread of COVID-19: The interactive effects of priming collectivism and mortality salience on virus-related health behaviour intentions. Br J Soc Psychol. 2022;61(1):410–431. https://doi.org/10.1111/bjso.12487

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Rekindling hope and purpose in resource-constrained areas during COVID-19: The merits of counselling for career construction

The COVID-19 pandemic has widened the gap between the career and life chances of learners with sufficient and those with insufficient access to personal and educational resources and structures. This article draws on an adapted, qualitative, systematic literature search to shed light on the effect of the pandemic on learners in resource-constrained areas especially. It discusses the merits of counselling for career construction as an intervention that can bring about transformative change, thereby rekindling learners' sense of hope and purpose. It also reflects on how counselling for career construction can help counsellors and teachers assist learners to deal with inadequate 'mastering of passive suffering' as well as inadequate mastering of developmental tasks during COVID-19. The article concludes with the view that 'hope-, purpose-, and action'-enhancing counselling for self and career counselling can bolster the sense of agency, empowerment, dignity, and self-worth of learners in underprivileged contexts in particular. It is argued that such counselling can promote career adaptability, improve present and future employability, and enhance the meaning-making of disadvantaged South African as well as other African learners.

Significance:

- Disadvantaged learners and the unemployed were more negatively affected by the COVID-19 pandemic than their more privileged counterparts.
- More than 2 years into the COVID-19 pandemic, very little has been reported on the need to bolster the sense of agency, empowerment, dignity, and self-worth of learners in underprivileged contexts in particular.
- The pandemic has amplified the divide between the career-life prospects of learners with sufficient access to educational resources and support and those without such access.
- Steps need to be taken urgently to implement interventions that can bring about transformative change in our schools to rekindle learners' sense of hope and purpose. This will help eliminate existing disparities and improve these learners' work–life future, with positive benefits for the stability and economy of the country.

The pandemic arriving at a particularly challenging time for workers

South Africa, like the rest of the world, faces challenges regarding the future of work. Discourses on the future of work revolve mainly around the unprecedented rate of change in the workplace, which is affecting unskilled and inadequately skilled workers in particular. Millions of jobs are being lost and further job losses are likely as a result of Work 4.0, including threats that robots will increasingly take over jobs formerly done by human beings.[1]

The perceived bleak future of disadvantaged learners

Many authors have argued directly and indirectly that little has changed for the better for learners in South Africa since 1994 and have written about the (perceived) bleak future of school learners and students (the focus of this article).[1-4] Amnesty International states that 'South Africa is failing too many of its young people when it comes to education'[2]. Moreover, year after year, the gap between the career-life prospects of learners with sufficient access to educational resources and those without access to essential resources and support is getting bigger.[2(p.6)] As a result, the so-called 'Matthew effect' is being amplified.[3] The widening education and future job opportunities divide between learners from affluent areas (in public as well as private schools) and those from less affluent areas is concerning.[4] The UNESCO goal of leaving no one behind is at the heart of the 2030 Agenda for Sustainable Development but is still far from being realised in South Africa.[5] (It should be stated that references to South African schools etc. can in most cases also be extended to African schools in general.)

Many researchers have expressed concern at the impact of the pandemic on disadvantaged learners' academic achievement[6,7] – especially in gateway subjects such as mathematics and physical sciences[8] – and on their longer-term work future. Even before the pandemic, disadvantaged learners were lagging in these subjects. These and other factors can undermine their choice of and performance in a job and a career. The need for career counselling services is at an all-time high, yet only a small percentage of South African learners have access to these (often costly) services. Moreover, although numerous research studies in developed countries in the Global North have shown the value of a more contemporary approach to career counselling[9,10], the outdated 'vocational guidance' ('test-and-tell') model of career counselling still prevails in developing (Global South) countries such as South Africa. Preliminary research reveals that contextualised career construction counselling in individual and group contexts in South Africa and a few other African countries has yielded encouraging outcomes.[8,9,11]

Rationale for the article

Several years ago while colleagues and I were researching the implementation of life orientation classes and the value of a postmodern, storied approach to career counselling in a seriously disadvantaged part of Limpopo Province, I put the following question to learners at the end of the intervention: 'Is there anything else about you that you want to share with me?'[12] A young woman (in Grade 11) responded as follows:

> *You asked about, for instance, what are or were our biggest challenges when we were young. When I go home after school, I return to an environment where there is little water and no toilets, where there is dirt everywhere, and where some of us do not even have a bar of soap in our homes without proper windows. How can we be expected to wash our hands after having been to the toilet?*

More recently, during a project in a deep rural region, and in response to the same question, another young woman listed 'How to avoid the Corona [sic]' as her current biggest challenge. When probed on her response, she replied: 'There are many different 'stories' about Corona, much uncertainty and confusion. People pay little attention to Corona measures.' (The responses of the participants are verbatim with only light editing in order to preserve their authenticity.) Touched by these two participants' sense of desperation, I later conducted in-depth interviews with them. These and other interviews deepened my compassion for the plight of disadvantaged learners in particular. The interviews also enhanced my understanding of the need to abandon all preconceived ideas when attempting to comprehend the situation of disadvantaged populations.

During the pandemic, many measures introduced to curb the spread of the virus were impracticable in underprivileged contexts (for instance, maintaining social distancing in already overcrowded classrooms and public spaces) and in some instances even contributed to widening the gap between the self- and career construction of advantaged and less advantaged learners. These issues have received little attention in the literature, and the current article represents a modest attempt to contribute to our understanding of the situation.

Goals of the article

It is clear from the above that a paradigm shift is needed to make psychological assessment and intervention accessible to most of the world's population, particularly people in low-resource, multicultural settings.[13] More particularly, a paradigm shift is needed in career construction counselling (namely an approach that enhances learner agency and changes the power relations in the educator/counsellor relationship). Against this background, this article describes an adapted, qualitative, systematic literature search that was aimed at shedding light on the effect of the pandemic on learners in resource-constrained areas in particular. It reflects on how counselling for career construction can help career counsellors and teachers assist learners to deal with inadequate mastering of passive suffering as well as inadequate mastering of developmental tasks during COVID-19. It also discusses the merits of counselling for career construction as an intervention that can bring about transformative change and rekindle learners' sense of hope and purpose.

Approach to the literature review

Adapted qualitative systematic literature review

This article is based on an adapted, qualitative, systematic literature search 'regarding the recent developments and debates on [the topic of this research] with the addition of metacommentary'[14(p.450)]. The aim was to establish a framework for understanding the research topic by uncovering 'gaps between what is known and what is yet to be known'[14(p.462)] about the topic. I was also mindful of Snyder's assertion that the 'literature review as a research method is more relevant than ever'[15(p.333)], provided that such a review is 'accurate, precise, and trustworthy'[15(p.334)]. Two years into the COVID-19 pandemic, very little has been reported on the value of counselling for career construction in rekindling people's sense of hope and purpose. I therefore considered it important to gather as much information on the topic as possible and to identify possible gaps in the theory and practice of the intervention requiring urgent research. With the assistance of Liesl Stieger, academic information specialist (Department of Educational Psychology, University of Pretoria), the following four broad literature review steps were followed[14]:

1. Clearly define the study goals.
2. Establish inclusion and exclusion criteria. *Inclusion criteria* comprised sources that illuminated the topic of the study, contained more information than merely personal views, and enhanced the literature review. *Exclusion criteria* comprised sources that were biased or merely personal opinions, did not relate sufficiently to our knowledge on the topic, and were outdated. However, we acknowledged the value of seminal citations in promoting academic thoroughness.
3. Select literature to review based on the above criteria. We were aware of the limitations of Internet-based sources and other non-peer-reviewed sources. However, given the short period of time since the advent of the pandemic, we were obliged to draw on several such sources to achieve a satisfactory degree of data saturation. We of course also selected 'standard' sources such as books, articles, and online sources such as social media (including magazines, Internet forums, and social blogs/vlogs). Likewise, we searched and selected sources from YouTube, podcasts, webinars, LinkedIn, Academia, and ResearchGate.
4. Peruse and synthesise (integrate) the relevant sources.[16,17] Ms Stieger used combinations of the following keywords as search terms: 'Career construction', 'Counselling', 'Covid-19', 'purpose', 'resource-constrained', and 'therapy'.

We followed the data-gathering method described below.[14]

i. We searched the web for article abstracts in numerous databases to gather a wide range of relevant sources.

ii. We signed up to many Internet publishing entities for information on the research topic (Rekindling hope and purpose in resource-constrained areas during COVID-19: The merit of counselling for career construction).

iii. We cleared inappropriate sources that did not shed light on the topic. We then either downloaded or requested full texts of appropriate sources.

iv. We assessed the value and relevance of the identified sources, which were then scrutinised to establish whether they contributed to our understanding of the research topic and whether they shed light on existing views on the topic.

Bearing in mind the discussion in the introductory part of this article, it is not surprising that the literature review confirmed the general view that disadvantaged learners and the unemployed have been more negatively affected by the COVID-19 pandemic than their more privileged counterparts.[18-20] In the next section, I reflect on the effect of the pandemic on learners in resource-constrained areas. The categories listed and discussed were gleaned from the systematic literature review and from my own interpretation of the texts. The categorisation of topics was structured in the following order[17]: microlevel-related issues followed by a number of mesolevel-related issues and then macro-level-related issues, including structural constraints.

Microlevel-related issues

It is not sufficient to focus only on the effects of the pandemic on learners' academic achievements. Even before the pandemic, most disadvantaged learners lacked the support structures needed to develop emotionally-socially, physically, spiritually, and in terms of well-being and resilience. They were (and still are) taught in overcrowded classrooms and did not have access to basic necessities such as food, running water, shelter,

and proper sanitation. Many did not attend classes at all or attended classes only every second day or week, resulting in, among other things, deficient socialising. Disadvantaged learners in particular also struggled to make the transition to online teaching and learning. Learners not living with either parent, learners from single-parent families, learners from child-headed families, and learners experiencing learning barriers were particularly hard hit by the pandemic.

Many authors have referred to the negative impact of the above factors on disadvantaged learners' academic achievement (self-actualisation). Their well-being and development in general, their emotional and spiritual well-being, and their socialising skills are even more critical in determining their academic success.[18-20,21]

Mesolevel-related issues

Teaching by poorly trained teachers (in mathematics, physical sciences, and English especially) impacts negatively on disadvantaged learners' chances of realising their potential, as it undermines their self- and career construction.[22] The pandemic (together with these learners' feelings of insecurity and alienation and teacher inadequacy in adjusting to a different modality of teaching and learning) has deepened the divide between the quality of teaching and learning in privileged and underprivileged schools.[23] Online teaching and learning is often experienced as bewildering, frustrating, and alienating by disadvantaged learners who have to adapt to online teaching and learning in conditions not conducive to such teaching and learning. Inadequate and unreliable Internet access in poor areas further compromises online teaching and learning. Privileged schools are generally closer to reliable Internet service providers and have the funds to pay for Internet access and better-trained teachers. Many disadvantaged learners feel disempowered and simply resign themselves to the inconvenience and hardship brought about by the pandemic. Many believe also that 'fate' or 'luck' determines what happens to them (share an external locus of control). Even before the pandemic, disadvantaged learners' sense of well-being and meaning-making was undermined by their circumstances.[24] Their lived experiences heightened their belief that not even hard work and commitment could help them escape the 'poverty trap' they found themselves in. This situation cannot be reconciled with the Convention on the Rights of the Child[2,25] and is unacceptable in a postmodern world.

Macrolevel-related issues[26]

Much has been written about the structural constraints (including structural inequalities and lack of support structures) in disadvantaged areas in South Africa (one of the most unequal countries in the world).[4,5,17,18,21,26] Learners from township and rural areas especially tend to be members of low-income families and live in resource-constrained environments. National and provincial education departments have done their best to minimise the adverse effect of the pandemic on teaching and learning and to ensure the continuation of teaching and learning in the face of increasing challenges. However, major structural constraints in low socio-economic areas have undermined efforts to prevent disadvantaged learners from falling further behind their more affluent counterparts.

Large numbers of disadvantaged learners have lost hope, have disengaged from the teaching and learning process, and have dropped out of school.[21] Although these learners often project a sense of hopelessness and defeatism, they have no one to turn to for guidance and counselling. The pandemic has heightened the need for general and career counselling especially in disadvantaged schools in low-economic status areas.[27,28] The need to facilitate change and transformation in teaching and learning has never been greater.

Inadequate management of learners' career counselling needs

Disadvantaged learners' career guidance, development, and counselling needs are not being met satisfactorily.[29,30] The few learners who do receive career counselling are rarely exposed to contemporary career counselling. Their subjective 'career-life stories' are generally neither elicited satisfactorily nor integrated with the outcomes of 'objective' tests completed by them. The pandemic has exacerbated this situation too as most teachers in disadvantaged areas lack the skills to provide online career guidance or simply do not have the time to devote to career guidance. Pillay[31] advocates the contextualisation and innovation of individual and group career counselling so that all learners can receive counselling. The focus should be on learners' strengths rather than on their areas for growth or development ('weaknesses'). The aim should ultimately be to enhance their personal, physical, emotional-social, and spiritual well-being and resilience.

It is particularly concerning that learners' mastery of critical development tasks has been seriously negatively impacted by the pandemic.

Learners' inadequate mastering of critical developmental tasks

The pandemic has hampered the ability of many disadvantaged learners to master basic developmental tasks. It has also led to isolation from their peers, inadequate expression of their emotions, inadequate normalisation of their experiences, and insufficient participation in sport and social events. Many learners have been so traumatised by the pandemic that they may experience post-traumatic stress for many years to come.

Erikson emphasises the importance of children's mastering critical developmental tasks during the following five stages of their development[32]:

1. First stage (1–2 years; essential trust contrasted with mistrust). Infants may develop anxiety if their care and trust needs are not addressed, which may lead to their distrusting other people.
2. Second stage (2–4 years; autonomy contrasted with shame and doubt). Infants become more independent and develop a will of their own provided they achieve a good sense of self and an adequate degree of personal control over their over physical proficiencies.
3. Third stage (4–5 years; initiative contrasted with guilt). Young children often develop a sufficient level of resolve to accomplish goals and acquire a sense of direction in their lives provided they are allowed to attempt to complete specified tasks on their own successfully (explore their capabilities).
4. Fourth stage (5–12 years; industry contrasted with inferiority). Young children often try to develop new proficiencies and gradually become more competent and able to execute more complicated tasks. Their chances of achieving a satisfactory level of self-worth and self-belief are increased if significant others acknowledge and reward their efforts appropriately and encourage them further.
5. Fifth stage (13–18 years; identity contrasted with role confusion). Significant others' constant support and reassurance are vital in helping teenagers develop a sufficient sense of identity (discover who they are). During this stage, they gradually become more independent of significant others provided the significant others give them sufficient opportunity to take on and complete tasks that are increasingly challenging.

Erikson's[32] views are strongly aligned with developmental psychology theories (Piaget[33]) as well as perspectives that emphasise the importance of integrating new knowledge into existing schemata. They are also in line with the (constructivist) view that idiosyncratic (individual) (self-) constructions do not occur in a void but are constructed in the context of interpersonal and social relationships as well as social systems. A reciprocal relationship exists between such systems and how individuals 'make meaning'.

Erikson[32], Freud[34], and Savickas[35,36] agree that the inability to master age-appropriate assignments is likely to result in the repeated re-emergence of these tasks later in life as a kind of pathology. Pain that has been 'suffered' earlier in learners' lives and/or age-appropriate assignments that have not been mastered adequately should be dealt with to ensure psychologically healthy development in learners. If these issues are not properly resolved, learners may re-experience the pain or the frustration

at not having mastered the assignments.[34] The findings of the literature overview (discussed above) indicate clearly the devastating effect of the pandemic on learners' mastery of multiple critical developmental tasks across the board. Timely intervention is needed to prevent, or at least ameliorate, the consequences of the pandemic in this regard.

Short-, medium-, and long-term implications of the pandemic

The primary focus of education stakeholders during the past 24 months has been on finding ways to deal with the short-term impact of the pandemic (such as deciding on and implementing measures to curb the spread of the virus and maintain a satisfactory level of teaching and learning). The medium-term impact has also received attention (such as ensuring that learners' knowledge base, academic achievement, and emotional-social well-being are not unduly compromised). The long-term impact of unmastered developmental tasks and 'pain' experienced earlier in learners' lives, as discussed above, is of particular importance. Many of the effects of the pandemic may manifest pathologically later in life. Psychologists working with school learners and students at tertiary level will require training on how to deal effectively with psychological challenges as and when they occur. Parents and guardians will also require training on how to promote the mastery of basic developmental tasks in their children.

In the next section I reflect on how to rekindle both disadvantaged and other learners' sense of hope and purpose in the current challenging times. I do this through the lens of counselling for career construction as an example of an intervention that holds considerable promise for transformative change.

Clarifying learners' career-life identity

From an early age, people seek to know who they are, where they fit in[37], how to achieve good academic and sports results, what direction to take in their future careers, find a 'job', provide for themselves and their families, and live meaningful lives – a never-ending, existential search. According to Flanagan et al., '[y]oung people's work and life roles are not siloed from one another; they require a multi-dimensional, whole-person approach to support'[38(p.27)]. The extent to which teachers can help learners clarify their career-life identity, improve their sense of self-respect and dignity (essential elements of psychological health), and appreciate the overlap between their personal and career life roles is important in assessing the success of the learning process (in addition to quantitative measures such as learners' scores in tests and examinations).

In the next section, I draw on the work of Savickas[35,36] and others to propose a theory-based strategy aimed at helping learners elicit their life themes and enact them in their career-lives and also at helping them actively master what they have passively endured to clarify their career-life identities. In this regard, I look at the pandemic as a way of creating opportunities. I agree with Kift et al. who maintain that '[c]rises can present opportunities for transformative change'[39(p.27)]. Discussions on the pandemic should shift from stressing the magnitude of challenges to using a 'positive career counselling' approach to find innovative solutions to these challenges. I elaborate below on how counselling for career construction can help meet the career counselling needs of disadvantaged learners in particular. I discuss also the value of building on the strengths of such counselling to achieve the kind of transformative change referred to above, to help these learners deal with the traumatisation of the pandemic[40], and to restore their sense of agency, empowerment, dignity, self-respect, and purpose.

Contextualised and innovative career counselling for disadvantaged learners

Dealing with the impact of the pandemic calls for introspection, reflection, open-mindedness, and a 'radical' reassessment of current thinking about career counselling in South African schools. These schools, in general, do not meet the distinctive career counselling needs of disadvantaged learners[41] or their existential needs. Disadvantaged learners' prospects of finding work are diminishing as are their chances of later remaining in one organisation for a long period of time. Yet, most of them (if they do at all receive career counselling) are 'told' what to become by career counsellors operating from the traditional vocational guidance ('test-and-tell') perspective. This approach has been described as unidirectional (non-dialogic), prescriptive, and non-responsive to contextual circumstances.[9,37] Drawing on this approach, career counsellors (who are considered 'the experts' on their assessees) 'tell' or advise assessees which fields of study, associated careers, and work environments would best 'match' or 'fit' their personalities. It was also believed that people could choose careers in which they could remain for a lifetime. In these careers, they could actualise (realise) or develop their (objectively assessed) potential optimally, be promoted regularly, and steadily climb the corporate ladder.[30] Most (disadvantaged) learners are interested merely in finding 'a job' that will help them either 'survive' or augment the income of their family. They are rarely confronted with the notion of being able to choose and construct a career and design themselves. Innovative, contextualised career construction counselling seems to be an idea whose time has come. Maree and Beck[42] have shown how much disadvantaged learners can benefit from being allowed to express themselves and narrate their micro-stories instead of being compelled to merely select responses from given sets of possible answers. Expressing themselves helps them establish a sense of control in their career-related decisions.

A postmodern, integrated qualitative-quantitative career counselling approach differs widely from the outdated one-job-in-a-lifetime approach. Narrating one's micro-stories is central to acquiring a stable sense of self and identity – key elements that will sustain people's stories in traumatic times. Career counsellors should be trained to listen *for* (rather than *to*) learners' life stories[43] as this will better enable them to help learners clarify, not only what field of study and associated career to go into, but also the 'deeper' meaning of their lives – such as who they essentially are and why they are here[44].

Although the theoretical framework of the intervention approach advocated here is counselling for career construction, career construction theory is closely linked to self-construction theory, which is discussed briefly below.

Self-construction theory

According to Guichard[45], the basic premise of self-construction theory is that learners take the initiative in constructing themselves through their interpersonal relationships. Self-construction theory holds that learners 'make meaning' through numerous small, medium, and long-term communications and by drawing on their memories – inspired in the process by their anticipated futures. By executing different private and career-related roles, learners develop, grow, communicate with others, and demonstrate a broad array of attitudes and behaviours. Over time, doing so helps them construct (as opposed to 'find') a sense of meaning and purpose in their lives. Ultimately, this trajectory helps them clarify their sense of identity (clarify who they are).

Career construction theory

The rapidly changing world of work and the global economy impose challenges regarding the appropriate selection of careers, necessitating a more contemporary, blended theoretical approach to career counselling. Career construction theory, according to Savickas[35,36], merges three career counselling approaches. First, the differential approach focuses on individual differences and fitting people to 'appropriate' work environments. Second, the developmental approach focuses on the different roles people fulfil in different life stages and how they develop careers by examining their readiness for different positions in organisations. Third, the psychodynamic (narrative, qualitative or storied) approach focuses on uncovering central life patterns, themes, and meaning for individuals in their emerging life stories and experiences.[35] Career construction theory has four facets: construction (narrating life stories), deconstruction (unpacking the meaning of these stories), reconstruction (transforming painful stories), and co-

construction (constructive co-authoring of people's stories by career counsellors and their clients).[35,36]

Career construction theory advances the idea of the self as people's internal, inspiring polestar that is drawn on to navigate career-life transitions. This approach is suited to identifying disadvantaged learners and to helping them elicit advice from within regarding critical career and personal life questions. Its primary point of departure is that every story starts with pain. Career construction intervention helps counsellors elicit clients' micro- life stories, which are then woven into a consistent macro-story. It focuses on the subjective facets of clients' personalities, on clients' uniqueness instead of their similarity, on clients' life themes rather than their interest patterns in isolation, and on action and forward movement.[35] Clients engage actively in authoring their life stories to help them find meaning and purpose in what they do, the core aim of life design.[35-46]

Narratability and autobiographicity

Counsellors provide clients with a safe ('sacred') space or holding environment[35-47] and thus promote the narration and connecting of their micro-stories to allow their central life themes to emerge (narratability). Autobiographicity is facilitated in this way. In other words, clients are provided with scripts (their autobiographies) consisting of proven success recipes ('blueprints') containing inner advice for finding answers to important personal and career-related questions and possible future challenges when they have to navigate transitions in the workplace. Narratability and autobiographicity help people take advantage of change[35] and move forward actively (actionality).[48] Narratability and autobiographicity also increase people's adaptability (help them adapt to ongoing workplace changes) and their employability (help them become more employable).[49]

The healing potential of enacting life themes

Life themes relate to unresolved personal trauma experienced by people earlier in their lives (and at work) and to unmastered developmental tasks.[32,33,50] Resolving such trauma and unmastered tasks is essential for people to deal successfully with occupational and personal transitions in today's ever-changing workplace. Counsellors engaged in assisting people in resolving unresolved trauma and mastering unmastered developmental tasks contend that eliciting and using life themes can help people clarify who they are, where they are heading, and the purpose of their lives. However, career counsellors rarely undertake such elicitation and use of life themes as many erroneously believe the strategy is too complex and challenging.

Drawing on counselling for career construction, I conceptualised and devised two novel career-counselling assessment instruments to facilitate the administration of contextualised, integrative QUALITATIVE-quantitative (uppercase indicating the priority accorded the qualitative paradigm) career construction intervention in individual and group contexts.[8]

Integrative QUALITATIVE-quantitative career construction counselling

This approach elicits and can be used to merge people's 'stories' (qualitative data) with their 'objective' (quantitative data) scores in tests. There is currently global acceptance of the importance of bringing into play people's uniqueness and sense of identity rather than emphasising the similarity between their 'test profiles' and the test profiles of others.[51] Uncovering and helping people perform their key life themes is prioritised over merely trying to elicit and use their interest patterns during the career-counselling process. Also prioritised is assisting people in enacting their career-related intentions and moving forward (transforming 'tension' into not only 'intention' but into real action).[35,36,52] From an 'active mastering of passive suffering' point of view, the integrative approach sees unmastered developmental tasks also as life themes that need to be uncovered and enacted in people's lives. These themes should then be channelled into the healing of others and the self. Integrating stories and scores culminates in enabling people to develop their mission statements in conjunction with vision statements.

Developing mission statements in conjunction with vision statements

Integrative career counselling concludes by crafting assessees' mission statements in conjunction with vision statements. First, assessees are requested to draw on their responses to questions asked during the career construction intervention to craft a sentence (an identity, value, or power statement) that merges their strengths and areas for growth into one value, power, or identity sentence that conveys their distinctiveness.[35,36,52] This is followed by extracting appropriate words and phrases from their reflections on questions asked during the intervention to complete a merged sentence that captures the spirit of their unique (career-)life story narrative. This sentence should reflect their future career-life intentions and connect to their so-called character arc and also briefly connect the beginning of a critical theme, its current status, and the envisaged end to the solution of a personal 'issue'. The sentence should shed light on what assessees want to achieve in their careers to experience personal meaning [mission statement]. It should also speak to how they wish to convert personal issues into social contributions and, at the same time, experience a sense of fulfilment, purpose, and hope in their (career-)lives [vision statement]. While counsellors serve as 'editors' of these statements or narratives, assessees themselves craft these statements and draw on inner advice for key 'ideas', wisdom, and advice. Subsequently, short-, medium-, and longer-term goals (in line with assessees' central purpose) aimed at enacting these statements are set and seen through to enactment by regularly following up on assessees' progress.

Value of the integrative approach

This article supports Laher's view that a paradigm shift is necessary for psychological assessment (and intervention) to be accessible to people throughout the world[13] – in particular people with low socio-economic status and minimal education and career counselling resources. Laher et al. describe the integrative approach outlined in this article as 'interesting also in [its] diverse applications of narrative research that do not necessarily conform to the method as explicated in methods textbooks'[16(p.11)]. These authors believe that this style of intervention and the associated research provide an 'excellent example of socially relevant research in contexts of practice'.[16(p.11)] It is an approach that yields excellent results in primary, secondary, and tertiary education and enables learners to examine, choose, and execute careers that can help them live purposeful lives.

Limitations

The views expressed in this article are mine alone and fill only a tiny part of the larger intellectual jigsaw puzzle. They may also have been influenced by my particular interest in teaching and learning at various educational levels in general and in disadvantaged areas in particular. Also, because of the relative recentness of the pandemic, we were able to find only a few scholarly publications on the research topic against which to measure my ideas and opinions.

Recommendations and implications for theory, practice, future research, and policy

The pandemic necessitated deep reflection on the strengths and weaknesses of teaching and learning in all teaching and learning contexts in South Africa.[17,53] What is needed is the revamping of teaching and learning strategies at all levels of education in tandem with the training and upskilling of teachers and lecturers to ensure that all learners have access to effective education and career counselling.[2] Particular emphasis should be placed on disadvantaged schools where the need is greatest. First, stakeholders (including teachers, education departments, learners, and their parents) should finalise and agree upon a valid, long-term, contextualised (qualitative) career development/construction intervention strategy. Second, life orientation teachers should be trained to administer qualitative career development/construction to learners under the supervision of psychologists. In addition to training in the fundamental aspects of adapted and contextualised career construction counselling, the training should include basic instruction in the theory

of psychosocial development. Ethical boundaries should be maintained at all levels, including referring learners to other health professionals when they present with problems outside teachers' scope of practice. Third, teachers should receive training in cross-cultural interaction and communication. Fourth, life orientation learning programmes should be revamped by replacing dispensable content with contemporary content (see below for more details) that has been shown to enhance people's 'thriving skills'. Fifth, short-, medium-, and long-term research on the value of this kind of training should be conducted and reported on in local and international scholarly journals. Sixth, additional time should be allocated to life orientation intervention in schools to allow teachers sufficient time to properly execute the intervention advocated here. Seventh, ongoing monitoring of learners' progress should be undertaken to increase the success of interventions. Learners should regularly be informed about available strategies if they experience difficulties with different aspects of their studies (including emotional and social issues). Here, I refer to, for instance, help with their study orientation, help with the provision of general, psycho-educational, and psychosocial information, help with career counselling, and help with digital learning issues. Lastly, a lot of time needs to be invested in these endeavours – there are no 'quick fixes', and a 'one-size-fits-all' approach will also not work).[54,55]

These recommendations should be read in conjunction with general recommendations for the improvement of teaching and learning in marginalised, disadvantaged areas in particular. Many of these recommendations have been referred to directly or indirectly in earlier publications.[18,41] One such recommendation is that libraries and well-resourced technology-enhanced learning centres with adequate connectivity should be established in disadvantaged areas especially to enable vulnerable (at-risk) learners to upgrade their skills base and improve their chances of success in their tertiary studies.[56] Lastly, whereas the above recommendations stress the time and effort needed to implement the recommendations, much time and effort will also be needed to design the learning-oriented programmes discussed earlier.

Conclusion

Steps need to be taken urgently to counter the impact of the pandemic on disadvantaged learners' teaching and learning and to meet their career counselling needs. This will help eliminate existing disparities and improve these learners' work–life future, with positive benefits for the stability and economy of the country.[57]

The implementation in South African schools of the integrative 'hope-, purpose-, and action-'enhancing career counselling strategy discussed in this article could go a long way towards bolstering the sense of agency, empowerment, dignity, and self-worth of learners in underprivileged contexts in particular. It could also promote the career adaptability, the present and future employability, and the meaning-making of these learners.

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Competing interests

I have no competing interests to declare.

References

1. Chinn D, Klier J, Stern S, Tesfu S. Safeguarding Europe's livelihoods: Mitigating the employment impact of COVID-19. Brisbane: McKinsey & Company; 2020. Available from: https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Navigating%20the%20coronavirus%20crisis%20collected%20works/Safeguarding-lives-and-livelihoods-collection.pdf
2. Amnesty International. Broken and unequal: The state of education in South Africa. London: Amnesty International Ltd; 2020. https://doi.org/10.1017/cbo9780511495120.012
3. Turok I, Visagie J. COVID-19 amplifies urban inequalities. S Afr J Sci. 2021;17(3/4), Art. #8939. http://dx.doi.org/10.17159/sajs.2021/8939
4. International Labour Organization (ILO). World employment and social outlook: Trends 2020. Geneva: International Labour Organization; 2020. Available from: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_734455.pdf
5. United Nations (UN). Transforming our world: The 2030 Agenda for Sustainable Development. New York: United Nations; 2015. Available from: https://sustainabledevelopment.un.org/post2015/transformingourworld
6. Gülsen C, Seçim G, Savickas ML. A career construction course for high school students: Development and field test. Career Dev. Q. 2021;69:201-215. https://doi.org/10.1002/cdq.12268
7. Organisation for Economic Co-operation and Development (OECD). The state of school education: One year into the COVID pandemic. Paris: OECD; 2021. Available from: https://www.oecd-ilibrary.org/education/the-state-of-school-education_201dde84-en?_ga=2.28414644.969289406.1630852623-887792630.1630852623
8. Maree JG. Innovating counselling for self- and career construction: Connecting conscious knowledge with subconscious insight. New York: Springer; 2020. https://doi.org/10.1007/978-3-030-48648-8
9. Maree JG. Group career construction counselling: A mixed-methods, intervention study with high school students. Career Dev Q. 2019;67:47–61. https://doi.org/10.1002/cdq.12162
10. Santilli S, Ginevra MC, Di Maggio I, Soresi S, Nota L. In the same boat? An online group career counseling with a group of young adults in the time of COVID-19. Int J Educ Vocat Guidance. Forthcoming 2021. https://doi.org/10.1007/s10775-021-09505-z
11. Sethlare R, Wood L, Meyer L. Exploring group life design with teachers in the context of poverty related psychosocial challenges. S Afr J Educ. 2017;37:1-8. https://doi.org/10.15700/saje.v37n4a1493
12. Maree JG, Molepo JM. Facilitating postmodern career counselling in the Limpopo Province of South Africa: A rocky ride to hope. Aust J Career Dev. 2007;16:62–70. https://doi.org/10.1177/103841620401300310
13. Laher S. Psychology as a discipline in an era of transdisciplinarity. Invited keynote presented at: 1st Pan-African Psychology Congress; 2017 September 18–21; Durban, South Africa.
14. Laher S, Hassem T. Doing systematic reviews in psychology. S Afr J Psychol. 2020;50:450–468. https://doi.org/10.1177/0081246320956417
15. Snyder H. Literature review as a research methodology: An overview and guidelines. J Bus Res. 2019;104:333–339. https://doi.org/10.1016/j.jbusres.2019.07.039
16. Laher S, Fynn A, Kramer S. Research as practice: Contextualising applied research in the South African context. In: Laher S, Fynn A, Kramer A, editors. Transforming research methods in the social sciences: Case studies from South Africa. Johannesburg: Wits University Press; 2019. p. 1–18. https://doi.org/10.18772/22019032750.6
17. Torraco RJ. Writing integrative literature reviews: Guidelines and examples. Hum Resour Dev Rev. 2005;4:356–367. https://doi.org/10.1177/1534484305278283
18. Brown J. COVID-19: Children eat wild plants to survive as hunger explodes [webpage on the Internet]. c2020 [cited 2022 Jan 14]. Available from: https://www.capetownetc.com/news/covid-19-children-eat-wild-plants-to-survive-as-hunger-explodes/
19. Lawal AM. Whose mental health suffered the most during COVID-19 lockdown in Nigeria. The Conversation. 2021 March 14 [cited 2022 Jan 14]. Available from: https://theconversation.com/whose-mental-health-suffered-the-most-during-covid-19-lockdown-in-nigeria-155890
20. Mareş G, Cojocariu V-N, Cîrtiţă-Buzoianu C. Making career decisions in the context of the COVID-19 pandemic. An analysis of disadvantaged student groups. Postmod Open. 2021;12:328–346. https://doi.org/10.18662/po/12.1/264
21. Education in SA. 500,000 dropped out in 16 months [video file]. 2021 September 29 [cited 2022 Jan 13]. Available from: http://www.youtube.com/watch?v=0Q2poe4R0Qg
22. VanderPlaat M. Activating the sociological imagination to explore the boundaries of resilience research and practice. Sch Psychol Internat. 2016;37:189–203. https://doi.org/10.1177/0143034315615938

23. South Africa. National Education Evaluation and Development Unit (NEEDU). School functionality in the COVID-19 environment: Practical examples of what works and does not work. Pretoria: Department of Basic Education; 2021. Available from: https://cramsurvey.org/wp-content/uploads/2021/07/11.-Shepherd-D-_-Mohohlwane-N.-2021.-Changes-in-education-A-reflection-on-COVID-19-effects-over-a-year.pdf

24. Theron LC. Facilitating adaptability and resilience: Career counselling in resource-poor communities in South Africa. In: Maree JG, editor. Psychology of career adaptability, employability and resilience. New York: Springer; 2017. p. 145–159. https://doi.org/10.1007/978-3-319-66954-0_9

25. Briddick WC, Sensoy-Briddick H. Paradigm and promise: Life-design, psychology of working, and decent work. In: Maree JG, editor. The psychology of career adaptability, employability, and resilience. Dordrecht: Springer; 2017. p. 317–327. https://doi.org/10.1007/978-3-319-66954-0_19

26. Bronfenbrenner U. Making human beings human: Bioecological perspectives on human development. Thousand Oaks, CA: Sage; 2005.

27. Cedefop, European Commission, ETF, ICCDPP, ILO, OECD UNESCO (CEEIIOU). Career guidance policy and practice in the pandemic: Results of a joint international survey – June to August 2020. Luxembourg: Publications Office of the European Union; 2020. Available from: http://data.europa.eu/doi/10.2801/318103

28. Olivier W. Education post-COVID-19: Customised blended learning is urgently needed. The Conversation. 2020 May 24 [cited 2022 Jan 11]. Available from: https://theconversation.com/education-post-covid-19-customised-blended-learning-is-urgently-needed-138647

29. Pillay AL. Prioritising career guidance and development services in post-apartheid South Africa. Afr J Career Dev. 2020;2:1–5. https://doi.org/10.4102/ajcd.v2i1.9

30. Savickas ML. Life design: A paradigm for career intervention in the 21st century. J Couns Dev. 2012;90:13–19. https://doi.org/10.1111/j.1556-6676.2012.00002.x

31. Pillay I. The impact of inequality and COVID-19 on education and career planning for South African children of rural and low-socioeconomic backgrounds. Afr J Career Dev. 2021;3, a36. https://doi.org/10.4102/ajcd.v3i1.36

32. Erikson EH. Childhood and society. 2nd ed. New York: WW Norton; 1964. https://doi.org/10.1126/science.113.2931.253

33. Piaget J. Judgement and reasoning in the child. London: Routledge; 1999. https://doi.org/10.4324/9780203207260

34. Freud S. The dissection of the psychical personality (Lecture 31). In: New introductory lectures on psychoanalysis. London: Penguin; 1991. https://doi.org/10.1037/e417472005-581

35. Savickas ML. Theories of psychotherapy series. Career counseling. 2nd ed. New York: American Psychological Association; 2019. https://doi.org/10.1037/0000105-000

36. Savickas ML. Career construction theory: Life portraits of attachment, adaptability, and identity. Rootstown, OH: Author; 2019.

37. Hartung PJ. Life design in childhood: Antecedents and advancement. In Nota L, Rossier J, editors. Handbook of life design: From practice to theory, and from theory to practice. Gottingen: Hogrefe; 2015. p. 89–101. https://doi.org/10.1027/00447-000

38. Flanagan SK, Margolius M, Ismail B, Hynes M, Jones EP. Finding a way forward: Young people's experiences navigating the world of work. Washington: Centre for Promise; 2020 [cited 2022 Jan 04]. Available from: https://www.americaspromise.org/sites/default/files/d8/FindingAWayForward_FINAL.pdf

39. Kift S, Zacharias N, Brett M. The best chance for all: A policy roadmap for post-pandemic panic. Stud Success. 2021;12:26–36. https://doi.org/10.5204/ssj.1782

40. Prideaux E. How to heal the 'mass trauma' of Covid-19. BBC Online. 2021 February 04 [cited 2021 Dec 15]. Available from: https://www.bbc.com/future/article/20210203-after-the-covid-19-pandemic-how-will-we-heal

41. Maree JG. The outcomes of a mixed-methods, innovative group life design intervention with unemployed youths. Int J Educ Vocat Guidance. Forthcoming 2021. https://doi.org/10.1007/s10775-021-09514-y

42. Maree JG, Beck G. Using various approaches in career counselling for traditionally disadvantaged (and other) clients: Some limitations of a new frontier. S Afr J Educ. 2004;24:80–87.

43. Welty E. One writer's beginnings. Cambridge, MA: Harvard University Press; 1998. https://doi.org/10.1017/cbo9780511485596.018

44. Maree JG. Counselling for career construction. Connecting life themes to construct life portraits: Turning pain into hope. Rotterdam: Sense; 2013. https://doi.org/10.14426/jsaa.v1i1-2.29

45. Guichard J. Self-constructing. J Vocat Behav. 2009;75:251–258. https://doi.org/10.1016/j.jvb.2009.03.004

46. Staunton T. Mark Savickas and Life Design – theories every careers adviser should know. BBC Online. 2017 August 16 [cited 2021 Dec 19]. Available from: https://runninginaforest.wordpress.com/2015/03/08/marksavickasandlifedesigntheorieseverycareersadvisershouldknow/

47. Winnicott DW. Maturational processes and the facilitating environment. London: Hogarth; 1965. https://doi.org/10.1093/med:psych/9780190271398.003.0042

48. Krieshok TS, Black MD, McKay RA. Career decision making: The limits of rationality and the abundance of non-conscious processes. J Vocat Behav. 2009;75:275–290. https://doi.org/10.1016/j.jvb.2009.04.006

49. Fugate M, Kinicki AJ, Ashforth BE. Employability: A psychosocial construct, its dimensions, and applications. J Vocat Behav. 2004;65:14–38. https://doi.org/10.1016/j.jvb.2003.10.005

50. Maree JG. The psychosocial development theory of Erik Erikson: Critical overview. Early Child Dev Care. 2021;91:1107–1121. https://doi.org/10.1080/03004430.2020.1845163

51. Swanson J. Understanding the complexity of clients' lives: Infusing a truly integrative career-personal perspective into graduate training. Couns Psychol. 2002;30:815–832. https://doi.org/10.1177/001100002237756

52. Hartung PJ. Life design: A unifying paradigm for international counseling psychology. Keynote paper presented at: The 29th International Congress of Applied Psychology; 2018 June 26–30; Montréal, Canada.

53. Schleicher A. The impact of COVID19 on education. Insights from education at a glance. Paris: OECD; 2020. Available from: https://www.oecd.org/education/the-impact-of-covid-19-on-education-insights-education-at-a-glance-2020.pdf

54. UNICEF. Learners in South Africa up to one school year behind where they should be. Pretoria: UNICEF South Africa; 2021. Available from: https://www.unicef.org/press-releases/learners-south-africa-one-school-year-behind-where-they-should-be

55. Savickas ML. Career construction theory and counseling model. In: Lent RW, Brown SD, editors. Career development and counseling: Putting theory and research into work. 3rd ed. New York: Wiley; 2020. p. 165–200. https://doi.org/10.1037/0000105-008

56. Changes planned for colleges and universities in South Africa. BusinessTech. 2021 September 28. Available from: https://businesstech.co.za/news/technology/524530/changes-planned-for-colleges-and-universities-in-south-africa/?utm_source=everlytic&utm_medium=newsletter&utm_campaign=businesstech

57. Reddy V. COVID learning losses: What South Africa's education system must focus on to recover. The Conversation. 2022 February 22 [cited 2023 Mar 02]. Available from: https://theconversation.com/covid-learning-losses-what-south-africas-education-system-must-focus-on-to-recover-176622

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The precarity of women's academic work and careers during the COVID-19 pandemic: A South African case study

The novel coronavirus set off a global pandemic of the COVID-19 disease that affected higher education institutions in profound ways. Drawing on the experiences of more than 2029 academic women, this article shows the precarity of academic women's work under pandemic conditions. We analysed seven persistent themes that emerged from the qualitative analysis of the open-ended responses to an online survey across South Africa's 26 higher education institutions. In short, these seven factors have rendered women's work precarious with serious implications for an already elusive gender inequality in the academy. Finally, we aim to provide insight for academic leaders and policymakers to accommodate support for women academics and families in higher education during this time and in the future.

Significance:

- This study offers a detailed empirical analysis of the pandemic disruption of women's academic work, confirming the precarious nature of their employment within the academy.
- The study shows that the variability in employment agreements for women contributes to the uncertainty that they already experience in terms of their careers and progression within the academy.
- Suggestions are made for higher education institutions to remedy the negative consequences of the pandemic lockdown for women's academic work and their professional futures.

Introduction

In the months immediately following the announcement of the novel coronavirus that set off a global pandemic of COVID-19 in 2020, there were already studies pointing to the unequal effects of nationwide lockdowns on female scientists.[1-3] At the same time, there appeared powerful narrative accounts of the emotional labour of academic lives[4], the emotional toll on female academics[5], and the unique challenges of the work–life balance for single academics[6]. Much of the literature was, however, based on statistical summaries of large-scale survey data or the individual experiences of one or more female academics.

Of course, gender inequalities in academic work preceded the coming of the coronavirus. Long before the pandemic, gender inequality in the academy was well established in research on women's recruitment, representation, recognition, compensation, leadership and productivity.[7] These factors have rendered women's work precarious, and the *systemic* and *institutionalised* nature of inequality has been well documented.[8,9] For example, in 'The Pandemic and the Female Academic'[10], Minello makes the vital point that for women, 'The beginning of an academic career is marked by a prolonged period of precariousness, one which coincides with women's productive period'.

Precarity is not a new concept within the academy[11], but an appreciation of its causes and effects has become more acute during the current pandemic. A recent collection of essays[12] captures the ubiquitous sense of uncertainty within the higher education sector. O'Keefe and Courtois[13] argue convincingly that precarious work and the lack of gender parity in academia result in female academics feeling like 'non-citizens' in the academy. Ivancheva et al.[11] put forward the idea for 'a more complete understanding of precarity that should take account not only for contractual security but also affective relational security in the lives of employees'.

Much has been written about the unequal effects of the pandemic on female scientists[1,14,15], yet little is known of the precarious academic work performed by the most vulnerable members in the workforce. In this research, we synthesise data out of the first large-scale survey on the precarity of women's academic work – this segmental analysis of a South African national study demonstrates the precarity of academic women's work during the enforced pandemic lockdown. Emerging evidence has been dominated by quantitative analyses.[1,14,16] These studies suggest that the COVID-19 pandemic disrupted the global academic enterprise in several ways. In this study, however, by using a qualitative approach, we aim to provide an account for, and explanations of, the precarity of women's work within the academy.

A theoretical perspective on gender and academic precarity from the Global South

There has been a steady criticism of the flattening effects of the Eurocentric narrative in studies of precarity[17] and the corresponding need for intersectional perspectives on precarious work[18]. It has also been argued that South Africa's academic labour market is very different from that of the Global North.[19] The dominant studies reviewed for this article start with the effects of late capitalism on the precariat, and yet, for large parts of the world's population, the roots of precarity lie within processes of colonialism[20(p.587-588)] and, in the context of this study, the ideology of apartheid which gave particular expression to gendered and racialised constructions of academic work.[21,22]

The academic labour market in South Africa faces some critical challenges that reflect on the career trajectories of lecturing staff. According to the latest available data from the Higher Education Management Information System (HEMIS 2020, personal communication), most academics are on temporary appointments (25 094 or 56.1%). The senior professoriate is still mainly white and male while the lower levels of appointment (junior lecturer, lecturer) mainly black especially in the former white universities. More men (10 314) than women (9587) are employed as research and instruction staff while many more women were appointed in administrative jobs (5758 more). This means that in a country with considerable political pressure and policy imperatives directing universities to employ more women and especially more black women in senior academic and management appointments, the pandemic disruption could be expected to slow down, if not negate, for the moment, those important commitments.[23]

The significance of this study, therefore, is two-fold. First, it makes visible the social relations of precarity within post-apartheid universities; and second, it demonstrates how, under extreme conditions (that is, a global pandemic lockdown) precarious academic work is experienced among women in higher education. The findings have implications for institutional policies regulating academic work that is at once sensitive to the diverse needs of different women in the academy even as it is attentive to the shared needs of all women in a patriarchal society.

The existing literature is not inattentive to *difference* in studies of precarity in women's work. Moreau[24], for example, examines how gender inequalities are produced differently among teachers in the contexts of English and French secondary schools. A study in a single Icelandic University shows how 'academic housework' (academic service work that receives little recognition in the making of careers) is unequally distributed between senior academics and newcomers.[25] Writing from the United Kingdom, Henderson and Moreau[26] argue that academics with caring responsibilities negotiate conferences as 'a mobility imperative' compared to those with no significant caring responsibilities. And in another single country study, Angervall and Beach[27] delineate how women chart their academic careers differently in relation to academic work such as teaching versus research, and how gendered attributes, such as care and competitiveness, constrain advancement in the Swedish academy; similar themes have been explored in South African studies on women and careers.[28]

What is missing in the prolific writings on gendered work and precarity in the academy are sustained accounts of the micropolitics of precarious work in the Global South, and then under conditions in which doing academic work from home is enforced by a pandemic-enforced lockdown. With respect to the first concern, this study responds with a political analysis of 'the experiential and subjective dimension of precarity'[29(p.16)] inside Southern institutions; and in respect of the second concern, this is one of the first empirical accounts of the workings of precarity in pandemic times. Given emerging evidence of the disproportionately negative effects of the pandemic lockdown on the future of women's academic careers[30,31], this study clearly has implications for the future of representation in the academy, given still unresolved concerns about gender justice and equity beyond the South African case.

The size, differentiation and shape of the South African higher education system has been written and contested about extensively.[32,33] Along with political and social changes brought by the new dispensation after 1994, were full-scale mergers amongst higher education institutions. It is well documented that under colonialism and apartheid, the social, political, and economic discrimination and inequalities of race profoundly shaped South African higher education, establishing patterns of systemic inclusion, exclusion, and marginalisation of particular institutions, social classes and groups.[32,33] In order to move away from the notion of historically black and disadvantaged institutions and historically white and advantaged ones, the restructuring of the sector led to 23 universities being established, with 3 additional institutions opening after 2007 to bring the current number of public universities in South Africa to 26.

Method

As part of a broader study addressing the impact of the pandemic lockdown on female academics, this study reports on the experiences of 2029 participants from 26 higher education institutions.[9,31] The largest numbers of responses per institution were from the University of South Africa with 287 responses; the University of Pretoria with 185; Stellenbosch University with 172; and the University of Cape Town with 111. To protect privacy, respondents are not identifiable beyond their institution, and no response will be attributed to any university in this paper. The career stages of respondents were evenly spread, with the largest group of respondents (29.8%) in the 0–5-year range of academic appointment. Ethical clearance was obtained from all of the participating universities following their prescribed processes. Clearance certificates were received from all but one university, and that one provided management consent to recruit participants. Participation was voluntary.

A pilot study was instrumental in the development of the study protocol and survey tool. Based on the pilot and the feedback received, the research team adapted the survey, reached consensus, and finalised it for distribution. A Likert-scale questionnaire consisting of 12 questions was subsequently distributed online, which remained accessible for responses for 3 months, from 1 July 2020 to 30 September 2020. The survey concluded with an opportunity for participants to share a narrative reflection on experiences of the enforced lockdown that impacted on their academic work. The qualitative content analysis of over 221 000 words followed a conventional approach, in which coding categories were derived directly from the text. The coding process started with all of the researchers reviewing the text independently. After reviewing and coding the responses, we reviewed each other's codes as a means of quality control. Seven themes were collectively identified as encapsulating the precarity of women's academic work and careers during the lockdown.[34] All of the researchers made use of ATLAS.ti version 22.0.0, a qualitative data analysis software program.

While the survey was open during a specified period, participants' narratives included reflections from 'level 5' through 'level 2' of South Africa's five-stage risk-adjusted strategy; the most severe regulations were at level 5 and the least at level 1. The lockdown phases were: level 5 from 23 March, level 4 from 1 May, level 3 from 30 June, and level 2 from 18 August to 30 September 2020. Face-to-face contact was not permitted during this period at any South African public university, except in certain fields such as medical student practicums and laboratory work.

In terms of reporting the findings, we use two identifiers to provide a richer description. These are parental status and academic career level. For career level, we classified women who had been in academia for less than 5 years as *early career*; for those in academia for more than 5 and less than 10 years as *mid-career*; for those with more than 10 and less than 15 years' experience as *experienced academic*; and, for those who had more than 15 years' of academic experience as *established academic*.

Findings

In presenting the narratives of academic women at different career stages across South Africa's 26 public universities, seven persistent themes emerged from the qualitative analysis of the 2029 open-ended responses to the online survey. These themes are: (1) the instability of appointments; (2) promotion prospects; (3) sabbaticals; (4) funding terms; (5) the interruption of postgraduate studies and an academic career; (6) a sense of resignation: is an academic career really worth it? and (7) the precarity of probation.

The instability of appointments

In the period 2005–2016, the higher education sector in South Africa saw an increase in both permanent and temporary academic staff; these data are presented in a Council on Higher Education (CHE) review[36] that points to a 'casualisation' of academic work and an increased 'precariousness' of the academic profession. For staff who are not permanently employed, this means that their academic career

is dependent on the 'precarity'[35] of temporary conditions of service that puts them at risk[36(p.299-300)].

A recurring theme that emerges from the qualitative data is the severity of the effect of the COVID-19 pandemic for many women who are not permanently employed because of the precariat nature of their conditions of service. The academic women in this study that constitute non-permanent staff include part-time employees, postdoctoral fellows, e-tutors (at the country's largest distance education university), external markers, and those existing on the precarity of soft-funding for short-term research projects.

Aligned to the arguments presented in the CHE review, the precarity of the temporary conditions of service for non-permanent academic staff during this once-in-a-lifetime pandemic has wreaked havoc on the academic futures of these female scholars, as one of them explained:

> *I have been on two three-year rolling contracts of some sort (first postdoctoral, then as a researcher) that were all self-funded (salary-wise) by independent funding since completing my PhD in 2009. I don't have the luxury of having one 'bad' year publication/output wise since I am not likely to have a fixed, permanent appointment at my institution and need to keep performing at a high level to be successful for competitive external grants for my employment.* (Experienced academic and mother of three young children)

Another experienced academic scientist reported that she needs postgraduate students to supervise and for the science laboratories to remain open. Without access to the lab, no tests can be run, and therefore no articles can be published. While there was, for her, fortunately, 'some data to write-up in the meantime', future outputs looked bleak. Even for project managers, the situation was dire: 'My main responsibility is research management, but no data collection is possible, which will impact my career', reported one established academic with a child in primary school and another in high school.

Performing artists, on the other hand, depend on opportunities to perform in public in order to advance academic goals and to earn an income. As one such artist expressed, the pandemic changed all of that:

> *I'm writing as a 'performing artist' who also works in the academia – this lockdown has made my life come to a standstill … where I am unsure about the future of my art – music is part of who I am – it is my identity – and without it, I feel an incredible loss. This pandemic made me dig deep to find other ways of being creative, since I can't perform in any concerts, festivals, or live events for the foreseeable future. My husband is a health-worker and it basically left me as a single parent with two boys aged 7 and 16, as well as working for 3 academic institutions. There is no number of words that can describe my feelings at this moment.* (Established academic with primary school student and a high schooler)

Thus, the anxiety about job security is the same for the bench scientist unable to access the laboratory as it is for the performing artist who cannot access a theatre. Yet there are other categories of employment that were also threatened by the lockdown, such as e-tutors and external markers, especially in the largest academic employer among the 26 public universities – the University of South Africa (Unisa), the continent's largest open distance learning institution. As the financial hardship of the lockdown hit universities, these additional staff were the most vulnerable to layoffs, as one examiner recalled:

> *As an external marker, the workload decreased significantly as there were no written June exams, so loss of work (and income from this work) as exams were changed to multiple-choice online exams.* (Early-career academic with two children in primary school)

We know that external examination is by its very nature often a short-term and temporary contract. What is reflected is the negative effects of the pandemic as well as how much precarious academic staff rely on these forms of additional income. This precariousness of academic work thus can act as a disincentive for many to pursue an academic career.

Promotion prospects

While holding onto a contract job was one problem, being *promoted* within an existing job was a different challenge that also could upend an academic career. Given the multiple demands on women during the lockdown, there was often a sense of being overwhelmed:

> *Trying to juggle research, lecturing, and supporting my students, attending numerous Zoom meetings; as well as cleaning house, making food and being a teacher to my children, I feel like I'm failing at everything. I don't have the skills or tools needed for online teaching. I know that this will be held against me during promotion. As much as lecturing and research is my passion, I'm seriously considering looking for other work, which breaks my heart.* (Early-career mother of two young children)

This sense that the rules of advancement have not changed, despite the impact of the pandemic on academic work, is something that runs through the responses of hundreds of women in this study, as this sampling of women's voices indicates:

> *My family and my students have been my main priority, but I'm yet again falling behind in the race to publish articles, the only thing that seems to be taken into consideration when applying for a promotion.* (Mid-career academic with two children in primary school)

> *My year was already over-committed with outputs towards academic promotion, and when the lockdown was announced, those outputs remained … I know, come time for promotion, none of the men, and also none of the women without young children or older children who require special attention, are going to give me an inch of slack. It will be 'well you know, such and such did it, why are you not able to?' So, I give up on sleep and doing exercise, so that I can squeeze every living minute out of a day, even over weekends, to make sure that I have something to show for this period of dread.* (Established academic with a child in primary school)

> *I hope universities will take these challenges to our work seriously when it comes to the annual targets academics are required to meet for performance assessment, probation and promotion. Unfortunately, so far there is no indication of this from above, at least not that I have been made aware of.* (Early-career academic without children)

> *I also have the highest teaching load of my division. The workload has really become unfair, as I have to work full-time on a part-time salary. Right now my research is dead. And I was really hoping to get one more article out, so I could apply for a promotion.* (Early-career mother of a pre-schooler)

In these reflections, academic women also gave vent to a harsh reality of advancement in South African universities: the almost exclusive emphasis placed on 'research outputs', even if promotions documents

pay lip service to the importance of teaching and service in the formal metrics.[9]

> *Keeping children learning, while cooking, cleaning and doing chores, and teaching online/ supervising students' clinical work remotely …. As a single parent, this struggle has been intensified during the lockdown … and has generally affected promotion prospects (in spite of excellent teaching rates).* (Mid-career academic with one child in kindergarten and another in high school)

Nor does academic administration carry any weight in promotion considerations, which invariably brings out strong feelings of resentment about the institutional arrangements:

> *The coordinator role I play is not financially rewarded, and has not been considered adequate for promotion. I feel stuck in a bind: compromise the quality of what the students get for my own career progression or stagnate where I am and become resentful.* (Experienced academic without children)

The aspirations and prospects for career progression of academic women were impacted detrimentally during the pandemic lockdown. Increasing workloads and time constraints – attributed particularly to the conversion of teaching and presentation materials for online delivery – as well as the care needs of children and households affected women's advancement prospects:

> *The lockdown has made it impossible for me to spend any time on my research, which will have a huge impact on my prospects of promotion from associate professor to professor. There is thus no time to spend on writing research papers and so forth.* (Mid-career academic with a child in primary school)

Long-term plans for advancement have suddenly been put in jeopardy as a result of the lockdown.[9] In this regard, the restrictions on travel featured prominently in the calculations of those female scholars for whom networks and libraries are important elements in their academic research:

> *The inability to access any of these resources has brought my monograph to a complete standstill … as a historian, my work is completely dependent on archives and archival documents. This requires travel, and, of course, it requires archives to be open (most archives are currently closed). I am very concerned about how all of this will impact my research outputs, as well as my ability to apply for promotion in 2021 (which I've been working towards for 3 years now). Overall, the lockdown has been completely disastrous for my academic work.* (Early-career academic without children)

Heavy academic workloads, coupled with the demands of housework, invariably meant compromising on the standards of research submissions, which, in turn, meant courting risks:

> *By the time I send something, I believe it's not of a good quality and it will jeopardise my progression. It's a never-ending spiral, and now my qualification is suffering because I am unable to give it the attention it deserves and this will also lower my chances of a promotion.* (Early-career mother of two young children)

One respondent recalled the difficulty of pursuing promotion and the financial burdens on the home when her husband lost his job, coupled with the impact of the disease on her family, which lost a member to COVID-19:

> *Psychologically, I am absolutely drained and that is affecting my motivation for work and my ability to concentrate. I reached out to our institution's psychological counsellor and received little help. I have not attended to my own studies at all and cannot be up for promotion in the foreseeable future as a result.* (Experienced academic with a toddler and a pre-schooler)

And then there is an often overlooked aspect of academic work: the high proportion of female scholars who only teach (called 'the fragmentation of work' in the literature), for whom advancement is not on the agenda – a situation described by one female academic at a major research institution who observed of her university that it 'runs on the work of middle-aged women who don't become research professors'.

Compromised sabbaticals

For several academic women in this study, the lockdown coincided with a well-planned sabbatical – the productive period of research and travel leading to publications that would have placed them in a stronger position for advancement. All of those plans fell through because, as one experienced respondent explained: 'The sabbatical was totally wasted, which meant that I elected not to apply for promotion, since I was unable to complete or publish what I had planned to.'

However, it was not only the isolation from the outside world that ruined sabbaticals, but also the combination of housework, schoolwork, and domestic work: 'I was on sabbatical this year with the intention to write up articles and register new projects', as one mid-career academic explained, but the demands of home schooling in the lockdown, and the general care of children, unravelled her academic work. She was not alone:

> *I lost the last month of a sabbatical when the lockdown started because of the school closures. Suddenly my children were at home and needing care and attention as we all tried to make sense of the pandemic.* (Mid-career academic)

> *I should note that I was on sabbatical during lockdown. The constant disruption by the children made working very difficult. I resorted to getting up early and working for 2 hours before they woke to keep me on track with tasks.* (Early-career academic)

Being on sabbatical without access to the full range of office and technology support also came at a cost. Participants lamented about scheduled travel plans that could not be fulfilled and the burden of multiple household responsibilities:

> *I am on sabbatical and doing everything on the computer, without a printer* [which] *slowed down review of theses …. More importantly, I had extensive travel and fieldwork plans that are basically ruined.* (Established academic without children)

While the sabbatical offers relief from teaching, one scholar wanted to make the point that there are other demands on women's work that must not be overlooked, even when on academic leave:

> *I have no children and this year was my sabbatical year, so I had minimal teaching and admin responsibilities, so perhaps I am not the ideal target for this survey. However, I have participated in order to point out that the questions have neglected the aspect of labour that falls to women to help run multiple households and care for elderly and vulnerable family members …. I am observing the labour of shopping, cooking, cleaning and dealing with health and welfare*

> *matters for a network of loved ones is falling heavily on women.* (Experienced academic)

What ruins a sabbatical, however, is not only the physical labour demanded in lockdown situations but the emotional trauma of dealing with the larger world in which the family is contained:

> *I was awarded sabbatical in 2020 to complete my PhD study. I would say that I have only managed to work at about 50% of my capacity. I have two very anxious children generally, but with lockdown, the uncertainty around school, drought in our region, and power failures, staying emotionally strong, available and supportive for them was the most draining thing I had to do.* (Mid-career academic)

Simply being at home on sabbatical, however, has also drawn some academic women into the pressing demands of the household, as one explained:

> *My household is relatively egalitarian, but because I am on sabbatical and able to be more flexible, I have ended up taking on the whole of childcare and the children's schooling, in addition to most of the housework and my own job. In the beginning, during lockdown 5, I also helped my partner keep his business afloat and helped with my local neighbourhood Community Action Network.* (Established academic)

In sum, while sabbatical definitely benefitted some academic women without children in the home and with adequate workspaces, most of the female academics in this study found their sabbatical plans compromised by the restrictions on 'getting out' (conferences, libraries, archives, fieldwork, etc.) and by the demands of 'staying in' (childcare, eldercare, housework, etc.). All of this has had an impact on their career advancement within the academy.

Funding terms

Academic women employed on soft funding (that is, not on the permanent payroll of the university) are particularly vulnerable as a result of the pandemic lockdown. When that external funding is threatened or disrupted, the situation of these academics becomes even more precarious:

> *As a soft-funded member of staff, I have not been able to access university support for additional data costs incurred by using internet at home* [and] *the lockdown here (as elsewhere) has affected not just research conduct (i.e., ability to do fieldwork and travel) but also future research prospects for finding funding, as research calls are drying up due to a combination of funders pausing on calls and/or redirecting funding to COVID/health issues. As a soft-funded academic, this has obvious consequences for my future.* (Experienced academic without children)

And it was not only the threat of external funding ceasing, but also the impact on the quality of research that concerned one academic:

> *Aborting data collection has led to smaller sample sizes impacting on the quality of the papers that will be produced. As a soft-funded academic, I have more anxiety about being able to procure future funding for salary support.* (Experienced academic with no children)

The interruption of postgraduate studies – and an academic career

A large group of women in this study hold academic appointments while pursuing their own postgraduate studies as master's or doctoral students. Completing these senior degrees is crucial to their holding on to or obtaining a secure academic appointment. Once again, it is the inevitable entwinement of women's academic ambitions and their domestic obligations that has disrupted the pursuit of further studies:

> *Sometimes I feel emotionally and psychologically stressed because I also want to finish my PhD this year. There is more stress for women because everything is on our plate. For example, I have to do house chores, help my three children with their schoolwork, teach online and focus on my studies.* (Early-career academic)

> *It has been very difficult to get consecutive hours of time to work with a toddler in the house 24/7. It is great getting to spend so much time with my child, but the reality is that I have to finish my PhD this year and this lockdown has delayed me significantly. I have had to work at night and on weekends in the hope of catching up.* (Early-career academic)

What is striking is that, even though some of the female academics in this study hold junior positions (or perhaps because they do), their administrative and teaching workloads combine to keep them from completing their own studies; what the pandemic lockdown has done, of course, is to make an already untenable situation simply impossible:

> *I found (find) this time extremely difficult. I'm teaching eight modules, have master's and honours students, am part of the management team of the department, and am registered for my PhD this year. My husband lost his job during the lockdown, which in turn influenced his motivation in such a negative way that he hardly ever helps out with household chores. My child is 21 months old and was in a creche before lockdown, and even though she doesn't have 'schoolwork', during lockdown I have to focus on her holistic development. How much did I spend on my own academic work? Basically nothing.* (Experienced academic)

When academic women do make progress with their studies, it comes at a serious cost – as with this experienced staff member: 'I am finalising my PhD, so the lockdown has given me time to do that, but burnout is a real threat with 7-day workweeks and no break since my daughter was born.' Still, the workload piles up on these academics, and some reach a breaking point when institutional support systems are not in place:

> *Feeling pressured to produce more work under abnormal circumstances got to me. Especially as a PhD student whose supervisor is a health care provider, the pandemic has had a negative impact* [on] *the time/energy she had to provide* [me with] *supervision. It is extremely tough, and I feel like quitting.* (Early-career academic without children)

Sometimes, the overworked student academic has simply had to find another way of continuing her studies, but this option has clearly been available only to a few, as institutional demands have not abated. As one woman explained: 'I am also busy with my master's research and could not dedicate any time to this. I had to take leave in order to dedicate uninterrupted time to my thesis.'

As in other examples of the precarity of women's academic careers, the question of children during lockdown continues to be the most important reason for disrupted ambitions, as this example illustrates:

> *I had hoped that the lockdown would mean a chance to really focus on my PhD proposal and make some progress, but when it took effect, the demand that my children (age 1 and 3) placed on my time was much more significant than I had first*

> *anticipated. I had to set up two lectures and an online tutorial and that took a lot more time than it usually would have due to only being able to work for around 1 hour a day. It caused me to have some mild panic attacks towards the end and so when I was given the chance, I pushed to get my nanny back so that I could do some work to catch up. It has made a significant impact on my timing of my PhD deliverables.* (Early-career academic)

Inequality in the distribution of academic work among male and female staff is a theme that runs through much of the data on the impact of the pandemic on teaching, research and administration in universities over the lockdown period. This point by one female academic is by no means an isolated one:

> *My male colleagues refuse to bear coordination burdens, citing their PhDs as the main reason. I have read towards a PhD and I am in the process of applying to a PhD programme. My male colleague who is busy with his PhD has been working primarily on the same second-year course since he joined the school 5 years ago. My point is that whilst women do bear disproportionate household responsibilities, they also have to contend with being evaluated unfairly at work.* (Experienced academic and mother of a pre-schooler)

It does not help when a department is short-staffed and the student academic has to carry the loads of others – another theme coursing through the data – and when the academic supervisor is not as available as before. As a result, the frustration of long-delayed promotion opportunities has become even more real during the lockdown:

> *I have not been promoted once in my 13 years at* [University X]*, and I am told it is not due to my excellent teaching or efficient admin, but the lack of measurable research. Hence the PhD. The lockdown has worsened this situation.* (Established academic with an adult child)

The frustration of delay runs deep for female academics, especially those whose labour is demanded for other duties, as in the case of an academic who has a joint appointment doing clinical work in a hospital and teaching work in a university:

> *I've had annual leave set aside for PhD progress cancelled 3 times. I had to defer a presentation of a stage of PhD progression twice. I've now taken a week of annual leave to push that submission but I'm exhausted, too tired to work.* (Early-career academic with no children)

A theme that runs throughout these stories of delayed promotions and appointments is the unfairness of heavy workloads, which, when combined with part-time status, causes incredible stress for the academic concerned:

> *I had, prior to COVID-19, decided to postpone completing my master's due to the stress caused by my financial insecurity as a close-to-retirement, part-time employed (60%) divorcee. Although I am part-time employed, the work is so much (100% plus) that there is insufficient time to do the study I would really love to continue with.* (Mid-career academic without children)

It is not unusual in South African universities that an academic appointment is conditioned upon the continuation of postgraduate studies. This became more important as universities pushed to increase the number of staff with advanced degrees. With the lockdown, the tying of employment to studies became a cause of strain for some academic women:

> *Coupled with guilt and pressure to perform because I am at home (I am single and live alone), so in the perfect world I have 'all the time', I was left in a negative headspace that triggered depression and anxiety that made me consider deferring my master's or leaving it altogether. But at the end of the day, I cannot do that. I am in a programme at Unisa that requires me to be a registered student in order to be employed, so if I quit my studies I should quit my job and that is not ideal for me right now.* (Early-career academic)

Nor is it helpful that academic women feel, again, that the institutional rules for recognition and advancement will not budge in the face of the extraordinary times of a global pandemic and its impacts on further studies; as one early-career woman put it: 'The university's expectations of continued research and PhD progress, as though the interruption to our academic norm has not occurred, is a major stress factor.'

And yet the fact that an academic career is so strongly tied to obtaining higher degrees forces many women to continue hanging on to their studies, despite the emotional and health costs:

> *I am a master's student and I just haven't had the mental strength or the time to work on my proposal. I work a full-time job and I am in academia part-time. The master's is so important, as I would like to have more of an impact in academia in my career.* (Early-career academic with no children)

Sometimes the mental health costs of the lingering pandemic lockdown have taken their toll and led to a sense of resignation among female academics.

A sense of resignation: Is an academic career really worth it?

In one extreme case, an experienced academic and mother of a teenager questioned the very meaning of advanced studies when life itself was threatened: 'What motivation did I have to complete my PhD when I could be dead before graduation?' Another made clear that 'this is not what I signed up for as an academic'. And a third early-career academic came to the conclusion that under such immense pressure, 'COVID-19 may have erased my academic future'. In short, the pandemic itself might have been a precipitating factor in altering the course of many academic women's careers, if not ending them completely.

Such a clear and emphatic feeling of giving up on the PhD and a career was fairly common across the data set:

> *I know I will be looked down upon because I am not publishing and yet I have a PhD but I honestly don't have time. I know I can't complain .... I will never encourage my family member to join academia – it is hell! I haven't received data from the institution. I have been sending e-mails since June. I do all this with my own data and spend R1,000 on data a month.* (Established academic without children)

This is a question many other female academics also asked themselves: Is an academic career really worth it, given what they experienced during the pandemic lockdown? Said one:

> *The communication received from management did not show any understanding for our situation or well-being. It is during this time that I started to weigh up whether all of this was worth my effort.* (Established academic and mother of a pre-schooler)

More than a few academic women spoke of impending retirement, but others of retiring early as an option for an exit from their careers,

given the unprecedented pressures of academic work: 'We were not given a chance to breathe. And I believe a lot of people will take early retirement due to pressure they experienced during the lockdown', said one established academic.

The feeling of being overwhelmed with academic labour more often has led to a sense of resignation, that there was nothing that could be done to reverse the duelling demands of work and home. For one postdoctoral fellow eager to continue her fellowship as a stepping stone to a more permanent academic job, there was a profound sense of resignation:

> *I've applied for a lecturing position, but I know that if I were on a hiring committee I wouldn't want to hire someone who has no publications to show for her postdoc. I've also lost a lot of confidence in my own work during lockdown. After four months of nothing at all but housework and childcare, I'm finding it really hard to believe that I ever was, or could be, an academic.* (Early-career mother of a pre-schooler)

The precarity of probation

On paper, academic appointments in South Africa are subject to a period of probation. Some institutions enforce this requirement more strenuously than others. It is the academic purgatory that sits between initial appointment and securing a full-time academic job. Meeting the demands of probation has also caused anxiety among the women in this study.

As with promotion, it was difficult to meet the conditions of probation during the lockdown, with the multiple demands of schoolwork, housework, teaching and, of course, the requirement to conduct and publish research. Because research has often been neglected due to other pressures under lockdown, passing probation has been called into question, as one mother of teenagers explained: 'I am nervous that I missed the completion of a Probation Interim Report and how this will affect decisions about my final appointment.' At the same time, academics felt that there might be little flexibility on probation from the institutions:

> *I hope universities will take these challenges to our work seriously when it comes to the annual targets academics are required to meet for performance assessment, probation, and promotion. Unfortunately, so far there is no indication of this from above, at least not that I have been made aware of.* (Early-career academic with no children)

The significance and implications of the study

This study on the precarity of the work of academic women under pandemic conditions is significant in four important ways that extend beyond the South African case.

First, while the work of academic women was precarious long before the pandemic[37], this qualitative inquiry offers insight into precisely *how* such precarity is experienced during lockdown in the working lives of academic women inside 'the structural conditions of precarity'[38]. Through thick, descriptive analyses of teaching, administration, domestic care and attempted research, this study offers vivid insights into the organisational structures and conditions that shape women's academic work.

Second, our study demonstrates how the intensity of 'the intersectionality of paid-work and care-work lives'[11] operates to frustrate and potentially terminate women's academic careers under the harsh regime of the lockdown. Through detailed attention to the micropolitics of housework and academic work under confined conditions, the findings make vivid the conflicts, compromises, contradictions, and constraints that women scholars encounter in the course of their lives. Perhaps the most important insight gained here was that academic work – teaching, research, administration, and service – in South African universities is carried out by a range of different classes of employees whose degrees of precarity vary in terms of the nature of their appointments.

Third, the study provides striking evidence of perceived institutional inflexibility, and its consequences, with regard to appointments, probation, promotion, and even continued postgraduate studies. As a result, academics often expressed a sense of resignation to their fate; one early-career respondent put it this way: 'I find myself caring less about my job and my future in academia.' At the same time, there is the hope that institutions might show mercy in the face of possible redundancy; one established academic made the case deftly: 'I simply have to believe that management logic will look upon my performance through the COVID-19 looking glass.'

Fourth, the study offers a glimpse into the world of academic women in the Global South in one particular way – the junior levels of appointment in South/African universities where a PhD is seldom a requirement for academic jobs at lecturer levels or even as senior lecturers in some disciplines (e.g. accountancy, medicine). These women face much more precarious positions in the academy in their roles as junior lecturers, markers, laboratory assistants etc. Many of these academics are therefore also postgraduate students and, as this research showed, the pursuit of higher degrees would also be interrupted under pandemic conditions.

There are at least four important implications from this study for institutional policy and practice with respect to the precarious labour of women academics:

1. To moderate management expectations from the top down in ways that recognise the exceptional circumstances imposed by the pandemic lockdown.[9]
2. To adjust timelines and schedules for promotion and advancement to allow for lapses in productivity as a result of the pandemic years.
3. To provide for research and administrative assistance to all female academics but especially those without the large research grants to be able to manage the new and competing demands on academic work.
4. To commit to institutional reach into the problem of precarity, especially under conditions of confinement, and allow those data to inform senior management deliberations on women's academic work on a consistent basis.

Conclusion

While political change, post-1994, has resulted in improved socio-economic experiences for women, academic institutions have been slow to do the same in South Africa. The pandemic's impact is still to be fully understood but has the potential effect of deepening the systemic and institutionalised inequalities that female academics experience. This study provides the accounts of female academics confirming the precarious nature of their employment within the academy. We contribute to existing research through introducing perspectives from the Global South and, more significantly, address women's perspectives of the impact of the lockdown on their employment prospects. This study shows that the variability in employment agreements for women contributes to the uncertainty that they already experience in terms of their careers and progression within the academy. What might appear as 'lost time' to maximise sabbaticals, had instead been filled with commitments to care for those within the home. Increased workloads, delays in completing qualifications, and extraneous factors that have impacted on the lives of women within the academy are felt to be ignored. While career and promotion prospects are under threat, it is the failure in the 'rules to adapt' under the prevailing conditions that has impacted the aspirations of women and led to an increased resentment within the South African academy.

Competing interests

We have no competing interests to declare.

Authors' contributions

C.W. conceptualised the original broader study from which the data were drawn and collected all the data. C.W. and A.B. conceptualised the manuscript's focus, proposed the objectives and prepared the draft manuscript. All authors contributed to the manuscript and approved the submitted version.

References

1. Myers KR, Tham WY, Yin Y, Cohodes N, Thursby JG, Thursby MC, et al. Unequal effects of the COVID-19 pandemic on scientists. Nat Hum Behav. 2020;4(9):880–883. https://doi.org/10.1038/s41562-020-0921-y
2. Zimmer K. Gender gap in research output widens during pandemic. The Scientist. 25 June 2020. Available from: https://www.the-scientist.com/news-opinion/gender-gap-in-research-output-widens-during-pandemic-67665
3. Kitchener C. Women academics seem to be submitting fewer papers during coronavirus. The Lilly. 24 April 2020. Available from: https://www.thelily.com/women-academics-seem-to-be-submitting-fewer-papers-during-coronavirus-never-seen-anything-like-it-says-one-editor/
4. Boncori I. The never-ending shift: A feminist reflection on living and organizing academic lives during the coronavirus pandemic. Gend Work Organ. 2020;27(5):677–682. https://doi.org/10.1111/gwao.12451
5. Gao G, Sai L. Towards a 'virtual' world: Social isolation and struggles during the COVID-19 pandemic as single women living alone. Gend Work Organ. 2020;27(5):754–762. https://doi.org/10.1111/gwao.12468
6. Utoft EH. 'All the single ladies' as the ideal academic during times of COVID-19? Gend Work Organ. 2020;27(5):778–787. https://doi.org/10.1111/gwao.12478
7. Huang J, Gates AJ, Sinatra R, Barabási A-L. Historical comparison of gender inequality in scientific careers across countries and disciplines. Proc Natl Acad Sci USA. 2020;117(9):4609–4616. https://doi.org/10.1073/PNAS.1914221117
8. Coe IR, Wiley R, Bekker L-G. Organisational best practices towards gender equality in science and medicine. Lancet. 2019;393(10171):587–593. https://doi.org/10.1016/S0140-6736(18)33188-X
9. Walters C, Mehl GG, Piraino P, Jansen JD, Kriger S. The impact of the pandemic-enforced lockdown on the scholarly productivity of women academics in South Africa. Res Policy. 2022;51(1):104403. https://doi.org/10.1016/j.respol.2021.104403
10. Minello A. The pandemic and the female academic. Nature. 17 April 2020. Available from: https://www.nature.com/articles/d41586-020-01135-9
11. Ivancheva M, Lynch K, Keating K. Precarity, gender and care in the neoliberal academy. Gend Work Organ. 2019;26(4):448–462. https://doi.org/10.1111/gwao.12350
12. Green W, Anderson V, Tait K, Tran LT. Precarity, fear and hope: Reflecting and imagining in higher education during a global pandemic. High Educ Res Dev. 2020;39(7):1309–1312. https://doi.org/10.1080/07294360.2020.1826029
13. O'Keefe T, Courtois A. 'Not one of the family': Gender and precarious work in the neoliberal university. Gend Work Organ. 2019;26(4):463–479. https://doi.org/10.1111/gwao.12346
14. Amano-Patiño N, Faraglia E, Giannitsarou C, Hasna Z. Who is doing new research in the time of COVID-19? Not the female economists. Vox EU. 2 May 2020. Available from: https://voxeu.org/article/who-doing-new-research-time-covid-19-not-female-economists
15. Collins C, Landivar LC, Ruppanner L, Scarborough WJ. COVID-19 and the gender gap in work hours. Gend Work Organ. 2021;28(S1):101–112. https://doi.org/10.1111/gwao.12506
16. Fazackerley A. Women's research plummets during lockdown – but articles from men increase. The Guardian. 12 May 2020. Available from: https://www.theguardian.com/education/2020/may/12/womens-research-plummets-during-lockdown-but-articles-from-men-increase
17. Scully B. Precarity North and South: A Southern critique of guy standing. Glob Labour J. 2016;7(2), Art. #2521. https://doi.org/10.15173/glj.v7i2.2521
18. Jinnah Z. Negotiated precarity in the Global South: A case study of migration and domestic work in South Africa. Stud Soc Justice. 2020;2020(14):210-227. https://doi.org/10.26522/ssj.v2020i14.1971
19. Mavundla B. Precariat experiences: Narratives of casual academic staff in South African universities [document on the Internet]. c2020 [cited 2022 Jan 31]. Available from: https://crishet.mandela.ac.za/getmedia/1acf6a2d-b922-4d83-b66a-766af7398807/Bongani-Mavundla?disposition=attachment
20. Flores Garrido N. Precarity from a feminist perspective: A note on three elements for the political struggle. Rev Radic Polit Econ. 2020;52(3):582-590. https://doi.org/10.1177%2F0486613420906930
21. Boswell B. Race, science, and gender: Producing the black woman's body as the deviant, degenerate 'other'. In: Jansen JD, Walters C, editors. Fault lines: A primer on race, science and society. Stellenbosch: African Sun Media; 2020. p. 163–174. https://doi.org/10.18820/9781928480495/10
22. Gouws A. Problematising race and gender in everyday research processes: A model of feminist research praxis. In: Walters C, Jansen JD, editors. Fault lines: A primer on race, science and society. Stellenbosch: African Sun Media; 2020. p. 175–188. https://doi.org/10.18820/9781928480495/11
23. South African Department of Higher Education and Training (DHET). Statistics on post-school education and training in South Africa: 2019. Pretoria: DHET; 2021. Available from: http://www.dhet.gov.za/DHET%20Statistics%20Publication/Statistics%20on%20Post-School%20Education%20and%20Training%20in%20South%20Africa%202019.pdf
24. Moreau M-P. A matter of time? Gender equality in the teaching profession through a cross-national comparative lens. Gend Educ. 2020;32(6):820-837. https://doi.org/10.1080/09540253.2018.1533918
25. Heijstra TM, Einarsdóttir Þ, Pétursdóttir GM, Steinþórsdóttir FS. Testing the concept of academic housework in a European setting: Part of academic career-making or gendered barrier to the top? Eur Educ Res J. 2017;16(2-3):200–214. https://doi.org/10.1177/1474904116668884
26. Henderson EF, Moreau M-P. Carefree conferences? Academics with caring responsibilities performing mobile academic subjectivities. Gend Educ. 2020;32(1):70–85. https://doi.org/10.1080/09540253.2019.1685654
27. Angervall P, Beach D. Dividing academic work: Gender and academic career at Swedish universities. Gend Educ. 2020;32(3):347–362. https://doi.org/10.1080/09540253.2017.1401047
28. Subbaye R, Vithal R. Gender, teaching and academic promotions in higher education. Gend Educ. 2017;29(7):926–951. https://doi.org/10.1080/09540253.2016.1184237
29. Bozzon R, Murgia A, Poggio B. Gender and precarious careers in academia and research. In: Annalisa M, Barbara P, editors. Gender and precarious research careers: A comparative analysis. New York: Routledge; 2018. p. 15–49. https://doi.org/10.4324/9781315201245
30. Buckle C. Research during the COVID-19 pandemic: Ethics, gender and precarious work. Eur J Hous Policy. 2021;21(3):433–450. https://doi.org/10.1080/19491247.2020.1857907
31. Walters C, Ronnie L, Jansen J, Kriger S. 'Academic guilt': The impact of the pandemic-enforced lockdown on women's academic work. Women's Stud Int Forum. 2021;88:102522. https://doi.org/10.1016/j.wsif.2021.102522
32. Badat S. The context of higher education. Paper presented at: The Carnegie Librarians Executive Management Academy Seminar; 2012 March 05; Stellenbosch, South Africa.
33. Essop A. The changing size and shape of the higher education system in South Africa, 2005–2017. Johannesburg: University of Johannesburg; 2020.
34. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol. 2006;3(2):77–101. https://doi.org/10.1191/1478088706qp063oa
35. Cahill R, Irving T. Radical academia: Beyond the audit culture treadmill. Wollongong: University of Wollongong; 2015. https://ro.uow.edu.au/cgi/viewcontent.cgi?article=3157&=&context=lhapapers&=&sei-redir=1&referer=https%253A%252F%252Fscholar.google.com%252Fscholar%253Fhl%253Den%2526as_sdt%253D0%25252C14%2526q%253DCahill%252Btreadmill%2526btnG%253D
36. Council on Higher Education (CHE). South African higher education reviewed: Two decades of democracy. Pretoria: CHE; 2016.
37. Murgia A, Poggio B. Gender and precarious research careers: A comparative analysis. New York: Routledge; 2019. https://doi.org/10.4324/9781315201245
38. Zheng R. Precarity is a feminist issue: Gender and contingent labor in the academy. Hypatia. 2018;33(2):235–255. https://doi.org/10.1111/hypa.12401

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Expert voices in South African mass media during the COVID-19 pandemic

Scientists increasingly recognise that media visibility allows them to gain influence in public and policy spheres. However, some scientists shy away from publicity and journalists are purposefully selective when they seek out experts to interview. This may result in a skewed representation of scientists in the mass media. In this study, we explored which South African scientific experts at the academic rank of 'professor' were quoted in the local mass media during the initial 6 months of the COVID-19 pandemic. Our analysis of 1164 media articles related to COVID-19 showed that, as far as gender is concerned, men dominated as expert sources, with women accounting for only 30% of quoted professors. In terms of research field, most experts were from the broad field of health and medicine, with an under-representation of social scientists. We reflect on the implications and consequences of a skewed media representation of scientific expertise, as well as some of the options to remedy these imbalances.

Significance:

- This is the first study to identify the most visible science experts in the mass media in South Africa during the COVID-19 pandemic.
- We recommend options for institutions, researchers, media editors and journalists to help diversify expert sources that are featured or quoted in the mass media.

Imbalances in scientists' media visibility

During a public health crisis, experts are needed to explain complex topics and contextualise news for media consumers.[1] These experts are typically highly accomplished individuals who hold prestigious positions in the scientific world.[2,3] As such, journalists rely on experts to add insight, credibility and news value to science-related mass media coverage[4] and expert sources are regarded as essential contributors to journalistic practice and the production of news, especially when it comes to coverage of specialist topics of a scientific nature.

However, relationships between journalists and scientists are clearly symbiotic. Despite some of the inherent risks, scientists stand to benefit in several ways when they achieve a high profile in the mass media. Media visibility empowers scientists to establish themselves as public experts, and to become agents of change with influence in public and policy arenas[5,6] and helps them to attract research funding[7]. This implies that gender and field disparities amongst media-visible scientists could lead to a skewed representation of expert opinion and power imbalances amongst scientists. Scientists' media visibility is influenced by several factors, including the ability and willingness of a scientist to take on the role of public expert[8], as well as journalists' selection criteria when identifying experts to interview[9]. From the perspective of journalists, the best sources are experts that are already visibly associated with a prestigious institution, but also accessible, able to provide relatable and relevant comments, and cooperative in terms of media demands.[7,10]

Earlier studies on *gender imbalances* in media representations of scientists show that female experts are notably under-represented when journalists report on new advances in science or write science feature articles.[11] The dominance of men as quoted experts and sources in the media has been confirmed in a study of news media in India, Kenya, Nigeria, South Africa, the UK, and the USA.[12] Even in Finland, which is believed to be a progressive and female-friendly Nordic country with a highly educated female workforce, less than 30% of scientific experts interviewed in the news media are women.[13]

Furthermore, female scientists are frequently portrayed in a tokenistic manner as being unusual within competitive research environments, while male scientists are represented as belonging in their professional positions.[14] Added to this, male scientists are in higher demand as expert media sources.[15,16] A study in South Africa[17] revealed that 63% of visible scientists in South Africa – as identified by journalists – were men. Female experts experience several prejudices when they appear in media interviews, including the perception that they are judged on their appearance, rather than their expertise.[18] These scholars discuss how the under-representation of female experts limits their power and influence, and affects public perceptions. Further negative consequences of excluding or underplaying female expertise in mass media coverage include that it perpetuates the notion that men are the only experts worth listening to, and dampens the professional aspirations of girls and young women regarding careers in science.[19-21]

Scholars have drawn attention to the scarcity of female expert voices in the mass media coverage of COVID-19.[22-24] There is evidence that women were far less likely to feature as experts compared to men[12] and that the views of female experts in COVID-19 stories were marginalised compared to non-COVID news stories[25].

In terms of *field imbalances*, it has been shown that, during a health pandemic, scientific experts are usually affiliated to research fields such as virology, epidemiology, medicine, biology and/or statistics, and are trained to understand and reflect on data and findings regarding pathogens.[26] The voices of epidemiologists and public health experts have inevitably dominated initial responses to the COVID-19 pandemic.[27] Media coverage and social platforms used biomedical data and concepts extensively and this, inevitably, influenced policy responses.[28] This

has meant that the social sciences have been sidelined and excluded from the processes informing the response and the way forward regarding the pandemic, despite recognition that social science expertise is crucial in order to understand and influence human behaviour during a pandemic.[29]

Gender differences in terms of academics' public engagement roles

The dominance of men at higher levels of the academic hierarchy is well documented, as is the evidence for a general structural bias against women in science and the failure to recognise contributions by female scientists.[30,31] For example, a longitudinal study of gender inequality in scientific careers across 83 countries and 13 disciplines[32] confirms that women are under-represented in most scientific disciplines and publish fewer articles throughout their careers, as well as that their work acquires fewer citations.

Due to the pervasive nature of gendered processes throughout the practice and culture of science, it is reasonable to expect that male and female scientists will have different views and experiences when it comes to communicating about their research in the public arena.[33] It has been suggested that the involvement of female scientists may be hindered by the so-called 'Matthew effect', as well as by the associated 'Matilda effect'. The 'Matthew effect' explains why well-known scientists frequently get more credit compared to researchers that are less well known, despite the fact that their work may be of similar nature and quality[34], while the 'Matilda effect' describes the systemic bias against women in science and the systematic under-recognition of their contributions[35].

Based on research exploring scientists' motivations and perceptions regarding public engagement about their work, science communication scholars propose a range of potential explanations for observed gender-based differences. Consistently, normative influences, which cause scientists to respond differently to the public engagement activities of male versus female colleagues, emerge as a key explanation.[36] While outreach activities (for example school visits and acting as role models) are frequently stigmatised and delegated to women[33,37], media visibility is associated with recognition and prestige, and men are especially in demand as media sources[15,16].

A 2020 survey provides evidence that, compared to their male colleagues, women are generally more hesitant and concerned about media appearances.[38] Results from this study show that women were generally more worried and fearful about making mistakes, being put on the spot, and appearing to be uninformed. These findings are in line with the idea that there is a so-called 'confidence gap' that separates men and women, with men generally being more self-assured about their opinions and less worried about being publicly wrong.[39] Similarly, a study focused on female experts in Australia, reports that women were mostly willing to be interviewed and positive about prior media experiences but lacked confidence about appearing on camera and an understanding of how the news media operates.[21]

Research question

Given the importance of achieving a balanced representation of scientists who become visible in the mass media during a public health crisis such as the COVID-19 pandemic, our study was guided by this research question: How prevalent are gender and field imbalances of expert voices in the South African mass media reporting on COVID-19?

Methodology

With the help of Pear Africa, a media monitoring company, we identified and downloaded all media articles containing the keywords 'corona*' and/or 'covid*', published during the first 6 months of the COVID-19 pandemic in South Africa (7 January 2020 to 6 July 2020) across nine major newspapers and five online news sites. This resulted in a data set of 14 991 print articles and 29 335 online articles related to COVID-19, adding up to a total of 44 326 articles.

To reduce the 44 326 articles to a set of articles that would focus on the voices and views of scientific experts, we tested several terms that could be used as proxies for academic expertise. We found that the application of terms such as 'scientist(s)', 'researcher(s)' or 'doctor(s)' did not necessarily deliver articles in which experts were quoted. However, articles that contained the term 'professor' mostly contained text in which the journalists quoted one or more leading academics directly or indirectly, as the term is used to identify specific individuals that were interviewed or referred to. In South African universities, the term 'professor' indicates a senior academic ranking and position of academic credibility, authority and leadership. It is well known that journalists also use 'professor' as a title to give credibility to their articles. We therefore applied this term, i.e. 'professor', to select those articles in which journalists quoted a leading academic.

Filtering for articles containing the term 'professor' reduced our data set to 1891 articles. After excluding articles that did not quote a scientific source, or where the quoted expert was not associated with a South African institution, our final data set consisted of 1164 articles. These articles were analysed using quantitative content analysis, guided by a detailed codebook. Amongst other aspects, we captured information about the names, affiliations, fields and gender. Where articles quoted more than one professor, data were captured for all of them. Their fields of expertise were openly coded (in vivo) and later categorised into common scientific fields.[26]

Two coders attended several coding training sessions before they each coded the same randomly selected 200 articles for reliability testing. Cohen's κ and Holsti's reliability coefficient (CR) were used to measure inter-coder reliability. Cohen's κ for the formal variables was $\kappa=0.94$ (CR=0.99); for the content-related variables, $\kappa=0.90$ (CR=0.97). These values indicated good agreement among coders. Hence, each coder then coded half of the final sample independently.

This study was approved by the Research Ethics Committee: Social Behavioural and Education Research of Stellenbosch University on 22 February 2021, with the Project Number: CREST-2020-17119.

Results

In our analysis of 1164 articles, we found 1458 distinct voices of professors, representing 430 individuals (Table 1). Most of the voices were counted from online ($n=1098$, 75%) as compared to print news media ($n=360$, 25%). While most articles quoted one professor only ($n=943$, 65%), some quoted two ($n=330$, 23%), three ($n=129$, 9%) or even more professors ($n=56$, 4%). Most frequently, direct quotes were used ($n=855$, 59%), as compared to indirect quotes ($n=296$, 20%); however, there was also a proportion of self-written copies ($n=305$, 21%).

Professor Salim Abdool Karim was quoted most frequently ($n=155$, 11%), followed by Professor Shabir Madhi ($n=83$, 6%) and Professor Glenda Gray ($n=47$, 3%). Table 2 provides an overview of the 10 most frequently quoted professors, showing that 7 out of 10 were from the broad field of health sciences and medicine, and 8 out of 10 were men.

The majority of the 1458 distinct voices (i.e. professors quoted) in the 1164 articles were male ($n=1024$, 70%), while female professors accounted for only 30% ($n=434$).

There were slight differences between print and online media ($\chi^2=5.819$; d.f.=1; $\varphi=0.063$) in terms of gender balance: in print media, the dominance of male ($n=271$, 75%) as compared to female professors ($n=89$, 25%) was more prevalent than in online media (male: $n=753$, 69%; female: $n=345$, 31%). Furthermore, there were slight differences regarding the type of publication ($\chi^2=8.403$; d.f.=2; $V=0.076$): special interest publications exhibited a higher gender imbalance (male: $n=56$, 84%; female: $n=11$, 16%) than tabloid publications (male: $n=27$, 82%; female: $n=6$, 18%), with quality publications noting the lowest gender imbalance (male: $n=941$, 69%; female: $n=417$, 31%).

Table 1: Information on the 14 media sources included in this study

Media source	Print or online	Number of articles	% Total articles	Frequency	Type/genre	Publisher
Business Day	Print	42	3	Weekdays	Special interest	Arena Holdings
City Press	Print	37	3	Weekly (Sunday newspaper)	Quality	Naspers
Daily Sun	Print	6	0.4	Daily	Tabloid	Naspers
Engineering News & Mining Weekly	Print	11	1	Weekly	Special interest	Creamer Media
Financial Mail	Print	14	1	Weekly	Special interest	Arena Holdings
Mail & Guardian	Print	39	3	Weekly	Quality	Mail & Guardian Media (Pty) Ltd
The Star	Print	110	8	Daily	Quality	Sekunjalo Independent Media
Sunday Times	Print	74	5	Weekly (Sunday newspaper)	Quality	Arena Holdings
You	Print	27	2	Weekly magazine	Tabloid	Naspers
Eyewitness News (EWN)	Online	125	9	Daily	Quality	Primedia Broadcasting
Independent Online (IOL)	Online	39	3	Daily	Quality	Sekunjalo Independent Media
Daily Maverick	Online	406	28	Daily	Quality	Independently owned
News 24	Online	383	26	Daily	Quality	Naspers
TimesLIVE	Online	145	10	Daily	Quality	Arena Holdings

Table 2: Gender and broad scientific field of the 10 most frequently quoted professors

Name	*n*	%	Gender	Broad scientific field
Salim Abdool Karim	155	11%	Male	Health sciences and medicine (epidemiology)
Shabir Madhi	83	6%	Male	Health sciences and medicine (vaccinology)
Glenda Gray	47	3%	Female	Health sciences and medicine (paediatrics)
Cheryl Cohen	42	3%	Female	Health sciences and medicine (epidemiology)
Alex van den Heever	35	2%	Male	Economics
Marc Mendelson	18	1%	Male	Health sciences and medicine (infectious diseases)
Charles Parry	18	1%	Male	Social sciences and humanities (psychology)
Lungile Pepeta	16	1%	Male	Health sciences and medicine (paediatrics)
François Venter	15	1%	Male	Health sciences and medicine (virology)
Raymond Parsons	15	1%	Male	Economics

Regarding scientific fields (see Figure 1), we found that 'health sciences and medicine' was most dominant (n=723, 51%), followed by 'social sciences and humanities' (n=307, 21%) and 'economics' (n=181, 12%).

There were gender differences according to the scientific fields of the quoted professors (χ^2=64.428; d.f.=5; V=0.209). Most prevalent was the gender imbalance with professors from engineering (male: n=30, 91%; female: n=3, 9%), followed by economics (male: n=157, 87%; female: n=24, 13%), natural sciences (male: n=79, 77%; female: n=24, 23%), and health sciences and medicine (male: n=509, 70%; female: n=214, 30%). There was more balance when professors from social sciences were quoted (male: n=193, 63%; female: n=114, 37%); for law, there was indeed a balance in genders (female: n=55, 51%; male: n=53, 49%).

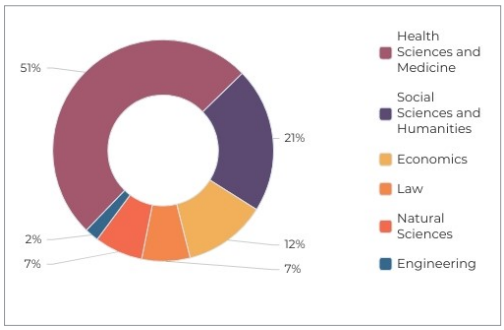

Figure 1: Broad scientific fields of professors quoted in COVID-19 related media articles.

Discussion

Our study confirms the existence of gender and field imbalances regarding experts who were quoted in the South African mass media during the first 6 months of the COVID-19 pandemic.

When considering the gender imbalance, the 70:30 dominance of male experts in the mass media, as revealed in our study, should be viewed in the context of the make-up of the South African academic workforce. Data from the South African Higher Education Management System (HEMIS) for 2019 show that, across all higher education institutions in South Africa, 48% of all staff responsible for instruction and research were women.[40] In addition, 2020 data from the South African Knowledgebase shows that female professors produced 40% of the publication outputs in 2020.[41] These figures already point towards an under-representation of women in the academic environment, especially when considering academic outputs by professors. However, our findings show that this under-representation (only 30% female voices amongst professors quoted) is further exacerbated in the mass media.

It is suggested that the under-representation of women at leadership levels in the academic arena is linked to socio-cultural constructs of women in South African society that promote male dominance and sustain institutional sexism, at the expense of the professional aspirations of female academics.[42,43] The situation is aggravated by societal expectations that women should take on specific gender roles and family responsibilities such as housework and childcare, which is structurally apparent in the disproportionate durations of maternity and paternity leave, and regularly disadvantages women's career progression to senior academic positions which require long working hours.[44] Another reason is that women often take on the advising and mentoring load in their faculty because they are perceived as intuitive and compassionate towards their students' needs, and, in turn, have less time to do media engagement than their male colleagues.[44] Further factors that impede women's advancement along the academic career ladder include feelings of isolation, and lack of childcare facilities and suitable role models.[45] These expectations, demands and burdens on female academics have intensified during the COVID-19 pandemic.[46-48]

In general, our findings highlight the need to ensure that women in science are equipped with confidence and skills to engage pro-actively and reactively with the mass media, and that they have the opportunities and support to do so. At the same time, more could be done to make media editors and journalists aware of the importance of diverse expert sources, and journalists should be encouraged and helped to diversify their expert sources.

We have ample evidence that media organisations and individual science journalists are keen and willing to help remedy gender imbalances in media coverage. Around the world, major publishers and science communication initiatives are rolling out remedial initiatives. For example, the BBC announced that they were joining other media organisations in striving for a target of equal gender representation across all of the BBC's programmes and sites, including an equal split in how many men and women are interviewed on camera and quoted in stories.[49] In June 2021, the top-tier scientific journal *Nature* announced that it would work harder to overcome gender inequalities.[50] The editor responded to several studies showing that men were quoted twice as often as women in general news media, as well as in news reports in *Nature*. The award-winning science journalist Ed Yong writes how he tries to redress the balance by spending more time searching for women to interview, using various online and social media channels to find relevant female sources.[51]

Globally, a number of initiatives have been set up to help journalists who are seeking out female voices to identify female experts, for example the Women's Media Center, the 'WomenAlsoKnowStuff' and an organisation called '500 Women Scientists'.[52-54] The Expert Women Project, run by City University of London's Journalism Department, has been set up to monitor the number of expert women featured on the news and this project has an arm focused on the situation in Ghana.[55] 'Ingenium Women in STEM' is a Canadian initiative that strives to overcome gender biases that continue to limit the roles of women in science, technology, engineering and mathematics, as well as to make female scientists more visible in society, and to celebrate their achievements.[56]

In South Africa, a non-profit company, Quote This Woman+, is growing a database of female experts to promote the inclusion of women's voices in the mass media, including female experts to appear on media panels.[57] The main aim of the Association of South African Women in Science and Engineering (SA WISE) is to strengthen the role of women in science and engineering in South Africa and to raise the profile of women scientists and engineers. During Women's Month, celebrated annually in August, the South African Department of Science and Innovation organises a series of events to celebrate and profile female scientists, including the South African Women in Science Awards.[58]

Institutions where scientists are employed are also well placed to help profile women as visible experts in the public sphere. A report by Boyce and Kitzinger[59] elaborates on the role that science media officers in research organisations and institutions can play to advance media interactions with female experts.

In terms of the field of expertise, we showed that voices from health sciences and medicine dominated and were present in 51% of the media content we analysed. However, we found that expertise from the social sciences was present in about one-fifth of the articles (21%) and was therefore not completely sidelined as feared by Bavel et al.[29] Notably, Connell[60] suggests that COVID-19 is a social emergency as much as a medical one, and Brossard (quoted in Lohwater[61]) points out that, with an issue as heavily politicised as COVID-19, we need expert guidance that goes beyond the medical sciences. Lohse and Canali[28] point out that social science expertise is needed to ensure sufficient attention to social issues, to identify gaps in policy, and to offer a more fine-grained harm–benefit analyses of different policy options. Soudien[62] highlights the importance of social science expertise to deal with the social trauma brought about by the pandemic, and outlines the work done by social scientists in South Africa – through research and grassroots involvement – during this public health crisis. Social scientists can help policymakers and colleagues from health and natural sciences to develop solutions that people are able and (crucially) willing to follow.[63,64] Political scientists could, for example, play a major role in terms of the pandemic response based on their knowledge of public risks and the role of governments.[28] Communication scientists know how to build public trust through credible public communication, which includes acknowledging uncertainty.[65,66]

Conclusion

The media representation of scientists, including their gender and field, affects who gets to influence science policy and public opinion. The present study highlights that male academics, as well as academics working in the broad field of health and medicine, were disproportionately featured as expert voices during the COVID-19 pandemic in the South African mass media, to the detriment of women and experts from other fields. Therefore, it is necessary to consider ways to address these gender and field disparities. Clearly, the problem cannot be solved by researchers or journalists on their own. This issue needs to be addressed jointly by research institutions (and their PR departments) along with researchers, journalists, and media editors. In the long term, initiatives working towards gender equity in academic leadership positions will increase the presence of female voices in the mass media. But, in the shorter term, institutions could make a difference by supporting and incentivising female experts for their media engagement work, and by profiling female experts. As far as media editors and journalists are concerned, it could help to make them more aware of the existence and effects of gender disparities in media coverage and help them to diversify their sources.

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Competing interests

We have no competing interests to declare.

Authors' contributions

M.J.: Conceptualisation; methodology. L.G.: Conceptualisation; methodology; data analysis; data validation. L.R.: Data analysis. All authors collaborated on the processing, presentation, and discussion of the findings.

References

1. Schuchat A, Bell BP, Redd SC. The science behind preparing and responding to pandemic influenza: The lessons and limits of science. Clin Infect Dis. 2011;52(1):8–12. https://doi.org/10.1093/cid/ciq007
2. Goldman AI. Experts: Which ones should you trust? Philos Phenomenol Res. 2001;63(1):85–110. https://doi.org/10.1093/0195138791.003.0007
3. Lavazza A, Farina M. The role of experts in the Covid-19 pandemic and the limits of their epistemic authority in democracy. Front Public Health. 2020;8(7):1–11. https://doi.org/10.3389/fpubh.2020.00356
4. Wagner M, Gurr G, Siemon M. Voices in health communication-experts and expert-roles in the German news coverage of multi resistant pathogens. J Sci Commun. 2019;18(6):1–23. https://doi.org/10.22323/2.18060203
5. Fahy D, Lewenstein B. Scientists in popular culture: The making of celebrities. In: Routledge handbook of public communication of science and technology. 3rd ed. New York: Routledge; 2021. p. 33–52. https://doi.org/10.4324/9780203483794.ch7
6. Olesk A. The types of visible scientists. J Sci Commun. 2021;20(2):A06. https://doi.org/10.22323/2.20020206
7. Peters HP, Brossard D, De Cheveigné S, Dunwoody S, Kallfass M, Miller S, et al. Interactions with the mass media. Science. 2008;321(7):204–205. https://doi.org/10.1126/science.1157780
8. Peters HP. Gap between science and media revisited: Scientists as public communicators. Proc Natl Acad Sci USA. 2013;110(3):14102–14109. https://doi.org/10.1073/pnas.1212745110
9. Boyce T. Health, risk and news: The MMR vaccine and the media. Bern: Peter Lang; 2007.
10. Albaek E, Christiansen PM, Togeby L. Experts in the mass media: Researchers as sources in Danish daily newspapers, 1961–2001. J Mass Commun Q. 2003;80(4):937–948. https://doi.org/10.1177/107769900308000412
11. Nelkin D, Elias J. Selling science: How the press covers science and technology. J Public Health Policy. 1996;17:501–503. https://doi.org/10.2307/3343109
12. Kassova L. The missing perspectives of women in COVID-19 news: A special report on women's under-representation in news media [document on the Internet]. c2020 [cited 2021 Sep 30]. Available from: https://www.iwmf.org/wp-content/uploads/2020/11/2020.11.19-The-Missing-Perspectives-of-Women-in-News-FINAL-REPORT.pdf
13. Niemi MK, Pitkänen V. Gendered use of experts in the media: Analysis of the gender gap in Finnish news journalism. Public Underst Sci. 2017;26(3):355-368. https://doi.org/10.1177/0963662515621470
14. Shachar O. Spotlighting women scientists in the press: Tokenism in science journalism. Public Underst Sci. 2000;9(4):347–358. https://doi.org/10.1088/0963-6625/9/4/301
15. Crettaz von Roten F. Gender differences in scientists' public outreach and engagement activities. Sci Commun. 2011;33(1):52–75. https://doi.org/10.1177/1075547010378658
16. Torres-Albero C, Fernández-Esquinas M, Rey-Rocha J, Martín-Sempere MJ. Dissemination practices in the Spanish research system: Scientists trapped in a golden cage. Public Underst Sci. 2011;20(1):12–25. https://doi.org/10.1177/0963662510382361
17. Joubert M, Guenther L. In the footsteps of Einstein, Sagan and Barnard: Identifying South Africa's most visible scientists. S Afr J Sci. 2017;113(11-12), Art. #2017-0033. https://doi.org/10.17159/sajs.2017/20170033
18. Chimba M, Kitzinger J. Bimbo or boffin? Women in science: An analysis of media representations and how female scientists negotiate cultural contradictions. Public Underst Sci. 2010;19(5):609–624. https://doi.org/10.1177/0963662508098580
19. Lemish D, Götz M. Beyond the stereotypes? Images of boys and girls, and their consequences. Yearbook 2017. Gothenburg: Nordicom, University of Gothenburg; 2017.
20. Sarikakis K. Power, patriarchy, profit: Barriers to gender mainstreaming in media policy. Media and gender: A scholarly agenda for the global alliance on media and gender. Paris: UNESCO; 2014. p. 66–69.
21. Shine K. Willing but wary: Australian women experts' attitudes to engaging with the news media. Journalism. 2021:1–16. https://doi.org/10.1177/14648849211007038
22. Carr T. In COVID-19 coverage, female experts are missing [webpage on the Internet]. NiemanLab. 29 June 2020 [cited 2021 Sep 30]. Available from: https://www.niemanlab.org/2020/06/in-covid-19-coverage-female-experts-are-missing/
23. Haq A. Experts, intellectuals with voices and why they matter [webpage on the Internet]. University World News: Africa Edition. 4 February 2021 [cited 2021 Sep 30]. Available from: https://www.universityworldnews.com/post.php?story=20210203055649823
24. Lygnerud Boberg E. Media, remember gender in your COVID-19 coverage [webpage on the Internet]. International Media Support. 26 March 2020 [cited 2020 Mar 03]. Available from: https://www.mediasupport.org/news/media-remember-gender-in-your-covid-19-coverage/
25. SDG Knowledge Hub. COVID-19 news mutes women's voices in coverage: Global study [webpage on the Internet]. International Institute for Sustainable Development. c2020 [cited 2021 Sep 30]. Available from: http://sdg.iisd.org/news/covid-19-news-mutes-womens-voices-in-news-coverage-global-study/
26. Saldaña J. Coding manual for qualitative researchers. 2nd ed. London: SAGE Publications Ltd; 2013. Available from: https://books.google.com/books/about/The_Coding_Manual_for_Qualitative_Resear.html?id=V3tTG4jvgFkC
27. Reisz M. Pandemic response needs 'wisdom' of social sciences, scholars say. Times Higher Education. 12 May 2020 [cited 2021 Mar 11]. Available from: https://www.timeshighereducation.com/news/pandemic-response-needs-wisdom-social-sciences-scholars-say
28. Lohse S, Canali S. Follow *the* science? On the marginal role of the social sciences in the COVID-19 pandemic. Eur J Philos Sci. 2021;11(4), Art. #99. https://doi.org/10.1007/s13194-021-00416-y
29. Bavel JJV, Baicker K, Boggio PS, Capraro V, Cichocka A, Cikara M, et al. Using social and behavioural science to support COVID-19 pandemic response. Nat Hum Behav. 2020;4(5):460–471. http://doi.org/10.1038/s41562-020-0884-z
30. Clark Blickenstaff J. Women and science careers: Leaky pipeline or gender filter? Gend Educ. 2005;17(4):369–386. https://doi.org/10.1080/09540250500145072
31. Ceci SJ, Williams WM. Understanding current causes of women's underrepresentation in science. Proc Natl Acad Sci USA. 2011;108(8):3157-3162. https://doi.org/10.1073/pnas.1014871108
32. Huang J, Gates AJ, Sinatra R, Barabási A-L. Historical comparison of gender inequality in scientific careers across countries and disciplines. Proc Natl Acad Sci USA. 2020;117(9):4609–4616. https://doi.org/10.1073/pnas.1914221117
33. Johnson J, Sharman Z, Vissandjee B, Stewart DE. Does a change in health research funding policy related to the integration of sex and gender have an impact? PLoS ONE. 2014;9(6), e99900. https://doi.org/10.1371/journal.pone.0099900
34. Merton RK. The Matthew effect in science. Science. 1968;159(3810):56–63. http://dx.doi.org/10.1126/science.159.3810.56
35. Rossiter MW. The Matthew Matilda effect in science. Soc Stud Sci. 1993;23(2):325–341. http://dx.doi.org/10.1177/030631293023002004
36. Crettaz von Roten F, Goastellec G. Understanding academics' popular science publishing: Institution culture and management style effects. J New Gener Sci. 2015;13(2):15–29.

37. Ecklund EH, James SA, Lincoln AE. How academic biologists and physicists view science outreach. PLoS ONE. 2012;7(5):3–7. https://doi.org/10.1371/journal.pone.0036240

38. SciOPS. Supporting scientists' engagement with the media [webpage on the Internet]. c2021 [cited 2021 Sep 30]. Available from: https://www.sci-ops.org/surveys/scientists-engagement-with-the-media-

39. Kay K, Shipman C. The confidence gap. The Atlantic. 2014;14(1):1–18. Available from: https://www.theatlantic.com/magazine/archive/2014/05/the-confidence-gap/359815/

40. Higher Education Management Information System [webpage on the Internet]. c2019 [cited 2021 Sep 30]. Available from: http://www.naci.org.za/nstiip/index.php/useful-links/117-hi

41. Centre for Research on Evaluation Science and Technology. South African Knowledgebase [webpage on the Internet]. c2020 [cited 2021 Sep 30]. Available from: https://db.crest.sun.ac.za/

42. Basford TE, Offermann LR, Behrend TS. Do you see what I see? Perceptions of gender microaggressions in the workplace. Psychol Women Q. 2014;38(3):340–349. https://doi.org/10.1177/0361684313511420

43. Savigny H. Women, know your limits: Cultural sexism in academia. Gend Educ. 2014;26(7):794–809. https://doi.org/10.1080/09540253.2014.970977

44. Maldonado H, Draeger J. Identifying, understanding, and responding to sexism in academia. In: Cole K, Hassel H, editors. Surviving sexism in academia. London: Routledge; 2019. p. 5–12. http://dx.doi.org/10.4324/9781315523217-1

45. Boshoff N. The representation of women academics in higher education in South Africa: Progress in the pipeline? S Afr J High Educ. 2005;19(2):359–377. https://doi.org/10.4314/sajhe.v19i2.25658

46. Malisch JL, Harris BN, Sherrer SM, Lewis KA, Shepherd SL, McCarthy PC, et al. Opinion: In the wake of COVID-19, academia needs new solutions to ensure gender equity. Proc Natl Acad Sci USA. 2020;117(27):15378–15381. https://doi.org/10.1073/pnas.2010636117

47. Oleschuk M. Gender equity considerations for tenure and promotion during COVID□19. Can Rev Sociol. 2020;57(3):502–515. https://doi.org/10.1111/cars.12295

48. Woitowich NC, Jain S, Arora VM, Joffe H. COVID-19 threatens progress toward gender equity within academic medicine. Acad Med. 2021;96(6):813. https://doi.org/10.1097/acm.0000000000003782

49. Ruggeri A. How we're tackling gender imbalance. BBC News. 17 January 2019. Available from: https://www.bbc.com/future/article/20190117-how-bbc-future-is-tackling-gender-imbalance

50. Nature Editorials. Confronting gender bias in *Nature*'s journalism. Nature. 2021;594(1):473–474. Available from: https://media.nature.com/original/magazine-assets/d41586-021-01676-7/d41586-021-01676-7.pdf

51. Yong E. I spent two years trying to fix the gender imbalance in my stories. The Atlantic. 6 February 2018 [cited 2021 Sep 23]. Available from: https://www.theatlantic.com/science/archive/2018/02/i-spent-two-years-trying-to-fix-the-gender-imbalance-in-my-stories/552404/

52. Women's Media Center. SheSource [webpage on the Internet]. No date [cited 2021 Sep 30]. Available from: https://womensmediacenter.com/shesource/

53. Women Also Know Stuff [homepage on the Internet]. Available from: https://www.womenalsoknowstuff.com/

54. 500 Women Scientists. Who we are [webpage on the Internet]. No date [cited 2021 Sep 30]. Available from: https://500womenscientists.org/who-we-are

55. Expert Women Project. The Ghana Project [webpage on the Internet]. c2021 [cited 2021 Sep 30]. Available from: https://expertwomenproject.com/the-ghana-project/

56. Women in STEM [webpage on the Internet]. No date [cited 2021 Sep 30]. Available from: https://womeninstem.ingeniumcanada.org/

57. Quote this Woman+ [homepage on the Internet]. Available from: https://quotethiswoman.org.za/

58. University of Cape Town. South African women in science and engineering [webpage on the Internet]. No date [cited 2021 Sep 30]. Available from: http://www.sawise.uct.ac.za/

59. Boyce T, Kitzinger J. Promoting women in the media: The role of SET organisations and their science media communicators. Vol. 4. Cardiff: UK Resource Centre for Women in Science, Engineering and Technology; 2008. Available from: https://orca.cardiff.ac.uk/17533/1/report_4_boyce.pdf

60. Connell R. COVID-19/Sociology. J Sociol. 2020;56(4):745–751. https://doi.org/10.1177/1440783320943262

61. Lohwater T. Quality science communication on COVID-19 requires context and relevance [webpage on the Internet]. c2020 [cited 2021 Sep 30]. Available from: https://www.aaas.org/news/quality-science-communication-covid-19-requires-context-and-relevance

62. Soudien C. The role of South Africa's social scientists in COVID-19 responses: Why it matters. The Conversation Africa. 10 March 2021 [cited 2021 Sep 30]. Available from: https://theconversation.com/the-role-of-south-africas-social-scientists-in-covid-19-responses-why-it-matters-155655

63. Middlemass R. How can the social sciences inform the response to COVID-19 ? The London School of Economics and Political Science. 25 August 2020 [cited 2021 Mar 11]. Available from: https://blogs.lse.ac.uk/impactofsocialsciences/2020/08/25/what-is-the-role-of-the-social-sciences-in-the-response-to-covid-19-4-priorities-for-shaping-the-post-pandemic-world/

64. Webster A. Recognize the value of social science. Nature. 2016;532(7597):7. https://doi.org/10.1038/532007a

65. Joubert M. From top scientist to science media star during COVID-19 – South Africa's Salim Abdool Karim. S Afr J Sci. 2020;116(7–8), Art. #8450. https://doi.org/10.17159/sajs.2020/8450

66. Krause NM, Freiling I, Beets B, Brossard D, Krause NM, Freiling I, et al. Fact-checking as risk communication: The multi-layered risk of misinformation in times of COVID-19. J Risk Res. 2020;23(7–8):1052–1059. https://doi.org/10.1080/13669877.2020.1756385

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Intellectual property framework responses to health emergencies – options for Africa

We debate whether intellectual property (IP) protection of medical products and devices required to prevent, treat and contain COVID-19 should be waived, as proposed by South Africa and India, under the World Trade Organization (WTO)'s Agreement on Trade-related aspects of Intellectual Property Rights (TRIPS Agreement). We discuss existing public policy mechanisms under the TRIPS Agreement and how these have been implemented at national level in Africa, and find that these have proven inadequate and that they have been sub-optimally implemented. We then consider the TRIPS Waiver proposal which has been tabled due to the inadequacy of existing mechanisms and outline the EU's counter proposal which is founded on existing mechanisms. Both proposals have served at multiple WTO council meetings and would have been the subject of the 2021 WTO Ministerial Conference, which was postponed and is now set to be held in June 2022. Meanwhile, the proposal has been the subject of negotiations between India, South Africa, the EU and the USA ('the quad') and, as of May 2022, has been opened for consideration by all Members. Whatever the outcome of WTO deliberations, African states must take necessary national IP regulatory reforms and cooperate at sub-regional and continental level to improve access to medical products and devices to meet their citizenry's healthcare needs.

Significance:

- There is need for a sustainable and comprehensive intellectual property framework that is responsive to health emergencies. Existing public policy mechanisms have not proven effective.
- Adaptation and innovation are required at the international norm-setting level as evidenced by the two in-progress proposals for a TRIPS Agreement waiver and for an International Treaty on Pandemics. Both are contested and may only actualise in the medium to long term.
- In the context of such uncertainty and delay, timely action should be taken at national level, through legislative reform coupled with necessary manufacturing capacity, which will be boosted by cooperation between African states.

Introduction

Since late 2019 the world has been confronted with an economic and health emergency caused by the COVID-19 pandemic. A multiplicity of responses is required, including an intellectual property (IP) law and policy framework ('regulatory') approach, which is the focus of this article and which will be of interest to IP scholars and practitioners and also to those engaged in efforts to develop COVID-19 vaccines, diagnostics and therapeutics. The article centres on Africa for two reasons. First, by mid-2021 some parts of the world had accessed and administered vaccines that enabled a return to economic and other activity, whilst the developing world, particularly Africa, remained in the grip of lockdown necessitated by lack of access to vaccines and the corollary rampant rise of COVID-19 infections, illness and deaths. For example, on 2 July 2021 it was reported that 'only 1% of people in low-income countries ha[d] received at least one dose'[1]. Second, no doubt spurred by its vulnerability, Africa has taken a leading position in seeking IP regulatory solutions at global level. South Africa and India proposed a waiver of the implementation, application or enforcement of the sections dealing with copyright, industrial designs, patents and protection of undisclosed information in the Agreement on Trade-related Aspects of IP (TRIPS Agreement). This proposal (TRIPS Waiver proposal) gained the support of more than 50% of the World Trade Organization (WTO) member states, including the 55 members of the African Union (AU). The proposal has been the subject of extensive deliberation at the WTO and was on the agenda at its 12th Ministerial Conference, initially scheduled for 30 November – 3 December 2021, but postponed to June 2022. It has been further negotiated between South Africa, India, the USA and the European Union (EU), the so-called 'quad negotiations' from which a text was leaked in March 2022[2]; the official text was later published by the WTO on 3 May 2022 for consideration by all WTO members[3]. This text is not considered in this article. There are also calls for a Treaty on Pandemics under the auspices of the World Health Organization (WHO) which will bring up IP as the Treaty protects devices, products, medicines and technologies required to fight pandemics, but the treaty will not focus on IP; the Treaty therefore falls outside the scope of this article and will be only briefly discussed. Medicines and product regulatory aspects are also not discussed in detail. This article focuses on IP laws and policies ('IP regulatory responses').

Previous international responses: Doha, TRIPS Waiver and amendment

IP rights (IPRs) were introduced into the world trade arena after the Uruguay Round of negotiations under the General Agreement on Tariffs and Trade.[4] The TRIPS Agreement, which establishes the minimum standards of protection for IP within the framework of the WTO, came into effect on 1 January 1995. WTO Members were obliged to fulfil their obligations within a certain period, with further transition periods being dependent on the status of a country as a developing country or a least developed country (LDC) as elaborated below. The TRIPS Agreement covers trade-related aspects of IP such as copyright and related rights, trademarks, patents, geographical indications, layout designs of integrated circuits and undisclosed information. It introduced obligations for enforcement which

include administrative procedures, civil and criminal sanctions, border measures and dispute settlement mechanisms at international level. Existing international treaties such as the Berne Convention for the Protection of Literary and Artistic Works (*Paris Act of 1971*, as amended in 1979) and the Paris Convention for the Protection of Industrial Property, left the issues of enforcement to the individual member states. Its preamble recognises the competing interests in protection and enforcement of IP and the need for a secure conducive social and economic environment.[5] Under Article 8.1, Members may adopt measures that they deem necessary to protect public health and nutrition. Developing nations and LDCs have found it very challenging to access essential medicines and other pharmaceutical products, more so in the face of the HIV/AIDS pandemic and other diseases such as malaria and tuberculosis.[6] IPRs, for example patents, play a significant role in the pricing of pharmaceutical products, which, in many cases, become too expensive and, therefore, inaccessible to developing countries and LDCs.[7]

TRIPS Flexibilities

The TRIPS Agreement contains flexibilities that may be used to ensure the balance between protection offered under the Agreement and other social, economic and public interests. For patents, they include 'transition periods, compulsory licensing, parallel importation, the Bolar Provision and exceptions from patentability'[8]. It is not possible to give a full account of flexibilities due to space constraints so only a few will be highlighted. For instance, LDCs are not required to apply the provisions of the TRIPS Agreement, save for Articles 3, 4 and 5 until 1 July 2034 or when they cease to be an LDC (whichever occurs first). This extension is the third granted to the LDCs, with the first granted in 2005 and the second, which expired on 1 July 2021, granted in 2013.[9] In addition, there is a pharmaceutical transition period until 1 January 2033 or when an LDC ceases to be an LDC, whichever occurs first.[10] Under this transition period, an LDC does not have to issue pharmaceutical patents.[11] However, many LDCs have chosen to forego this flexibility and have been granting pharmaceutical patents for a considerable period of time.[12] African countries have not taken advantage of flexibilities at their own peril[13,14], and only six countries exclude pharmaceutical patents in their national legislation, namely Angola, Burundi, Liberia, Madagascar, Rwanda and Uganda[15,16]. In addition, Rwanda's IP Policy of 2018 recommended the adoption of an international exhaustion regime to facilitate parallel importation of generic medicines. Rwanda is unique in its approach and consistency.

Article 30 allows WTO Members the power to provide limited exceptions to the exclusive rights granted under patents. These exceptions are subject to the three-step test, specifically that they (1) should not unreasonably conflict with the normal exploitation of the patent; (2) should not unreasonably prejudice the interests of the legitimate patent holder; and (3) should consider the legitimate interests of the third parties.[17] Article 31 provides for compulsory licensing subject to several conditions, including that the authorised use shall be limited to the domestic market and subject to payment of adequate remuneration to the patent holder. This flexibility is of little or no use to developing countries and LDCs with limited or no manufacturing capacity for pharmaceutical products and which would not be in a position to pay for the remuneration to the patent holder where a compulsory licence is issued pursuant to Article 31 (h). This issue is addressed further below.

Exclusion of the patentability of pharmaceuticals does not per se lead to access to medicines, because patent information may not be immediately available to be replicated and may be guarded as undisclosed information. Further, if countries do not have adequate manufacturing capacity to produce the medicines, the availability of information and technology will not solve the problem. Currently, only a few African states have manufacturing capacity that can be dedicated to COVID-19 vaccines production, such as: Egypt, Morocco, Senegal, South Africa and Tunisia.[18] Under the Partnerships for African Vaccine Manufacturing (PAVM) launched in April 2021 by the AU, several new partnerships were developed which will enable other countries, including Rwanda, Congo and Senegal, to produce vaccines using the mRNA technology.[19] However, these solutions target specific and limited actions that do not address a systemic lack of manufacturing capacity in Africa. A cooperative approach is necessary to ensure adequate manufacture and distribution of pharmaceuticals and medical devices across the continent, which includes enhanced procurement and import of pharmaceuticals and medical devices into the continent.[20] The adoption of a regional or international exhaustion of IP rights regime by African states would ensure that there is meaningful movement of these supplies across the continent. Therefore, it has been recommended that such an approach be advanced by the IP Protocol of the African Continental Free Trade Agreement that is being negotiated.[21]

Doha Declaration, TRIPS Waiver and Article 31bis of TRIPS Agreement

Prior to 2005, countries like India and Brazil had flourishing pharmaceutical industries dealing in generic medicines that they produced for their domestic market as well as for export because they did not have patent protection for the original pharmaceutical products.[22] As of 2005, when they became obliged to protect product patents, their production and export of generic pharmaceutical products was no longer possible where there was a patent on the originator pharmaceutical. Further, even where this was done under a compulsory licence, there were difficulties with the transit of generics.[23]

The HIV/AIDS crisis highlighted developing countries' and LDCs' difficulties in accessing medicines.[24] This difficulty was brought to the fore when a pharmaceutical industry association with its 39 affiliate companies filed an application against the South African government[25], alleging that the introduction of parallel importation provisions, among others, by the *Medicines and Related Substances Control Amendment Act* was inconsistent with the provisions of the TRIPs Agreement. A full account of this litigation is available elsewhere.[26-30] This matter was ultimately settled and the amendments were implemented, following the adoption of the Doha Declaration on the TRIPS Agreement and Public Health (Doha Declaration).

The Doha Declaration was adopted on 14 November 2001 at the WTO Ministerial Conference[31] to address the complex issues that arose in relation to access to essential medicines[32]. The Declaration applied to access in relation to a broad spectrum of public health issues and is not limited to a set of certain limited circumstances as provided for under Article 31 (h) of the TRIPS Agreement.[32] Paragraph 6 of the Declaration enabled the use of compulsory licences to facilitate access to medicines for Members with insufficient or no manufacturing capacities in the pharmaceutical sector. Under the WTO General Council Decision on Implementation of Paragraph 6 of the Doha Declaration[33], Members agreed to waive Article 31 (f) of the TRIPS Agreement to allow importation of pharmaceutical products, under compulsory licence, by Members without manufacturing capacity, subject to specific conditions. It also permitted the issuance of a compulsory licence by any Member for the manufacture of essential pharmaceutical products. Eligible importing members are defined as LDCs and other states which notify their intention to use the system.[34] They are required to notify the Council for TRIPS of the pharmaceutical products they intend to import as well as the quantities.[33] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and the United States of America indicated that they would not use the system as importing states. Other states indicated that they would have recourse to it in a limited way such as during national emergencies.[35] In 2005, the Protocol amending the TRIPS Agreement rendered the above mechanism permanent.[36] The amendment, (article 31*bis*) together with an Annex, came into force on 23 January 2017 after it was accepted by two thirds of WTO Members. The waiver provisions under the General Council Decision of 30 August 2003 on the implementation of Paragraph 6 of the Doha Declaration continue to apply to those Members which are yet to accept the protocol, and the amendment is currently open for acceptance until 31 December 2023.[37]

African implementation of the TRIPS Waiver and Article 31*bis*

Only 29 African states had accepted the TRIPS amendment by 30 April 2022[38], raising the following related questions: (1) Why have some African states not accepted the amendment? (2) Why have those that have accepted the amendment not filed notification of their intention to use the system as importing states? (3) Why have those which have not accepted the amendment not filed their notifications, because it is not dependent on acceptance of the amendment, as the waiver decision applies to those states which are yet to accept the amendment? Finally, one may ask, generally: Why has the system not been extensively used to date? There is no official statement from any state on why it has not accepted the amendment nor filed a notification to use the system as an importing state, so it is difficult to state the answers to the first three questions with any certainty. There has been some scholarly commentary on the minimal use of the system which will be discussed below, to advance potential answers to the fourth question.

Since its adoption in 2003, the system has been used only once by Canada (exporter) and Rwanda (importer). However, since the start of the COVID-19 pandemic, Antigua and Barbuda[39] as well as Bolivia[40] filed notices of their intention to use the system as importers. They await notification by other WTO member states of their availability to serve as exporters. Specifically, Bolivia has entered into an option agreement with Biolyse, in the hope that Canada will issue a compulsory licence that will enable the firm to export pharmaceuticals to Bolivia.[41]

The minimal use of the system has been attributed to several factors. The bureaucratic strictures of the notification process which is coupled with navigating the exporting state's national laws on compulsory licensing are unduly burdensome. Canada's Access to Medicines Regime (CAMR)[42] under which compulsory licences are issued for the manufacture of pharmaceuticals for export to eligible importing countries, has proven to be complicated and lengthy.[43-45] The Canadian company seeking a compulsory licence must first negotiate a voluntary licence (which usually takes a significant period), and upon the failure of such negotiations, must obtain a compulsory licence, which also takes some time. These licences are subject to challenge in court under a good faith clause to ensure that the generic manufacturer is not competing with the originator manufacturer. In the single use of the system, the delay was also because Rwanda had to file its notification[46] as an importing country before Apotex could seek a voluntary licence. It took at least 3 years to navigate the CAMR before the Canada–Rwanda export–import could be implemented.[45] This arduous process likely discouraged any further efforts to use the system, until the notifications filed in 2021 as noted above. As noted by Nkomo[43(p.289)] and others[11-16], there seems to be an engrained reluctance to use health-related TRIPS flexibilities by African states. However, if the export–import process takes up to 3 years, then it is not suitable for emergency situations as innumerable lives will be lost as the process unfolds.

Concerns about the profitability of such schemes or strong incentivisation of generic manufacturers have been raised.[43-45] The CAMR's 4-year maximum duration of the compulsory licence and the maximum quantity requirement also contribute to the unworkable nature of the system. Rwanda, a LDC, faced no significant internal hurdles as there were no relevant patents in relation to which compulsory licences had to be sought. In an importing country where relevant patents are in place, domestic licences must be obtained to enable the import of generics which would further complicate and delay the inbound process. Indeed, as Vincent[45(p.3)] has noted, 'in practice, the compulsory licensing system under Article 31*bis* does not meet the standards it aims to establish and represents little more than a patchwork to fix specific problems that arose from Article 31'. Therefore, it is understandable how it has not fulfilled the promise it initially held out and why the TRIPS Waiver proposal has been tabled, as set out below.

TRIPS Waiver for the prevention, containment and treatment of COVID-19

India and South Africa presented a proposal to waive the implementation, application or enforcement of the sections dealing with copyright, industrial designs, patents and protection of undisclosed information in the TRIPS Agreement in October 2020.[47] The proposal is not limited to patents because hindrance to access to COVID-19 related technologies extends beyond patents and includes other IPRs such as the protection of undisclosed information embedded in all processes of research and development.[48] Revised proposal text was presented on 25 May 2021, which refined the scope to include products and technologies, their materials or components, as well as their methods and means of manufacture, and focused only on COVID-19 prevention, treatment and containment.[49] Waivers to rules established by WTO legal instruments are provided for in Article IX.3, 4 and 5 of the Agreement Establishing the WTO. Article IX.3. (b) establishes that 'A request for a waiver concerning the Multilateral Trade Agreements in Annexes 1C and their annexes shall be submitted initially to the Council for TRIPS which is mandated to discuss it within 90 days and submit a Report to the Ministerial Conference.' The Ministerial Conference should make a decision within the 90 days and if consensus is not reached during the time period, any decision to grant a waiver shall be taken by three fourths of the Members. Article IX.4 requires that the following be contained in the Ministerial Conference decision: exceptional circumstances justifying the decision, the terms and conditions governing the application of the waiver, and the date on which the waiver shall terminate. This is to ensure compliance with the exceptional nature of the waivers and that the waiver is granted for a limited period. Further, if the waiver is granted for a period of more than one year, it shall be reviewed by the Ministerial Conference not later than one year after it is granted, and thereafter annually until the waiver terminates. Pursuant to the outcome of the annual review, the waiver may be extended, modified or terminated.

The TRIPS Waiver proposal articulates the exceptional circumstances that motivate it as the failure to make diagnostics, therapeutics and vaccines for COVID-19 available promptly, in sufficient quantities and at affordable prices to meet global demand. Further, developing countries and LDCs face challenges in relation to using TRIPS flexibilities, such as compulsory or government use licences, and navigating the cumbersome and lengthy process for the import and export of pharmaceutical products for countries with no manufacturing capacity.

The proponents highlighted the need for WTO Members to work together to ensure that IPRs do not hinder timely access to affordable medical products including vaccines and medicines or to scaling up of research, development, manufacturing and supply of medical products essential to combat COVID-19. They called for global solidarity. The proposed duration of the waiver is an initial period of 3 years, to continue until widespread vaccination is in place globally and the majority of the world's population has developed immunity. The proposal also urges WTO Members not to challenge any measures taken in conformity with the provision of the waivers nor to resort to WTO's Dispute Settlement Mechanism.

The proposal was promptly embraced by more than 100 countries, including all AU member states and other developing states, which included Bolivia, Fiji, Indonesia, the LDC Group, Maldives, Mongolia, Pakistan, Vanatu and Venezuela. By mid-2021, it was supported by developed states such as the USA (qualified support)[50], but it faced resistance from other developed states, particularly the EU, which argued that IP is not the major obstacle to access to health products and technologies related to COVID-19. Instead, they place the blame on infrastructure, supply chains and production capabilities and capacity in recipient countries as the major stumbling blocks in distributing medicines and vaccines.[51] They further warn of the risk that the IP Waiver may undermine R&D and innovation, as it may reduce the incentives that spark innovation.[52,53]

This argument overlooks the fact that the research that led to the existing vaccines was largely financed by public funds.[48,54] Hence, the argument of threats to the reward to the investors seems not to hold on this occasion.

It is also argued that there are many alternatives to the waiver, such as the voluntary and compulsory licences and even bilateral arrangements with suppliers which are already selling the vaccines at 'reasonable prices'. Finally, it is pointed out that the waiver will not address the main concerns of developing countries, such as lack of manufacturing capacity or the transfer of technology and goodwill, hence it is useless. Efforts to enhance manufacturing capacity on the continent have already been outlined above.

Those in support of the proposal view call for its urgent adoption as it will contribute to a fair distribution of vaccines and is in keeping with the human rights obligations of states.[55] The TRIPS Waiver could assure manufacturers that their activities will not attract litigation or seizure of their vaccines during the process of export with allegations of patent infringement. It is far more effective than compulsory licences due to the procedural intricacies that surround compulsory licences, as outlined above.[48] There are further disadvantages in using compulsory licences, including that they are applicable on a product-by-product, and country-by-country basis due to the territorial nature of IP rights, and some countries are reluctant to make use of them for fear of reprisals or sanctions. Further, regulatory obstacles – including protection of data and marketing exclusivities – pose serious hindrances. It is unclear what should constitute adequate remuneration required for the rights holders in times of a pandemic and the lack of information on the existing relevant patents to vaccines, their content, manufacturing and regulatory processes makes it difficult to be precise about which IP rights a compulsory licence should target.

Notwithstanding the shortcomings in the compulsory licensing system, the EU presented a communication on 'Urgent trade policy responses to the COVID-19 crisis' to the General Council and to the TRIPS Council on 4 June 2021.[56] The EU proposes a global trade initiative for equitable access to COVID-19 vaccines and therapeutics encompassing: (1) trade facilitation and disciplines on export restrictions; (2) expansion of production, including through pledges by vaccine producers and developers; and (3) clarification and facilitation of TRIPS Agreement flexibilities relating to compulsory licences. In essence, it hinges on the compulsory licence mechanism to meet the objectives of providing COVID-19 vaccines for all. It has been denounced as a diversion from the India–South Africa proposal.[57,58] Indeed, instead of maintaining the text-based negotiation of the previous proposal, it reopens the discussion and redirects the debates on the effectiveness of compulsory licences, which as illustrated above, are inadequate. However, at the TRIPS Council, Members agreed to continue the discussions based on both proposals, which they have done primarily through the quad negotiations, and the proposals will be considered at the 12th Ministerial Conference which has been postponed until June 2022.

IP and the International Treaty on Pandemics

WHO indicates that the proposed International Treaty on Pandemics aims at providing improvement in alert systems, data sharing, research, and local, regional and global production and distribution of vaccines, medicines, diagnostics and personal protective equipment.[59] The European Council proposal for the Convention highlights: risk monitoring, better financing and coordination of research, greater efficiency in alerts and information sharing, improved access to healthcare resilience by strengthening healthcare systems, and secure supply chains.[60] However, notwithstanding the rhetoric of a 'comprehensive and multisectoral instrument' the proposed solution is not a systemic and all-encompassing response. First, the WHO's starting premise is that access to vaccines is predominantly a health issue.[61] This needs to be extended by an appreciation of the crucial role of other areas – such as trade rules, IP, technology transfer and environment – in facilitating access to medicines and health technologies. Indeed, a holistic approach to access to health care must not overlook the research and development, innovation, ownership and exploitation of the intangible assets developed which will have a final bearing on access to medicines and health-related technologies. So, the ongoing WHO, World Intellectual Property Organization (WIPO) and WTO Trilateral Cooperation on Public Health, IP and Trade is welcomed. However, it remains to be seen whether WHO, as a sectoral agency, will be the most suitable site to implement and enforce a Treaty that is by its nature cross-cutting.

Second, the WHO seeks to make this Treaty binding, like the Framework Convention on Tobacco Control and the revised International Health Regulations which entered into force in 2007. The overwhelming ratification of the Framework attests to the fact that health issues prevailed over the tobacco lobbies. However, the Treaty may not have the same fate. The pharmaceutical industry lobby has shown more strength and may not be amenable to a binding instrument that may hurt its commercial interests. There are two examples that demonstrate that treaties with mandatory technology transfer provisions fail. After more than a decade of negotiations, the UNCTAD 'Draft International Code of Conduct for the Transfer of Technology' failed because of divergent positions regarding its binding character.[62] Developing countries wanted a binding instrument while developed countries preferred guidelines. The success of the Convention on the Law of the Sea only came after the removal of mandatory rules on technology transfer because, with such provisions in place, Western states, led by the USA, did not join the Convention.[63] The deadlock was only overcome in 1994 through UN Resolution 48/263 ('Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982') that repealed article 5(3) that had imposed the mandatory regime. Thereafter, ratifications started to flock in. Therefore, although the Pandemics Treaty seems to be consensual and was initiated in the political sphere, it may suffer deadlock if it includes obligations related to IP and transfer of technology related to medicines, vaccines and health technologies. However, a non-binding instrument may also be problematic: some have highlighted that the current pandemic could have been tackled efficiently if the existing International Health Regulations as revised in 2005 were binding and had been enforced.[64-66]

Third, what emerges clearly is that the proposed instrument is not an IP Treaty, but as access to vaccines and health technologies is entangled with IP, the proposed Treaty should consider IP matters with sufficient detail, which can only result from diplomatic negotiations. One can foresee probable minimum content such as: possible automatic waivers of IP during pandemics, compulsory licences, remuneration to rights holders, incentives to encourage transfer of technology, access to relevant information and data, technical assistance to LDCs, free flow of required medicines and health technologies, and empowerment of developing countries to gain manufacturing capacities.

Fourth, the proposed Treaty seems to focus on operational issues to tackle emergency situations such as risk monitoring, early alert to outbreaks, and mobilisation of financial resources to curb the pandemics. However, some pandemics are a result of excessive global consumption and trade patterns that are overstretching the capacities of the globe.[67,68] Therefore, the response must also encompass the transformation of human behaviours and encouragement of sustainable practices. The Treaty must therefore go beyond health and trade and include environment preservation and balanced exploitation of natural resources.

Fifth, the proposed framework seems to focus on the public sector response. It became clear during the current pandemic that health and technology endeavours are owned by private entities and governments struggle to force companies to share their knowledge and intangible assets. In the context of implementation of article 66.2 of the TRIPS Agreement, developed states have always expressed their inability to force transfer of technology to occur, claiming that they do not own most technologies subject to transfer and cannot force the private sector to transfer technologies.[69] And yet, the current debates on the Pandemic Treaty were sparked by political figures, driven by them and seem to rely on private sector commitment. A statement by the International Federation of Pharmaceutical Manufacturers & Associations issued on 30 March 2021 attests to the desire of the private sector to be included in the negotiation of the new Treaty.[70] Lack of private sector cooperation may derail operationalisation of government commitments. This situation may be evidenced by the recent case of the C-TAP mechanism which failed partially due to lack of endorsement and support by the pharmaceutical industry.

Conclusion: Necessary national and continental responses

The proliferation of multilateral IP rules has restrained the policy space available for developing countries, especially in Africa, to craft balanced patent laws that enable pursuit of public policies, including that of facilitating access to medicines. However, some policy space compatible with TRIPS is still available, and should be used, to undertake reforms, such as: reviewing patentability standards, use of pre- grant and post-grant opposition, facilitating legal challenges to the validity of patents, adopting stricter rules of examination of patents and involving other public authorities in examination or litigation, imposing legal sanctions for misconduct by patent applicants and holders leading to abuse of patent rights and remedies, limiting divisional applications, and increasing registration and maintenance fees to dissuade patent applicants from filing trivial applications.[71] Scholarship is also focused on the desirability of compulsory licensing for trade secrets, which, due to space constraints, we cannot address here. Suffice it to note that the COVID-19 pandemic has clearly emphasised the significance of trade secrets in the race to produce and supply the necessary products and therapeutics. For various reasons, discussed above, this policy space has not been fully used by African states to reform patent laws to ensure that they fully cater for the public interest. Specifically, in relation to LDCs, the general LDC transition period and the pharmaceutical exemption period outlined above, are very significant as they provide them with policy space to refrain from application of patent laws before the specified date. However, as also noted above, many LDCs surrendered these transitional periods and enacted legislation almost fully compliant with the TRIPS Agreement before they were required to do so. Similarly, African states have neglected the reform of other IP laws which may be beneficial to scientific endeavours to develop medical products and devices to prevent, treat and contain COVID-19. A full discussion of the national solutions required under the current TRIPS rules is precluded by space constraints. Suffice it to note that it has been the subject of scholarly commentary elsewhere and may inform follow-on publications in this journal by the authors.

Having said that, it is important to reiterate that the existing mechanisms are inadequate and have failed to meet COVID-19 challenges, and those of endemic diseases. A case in point is the WHO backed mRNA vaccine technology transfer hub in South Africa which has shown impressive capacity in developing its own copy of the Moderna vaccine but is not yet able to produce the amounts of vaccine required to meet the dire need. Momentum would be aided by a royalty-free voluntary licence for low-income and low-to-middle-income countries but this is unlikely. Therefore, it is evident that a private sector/market reliant response that hopes for charity is inadequate, and the IP legal framework needs to be revised as well, to ensure equity and the full use of existing and future manufacturing capacity. Hence the proposal for a TRIPS Waiver that would suspend copyright, industrial designs, patents and protection of undisclosed information. African states, collectively, have supported the TRIPS Waiver, which may provide a fix to the current COVID-19 pandemic but is not a sustainable solution for possible recurrent pandemics in the future. Hence, the calls for the adoption of an International Treaty on Pandemics; it behoves the continent to also support this Treaty as a possible complementary response, and its progress merits watching.

Finally, the TRIPS Waiver, if it were passed, would not be self-executing, so national legislative changes would have to be enacted to implement it domestically. Even if it were not passed, African states must take domestic action to enhance access. Indeed, it is odd that they would spearhead international norm-setting reforms, whilst neglecting to act domestically. For instance, there have been sustained calls for South Africa to reform patent laws spanning at least a decade, yet even in this period of crisis, the necessary reforms are not forthcoming. The introduction of substantive patent examination, in accordance with the National IP Policy, Phase 1, 2018, would have gone a long way in preparing the patent office to deal with COVID-19 related patent applications.

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We have no competing interests to declare.

Authors' contributions

Each author contributed to the conceptualisation, research, writing and finalisation of the manuscript. Authors are listed alphabetically. C.B.N. served as project manager and leader.

References

1. Our World in Data. Share of people who received at least one dose of COVID-19 vaccine [webpage on the Internet]. c2020 [updated 2021 Jul 01; cited 2021 Oct 02]. Available from: https://ourworldindata.org/grapher/share-people-vaccinated-covid?country=High+income~Upper+middle+income~Lower+middle+income~Low+income
2. Health Justice International. TRIPS WAIVER negotiations – Leaked text [webpage on the Internet]. 2022 March 24 [cited 2022 Apr 11]. Available from: https://healthjusticeinitiative.org.za/2022/03/24/trips-waiver-negotiations-leaked-text/
3. World Trade Organization (WTO). Council for Trade Related Aspects of Intellectual Property Rights (Council for TRIPS). Communication from Chairperson; 3 May 2022, IP/C/W/688.
4. World Trade Organization (WTO). Intellectual property: Protection and enforcement [webpage on the Internet]. No date [cited 2021 Aug 24]. Available from: www.wto.org/english/thewto_e/whatis_e/tif_e/agrm7_e.htm
5. Mitchell AD, Voon T. The TRIPS Waiver as a recognition of public health concerns in the WTO. In: Pooge T, Rimmer M, Rubenstein K, editors. Incentives for global public health: Patent law and access to essential medicines. Cambridge: Cambridge University Press; 2010. p. 56. https://doi.org/10.1017/CBO9780511750786.005
6. Correa CM. TRIPS Agreement and access to drugs in developing countries. SUR Int J Hum Rights. 2005;3(2):26–39.
7. Cottier T. The Doha Waiver and its effects on the nature of TRIPS system and competition law: The impact of human rights. NCCR Trade Regulation Working Paper No. 2006/21. SSRN. https://doi.org/10.2139/ssrn.1036381
8. Nicole D, Owoeye O. Using TRIPS flexibilities to facilitate access to medicines. Bull WHO. 2013;91:533–539. https://doi.org/10.2471/BLT.12.115865
9. World Trade Organization (WTO). WTO Members agree to extend TRIPS transition period for LDCs until 1 July 2034 [webpage on the Internet]. c2021 [cited 2021 Jul 05]. Available from: www.wto.org/english/news_e/news21_e/trip_30jun21_e.htm
10. WTO Council for TRIPS. Extension of the transition period under article 66.1 of the TRIPS Agreement for least developed country members for certain obligations with respect to pharmaceutical products (Decision of the Council for TRIPS of 6 November 2015, IP/C/73).
11. Baker B. A full description of WTO TRIPS flexibilities available to ARIPO member states and a critique of ARIPO's comparative study analyzing and making recommendations concerning those flexibilities [document on the Internet]. c2019 [cited 2021 Oct 02]. Available from: www.bu.edu/gdp/files/2020/05/ARIPO-Member-States-obligations-and-flexibilities-under-the-WTO-TRIPS-Agreement-March-2019.pdf
12. Adusei P. Patenting of pharmaceuticals and development in sub-Saharan Africa: Laws, institutions, practices, and politics. Heidelberg: Springer Science & Business Media; 2012. p. 15.

13. Nkomo M. The under-utilization of TRIPS flexibilities by developing countries: The case of Africa. WIPO-WTO Colloquium Paper 1; p. 125–126 [document on the Internet]. c2010 [cited 2021 Aug 24]. Available from: https://www.wto.org/english/tratop_e/trips_e/colloquium_papers_e/2010/chapter_11_2010_e.pdf

14. Vawda YA, Shozi B. Eighteen years after Doha: An analysis of the use of public health TRIPS flexibilities in Africa. SSRN. 2020 February 15 [cited 2021 Aug 24]. http://dx.doi.org/10.2139/ssrn.3559478

15. Motari M, Nikiema JB, Kasilo OMJ, Kniazkov S, Loua A, Sougou A, et al. The role of intellectual property rights on access to medicines in the WHO African region: 25 years after the TRIPS agreement. BMC Public Health. 2021;21, Art. #490. https://doi.org/10.1186/s12889-021-10374-y

16. Banda M. WTO TRIPS Agreement: A hindrance to the economic development of least developed countries? The Case of Malawi and Rwanda. WIPO-WTO Colloquium Paper 9; p. 130–131 [document on the Internet]. c2019 [cited 2021 Aug 24]. Available from: https://www.wto.org/english/tratop_e/trips_e/colloquium_papers_e/2019/chapter_9_2019_e.pdf

17. Christie AF, Wright R. A comparative analysis of the three-step tests in international treaties. IIC. 2014;45(4):409–433. https://doi.org/10.1007/s40319-014-0202-2

18. World Health Organization (WHO). What is Africa's vaccine production capacity? 19 March 2021 [cited 2021 Sep 05]. Available from: www.afro.who.int/news/what-africas-vaccine-production-capacity

19. AU/Africa CDC. Statement on the remarkable progress made by several African countries as part of the Partnerships for African Vaccine Manufacturing (PAVM). 13 July 2021 [cited 2021 Sep 05]. Available from: https://africacdc.org/news-item/statement-on-the-remarkable-progress-made-by-several-african-countries-as-part-of-the-partnerships-for-african-vaccine-manufacturing-pavm/

20. Nelson Mandela School of Public Governance. Policy Brief on Pharmaceuticals, Healthcare Value Chains and Health Resilience [document on the Internet]. c2021 [cited 2021 Aug 24]. Available from: https://issuu.com/buildingbridgesuct/docs/tms_w1_pharma_policy_brief_2204

21. United Nations Economic Commission for Africa (UNECA), AU, United Nations Conference on Trade and Development (UNCTAD). Assessing regional integration in Africa: ARIA IX: Next steps for the African Continental Free Trade Area. Addis Ababa: UNECA, AU, UNCTAD; 2019. p. 103–130.

22. World Trade Organization (WTO). TRIPS fact sheet [webpage on the Internet]. No date [cited 2021 Jul 22]. Available from: https://www.wto.org/english/tratop_e/trips_e/factsheet_pharm04_e.htm

23. Ncube CB. Enforcing patent rights against goods in transit: A new threat to trans-border trade in generic medicines. SA Merc LJ. 2009;21:680–694.

24. World Health Organization (WHO). Access to affordable medicines for HIV/AIDS and hepatitis: The intellectual property rights context. No. SEA-TRH-16. New Delhi: WHO Regional Office for South-East Asia; 2014.

25. Pharmaceutical Manufacturers' Association v The President of the Republic of South Africa. (CCT31/99) [2000] ZACC 1.

26. Ncube CB. South Africa's three decades of access to medicine discourse: Blight or benefit. In: Ragavan S, Vanni A, editors. Intellectual property law and access to medicines: TRIPS Agreement, health, and pharmaceuticals. Abingdon: Routledge; 2021. p. 235–251. https://doi.org/10.4324/9781003176602-15

27. Heywood M. Debunking 'Conglomo-talk': A case study of the amicus curiae as an instrument for advocacy, investigation and mobilisation. Law Democracy & Development. 2001;5(2):133–144.

28. Fisher WW, Rigamonti CP. The South Africa AIDS controversy: A case study in patent law and policy [document on the Internet]. c2005 [cited 2021 Oct 02]. Available from: http://cyber.law.harvard.edu/people/tfisher/South%20Africa.pdf

29. Cleary S, Ross D. The 1998–2001 legal struggle between the South African government and the international pharmaceutical industry: A game-theoretic analysis. J Soc Political Econ Stud. 2002;27(4):445–494.

30. Sacco SF. A comparative study of the implementation in Zimbabwe and South Africa of the international law rules that allow compulsory licensing and parallel importation for HIV/AIDS drugs. Afr Hum Rights Law J. 2005;5(1):105–128.

31. World Trade Organization (WTO). Declaration of the TRIPS Agreement and Public Health of 14 November 2001, WTO Doc. WT/MIN(01) EC/2,41 ILM 755; 2002.

32. Abbot FM. The Doha Declaration on the TRIPS Agreement and public health: Lighting a dark corner at the WTO. J Int Econ Law. 2002;2:469–490. https://doi.org/10.1093/jiel/5.2.469

33. WTO General Council WT/L/540 2 September 2003, Implementation of Paragraph 6 of the Doha Declaration on the TRIPS Agreement and Public Health.

34. Mitchell AD, Voon T. The TRIPS Waiver as a recognition of public health concerns in the WTO. In: Pooge T, Rimmer M, Rubenstein K, editors. Incentives for global public health: Patent law and access to essential medicines. Cambridge: Cambridge University Press; 2010. p. 63–65. https://doi.org/10.1017/CBO9780511750786.005

35. WTO General Council Chairperson's statement. Excerpt from the minutes of the General Council Meeting 30 August 2003 (paragraph 29) [document on the Internet]. c2003 [cited 2021 Oct 02]. Available from: www.wto.org/english/tratop_e/trips_e/gc_stat_30aug03_e.htm

36. WTO General Council Amendment to the TRIPS Agreement, Decision of December 6, 2005, (WT/L/641).

37. WTO General Council Decision WT/L/1122 Amendment of the TRIPS Agreement – Eighth extension of the period for the acceptance by members of the protocol amending the TRIPS Agreement General Council Decision, adopted on 22 November 2021.

38. WTO Amendment of the TRIPS Agreement: Members and dates of acceptance [webpage on the Internet]. No date [cited 2022 May 13]. Available from: www.wto.org/english/tratop_e/trips_e/amendment_e.htm

39. WTO Council for TRIPS. Notification under the amended TRIPS Agreement: Notification of intention to use the special compulsory licensing system as an importing member. 17 May 2021IP/N/8/ATG/1.

40. WTO Council for TRIPS. Notification under the amended TRIPS Agreement: Notification of intention to use the special compulsory licensing system as an importing member. 19 February 2021 IP/N/8/BOL/1.

41. Abinader LG. Bolivia seeks to import COVID-19 vaccines from Biolyse, if Canada grants them a compulsory license. Keinonline.org. 11 May 2021 [cited 2021 Oct 02]. Available from: www.keionline.org/36119

42. Government of Canada. Introduction to the Canada's Access to Medicines Regime [webpage on the Internet]. No date [cited 2021 Oct 02]. Available from: www.canada.ca/en/health-canada/services/canada-access-medicines- regime/introduction.html

43. Nkomo M. Rwanda's new intellectual property law and compulsory licensing for export under the WTO: Not quite a panacea. Afr J Int Comp Law. 2013;21(2):279. https://doi.org/10.3366/ajicl.2013.0062

44. Cotter C. The implications of Rwanda's Paragraph 6 Agreement with Canada for other developing countries. Loyola University Chicago International Law Review. 2008;5:177–179.

45. Vincent NG. Trip-ing up: The failure of TRIPS Article 31bis. Gonzaga J Int Law. 2020:1–37.

46. WTO Council for TRIPS. Annual review of the decision on the implementation of Paragraph 6 of the Doha Declaration on the TRIPS Agreement and public health: Report to the General Council. WTO Doc. IP/C/57. 10 December 2010.

47. WTO Council for TRIPS. Waiver from certain provisions of the TRIPS Agreement for the prevention, containment and treatment of Covid-19 – Communication from India and South Africa IP/C/W/669. 2 October 2020.

48. Thambisetty S, McMahon A, McDonagh L, Kang HY, Dutfield G. The TRIPS intellectual property waiver proposal: Creating the right incentives in patent law and politics to end the COVID-19 pandemic. Law, Society and Economy Working Papers 06/2021 1, 21–22. SSRN. https://doi.org/10.2139/ssrn.3851737

49. WTO Council for TRIPS. Waiver from certain provisions of the TRIPS Agreement for the prevention, containment and treatment of Covid-19 – Revised decision text communication from the African Group, The Plurinational State of Bolivia, Egypt, Eswatini, Fiji, India, Indonesia, Kenya, The LDC Group, Maldives, Mozambique, Mongolia, Namibia, Pakistan, South Africa, Vanuatu, The Bolivarian Republic of Venezuela and Zimbabwe IP/C/W/669/Rev.1. 25 May 2020 [cited 2021 Aug 15]. Available from: https://docs.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=q:/IP/C/W669R1.pdf&Open=True

50. USTR. Statement from Ambassador Katherine Tai on the Covid-19 TRIPS Waiver [press release]. 5 May 2021 [cited 2021 Jun 01]. Available from: https://ustr.gov/about-us/policy-offices/press-office/press-releases/2021/may/statement-ambassador-katherine-tai-covid-19-trips-waiver

51. Mercurio B. WTO Waiver from intellectual property protection for COVID-19 vaccines and treatments: A critical review. VA J Int Law. 2021;62:9–32.

52. Bacchus J. An unnecessary proposal: A WTO Waiver of intellectual property rights for COVID-19 vaccines [webpage on the Internet]. c2020 [cited 2021 Aug 15]. Available from: www.cato.org/publications/free-trade-bulletin/unnecessary-proposal-wto-waiver-intellectual-property-rights-covid

53. Hilty RM, Battista P, Carls S, Kim D, Lamping M, Slowinski PR. Covid-19 and the role of intellectual property: Position statement of the Max Planck Institute for Innovation and Competition of 7 May 2021. Max Planck Institute for Innovation & Competition Research Paper 21-13. SSRN. https://doi.org/10.2139/ssrn.3841549

54. Medicins Sans Frontiers. WTO COVID-19 TRIPS Waiver proposal: Myths, realities and an opportunity for governments to protect access to lifesaving medical tools in a pandemic [webpage on the Internet]. c2020 [cited 2021 Aug 15]. Available from: https://msfaccess.org/wto-covid-19-trips-waiver-proposal-myths-realities-and-opportunity-governments-protect-access

55. International Commission of Jurists (ICJ). Human rights obligations of states to not impede the proposed COVID-19 TRIPS Waiver. Expert Legal Opinion [webpage on the Internet]. 8 November 2021 [cited 2021 Nov 11]. Available from: https://www.icj.org/wp-content/uploads/2021/11/Human-Rights-Obligations-States-Proposed-COVID-19-TRIPS-Waiver.pdf

56. WTO Council for TRIPS. Urgent trade policy responses to the COVID-19 crisis: Intellectual property – Communication from the European Union to the Council for TRIPS IP/C/W/680 4 June 2021.

57. Medicins Sans Frontiers. The European Union's position on compulsory licensing and the TRIPS waiver in the COVID-19 pandemic [webpage on the Internet]. c2021 [cited 2021 Aug 15]. Available from: https://msfaccess.org/analysis-eu-position-compulsory-licensing-and-trips-waiver-covid-19-pandemic

58. Ravi D, Kanth R. EU proposal seeks to derail TRIPS Waiver discussions at WTO. Third World Network Info Service on WTO and Trade Issues. 08 June 2021 [cited 2021 Aug 15]. Available from: https://twn.my/title2/wto.info/2021/ti210603.htm

59. World Health Organization (WHO). COVID-19 shows why united action is needed for more robust international health architecture. Geneva: WHO; 2021. Available from: www.who.int/news-room/commentaries/detail/op-ed---covid-19-shows-why-united-action-is-needed-for-more-robust-international-health-architecture

60. European Council of the European Union. An international treaty on pandemic prevention and preparedness. Brussels: European Council of the European Union; 2022 Available from: https://www.consilium.europa.eu/en/policies/coronavirus/pandemic-treaty/

61. Alvarez J. The WHO in the age of the coronavirus. Am J Int Law. 2020;114(4):578–587. https://doi.org/10.1017/ajil.2020.70

62. UN Digital Library (UNDL). Draft International Code of Conduct for the Transfer of Technology. Geneva: UNDL; 1985. Available from: https://digitallibrary.un.org/record/86199?ln=en

63. Stavridis J. Marine technology transfer and the Law of the Sea. Nav War Coll Rev. 1983;36(4):38–49.

64. Tomlinson C. The politics and promise of a pandemic treaty. New Frame. 2021 April 16 [cited 2021 Aug 16]. Available from: www.newframe.com/the-politics-and-promise-of-a-pandemic-treaty/

65. Burci GL. The outbreak of COVID-19 coronavirus: Are the International Health Regulations fit for purpose? EJIL Talk. 2020 February 27 [cited 2020 Aug 16]. Available from: www.ejiltalk.org/the-outbreak-of-covid-19-coronavirus-are-the-international-health-regulations-fit-for-purpose/

66. Burci GL. The legal response to pandemics: The strengths and weaknesses of the International Health Regulations. J Int Humanit Leg Stud. 2020;11:204-221. https://doi.org/10.1163/18781527-01102003

67. The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) workshop report on biodiversity and pandemics [document on the Internet]. c2020 [cited 2021 Aug 16]. Available from: https://ipbes.net/sites/default/files/2020-12/IPBES%20Workshop%20on%20Biodiversity%20and%20Pandemics%20Report_0.pdf

68. Henrique L, Middleton J. What should we ask of a new global treaty for pandemic preparedness? The BMJ Opinion. 2021 April 26 [cited 2021 Aug 16]. Available from: https://blogs.bmj.com/bmj/2021/04/26/what-should-we-ask-of-a-new-global-treaty-for-pandemic-preparedness/

69. World Trade Organization (WTO). Report on the implementation of Article 66.2 of the TRIPS Agreement European Union (IP/C/W/631/Add.7. 16 October 2017).

70. The International Federation of Pharmaceutical Manufacturers & Associations (IFPMA). COVID-19 vaccine and treatment innovators response to global leaders urgent call for International Pandemic Treaty [document on the Internet]. c2021 [cited 2021 Aug 16]. Available from: www.ifpma.org/wp-content/uploads/2021/03/IFPMA_Statement_International_Pandemic_Treaty_30March2021.pdf

71. Syam N, Muñoz Tellez V. Innovation and global intellectual property regulatory regimes: The tension between protection and access. Research Paper No. 67 Geneva: South Centre; 2016.

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Trajectories for South African employment after COVID-19

The COVID-19 health response shut down the South African economy for a period, and then continued to constrain face-to-face services such as tourism, hospitality and personal services. These industries create the majority of jobs in all middle- and high-income economies. The COVID-19 interventions further aggravated pre-existing and rising unemployment and poverty levels. By 2021, only 42% of the working-age population in South Africa was employed, as compared to the National Development Plan's target of 60% by 2030. South Africa has had high unemployment since at least 1978, with an historical policy path that appears to direct the economy towards slow growth and low employment. This article outlines the results of employment scenarios modelling: the purpose is to envisage the future of employment in South Africa in the context of the COVID-19 pandemic, with a view to 2050. Two 'plausible' scenarios are modelled. The upper and lower trajectories are aligned to historical growth paths between 1970 and 2019, with three decades experiencing an average 1.5% GDP growth and two decades an average 3.6% growth. An average economic growth rate rising from 2% to 3.5% between 2022 to 2050 would result in the achievement of the National Development Plan's employment targets. The modelling also shows what the employment trajectory might have been in the absence of the COVID pandemic.

Significance:

- This article evaluates the potential pathway for South African employment after COVID-19.
- After a rapid and significant fall caused by policies to manage COVID-19, employment might only recover to peak 2018 levels by 2024–2026.
- The COVID-19 pandemic may have long-term implications for employment. In the absence of the pandemic, there could have been between 500 000 and 1.6 million more people working by 2050.

Introduction

The COVID-19 health response has caused economic crises globally. The interventions specifically targeted face-to-face activity, which is the main source of employment in middle- and high-income economies.[1] Constraining these services is especially damaging for women and youth, whose main work opportunities are found in services driven by such face-to-face activity – like personal services, hospitality, tourism and retail. Many countries have implemented some combination of economic lockdown and 'risk-adjusted strategies' to balance the COVID-19 health risks and other social and economic risks. The way that developed economies locked down activity was emulated in some developing economies, including South Africa.

South Africa has extremely high rates of unemployment, poverty and inequality. As a country that seeks to reverse the damaging effects of its apartheid past, achieving full employment, eradicating poverty, and reducing inequality are the apex goals, reflective of the Constitution and as translated into the National Development Plan.[2] This article focuses on the employment objective. Since the advent of democracy in 1994, there have been notable successes in creating employment and reducing unemployment. However, there were reversals prior to the onset of the COVID-19 pandemic. The policy responses to contain the COVID-19 pandemic resulted in significant negative impacts on employment, to the extent that unemployment rates have reverted to those seen in the mid-1990s. The economic crisis caused by local and global COVID-19 policy responses and its impact on employment therefore need to be understood in relation to the country's historical challenges and long-range aspirations.

This article presents the potential path for South African employment and unemployment in the aftermath of the COVID-19 pandemic, based on findings of employment scenarios modelling. The employment context as relevant to the scenarios is laid out and the approach to the scenarios is explained. Two employment scenarios to 2050 are presented and compared to what might have happened in the absence of COVID-19.

Employment and unemployment in South Africa

South Africa has had high unemployment since at least 1978, with an historical policy path that appears to direct the economy towards slow growth and low employment.[1,2]

There has been some debate about whether South Africa leans to jobless or job-creating growth.[1] However, the evidence clearly indicates that there is a close relationship between employment and growth. High unemployment has not been caused by jobless growth, but rather the absence of growth.

Growth has been persistently slow over the past 50 years, with per capita GDP growth averaging around 1.6% per annum as seen in Figure 1.[3] There were only two meaningful accelerations – in the 1960s and 2000s – but they were not sustained. Table 1 shows that in the past 50 years there were three decades with an average GDP growth rate of between 1.4% and 2.0% and two decades with an average growth rate of 3.6%.[4]

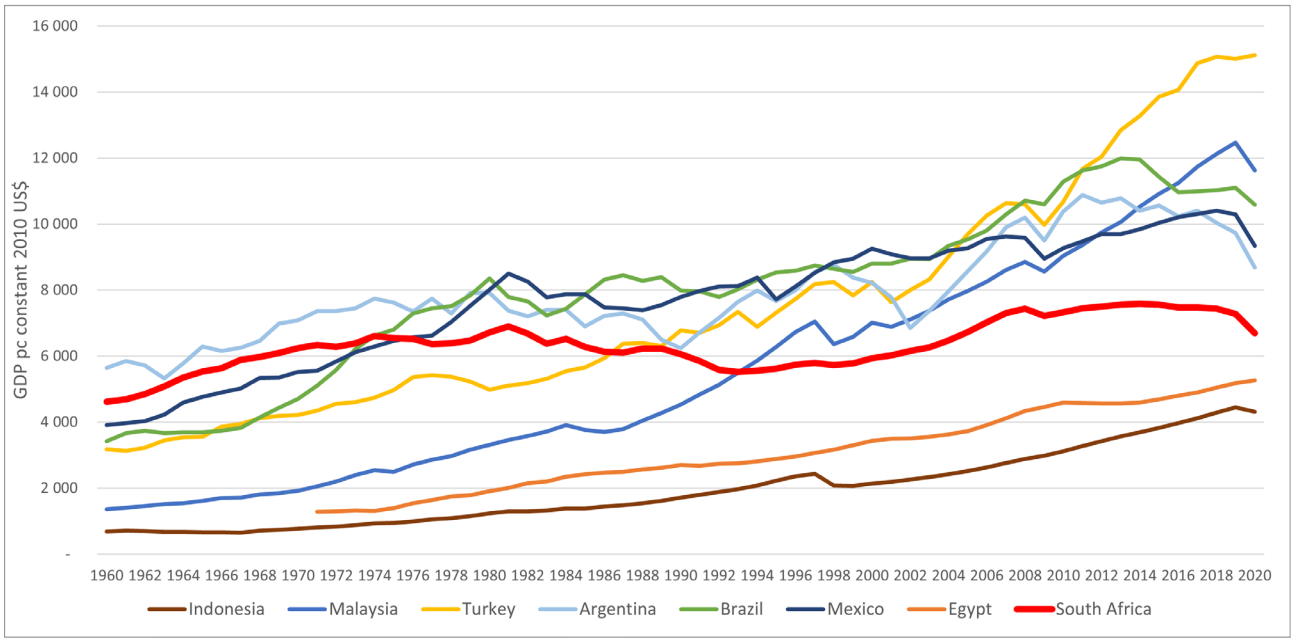

Figure 1: GDP per capita in comparative emerging economies (1960–2020).[16]

Table 1: South African GDP growth (2015 Rand)[17]

Period	Average annual growth
1960–1969	6.3%
1970–1979	3.6%
1980–1989	2.0%
1990–1999	1.8%
2000–2009	3.6%
2010–2019	1.4%

In South Africa, for every 1% GDP growth, employment can be expected to grow by about 0.6% to 0.7%.[1,5] By global standards, this employment elasticity of growth is high and may be explained by slow productivity growth. For example, the average employment elasticity between 1995 and 2003 was 0.14 to 0.18 in East Asia, 0.20 to 0.42 in Southeast Asia, 0.41 to 0.64 in Latin America, and 0.21 to 0.34 in developed economies.[5]

Between 2001 and 2008, a period of positive economic growth, employment expanded by 2.4 million and the unemployment rate fell from 30% to 23%. The employment elasticity of growth was 0.6 over this period.[1]

The South African economy experienced falling rates of GDP growth from 2009, and negative growth in 2019 as shown in Figure 2.[4] Real GDP per capita in 2019 was the same as for 2007. In the period from the second quarter of 2008 to 2019, employment grew slowly. Approximately 1.7 million jobs were created, as compared to 4.1 million people added to the labour market.[6] As a result, the official (broad) unemployment rate rose from 21.5% (26.2%) in the fourth quarter of 2008 to 29.0% (36.6%) in the second quarter of 2019. The proportion of the working-age population in employment fell from 46.2% to 42.4% over the same period.

Falling growth rates over a sustained period suggest the possibility of underlying structural and/or institutional factors that contain potential growth rates. It is possible to break out to higher rates of growth and development with sustained commitment to actions that reform markets and public institutions; however, South African growth metrics indicate that this has not yet happened. Figure 1 compares per capita growth in a number of emerging and developing economies between 1960 and 2020. South Africa has fallen behind comparator countries and especially other middle-income economies, even since the transition in 1994.[3]

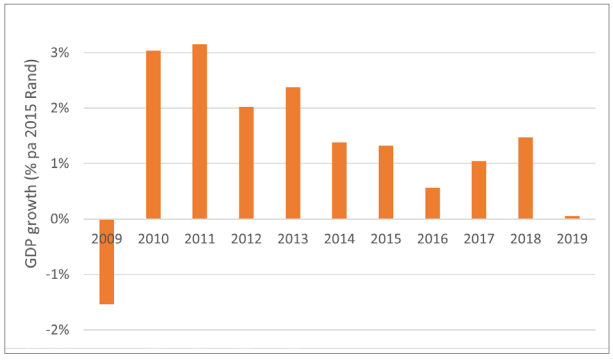

Figure 2: Decline in GDP growth rates.[17]

Employment impacts of the COVID-19 pandemic policy response

Some observations can be made about the impact of the COVID-19 pandemic policy response on employment.

The initial lockdown in March to June 2020 resulted in the loss of 2.24 million jobs, and by the second quarter of 2021, total employment was still 1.44 million lower than at the onset of the lockdown.[6] These high-level employment indicators mask the possible ways that pre-existing inequalities may have deepened.

There are important race, age, and gender dynamics associated with employment, unemployment, and poverty levels in South Africa. These dynamics are found globally, but are particularly extreme in South Africa due to its historical legacy. The imperative to achieve higher economic and employment growth rates is particularly important from the perspective of creating a future in which the whole population enjoys more-equitable access to the opportunity to achieve a decent standard of living.

South Africa has had high black African unemployment since the 1970s; this figure exceeded 20% by 1978[2] and the trend has persisted. In 2018, 84% of all those not in education, training or employment (NEET) were

black African, accounting for 42% of the black African working-age population. By 2021, 50% of the black African population were NEET. By comparison 25% of the white population were NEET in 2018.[7]

Women's prominence in face-to-face service work has resulted in disproportionately negative labour market outcomes. Women were more likely to lose their jobs in the initial lockdown period, accounting for two thirds of the jobs lost in the first lockdown period. Employment recovery as the economy opened was slower for women than for men. By March 2021, men's employment and working hours appeared to have restored to pre-pandemic levels, compared with women whose employment and working hours were still 8.4% and 6.0% below pre-lockdown levels, respectively. In addition, the disproportionate domestic responsibility carried by many women was deepened in the context of school closures and families working from home. By March 2021, the presence of children in the household continued to reduce the probability of employment for women, but did not have this effect on men.[8]

Pre-pandemic, 69% of white adults were employed as compared with 40% of black adults. By mid-2021, these figures had fallen to 67% and 36%, respectively. Women in the informal sector were particularly hard hit, with an employment drop of 16% by mid-2021 as compared with a fall of 3% for men.[9]

The closure or containment of workplaces has in many cases assumed that work would take place at home. The ability to work from home is positively correlated with socio-economic status, the type of home, educational attainment and earnings. For example, those who could work from home earned an average of about one-third more than those who could not work from home. In the South African context, this therefore translates into a race bias, with black African workers least able to work from home and/or being in types of employment that cannot be done from home.[10]

Low-paid workers (earning less than ZAR3000 per month) were eight times as likely as top earners (earning more than ZAR24 000 per month) to have lost their jobs in the initial lockdown of March/April 2020. Black African workers had a 43% probability of losing their job, compared with 17% for white workers.[11] At the time of writing this article, the pathway of employment recovery is still unclear. There has been significant labour market churn below the aggregate numbers: almost one quarter of those employed in February 2020 were no longer employed a year later, and almost one third of those without employment in February 2020 did find employment by March 2021.

Youth unemployment is a global phenomenon, and is usually about two to three times the national rate. In 2018, about 50% of NEETs were aged 15–24. High unemployment therefore specifically entrenches racial disparities for the future. The pandemic hit youth employment disproportionately, with employment of workers under 35 falling by 14%; they accounted for two thirds of all formal-sector job losses between the first quarter of 2020 and the second quarter of 2021, despite having accounted for only one third of total formal employment pre-COVID.[9] There is some indication that older workers left the labour market and that youth were net gainers in the recovery.[12]

Employment recovery after economic crisis

Previous experience of economic crises may be an indicator of how employment recovery might progress after COVID.

The 2008 global economic crisis is the most recent pre-COVID-19 example of South Africa's response to a global shock, although its causes and character differed, emanating from a financial crisis with its epicentre in the USA. In that crisis, developing and emerging economies reverted to pre-crisis levels of output within 2 years, while advanced economies that were at the epicentre took longer to be restored.[13]

Unlike other emerging economies where the impact of the global economic crisis was transmitted largely via decreases in traded manufactures and remittances, South Africa was impacted largely by decreases in private-capital inflows, commodity exports, and trade revenues.[14]

The global economic crisis took some time to reach South Africa. While the financial crisis took place in 2008, South African output fell by 1.5% in 2009 and recovered to pre-crisis levels in 2010. The fall in employment lagged and was substantially larger than that in output. Table 2 offers a picture of employment losses and gains during the global economic crisis. Employment fell by almost 10% (1.466 million) between the fourth quarter of 2008 and the third quarter of 2010 (almost 2 years). Employment recovered to pre-crisis levels by the second quarter of 2013 (almost 3 years). Even though employment levels were restored, unemployment rose.[14]

The pathway to recovery from the economic crisis emanating from the COVID-19 health response would be different from that due to a domestic or global crisis that is caused by market phenomena. This is because the initial channel into the economy is direct, with government shutting down activity by fiat. The second channel arises through other global phenomena such as trade flows and cross-border movement of people.[9,15-17]

The World Bank expects developing countries and emerging markets to be slower in reverting to pre-crisis levels of output this time, compared with the majority of developed countries, which have invested heavily to stimulate their economies in a way that developing economies cannot.[13]

Table 2: Employment and unemployment – past, present and future[7]

		Financial crisis period			Pre-COVID-19[a]	COVID-19 period[b]		Est	Low growth scenario[c]				Medium growth scenario[d]			
	2008	2009	2010	2012	2018	2020	2021	2022	2025	2030	2040	2050	2025	2030	2040	2050
Employment ('000s)	14 584	14 357	13 809	14 330	16 288	14 148	14 942	15 357	16 282	17 157	19 027	21 101	16 804	18 449	23 103	28 537
Unemployment (strict) ('000s)	4267	4341	4622	4721	6083	4295	7826	7755	7917	8806	9632	8997	7394	7515	5566	1561
Unemployment rate (strict)	22.6%	23.2%	25.1%	24.8%	27.2%	38.9%	34.4%	33.6%	32.7%	33.9%	33.6%	29.9%	30.6%	28.9%	19.4%	5.2%
Unemployment rate (broad)	26.9%	29.0%	32.3%	33.1%	35.5%	45.6%	42.7%	41.7%	40.9%	41.1%	40.7%	37.4%	39.0%	36.7%	27.1%	11.4%
Employment/ Working-age population	46.0%	44.5%	42.0%	41.6%	43.1%	36.3%	37.7%	38.3%	38.9%	38.4%	38.9%	41.2%	40.1%	41.3%	47.2%	55.7%

[a] Employment peak – Q4 2018 = 16.529 m
[b] Employment fell to 16.383 m by Q1 2020
[c] Employment could revert to peak 2018 levels by Q4 2026
[d] Employment could revert to peak 2018 levels by Q2 2024
Note: Figures refer to Q2

The process of designing and implementing policy to manage the evolving pandemic changed over time, requiring considerable monitoring and adaptation. The impact of the economic policy responses is not yet known, and information is provided here simply for context. The President invoked a State of Disaster and established the National Command Council. The first phase of the response involved an almost complete economic and social lockdown for 35 days, followed by a month in a slightly more open lockdown phase. Thereafter, there was a process of re-opening economic activity. A risk-adjusted approach reflecting an acceptance of the idea that the containment of the pandemic would have to be balanced with other social, economic, and health considerations was introduced in May 2020. In 2021 and 2022 there has been growing capacity to enable the use of non-pharmaceutical interventions and vaccination of the adult population, which together could pave the way for a full return to work.

Some economic and social measures were put in place by the public and private sectors to support individuals and businesses adversely affected by policies aimed at containing the pandemic. Some examples are the loan guarantee schemes; the introduction of a special wage subsidy; and COVID-TERS, which was funded by the Unemployment Insurance Fund.[9] Support of ZAR350 per month was introduced as part of the Social Relief of Distress programme for unemployed persons who do not access other social grants, in recognition of the surge in the number of food-insecure adults who would otherwise have no other means.

Government introduced the Economic Reconstruction and Recovery Plan in October 2020.[18] It was aimed at driving immediate interventions for economic recovery amid COVID-19, but also at 'rebuilding and growing the economy'. Some of the most prominent elements included a commitment to expanding infrastructure investment and introducing reforms to network industries such as transport and energy. It also introduced an employment stimulus aimed at creating public-sector-funded social-economy jobs aimed especially at youth.

After an overall decline in GDP by 6.4% in 2020, there was a 4.8% recovery in 2021 and a forecast of 1.7% growth for 2022.[19] Output, which fell due to the economic shutdown locally and globally, is expected to recover within approximately 2.5 years. By comparison, 2.2 million jobs were lost in the second quarter of 2020, accounting for 13.6% of total employment. Only 800 000 jobs were recovered a year later.[6] It is expected that in 2022 there will still be one million fewer employed than in the pre-crisis period, as seen in Table 2.

Employment scenarios in a post-COVID-19 pandemic future

The purpose and design of employment scenarios

I have prepared employment scenarios for South Africa since 2004. They were the foundation for the Human Sciences Research Council's Evidence-based Employment Scenarios, which were prepared before and after the 2008 global economic crisis. These scenarios contributed to the setting of national targets in respect of employment and related policies.[1,20] The second major set of scenarios was prepared for the National Planning Commission in the South African Presidency for the National Development Plan.[21] A smaller employment scenarios exercise was done in the early phase of the COVID-19 pandemic.[22]

Futuristic scenarios were used to help visualise the following:

- A future state in which there is significant structural change associated with the development process.
- A pathway to solving for a seemingly intractable challenge such as extreme unemployment, poverty, and inequality as found in South Africa.
- Possible validation of a current path, or the identification of risks that require attention and course correction towards the desired path and end goal.

Employment generally grows incrementally and, if sustained, expands in a cumulative fashion, in some proportion to output growth. In the context of very high unemployment, small variations in economic and employment growth rates can seem trivial in the near term. However, these small differences can make a very significant impact when sustained over decades.

Methodology

When the employment scenarios were done previously at the Human Sciences Research Council and for the National Planning Commission, the government's national target of halving unemployment and achieving full employment was set, and a path to achieving that goal proposed. These scenarios were prepared in the belief that the installation of a new regime and democratic government would bring significant change in institutional and policy orientation that could guide the way to faster employment creation and economic inclusion. The purpose was realising a future with full employment, with a view to the high-level targets as well as second-order targets and dependencies. The method involved defining and calculating the half-unemployment mark and then linking it to other metrics such as employment or labour force participation. In 2004, the target official unemployment rate was 14% by 2014 and 6% by 2024. In the National Development Plan, those targets were shifted outwards to 2020 and 2030, respectively. More importantly, the National Development Plan set an employment target of 11 million jobs created between 2010 and 2030, with the aim of 60% of the working-age population being employed by then.

The employment scenarios presented in this article use a different method. They do not involve the setting of future goals and do not assess how to achieve any specific employment goal. Instead, they focus on two plausible economic trajectories and then apply a set of assumptions to model possible employment and labour market outcomes.

The COVID-19 pandemic has had especially negative impacts in our country that is already challenged by extremely high unemployment. These employment scenarios are aimed at revealing possible trajectories for employment recovery coming out of the pandemic, and up to 2050.

The gravitational pull of South Africa's path was underestimated in this earlier work. Path dependence and the challenges associated with significant institutional and policy reorientation have to be accounted for in any temporal thinking around change. The two scenarios described in this article are shaped by plausible outlooks in the context of this institutional experience.

With this in mind, the employment scenario modelling has been revised from earlier versions to take account of potential economic growth, the relationship between employment and growth, labour market growth, and official versus broad unemployment.

A simple linear model is used. The assumptions and formula are presented in Table 3. The reasoning behind these assumptions are explained in the previous section. It is assumed that:

- The lower-bound GDP growth rate falls to 1.6% per annum on average and the higher-bound growth rate rises to an average of 3.5% per annum. In the near term, the modelling uses recent forecasts by the South African Reserve Bank, which sees GDP growth falling to 1.7% in 2022 and rising to 2% by 2024.[23] The potential growth rate rises as economic capacity expands, and can therefore be influenced. It had risen to 3.5% by 2008, but fell to 1.7% between 2010 and 2015.[24] The potential growth rate is now estimated to fall below 1%.[23,25]
- The employment elasticity of growth ranges between 0.60 and 0.65. The modelling assumes that employment grows by more than 0.65% of GDP growth in the near term. This takes account of expected further recovery of jobs in labour-intensive activities such as retail, personal services, tourism, and hospitality. The elasticity then falls to 0.60.
- Between Quarter 3 of 2019 and Quarter 3 of 2021, 1.136 million jobs had still not been recovered in the highly labour-intensive

Table 3: Assumptions and formula used in employment scenarios

	Low growth	Medium growth
GDP growth annual	2021 = 4.8% 2022 = 1.7% 2023 = 1.8% 2024 = 2.0% 2025 = 1.8% 2026 = 1.7% 2027 – 2050 = 1.6%	2021 = 4.8% 2022 – 2023 = 2.2% 2024 – 2026 = 2.5% 2027 – 2030 = 3.0% 2031 – 2050 = 3.5%
Discouraged unemployed	19% ≥ UEd ≥ 17% /NEA	19% ≥ UEd ≥ 10% /NEA
Employment bounce-back effect in labour-intensive services	2022 = 250 000 2023 = 350 000	2022 = 250 000 2023 = 350 000 2024 = 300 000
Employment elasticity	0.65	2022 – 2039 = 0.65 2040 – 2050 0.64 ≥ η ≥ 0.60
Formula	• $E_t = E_{t-1}\ x\ Y_t\ x\ \eta$ • $EA_t\% = \frac{E}{WAP}\ x\ 100$ • $UE_s = LF - E$ • $UE_s\% = \left(\frac{UE_s}{LF}\right)\ x\ 100$ • $UE_b\% = \frac{UE_s + UE_d}{LF + UE_d}\ x\ 100$	
Notation and acronyms	WAP = working-age population = aged 15–64 LF = labour force = WAP employed or searching for work as per official definition E = total employment E_t = total employment in year t UE_s = strict unemployment UE_b = broad unemployment UE_d = discouraged unemployment = likely % of NEA that is discouraged based on history EA = employment absorption NEA = not economically active = $WAP - LF$ Y = GDP ΔYt = GDP% change in t year η = employment elasticity = $\frac{\Delta E}{\Delta Y}$	

'trade' and in 'social and community services'. It is assumed that 600 000 to 900 000 jobs are added in a lagged recovery of these services between 2022 and 2024.

- 63% of the growth in the working-age population consists of those entering the labour market each year and 37% becoming not economically active, as has been the case over the period from the fourth quarter of 2008 to the fourth quarter of 2018.[6] Over the period from 2008 to 2018, approximately 63% of the growth in the working-age population entered the labour market and 37% were not economically active.
- Estimates on labour market growth rely on United Nations population projections. These foresee annual growth in the South African working-age population falling from about 550 000 currently to about 150 000 by 2050.[26] This demographic transition has a significant positive impact on unemployment rates after 2030.

Employment outcomes in the low- and medium-growth scenarios are then compared to what might have happened in the absence of the COVID-19 crisis. It is assumed that employment could have grown by about 1% in 2020 and 2021, had the economy expanded by about 1.6% in each of those years. Growth of 1.6% per annum would be consistent with the South African Reserve Bank and other assessments of the potential growth rate of the South African economy.[25]

Results

Two simple employment scenarios to 2050 are modelled, with results presented in Table 2. The modelling assumptions are found in Table 3. Figure 3 offers a visual of employment and unemployment pathways in these two scenarios.

Both scenarios are domestically focused, even though South Africa is highly vulnerable to global cycles. Neither scenario is concerned with global dynamics, because resilience domestically will aid in reversing decline, accelerating growth and development, and responding to global up- and downswings.

Scenario 1 envisions low growth, recovery from the COVID-19-policy-induced economic crisis, and a reversal of the pre-COVID-19 economic decline. In this scenario, GDP grows by 1.7% in 2022, falling to an average of 1.6% per annum from 2027 to 2050. This is aligned with forecasts by the South African Reserve Bank and its assessment of potential economic growth prior and subsequent to the onset of COVID-19.[23,25] Also in this scenario, employment reverts to 2018 levels by 2025; about 5.74 million jobs are created between 2022 and 2050; and strict and broad unemployment both rise, as an average of 205 000 jobs created annually is not sufficient to absorb labour market entrants. By 2050, there are 21 million people working and 12.6 million unemployed or discouraged. The strict and broad unemployment rates are 29.9% and 37.4%, respectively. Only 41.2% of the working-age population is employed.

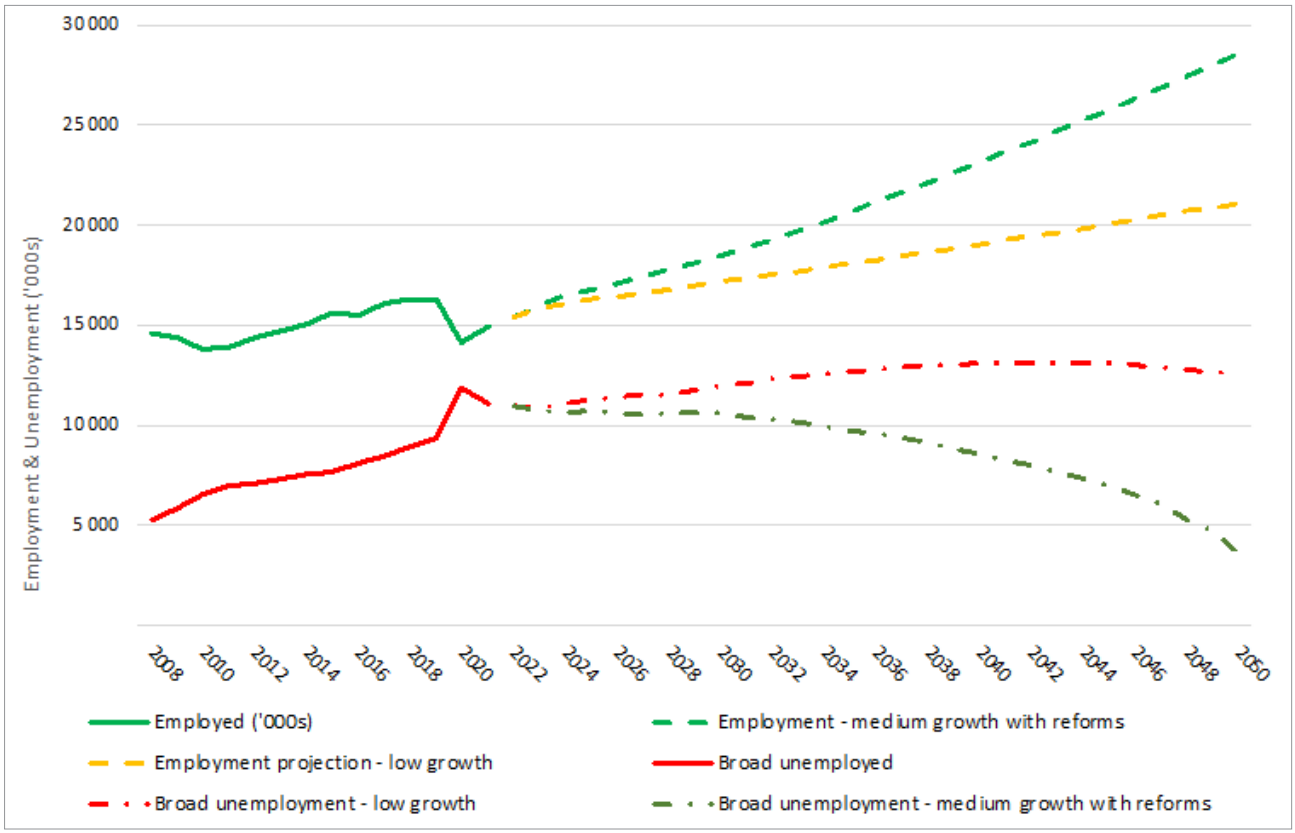

Figure 3: Employment and unemployment – past, present and future.

Scenario 2 envisions medium growth for a sustained period. GDP growth is 2.2% per annum in 2022 and rises to an average of 3.5% per annum from 2031 to 2050. The investment in human and institutional capacity causes the potential growth rate to rise steadily over this period. Also in this scenario, employment reverts to 2018 levels by 2023 or 2024; about 13 million jobs are created between 2022 and 2050; and the rates of strict and broad unemployment both fall, with an average of 470 000 jobs created annually. By 2050, there are 28.5 million people working and almost 3.7 million unemployed or discouraged; the strict and broad unemployment rates are 5.2% and 11.4% respectively; and almost 56% of the working-age population is employed. On the way to full employment, the number of unemployed is far lower than in scenario 1 but is nevertheless significant for most of this period. For example, there are 10.6 million broadly unemployed in 2030, with this falling to 8.6 million by 2040.

Scenario 2 is likely the best possible outcome South Africa could achieve to 2050. However, scenario 1 does not represent the worst South Africa could face.

Failure to reverse the underlying causes of economic decline from 2010 would result in further deterioration in state capacity and services, thereby undermining production capacity of the economy as well as alienating investors, skilled personnel, and communities. Stagnation and/or economic contraction can result in a downward spiral and dramatic political upheaval, which could in turn lead to economic contraction, employment loss, diminishing human and institutional capacity, as well as reduced availability of public resources to pay for critical economic and social expenditures. Nevertheless, a third scenario was not prepared as it would require a different methodology. South Africa has seen decades of misdirected, wasteful, and harmful resource allocation and practices, and nevertheless muddled through at low rates of growth. Examples range from separate development policies, isolationism that led to international sanctions, and deep military expenditure in the 1970s and 1980s to the arms deal of 1998 and, more recently, state capture. This is the context for historical slow growth and rising unemployment in the black population. The character of economic decline would require an understanding of its special dynamics.

Table 4 shows how these scenarios would have differed in the absence of the COVID-induced crisis. All the assumptions are the same as those in the two scenarios, except insofar as 2020 was a year of anaemic growth and not one of severe contraction. Slow growth, rather than a growth spurt associated with recovery, is found in 2021 to 2023. The losses that take place in 2020 are never fully recovered even by 2050. Employment grows cumulatively wherein each year's growth is on the back of the previous year's. A one-year slide can have significant impacts on long-term success. In a low-growth scenario, 1.6 million more people would have been working by 2050 in the absence of COVID. The strict unemployment rate would have sat at around 28%, with 44% of the working-age population employed. In the medium-growth scenario, faster GDP growth would have narrowed this gap: by 2050, there would have been about 500 000 more people working in the absence of COVID and 56.7% of the working-age population would have been in employment.

Discussion

The initial exuberance in the post-democratic era in envisioning much-improved rates of employment was dampened by the evident challenges in implementing institutional reform aimed at achieving sustained inclusive growth.

Efforts towards building state capacity development and achieving economic reform that started around 1996 finally seemed to make a positive impact on economic and employment growth from the early 2000s. These gains have been severely reversed as a result of 'state capture', which has hollowed out significant parts of state capacity and therefore undermined the quality of public spending and services, which has in turn undermined economic capacity.[21]

There are important areas of economic and social policy that have not been addressed sufficiently in the democratic era. Most notably these include a housing policy that located settlements far away from

Table 4: Employment scenarios in the absence of COVID-19

	Low growth scenario				Medium growth scenario			
	2020	**2030**	**2040**	**2050**	**2020**	**2030**	**2040**	**2050**
With COVID-19								
Employment ('000s)	14 148	17 157	19 027	21 101	14 148	18 449	23 103	28 537
Unemployment (official)	38.9%	33.9%	33.6%	29.9%	38.9%	28.9%	19.4%	5.2%
Employment / WAP	36.3%	38.4%	38.9%	41.2%	36.3%	41.3%	47.2%	55.7%
Without COVID-19								
Employment ('000s)	16 547	18 462	20 474	22 706	16 547	18 760	23 493	29 049
Unemployment (official)	28.4%	28.9%	28.6%	28.9%	28.4%	27.7%	18.0%	3.5%
Employment / WAP	42.4%	41.3%	41.8%	44.3%	42.4%	42.0%	48.0%	56.7%

Note: Without covid assumes 1% employment growth in 2020 and 2021
WAP, working-age population

economic activity, weak passenger transport systems that entrench a high cost of living, and limited access to quality health and education systems, with the result that the indices of human development for South Africa align more closely with those of a low-income country. Current policy behaviour in important areas that underpin the employment orientation of the economy persists in mirroring pre-1994 approaches, even though the policy agenda associated with separate development was discontinued. This might also be seen as a form of hysteresis, where historical approaches have not been replaced sufficiently with new know-how appropriate to the structural change that is consistent with the current agenda for inclusive growth.[7,21,27-29.]

Employment and growth are outcomes of actions and are not impacted directly. Growth is an outcome of success in building the country's capital and human asset base, developing appropriate and strong institutions, and raising technological capability. Employment, in particular, relies on growing urban areas with integrated and well-designed human settlements, policies that enable business activities and competition, thriving productive rural areas, an affordable cost of living, and investment in lifting human development and capabilities. The apartheid separate development policy promoted the opposite approach and was effectively a low-employment policy. This explains why economic growth has been slow since the 1970s and why black African unemployment exceeded 20% by 1978[2] and continued to rise for the next 20 years to reach 36% by 1998.[6]

The economic policies aimed at containing COVID-19 in South Africa must be understood within this context. In a country with high unemployment, extensive poverty and slow growth, constraining or locking down economic activity can be devastating. This is particularly so where the focus of the lockdown is on the industries where most people work. Initially, the rationale for a lockdown was to create opportunity to put into place capacity in the health system. In 2020 and 2021, policymakers juggled health and economic decisions, shifting from lockdowns to 'risk-adjusted strategies'.[22] In this vein, possible explanations for each scenario may be found.

Slow positive growth in Scenario 1, rather than continued decline, could arise from actions that stabilise the economy, enable the restoration of economic activity and introduce stronger institutional governance in key institutions. Examples might include[21,22,27-29]:

- Success in vaccinating the population and related actions to manage COVID-19 in ways that enable a return to work.
- Support for businesses specifically harmed by COVID-19, such as tourism businesses and small and microenterprises, a managed opening up of the economy to full services, and stronger commercial diplomacy with key markets to restore and promote trade and tourism.
- A progressive introduction of capable leadership in key locations is found in the public sector, ranging from top infrastructure state-owned enterprises such as Eskom, Prasa and Transnet, to the leadership of key municipalities and oversight of infrastructure procurement and delivery.
- A growing ability for the public and private sectors to partner.
- The worst excesses in crime and corruption in both sectors are brought under control.

Sustained economic growth in Scenario 2 might be found with implementation of actions that go deeper into strengthening key state institutions. Examples include[7,21,22,27-29]:

- implementing meaningful reforms that encourage greater dynamism and institutional learning in public and private sectors and in communities
- strengthening fiscal and financial management
- transforming state-owned enterprises involved in infrastructure delivery to be more dynamic
- building state capacity to strengthen delivery
- deepening quality and impact in public education and health services
- densifying housing and creating thriving human settlements located near economic activity
- activating communities to participate in service delivery
- enabling small local businesses to thrive

Conclusion

Most countries globally have experienced severe labour market impacts as a result of economic interventions aimed at containing the COVID-19 pandemic. These impacts are particularly challenging in South Africa with its extremely high pre-existing unemployment rates. Two scenarios were modelled to assess plausible future pathways for employment growth in South Africa. The scenarios are focused on plausible pathways given the significant institutional resistance to reforming the economy towards a dynamic employment-absorbing path. The low-growth scenario sees an average annual GDP growth rate of 1.6% to 2050,

resulting in a 30% unemployment rate. This could not be achieved under status quo conditions: it would require basic reforms in leadership, governance, accountability and in crime and corruption that reverse economic decline. The medium-growth scenario sees an average annual GDP growth rate rising from about 2.2% in 2022 to 3.5% by 2031. If sustained, the unemployment rate falls to 5% by 2050. This would require significant institutional reforms to drive greater economic dynamism, competition, small business activity, regional integration and trade. Most importantly, it would involve intensified investment in human capacity.

Several research questions emanate from this work:

- A scenario of decline was not prepared. I propose that a different methodology would be required to determine the factors that might cause contraction over sustained periods. South Africa has not yet experienced this, despite significant resource mis-allocation over many decades.
- The UN forecasts a demographic transition in South Africa, as the population ages and the youth bulge becomes smaller. Unemployment rates fall faster as a result after 2031. This also has implications for other social policy, most notably sustained fiscal resources to support an aging population that is dependent on a small working population. This should increase pressure to stimulate the economy and provide social protection that can be sustained for decades.
- It is possible that there could still be about 8 million unemployed by 2040, even in the best scenario. A faster pace of economic reform and stimulation is needed, combined with a sustainable social protection policy so that all households can reasonably chart to a decent standard of living, even in this challenging context.
- The modelling makes assumptions about the employment elasticity of growth, which has been high in South Africa, possibly due to low productivity growth. Economic policy can be framed to elevate the employment elasticity of growth, with an emphasis on employment absorbing activities.
- It is possible that employment does not fully recover to pre-crisis levels due to hysteresis. Lower employment levels may persist, even once the COVID-19 crisis has passed and industries have become fully operational. If this happens, one explanation would point to employers learning how to deliver the output with fewer workers and/or with fewer work hours. The pandemic-induced postponement of investment plans can also result in foregone job creation.[14,15]
- In the near term, the scenarios foresee employment recovering to its 2018 peak by 2024 to 2026: in 2022, there may still be a shortfall of over 1.2 million jobs. The pace of employment recovery depends considerably on policy choices in respect of safely restoring economic and social activity and in stimulating the movement of people between major trade and tourism partners.

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Competing interests

I have no competing interests to declare.

References

1. Altman M. The challenge of employment creation in South Africa. In: Pillay U, Hagg G, Nyamnjoh F, Jansen JD, editors. State of the nation: South Africa 2012–2013: Addressing inequality and poverty. Pretoria: HSRC; 2013. p. 185–221. Available from: https://miriamaltman.com/research/the-challenge-of-employment-creation-in-south-africa/
2. Bell T. Unemployment in South Africa: Occasional paper number 10. Durban: University of Durban-Westville Institute for Social and Economic Research; 1984. Available from: http://scnc.ukzn.ac.za/doc/COMM/labour/Bell_Trevor_Unemployment_SA.pdf
3. World Bank. World development indicators. Series on GDP per capita in constant 2010 US dollars. Washington DC: World Bank; 2022. Available from: https://databank.worldbank.org/source/world-development-indicators#
4. South African Reserve Bank. South Africa: Gross domestic product by expenditure approach, 2015 rand. Pretoria: South African Reserve Bank; 2022.
5. Altman M. Revisiting South African unemployment trends in the 1990s. S Afr J Econ. 2008;76(S2):S126–S147. https://doi.org/10.1111/j.1813-6982.2008.00185.x
6. Statistics South Africa. Quarterly labour force survey. Pretoria: Statistics South Africa. Available from: http://www.statssa.gov.za/?s=QLFS&sitem=publications
7. South African National Planning Commission. Economic progress towards the National Development Plan's vision 2030: Recommendations for course correction. Pretoria: National Planning Commission, The Presidency; 2020. Available from: https://www.nationalplanningcommission.org.za/assets/Documents/Review%20of%20Economic%20Progress%20NPC%20Dec%202020.pdf
8. Casale D, Shepherd D. The gendered effects of the COVID-19 crisis and ongoing lockdown in South Africa: Evidence from NIDS-CRAM Waves 1–5. Dev South Afr. Forthcoming 2022. https://doi.org/10.1080/0376835X.2022.2036105
9. Makgetla N. Industrial policy and the Covid-19 pandemic: The South African experience. Working paper. Pretoria: Trade and Industrial Policy Strategies; 2021.
10. Nwosu C, Kollamparambil U, Oyenubi A. Socioeconomic inequalities in ability to work from home during the coronavirus pandemic: The case of South Africa [document on the Internet]. c2021 [cited 2022 Feb 14]. Available from: https://cramsurvey.org/wp-content/uploads/2021/07/9.-Nwosu-C-Kollamparambil-U.-Oyenubi-A.-2021-Socioeconomic-inequalities-in-ability-to-work-from-home-during-the-coronavirus-pandemic-The-case-of-South-Africa.pdf
11. Ranchhod V, Daniels R. Labour market dynamics in South Africa in the time of COVID-19: Evidence from Wave 1 of the NIDS-CRAM survey [document on the Internet]. c2020 [cited 2022 Feb 14]. Available from: https://cramsurvey.org/wp-content/uploads/2020/07/Ranchhod-Labour-market-dynamics-in-the-time-of-COVID-19..pdf
12. Spaull N, Daniels R. Synthesis report NIDS-CRAM Wave 5 [document on the Internet]. c2021 [cited 2022 Feb 14]. Available from: https://cramsurvey.org/wp-content/uploads/2021/07/1.-Spaull-N.-Daniels-R.-C-et-al.-2021-NIDS-CRAM-Wave-5-Synthesis-Report.pdf
13. World Bank. Global economic prospects. Washington DC: World Bank; 2021. https://doi.org/10.1596/978-1-4648-1665-9
14. Ngandu S, Altman M, Cross C, Jacobs P, Hart T, Matshe I. The socio-economic impact of the global downturn on South Africa: Responses and policy implications. Pretoria: HSRC; 2010. Available from: https://miriamaltman.com/research/the-socio-economic-impact-of-the-global-downturn-on-south-africa-responses-and-policy-implications-2/
15. International Labour Organization. World employment and social outlook: Trends 2021 [document on the Internet]. c2021 [cited 2022 Feb 14]. Available from: https://www.ilo.org/global/research/global-reports/weso/trends2021/lang--en/index.htm
16. International Monetary Fund. World economic outlook – Recovery during a pandemic. Washington DC: International Monetary Fund; 2021. https://doi.org/10.5089/9781589068988.081
17. World Bank. Global economic prospects. Washington DC: World Bank; 2022. https://doi.org/10.1596/978-1-4648-1758-8

18. Government of South Africa. The South African Reconstruction and Recovery Plan. Pretoria: The Presidency; 2020. Available from: https://www.gov.za/sites/default/files/gcis_document/202010/south-african-economic-reconstruction-and-recovery-plan.pdf

19. South African Reserve Bank. Statement of the Monetary Policy Committee. Pretoria: South African Reserve Bank; 2022. Available from: https://www.resbank.co.za/content/dam/sarb/publications/statements/monetary-policy-statements/2022/statement-of-the-monetary-policy-committee/Monetary%20Policy%20Committee%20Statement%20January%202022.pdf

20. Altman M. Employment scenarios to 2014 & 2024 in the context of a global economic slowdown. HSRC research report. Pretoria: HSRC; 2009. Available from: https://miriamaltman.com/research/employment-scenarios-to-2014-2024-in-the-context-of-a-global-meltdown/

21. South African National Planning Commission. National Development Plan: Our future – make it work. Pretoria: National Planning Commission, The Presidency; 2012. Available from: http://www.nationalplanningcommission.org.za/Pages/NDP.aspx

22. Altman M. Top Covid-19 policy priorities for protecting employment. Covid-19 Economy Group Policy Brief [webpage on the Internet]. 25 May 2020 [cited 2022 Feb 14]. Available from: https://covid19economicideas.org/2020/05/25/top-covid-19-policy-priorities-for-protecting-employment/

23. South African Reserve Bank. QPM assumptions summary table January 2022 MPC. Pretoria: South African Reserve Bank; 2022. Available from: https://www.resbank.co.za/content/dam/sarb/publications/statements/monetary-policy-statements/2022/statement-of-the-monetary-policy-committee/Assumptions%20January%202022.pdf

24. Fedderke JW, Mengisteab DK. Estimating South Africa's output gap and potential growth rate. S Afr J Econ. 2017;85(2):159–318. https://doi.org/10.1111/saje.12153

25. South African Reserve Bank. QPM forecast summary table January 2022 MPC. Pretoria: South African Reserve Bank; 2022. Available from: https://www.resbank.co.za/content/dam/sarb/publications/statements/monetary-policy-statements/2022/statement-of-the-monetary-policy-committee/QPM%20Summary%20tables%20press%20table%20forecast_Jan%202022%20MPC.pdf

26. United Nations. World population prospects 2019. New York: United Nations; 2019. Available from: https://population.un.org/wpp/Download/Standard/Population/

27. Organisation for Economic Co-operation and Development (OECD). South Africa Economic Snapshot: Reform priorities [document on the Internet]. c2021 [2022 Feb 14]. Available from: https://www.oecd.org/economy/growth/South-Africa-country-note-going-for-growth-2021.pdf

28. International Monetary Fund. South Africa 2021 Article IV Consultation. Country report no. 2022/037 [press release]. 11 February 2022 [cited 2022 Feb 14]. Available from: https://www.imf.org/en/Publications/CR/Issues/2022/02/10/South-Africa-2021-Article-IV-Consultation-Press-Release-Staff-Report-and-Statement-by-the-513001

29. National Treasury. Medium term budget policy statement. Pretoria: National Treasury; 2021. Available from: http://www.treasury.gov.za/documents/mtbps/2021/default.aspx