

Life under lockdown: Illustrating tradeoffs in South Africa's response to COVID-19

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Highlights

- We analyze subnational variation in population mobility as a response to COVID-19 in South Africa.
- We leverage anonymized mobile phone data to capture mobility reductions across provinces.
- People tend to reduce mobility substantially in response to government's initial lockdown orders.
- Mobility reductions are significantly and negatively associated with COVID-19 growth rates.
- We illustrate how the government's response and corresponding mobility reductions can exacerbate existing inequalities.

Abstract

This research note sheds light on the first three months of the COVID-19 outbreak in South Africa, where the virus has spread faster than anywhere else in the region. At the same time, South Africa has been recognized globally for its swift and efficient early response. We consider the impact of this response on different segments of the population, looking at changes in mobility by province to highlight variation in the willingness and ability of different subsets of the population to comply with lockdown orders. Using anonymized mobile phone data, we show that South Africans in all provinces reduced their mobility substantially in response to the government's lockdown orders. Statistical regression analysis shows that such mobility reductions are significantly and negatively associated with COVID-19 growth rates two weeks later. These findings add an important perspective to the emerging literature on the efficacy of shelter-in-place orders, which to date is dominated by studies of the United States. We show that people were particularly willing and able to act in the provinces hit hardest by the pandemic in its initial stages. At the same time, compliance with lockdown orders presented a greater challenge among rural populations and others with more precarious livelihoods. By reflecting on South Africa's inequality profile and results of a recent survey, we demonstrate how the country's response may deepen preexisting divides. This cautionary tale is relevant beyond South Africa, as much of the continent – and the world – grapples with similar tradeoffs. Along with measures to contain the spread of disease, governments and other development focused organizations should seriously consider how to offset the costs faced by already marginalized populations.

Keywords

Africa; South Africa; Social Distancing; Covid-19; Mobility; Inequality

1. Introduction

As COVID-19 began its global spread, it still appeared that some world regions might be spared – in particular, sub-Saharan Africa (Otu et al., 2020). In short order, however, it became clear that such optimism was not merited. The virus quickly took a firm footing on the continent and as of August 7, 2020 the number of confirmed cases exceeded one million¹ – likely a significant underestimate given limited testing capacity.

The virus’s impact has varied considerably across the continent, reflecting countries’ varying degrees of global integration and capacity to respond (Gilbert et al., 2020). One country that stands out in both regards is South Africa. As seen in Figure 1, the virus has spread faster in South Africa than in any of the continent’s other large economies.

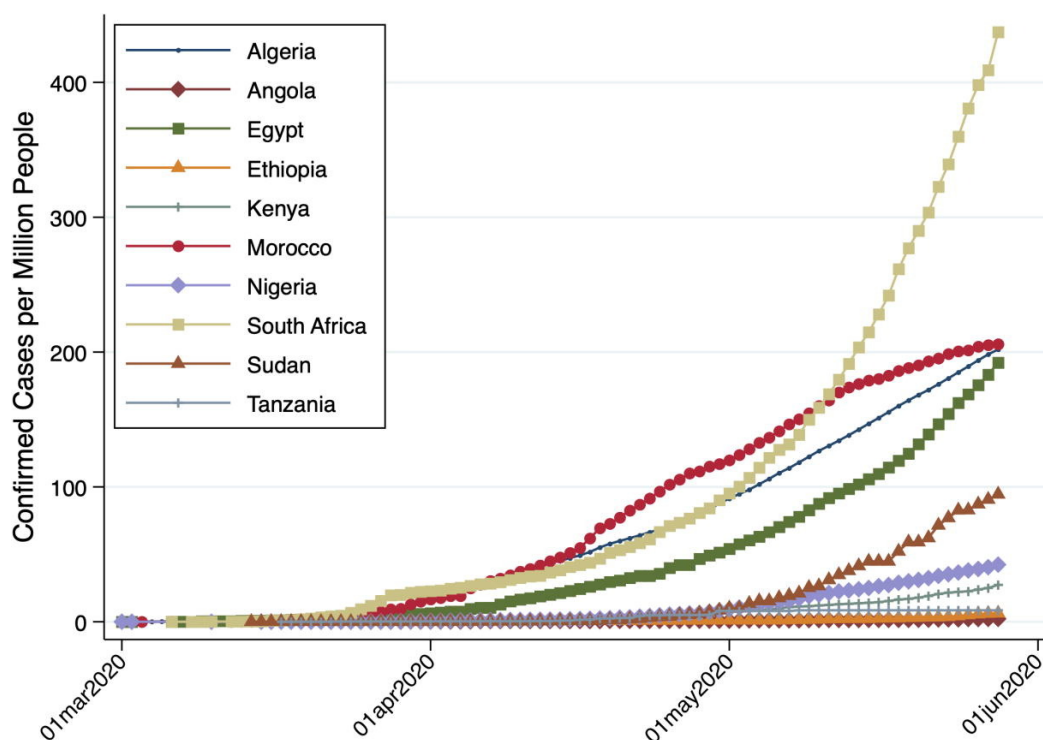


Figure 1. Confirmed cases per million people, Africa’s 10 largest economies. Data from European Centre for Disease Prevention and Control (ECDC) in Roser et al. (2020).

At the same time, South Africa has been recognized globally for its swift and efficient response (Kavanagh & Singh, 2020). In this research note, we illustrate how the South African government’s response affected the lives of ordinary people, focusing on the initial outbreak and subsequent lockdown.

First, we look at the impact of the government’s strict lockdown orders on population mobility, which may be understood as a proxy for compliance. We leverage anonymized mobile phone data from Google’s COVID-19 Community Mobility Reports, which chart trends over time, across different categories of places such as retail and recreation, transit stations, and workplaces. We look at changes in mobility by province to highlight variation in the willingness and ability of different subsets of the population to comply with lockdown orders.

We then analyze how changes in population mobility relate to the spread of disease, and conduct statistical regression analysis to show that mobility reductions are significantly and negatively associated with COVID-19 growth rates two weeks later. While this suggests the lockdown measures have been effective in achieving their goals, we also reflect on how the government's response and corresponding mobility reductions interact with existing inequalities, keeping in mind the country's status as the world's most unequal nation.²

This research note contributes to a rapidly expanding literature on COVID-19's impact in the Global South, and in particular to studies that demonstrate and explain variation *within* countries (Okoi and Bwawa, 2020, Wenham et al., 2020, Brauer et al., 2020). To our knowledge, ours is the first subnational analysis of population mobility in response to COVID-19 for South Africa.³ We also contribute an important perspective to the emerging literature on the efficacy of shelter-in-place orders, which to date has been dominated by studies of the United States.⁴ Finally, by discussing the tradeoffs inherent to stringent containment measures, we tell a story that resonates across the African continent and in other parts of the world where efforts to contain the spread of COVID-19 may have as many or more negative consequences as the disease itself (Coetzee & Kagee, 2020).

This research note proceeds as follows. [Section 2](#) details South Africa's efforts to contain COVID-19, and compares the country's response to others on the continent. [Section 3](#) then presents our analysis of mobility trends and their relation to the growth rate of new infections. [Section 4](#) describes the nature of inequality in South Africa in order to situate our results in context. [Section 5](#) concludes.

2. South Africa's response

(a) Timeline and Actions of Government

The first case of COVID-19 in South Africa was confirmed on March 5th, 2020; subsequent cases were confirmed in the days that followed among citizens who had traveled to Italy on a ski trip. While the initial cases suggested the disease might be limited to the country's affluent, cosmopolitan population, President Cyril Ramaphosa announced broad measures to combat the spread of COVID-19 on March 15th.⁵ As the timeline depicted in [Table 1](#) shows, the response accelerated quickly from there.

Table 1. Timeline of Government Response to COVID-19 in South Africa.

| Date | Key Event(s) |
|------------------------------|---|
| <i>Discovery</i> | |
| 05-Mar-2020 | First case of COVID-19 confirmed in KwaZulu Natal Province |
| 07-Mar-2020 | Second case of COVID-19 confirmed in KwaZulu Natal Province |
| 11-Mar-2020 | First case of COVID-19 confirmed in Western Cape Province |
| 12-Mar-2020 | First case of local transmission confirmed in Free State Province |
| <i>Early Response</i> | |
| 15-Mar-2020 | President announces measures to combat COVID-19 |
| 16-Mar-2020 | Government declares State of National Disaster |
| 16-Mar-2020 | Ports of entry closed (Namibia, Botswana, Lesotho, Mozambique, & two Seaports) |
| 17-Mar-2020 | Travel advisory issues in response to the COVID-19 pandemic |
| 18-Mar-2020 | First government regulations (guidelines) published to reduce social interaction |
| 20-Mar-2020 | Essential services during lockdown period announced |
| <i>Scaled Up Response</i> | |
| 26-Mar-2020 | South Africa goes into hard lockdown for 21 days with lockdown regulations released |
| 01-Apr-2020 | COVID-19 Testing capacity increased with 60 new mobile lab units launched |
| 08-Apr-2020 | Critical personal protective equipment secured for frontline healthcare workers |
| 09-Apr-2020 | Lockdown extended until end of April (with seven days travel grace across provinces for relocation) |
| 18-Apr-2020 | Government postpones May/June Exam rewrites |
| 20-Apr-2020 | President announces interventions to address livelihoods of the vulnerable groups |
| 21-Apr-2020 | President outlines expanded COVID-19 economic and social relief |
| 21-Apr-2020 | Government recommends wearing of a cloth non-medical face mask when in public |
| 23-Apr-2020 | President announces risk-adjusted strategy to respond to COVID-19 pandemic [5 levels] |
| <i>Preliminary Reopening</i> | |
| 01-May-2020 | South Africa relaxes lockdown (stringency) conditions from Alert Level 5 to Alert Level 4 |
| 01-May-2020 | Government issues directive on once off movement between places of residence and work (1–7 May) |
| 11-May-2020 | Government announces Special COVID-19 Social Relief of Distress Grant |
| 01-Jun-2020 | South Africa relaxes lockdown conditions from Alert Level 4 to Alert Level 3 |

Formal regulations were published on March 18th, promoting social distancing at one person per square meter of floor space ([RSA Government, 2020a](#)). The regulations also closed

schools, called for isolation of sick people, quarantining of asymptomatic people, limited gatherings to 100 people, and to 50 people at the premises where alcohol is sold and consumed.

These regulations were amended on March 25th, ushering in a strict lockdown phase ([RSA Government, 2020b](#)). Beginning March 27th, all businesses were to remain closed, except those involved in the production and provision of essential goods and services.⁶ Every person was to be confined to a place of residence unless performing essential services, obtaining essential goods or services, collecting social grants, emergency care or chronic medication attention. All places of work were to be closed except those providing essential services. Movements between provinces, metropolitan areas and districts were prohibited, including commuter transport services, except when rendering essential services.

The lockdown was extended on April 16th to the end of the month ([RSA Government, 2020c](#)) to allow the government further time to prepare for management of the disease ([Karim and Abdool, 2020](#)). Revised regulations prohibited evictions from rental properties, permitted opening of refineries, and allowed mining to operate at reduced capacity. These were seen as laying the groundwork for re-opening the economy ([RSA Government, 2020d](#)). At the end of April, the lockdown was relaxed to allow transition into Alert Level 4 beginning May 1st, 2020 ([RSA Government, 2020e](#)).⁷ The country transitioned to Alert Level 3 on June 1st ([RSA Government, 2020g](#)), which provided for movements of school children across provinces and limited religious gathering to 50 people.

(b) South Africa's response in context

Compared to many of its neighbors on the continent, South Africa's response has been swift and extensive, as shown in [Figure 2](#). As of April 1st, 2020, South Africa scored an 88 out of 100 on the "Stringency Index," as coded by the Oxford COVID-19 Government Response Tracker ([Hale et al., 2020](#)). Only 10 of 54 other countries on the continent were coded as having more stringent responses as of that date.

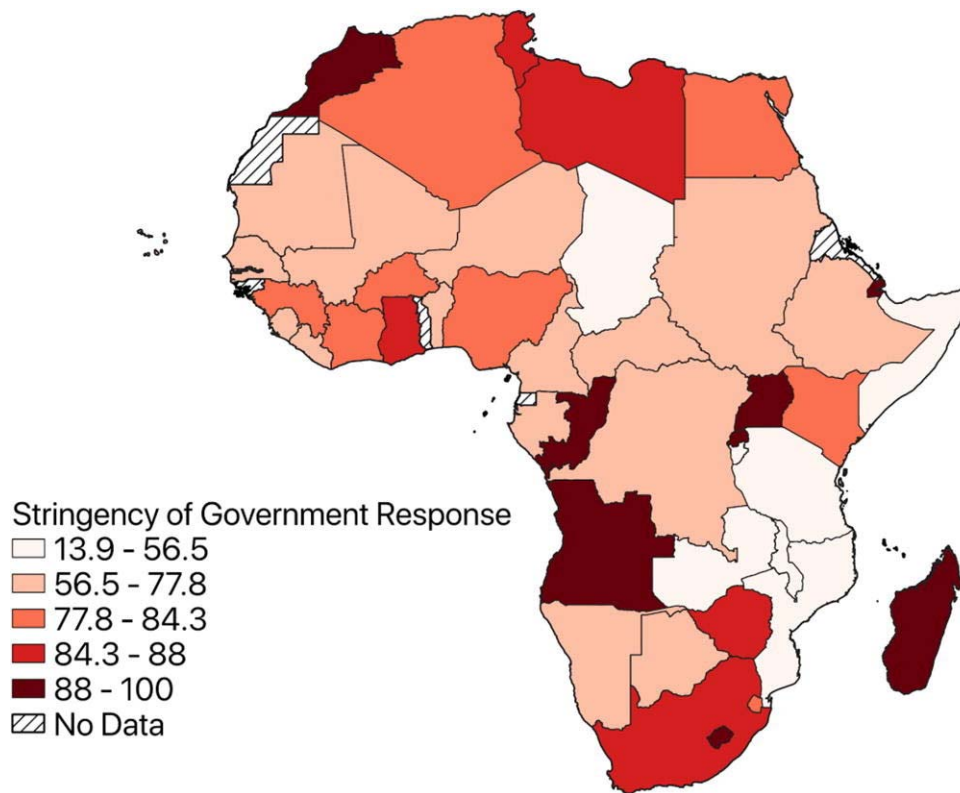


Figure 2. Stringency of African Government Responses (April 1, 2020). Data from Oxford COVID-19 Government Response Tracker (Hale et al., 2020).

As we show in the next section, the country’s residents acted accordingly to reduce spread of the disease by dramatically reducing their mobility.

3. Analysis of mobility trends

(a) Mobility trends over time and space

This section examines how South African citizens responded to the government’s strict containment measures, drawing on Google’s COVID-19 Community Mobility Reports. These reports are based on aggregated, anonymized data from users of Google Maps, and show how visits and length of stay at different places change compared to a baseline.^{8,9} We examine four categories:

1. *Workplaces*: Mobility trends for places of work.
2. *Retail & recreation*: Mobility trends for places like restaurants, cafes, shopping centers, theme parks, museums, libraries, and movie theaters.
3. *Transit stations*: Mobility trends for places like public transport hubs such as subway, bus, and train stations.
4. *Grocery & pharmacy*: Mobility trends for places like grocery markets, food warehouses, farmers markets, specialty food shops, drug stores, and pharmacies.

Figure 3 shows that South Africa¹⁰ consistently “outperforms” its peers in terms of reduced mobility relative to the stringency of government response with the exception of grocery and pharmacy visits reflecting the exemption of such businesses from the lockdown order.

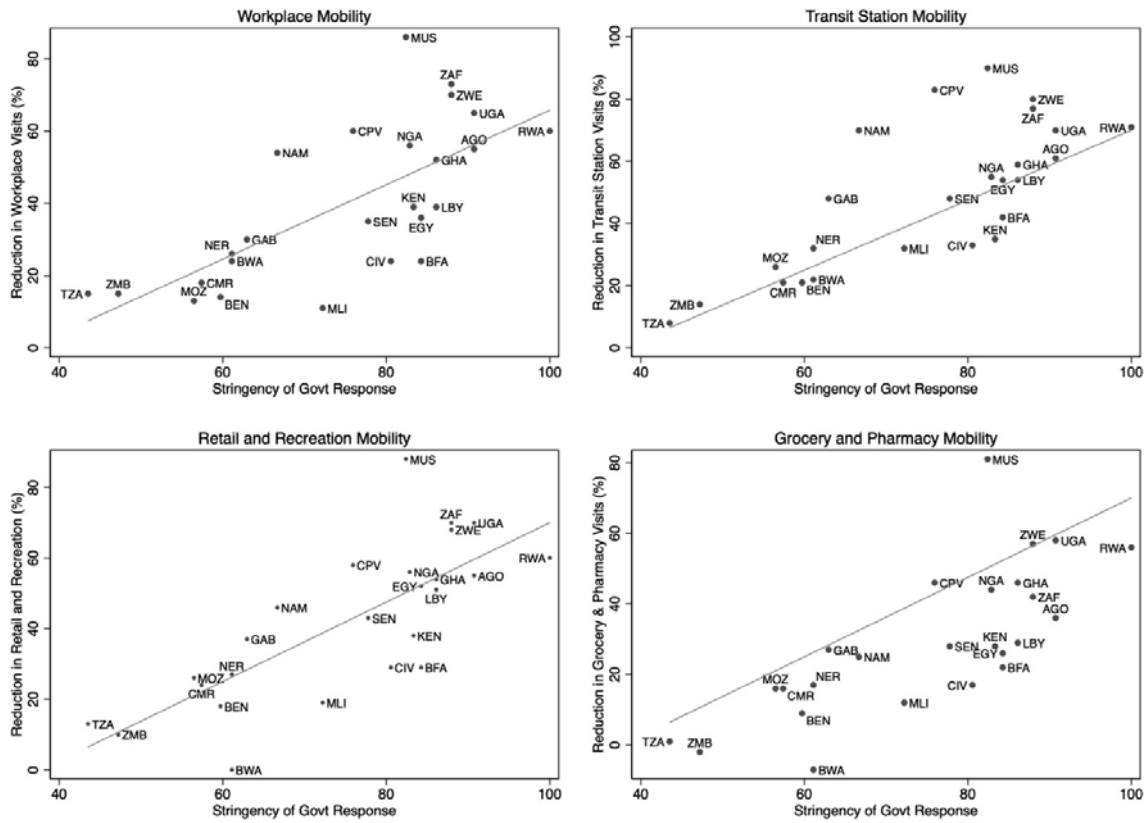
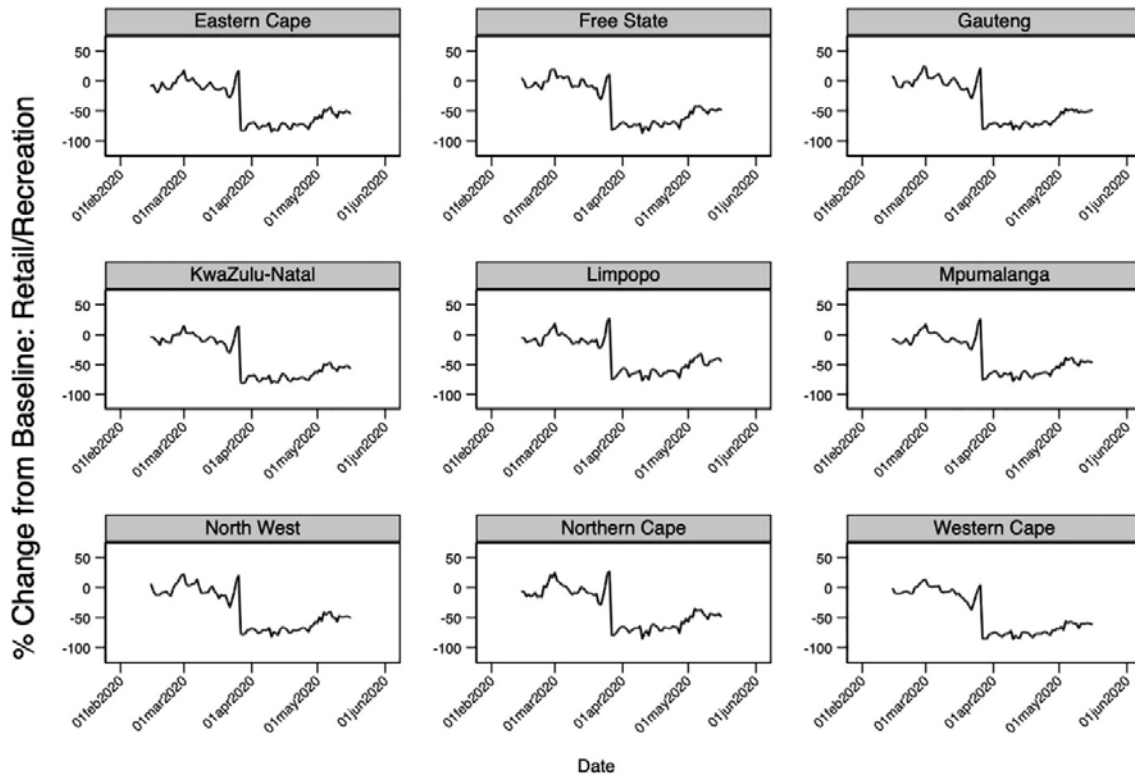


Figure 3. Comparing Government and Citizen Responses (April 1, 2020).

The national average reduction in mobility masks considerable variation within the country. Figure 4 illustrates mobility trends by province¹¹ in terms of retail and recreation from February 14-May 15, 2020.¹² Although the provinces exhibit differences, in each case we can observe a substantial dip corresponding to the beginning of the strict lockdown period.



Graphs by Province

Figure 4. Mobility Trends (Retail/Recreation) by Province.

Table 2 depicts the overall average percent change in mobility reductions during the most stringent lockdown period (27 March-30 April 2020) by provinces for the different categories.

Table 2. Average Mobility Reductions, by Category: March 27-April 30, 2020.

| Province | % Change in Mobility to... | | | |
|---------------|----------------------------|-------------------|------------------|------------------|
| | Workplaces | Retail/Recreation | Transit Stations | Grocery/Pharmacy |
| Eastern Cape | -62 | -75 | -77 | -46 |
| Free State | -57 | -73 | -62 | -44 |
| Gauteng | -69 | -73 | -80 | -46 |
| KwaZulu-Natal | -63 | -73 | -79 | -47 |
| Limpopo | -57 | -64 | -66 | -48 |
| Mpumalanga | -54 | -66 | -57 | -43 |
| North West | -58 | -71 | -61 | -46 |
| Northern Cape | -53 | -69 | -74 | -45 |
| Western Cape | -71 | -78 | -84 | -50 |

Western Cape registers the largest average decrease in mobility for all categories. On the other side, Limpopo registers the smallest decline in retail/recreation; Mpumalanga the smallest declines in grocery/pharmacy and transit station visits; and Northern Cape the smallest declines in workplace visits and smallest increase in residential mobility.

We also calculate the average mobility reduction for the three most highly correlated categories: retail/recreation, workplace mobility, and transit stations (see correlation matrix in Appendix Table A4). This is depicted graphically in [Figure 5](#).

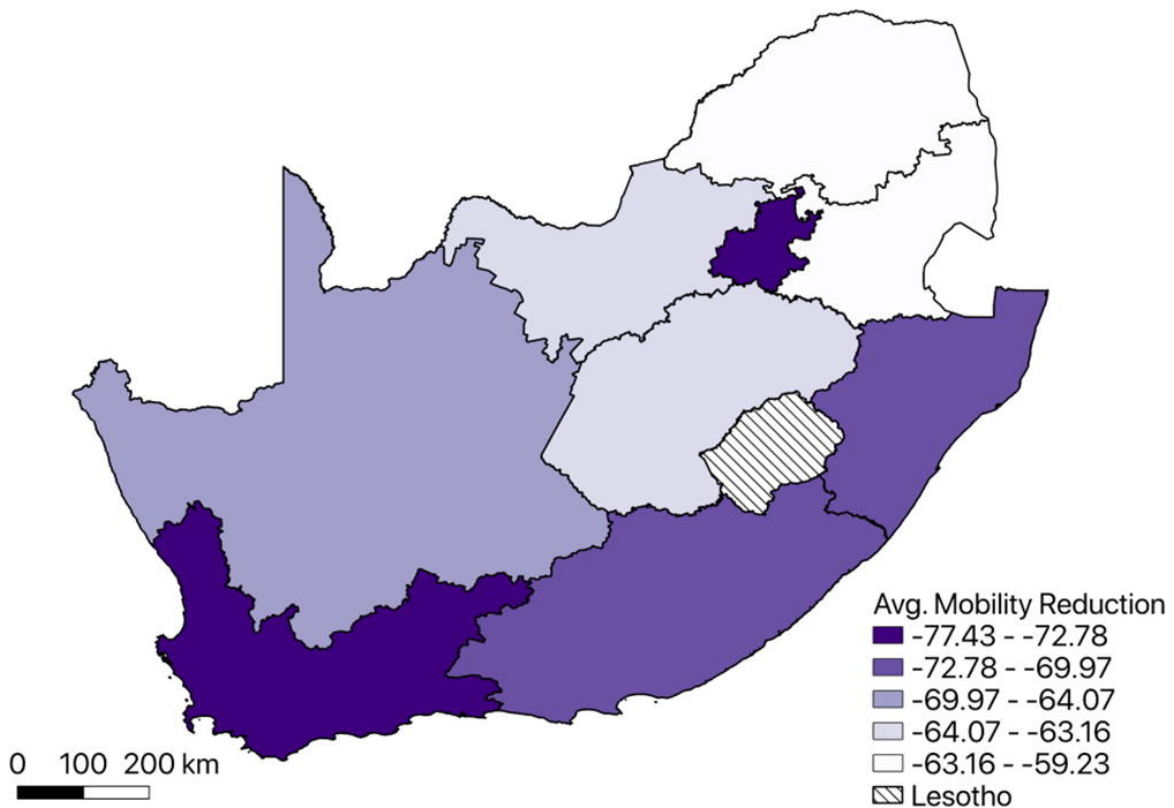


Figure 5. Average Mobility Reductions, March 27-April 30, 2020.

In order to account for variation in mobility trends across provinces, we consider a number of economic and demographic factors. We also consider each province's caseload (number of confirmed cases) at the beginning of the lockdown period. These features are summarized in [Table 3](#).

Table 3. Key Provincial Characteristics.

| Province | Population (millions) | Pop. Density (inh. per km ²) | Contribution to GDP | % in Poverty | % Agricultural Households | Confirmed Cases Pre-Lockdown |
|---------------|-----------------------|--|---------------------|--------------|---------------------------|------------------------------|
| Eastern Cape | 6.7 | 39.7 | 7.5 | 12.7 | 35.4 | 5 |
| Free State | 2.9 | 22.2 | 5.2 | 5.5 | 24.4 | 49 |
| Gauteng | 15.2 | 834.9 | 34.8 | 4.6 | 7.1 | 409 |
| KwaZulu-Natal | 11.3 | 119.6 | 16.1 | 7.7 | 28.2 | 134 |
| Limpopo | 6.0 | 47.6 | 7.2 | 11.5 | 33.1 | 6 |
| Mpumalanga | 4.6 | 60.0 | 7.3 | 7.8 | 24.5 | 9 |
| North West | 4.0 | 38.4 | 5.9 | 8.8 | 20.2 | 5 |
| Northern Cape | 1.3 | 3.4 | 2.2 | 6.6 | 18.3 | 2 |
| Western Cape | 6.8 | 52.9 | 13.9 | 2.7 | 5.2 | 229 |

We use qualitative comparative analysis (QCA) to identify the features shared by the provinces experiencing the greatest mobility reductions.¹³ Our analysis suggests that the main factors associated with substantial mobility reductions are the number of confirmed cases prior to the lockdown period and the relative size of the provincial economy. The provinces containing South African’s metropolitan hubs – Gauteng (containing Johannesburg) and Western Cape (containing Cape Town) also tended to experience larger mobility reductions. This may reflect the challenge of reducing mobility in rural areas among populations that are more likely to be food insecure ([Tibesigwa and Visser, 2016](#)). Emerging research on the determinants of compliance with social distancing and other measures suggests that concerns about income losses play an important role in determining compliance ([Wright et al., 2020](#), [Bodas and Peleg, 2020](#)).

In contrast to the United States, where partisanship has been shown to be a key determinant of mobility reductions and other efforts to contain the spread of disease ([Grossman et al., 2020](#), [Adolph et al., 2020](#)), party politics do not seem to feature prominently when it comes to explaining variation in mobility in South Africa. Both Gauteng (controlled by the ruling African National Congress party) and Western Cape (the only province held by the main opposition party, the Democratic Alliance) exhibit similar trends when it comes to mobility reductions. That said, such unity appears to be waning. For example, the Democratic Alliance filed a legal challenge against some coronavirus lockdown rules in mid-May ([Democratic Alliance, 2020](#)). The Economic Freedom Fighters (the second largest opposition party) subsequently issued a statement calling for prolonged stringent lockdown ([Economic Freedom Fighters, 2020](#)).

(b) Reduced mobility predicts lower growth of new infections

South Africa’s strict lockdown policies – and corresponding reductions in mobility by the country’s citizens – were put in place with the aim of reducing the spread of COVID-19. This leads us to ask: how effective have they been? Before we attempt to answer this question, we first present the trajectory of disease by province in Figure 6 up until May 24th, 2020. Although the first cases were confirmed in KwaZulu-Natal, the figure indicates how the disease has taken hold primarily in Western Cape.¹⁴

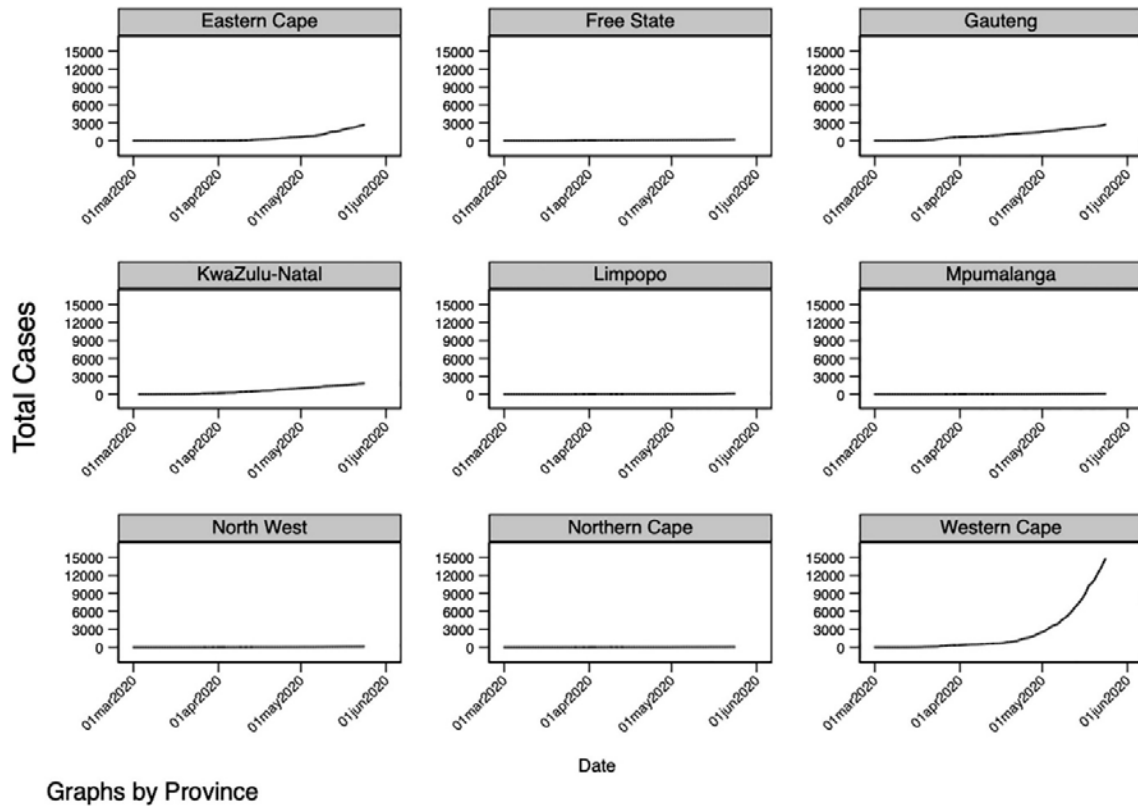


Figure 6. Confirmed Cases by Province, March 1-May 24, 2020.

In order to determine how the spread of disease has changed as a consequence of the mobility reductions discussed above, we estimate a series of regression models with average weekly exponential growth in confirmed cases as the dependent variable.¹⁵ The independent variables are average weekly mobility reductions for each of the three main categories discussed above (workplace, retail/recreation, and transit stations) for the preceding two weeks.¹⁶ All models include province fixed effects and standard errors clustered by province. We also include a time trend to account for any other factors changing over time within each province. The results, depicted in Table 4, suggest that people’s mobility reductions have indeed helped to play an important role in reducing the rate of new infections. However, as we discuss in the next section, the benefits and costs of lockdown are unlikely to be distributed equally.

Table 4. Regression of Mobility Reduction on Growth in Cases (February 23-May 24, 2020).

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|----------|----------|----------|----------|----------|----------|---------|----------|
| L14.Average weekly reduction in mobility (workplaces) | -0.14*** | | | | -0.14*** | | | |
| | (0.03) | | | | (0.03) | | | |
| L14.Average weekly reduction in mobility (retail/recreation) | | -0.14*** | | | | -0.12*** | | |
| | | (0.02) | | | | (0.02) | | |
| L14.Average weekly reduction in mobility (transit stations) | | | -0.13*** | | | | -0.12** | |
| | | | (0.04) | | | | (0.04) | |
| L14.Avg. Overall Weekly Mobility Reduction | | | | -0.13*** | | | | -0.13*** |
| | | | | (0.03) | | | | (0.03) |
| Time trend | | | | | -0.00 | -0.00 | -0.01 | 0.00 |
| | | | | | (0.01) | (0.01) | (0.01) | (0.01) |
| Observations | 707 | 711 | 628 | 707 | 707 | 707 | 628 | 707 |
| R² | 0.196 | 0.059 | 0.206 | 0.197 | 0.196 | 0.189 | 0.207 | 0.197 |

Standard errors in parentheses.

The dependent variable is the weekly average of the daily exponential growth rate of confirmed cases. All models include province fixed effects and robust standard errors clustered by province.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4. Implications for inequalities

(a) Nature of inequality in South Africa

As noted above, South Africa bears the unflattering distinction of the world's most unequal nation in terms of income inequality. Furthermore, the nature of inequality in South Africa extends beyond economic well-being (Leibbrandt et al., 2012, Tibesigwa and Visser, 2016). We consider five additional dimensions:¹⁷

1. *Asset and wealth inequality*: Recent years have seen an overall increase in the number of assets owned by households in South Africa, and the assets Gini coefficient has dropped from 0.62 in 2009 to 0.59 in 2015. While black Africans reported the largest increase in average assets scores since 2009, this group still has the lowest amount of assets overall.

2. *Labor market inequality*: The unemployment rate has increased from 24.8% in 2011 to 27.5% by 2017, and rose to 29.1% by the fourth quarter of 2019 ([Statistics South Africa, 2020a](#)).

3. *Inequality in the social domain*: Whereas access to basic education is high and fairly even across the country, access to health care is characterized by greater inequality. More than 80% of Black Africans use public health facilities and less than 20% use private health facilities. There are considerable differences in access to private medical care across provinces, with Limpopo reporting private coverage below 10%, whereas Gauteng and Western Cape reported rates of 25.0% and 24.8% in 2017, respectively.

4. *Gender inequality*: Women were less likely to participate in the formal labor market as compared to men and also experienced higher unemployment (29.6%) compared to men (25.7%) in 2017. Gender inequality is also observable in food security ([Tibesigwa and Visser, 2016](#)).

5. *Social mobility*: Data from the National Income Dynamics Survey reveals that 85.3% of the population experienced at least one poverty spell between 2008 and 2017, while 36.1% remained consistently below the poverty line.

This multidimensional view of inequality is important to keep in mind when it comes to identifying tradeoffs associated with the country's response to COVID-19.

(b) Implications of COVID-19 outbreak and response for inequality

The dramatic reductions in population mobility documented above have come at a cost for many households, particularly those who are no longer able to work. Income from the labor market has been the main source of household income in South Africa, accounting for over 70% of overall income ([Statistics South Africa, 2019](#)). Fears of losing such income can reduce compliance with measures to mitigate the spread of COVID-19, especially in low income areas ([Wright et al., 2020](#), [Coetzee and Kagee, 2020](#)).

A web-based survey¹⁸ conducted between April 29th - May 6th 2020 ([Statistics South Africa, 2020b](#)) paints a picture of the pandemic's impact on employment, income, and hunger, highlighting the potential for deepening inequality. While 60.2% of the respondents were employed on a permanent basis during the national lockdown, just under 2.0% lost their jobs and 5.2% had to close their businesses. Further, while 89.5% of those who were employed before the national lockdown remained employed during this period, 8.1% lost their jobs or had to close their businesses, 1.4% became unemployed and 0.5% were out of the labor force. For those who stayed employed during the lockdown, 21.3% indicated reduced income. Given the voluntary, web-based nature of the survey, these and other estimates are likely significant underestimates.¹⁹

The survey also showed that while a majority (75.4%) of respondents who had businesses before national lockdown were white, among black Africans and the coloured population, the share among those who had to close businesses were larger than their share of business ownership (19.9% vs. 14.6% and 6.4% vs. 4.6% respectively).

While social grants and remittances have played a crucial role in reducing income inequality over the years in South Africa, the survey shows other coping strategies. For example, 74.9% of respondents reduced their spending to compensate for the loss of income, while about half of respondents had to access their savings to close the income gap. Some respondents (36.8%) relied on extended family members, friends and/or their communities for support,

while 14.6% relied on claims from the Unemployment Insurance Fund. Disaggregated analysis of these claims is not yet possible but would shed further light on the extent to which lockdown has furthered pre-existing inequalities.

As noted above, the more rural provinces and black Africans on average have tended to lag further behind in access to basic services (Statistics South Africa, 2019). The COVID-19 pandemic appears to have further deepened these inequalities. The survey shows that the majority of those able to work from home are in suburban areas (88%). In contrast, just 5.4% of township residents reported being able to work from home, followed by just 3.9% of those residing on farms and 0.9% of respondents in rural areas.

The survey also revealed considerable food insecurity and income losses. Since the start of lockdown, the proportion of respondents who reported experiencing hunger increased from 4.3% to 7.0%. The percentage of respondents who reported no income increased from 5.2% to 15.4% by the sixth week of lockdown. Again, these figures are likely significant underestimates.

Notably, the government of South Africa has provided a number of relief measures, including the release of disaster relief funds, emergency procurement, wage support through the Unemployment Insurance Fund, and funding to small businesses. On April 21, 2020, the President announced a massive social relief and economic support package of R500 billion (\$30,50 billion), amounting to around 10% of GDP (RSA Government, 2020h). This was complemented by the South African Reserve Bank easing monetary policy with reduced interest rates (SARB, 2020) and subsequent loan of about \$4.5 billion from IMF (RSA Government, 2020i). These resources have been deployed to prepare health infrastructure, provide food and income support, and provide financial relief to businesses and individuals. The effectiveness and efficiency of such efforts are still yet to be determined.

5. Conclusion

This research note paints a picture of life under lockdown in South Africa, the world's most unequal nation. We present evidence of swift and effective action by the government – mirrored in substantial reductions in mobility among the population. People were particularly willing and able to act in the provinces hit hardest by the pandemic in its initial stages (Gauteng and Western Cape). At the same time, compliance with lockdown orders presents a greater challenge among rural populations and others with more precarious livelihoods. By reflecting on South Africa's inequality profile and results of a recent survey conducted during lockdown, we demonstrate how the country's response may deepen preexisting divides. This cautionary tale is relevant beyond the South Africa's borders, as much of the continent – and the world – contemplates similar tradeoffs. Along with measures to contain the spread of disease, governments and other development focused organizations should seriously consider how to offset the costs faced by already marginalized populations.

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Notes

- ¹Estimate as of August 10, 2020 from the European Centre for Disease Prevention and Control (ECDC) cited in [Roser et al. 2020](#).
- ²According to the World Bank’s World Development Indicators, South Africa’s Gini Index is 63/100, the highest in the world according to available data.
- ³The paper that bears the most similarity to ours is [Nyabadza et al. \(2020\)](#), which models the impact of social distancing on the transmission dynamics of COVID-19 in South Africa. Mobility trends are included for illustrative purposes only.
- ⁴See, e.g., [Courtemanche et al. \(2020\)](#); [Siedner et al. \(2020\)](#).
- ⁵These included travel restrictions, encouraging social distancing, limiting contact between persons who may be infected, and working to strengthen the public health response.
- ⁶The prohibitions included the sale, dispensing, or transportation of alcohol.
- ⁷The government has devised five Coronavirus Alert Levels, in line with a risk-adjusted strategy that seeks to slow down the rate of infection and flatten the curve. Level 5 entails “drastic measures are required to contain the spread of the virus to save lives,” whereas Level 4 aims for “extreme precautions to limit community transmission and outbreaks, while allowing some activity to resume” ([RSA Government, 2020f](#)).

⁸Further details about these reports and other data sources analyzed in this research not can be found in Table A1 in the Appendix.

⁹We note that these data are based on the activities of smartphone users only. According to the World Bank's World Development Indicators, the country had 159.9 mobile cellular subscriptions per 100 people, and smartphone penetration was estimated to be 91.2% in 2019 (ICASA, 2020). That said, our estimates of population mobility may not be representative of the non-smartphone using population, though it is not immediately clear what the direction of the bias would be. We note that several recent studies on COVID-19 impact leveraged these reports to track population mobility in South Africa and other countries with similar levels of smartphone penetration (Nyabadza et al, 2020; Czech et al, 2020).

¹⁰South Africa is labeled by its 3-letter country code, "ZAF."

¹¹The province is the lowest level at which comparable data on mobility trends is available. We supplemented our analysis with data from the Mobility Trends Reports published by Apple Maps (<https://www.apple.com/covid19/mobility>), which allow us to compare trends for Cape Town and Johannesburg with the surrounding provinces. As shown in the Appendix, this analysis depicts largely similar trends to those captured by the Google Reports.

¹²Additional province-level comparison charts are shown in the Appendix.

¹³This process is described in detail in the Appendix.

¹⁴An alternative version of this figure, excluding Western Cape, is presented in the Appendix for better visualization of the other provinces.

¹⁵We first calculate the daily exponential growth rate and then take the weekly average. Daily exponential growth is calculated as the natural log of cumulative confirmed cases minus the log of cumulative confirmed cases on the prior day. As in other recent studies (Courtemanche et al. 2020), we use this functional form because epidemiological models predict exponential growth in the absence of intervention. In computing exponential growth, we follow recent studies and add one for province-dates with zero cases to avoid dropping observations.

¹⁶We take weekly averages given fluctuations in mobility, e.g. in workplace trends where the average reduction in mobility is considerably lower on weekends when people are typically less likely to go to their workplaces.

¹⁷This section draws heavily on a recent report profiling trends since 1994 conducted by the country's statistical agency (Statistics South Africa, 2019).

¹⁸The survey drew on a non-probability, convenience sample of 2,688 South African residents.

¹⁹The most recent Afrobarometer survey, conducted between August-September 2018, indicates that nearly 50% of all rural residents in South Africa never use the Internet compared to 29.5% of urban residents (<http://afrobarometer.org/online-data-analysis/analyse-online>).