



# South African COVID-19 Vulnerability Index

Adjusting the SACVI to support an evidence-  
led approach to the country's vaccine roll out



**stats sa**

Department:  
Statistics South Africa  
REPUBLIC OF SOUTH AFRICA

# Table of Contents

- Table of Contents .....2
- 1 Background.....3
  - 1.1 The COVID-19 Vaccine Rollout Strategy in summary.....4
  - 1.2 The Vulnerability Index in summary .....5
- 2 Methodology ..... **Error! Bookmark not defined.**
  - 2.1 Indicator selection methodology..... **Error! Bookmark not defined.**

# 1 Background

The COVID-19 pandemic has had a devastating multi-sectoral impact in South Africa; as of 16 June 2021, there have been almost 1,76 million positive cases identified, with total confirmed deaths from the virus exceeding 58 000. Combined with the contraction of the South African economy and a fall of over 16% in the Gross Domestic Product (GDP), as well as the associated job losses and increasing costs of healthcare, a solution to addressing this crisis has become pressing. The development and roll-out of an effective vaccine programme is one of the main tools needed to fight against COVID-19 and interrupt the transmission of the virus. Current vaccine allocation guidelines urge planners to allocate vaccines in ways that recognize, and ideally reduce, existing societal inequities.

The country has secured the supply of over 20 million vaccine doses and, as of 16 June 2021, has administered just over 1,8 million doses. Given that the COVID-19 vaccines are in short supply and countries are actively competing for access, it is critical for government to carefully manage its supply and prioritise distribution, especially as Phase 2 kicks off. A Ministerial Advisory Committee on COVID-19 Vaccines has been appointed and developed a strategy to ensure equitable access to vaccines that includes identifying priority groups for vaccination. Limitations are noted in the strategy and this has led to the proposal of using vulnerability to highlight areas for targeting the vaccine roll-out. Similar approaches have been used in other countries (e.g. the USA Social Vulnerability Index algorithm) to highlight and target the most vulnerable communities. Building on this approach, Stats SA has adjusted the design of its recently released South African Vulnerability Index (known as the SACVI) to support the process and strengthen the vaccine roll-out approach within the context of the current 3rd wave and the emerging new variants.

The SACVI was developed as a way of using the smallest area population data available and incorporating dimensions and indicators to statistically reflect localised risk factors that may contribute to the spread of COVID-19 for each individual against a set criteria being measured.

The index uses a natural counting approach to determine the headcount of vulnerable individuals within a population, as well as measure their level of simultaneous vulnerability determining intensity. The index was produced to identify these populations that are at multiple risk to identify areas where the population are considered most vulnerable to COVID-19. The index uses the Alkire-Foster (AF) method as this technique allows an informed vulnerability approach incorporating indicators under different dimensions and indicators which can be mapped via a small-area map-based interface.

**The South African COVID-19 Vulnerability Index (SACVI) aims to statistically and spatially identify vulnerable populations that are more likely to be adversely affected should COVID-19 spread in the affected area.**

The index uses Census 2011 data and eight indicators related to labour force activity, access to media and household services, overcrowding, multigenerational status, age, and chronic illness to output a composite measure that reflects the vulnerability status of residents to the COVID-19 virus and where these individuals are located.

## Index indicators



Employed with private vehicle



Access to media



Access to water



Access to sanitation



Overcrowding



Multi-generational households



Age (elderly 60+)



Chronic medication

## 1.1 The COVID-19 Vaccine Rollout Strategy in summary

<b>Rationale</b>	South Africa's vaccination distribution plans have been designed to ensure that those most in need receive vaccines first. The country is aiming to vaccinate 67% of its population to achieve 'herd' or population immunity and to prevent ongoing transmission of COVID-19.																		
<b>Leadership and coordination</b>	<p>The vaccine rollout will be lead nationally in coordination with provincial health departments and the private healthcare sector with the following committees established:</p> <ul style="list-style-type: none"> <li>• A national vaccine coordinating committee will be established at the NDOH by the DG with representatives from various clusters involved;</li> <li>• Provincial coordinating committees appointed by HODs and structures at district level to manage the mass rollout; and</li> <li>• A private health sector coordinating committee.</li> </ul>																		
<b>Phased approach</b>	<p>A three-phased approach will be defined for vaccine introduction as illustrated below.</p> <table border="1" data-bbox="341 725 1102 1144"> <tr> <td colspan="2"><b>Phase 1:</b></td> </tr> <tr> <td><b>Frontline healthcare workers</b></td> <td>Target population: 1 250 000</td> </tr> <tr> <td colspan="2"><b>Phase 2:</b></td> </tr> <tr> <td><b>Essential workers</b></td> <td>Target population: 2 500 000</td> </tr> <tr> <td><b>People in congregate settings</b></td> <td>Target population: 1 100 000</td> </tr> <tr> <td><b>People over 60 years old</b></td> <td>Target population: 5 000 000</td> </tr> <tr> <td><b>People over 18 years old with co-morbidities</b></td> <td>Target population: 8 000 000</td> </tr> <tr> <td colspan="2"><b>Phase 3:</b></td> </tr> <tr> <td><b>Other persons over 18 years old</b></td> <td>Target population: 22 500 000</td> </tr> </table> <p>For Phase 2, priority groups have been defined as follows:</p> <ul style="list-style-type: none"> <li>• <b>Essential workers:</b> Police officers, miners and workers in the security, retail, food, funeral, teachers, banking and essential municipal and home affairs, border control and port health services.</li> <li>• <b>Persons in congregate settings:</b> Persons care homes, detention centres, shelters and prisons, hospitality and tourism industry, and educational institutions.</li> <li>• <b>Persons 60 years and older</b></li> <li>• <b>Persons older than 18 years with co-morbidities:</b> Persons living with uncontrolled diabetics, chronic lung disease, poorly controlled cardiovascular disease, renal disease, HIV, tuberculosis, and obesity.</li> </ul>	<b>Phase 1:</b>		<b>Frontline healthcare workers</b>	Target population: 1 250 000	<b>Phase 2:</b>		<b>Essential workers</b>	Target population: 2 500 000	<b>People in congregate settings</b>	Target population: 1 100 000	<b>People over 60 years old</b>	Target population: 5 000 000	<b>People over 18 years old with co-morbidities</b>	Target population: 8 000 000	<b>Phase 3:</b>		<b>Other persons over 18 years old</b>	Target population: 22 500 000
<b>Phase 1:</b>																			
<b>Frontline healthcare workers</b>	Target population: 1 250 000																		
<b>Phase 2:</b>																			
<b>Essential workers</b>	Target population: 2 500 000																		
<b>People in congregate settings</b>	Target population: 1 100 000																		
<b>People over 60 years old</b>	Target population: 5 000 000																		
<b>People over 18 years old with co-morbidities</b>	Target population: 8 000 000																		
<b>Phase 3:</b>																			
<b>Other persons over 18 years old</b>	Target population: 22 500 000																		
<b>Delivery platforms</b>	<p>The vaccination roll-out will use the following service delivery platforms:</p> <ul style="list-style-type: none"> <li>• Public facility vaccination</li> <li>• Vaccination Centres (facility based vaccination centres)</li> <li>• Outreach vaccination programme (mobile clinics)</li> <li>• Work-based vaccination programme</li> </ul>																		
<b>Data management</b>	<p>Data is needed for monitoring vaccine uptake and coverage, prioritization, planning, safety monitoring, and vaccine effectiveness studies. A Electronic Vaccination Data System (EVDS) has been developed to collect:</p> <ul style="list-style-type: none"> <li>• Patient information;</li> <li>• Health establishment where service is accessible;</li> <li>• Vaccine administered; and</li> <li>• A record of vaccination.</li> </ul> <p style="text-align: right;">Source: Department of Health</p>																		

## 1.2 The South African Vulnerability Index in summary

<b>Rationale</b>	The SACVI considers eight indicators related to labour force activity, access to media and household services, overcrowding, multigenerational status, age, and chronic illness to output a composite measure that shows the vulnerability status of residents to the COVID-19 virus and where these individuals are located.
<b>Coverage</b>	<p>The index considers the population in all Enumeration Areas (EA) as defined by Stats SA's census geography which is used for sampling frames.</p> <p><i>While it is the lowest level of geographic reporting by Stats SA, the data remains anonymous and are aggregated to the total population within the specific EA to maintain confidentiality.</i></p>
<b>Data Source</b>	The index uses the 2011 Census data produced by Statistics South Africa. While this data may not be current, it is the only data that reports at a level of EA and allows for a more granular picture of where the most vulnerable of populations are located.
<b>Indicators used</b>	<p>Eight indicators were used for the index ranging from labour force activity to access to services and household status. These indicators are as follows:</p> <ul style="list-style-type: none"> <li>• Employment without ownership of a car;</li> <li>• No access to internet, radio, and television;</li> <li>• No access to water within 200m of the dwelling;</li> <li>• No access to flush and chemical toilets;</li> <li>• Overcrowding status of the household;</li> <li>• Multigenerational households;</li> <li>• Elderly (60+); and</li> <li>• Use of chronic medication.</li> </ul>
<b>Method</b>	<p>An adaptation of the Alkire-Foster method was used. This method is commonly used to construct multidimensional national poverty indices. The index uses a natural counting approach to determine the headcount of vulnerable individuals within a population, as well as measure their level of simultaneous vulnerability determining intensity.</p> <p>A composite index was calculated and produced based on 8 indicators. All indicators have equal weights and hence each have a share of 1/8 contributed to the total weight of 1.</p> <p>The vulnerable were identified using a vulnerability cut-off, which represents the proportion of minimum deprivation a person must experience in order to be identified as vulnerable. The intensity of the vulnerability was then computed based on the number of dimensions/indicators that an individual is vulnerable in.</p> <p>The SACVI score was then finally computed, which is the headcount multiplied by the intensity. The final score was then ranked from 0-5 with 5 being the most vulnerable and 0 the least.</p>
<b>Limitations</b>	The index makes use of 2011 Enumeration Areas and 2011 Census data and thus, this data is almost 10 years old. There have been many changes in living circumstances, as well as population movements and growth that is not fully reflected in the SACVI. Nonetheless, it is felt this data source is still relevant and the value of small area indicators is unique and invaluable. Additionally, for the health dimension, data sources were not available at EA level and so a proxy indicator based on the use of chronic medication was used for the health dimension.
<b>Use</b>	The SACVI is a tool that can assist with and inform a targeted response to issues relating to COVID-19 as it highlights areas in which vulnerability to COVID (as defined by the indicators) are most prevalent.

## 2 Using the SACVI to support vaccine roll out

Defeating the COVID-19 pandemic requires well-informed, data-driven decisions at all administrative levels across national, provincial, and district health departments. The COVID-19 pandemic is a serious challenge and thus, the country's vaccine response requires informed decision-making and communication supported by the best available data. Stats SA has created a tool to support such a process. This tool allows us to identify those most vulnerable to COVID-19 infections and therefore, it can be useful in the identification of priority communities for vaccine roll-out. The SACVI visually synthesizes placename-level vulnerability in a user-friendly context.

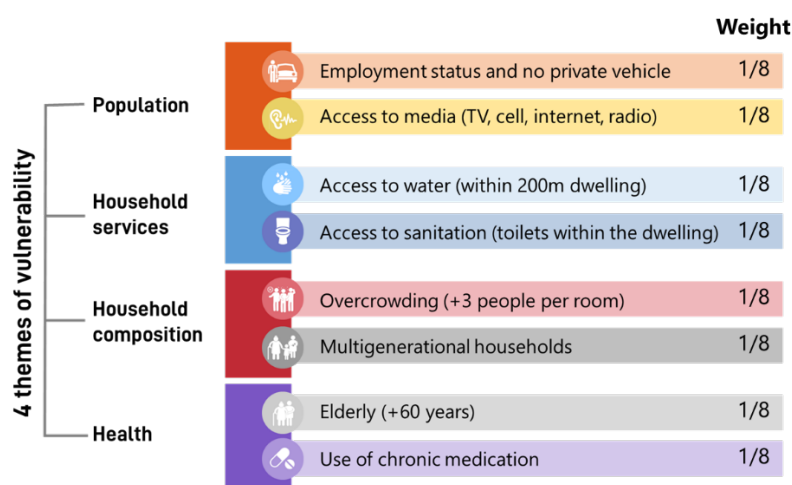
Ideally, the SACVI would be used in conjunction with corresponding health data by integrating baseline data on relevant community vulnerabilities with dynamic data on local infection rates and interventions. Unfortunately, data limitations preclude this. Nevertheless, the SACVI does have applicability and relevance in Phase 2 and 3 of the vaccination roll-out. Limitations are noted in the strategy for roll-out in the following areas, where the SACVI could potentially support:

1. There is no indication of what data will be used to select prioritized groups directly, the index (or a modified version) can assist government in this process as an unbiased tool for locating vulnerable communities.
2. There is reference to a communication plan, the index can assist to define priority groups and the best methods of communicating to help define a tailored outreach and communication plan.
3. There is reference to the delivery sites to be used, the index can assist to plan the location of dispensing sites, especially for the mobile units, and to monitor uptake.

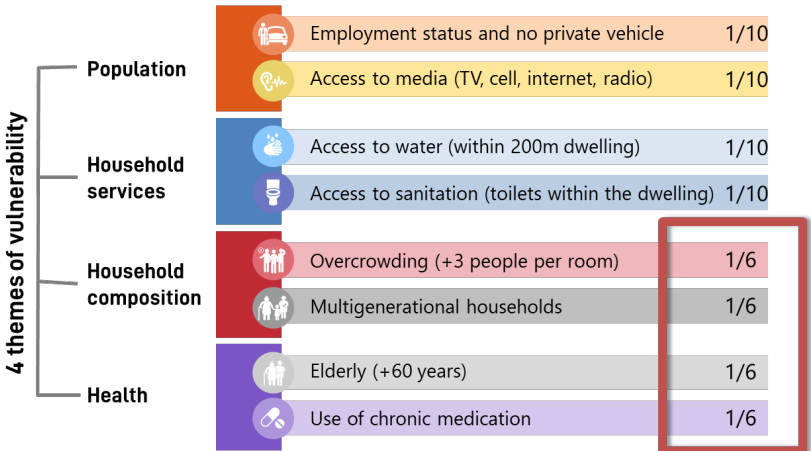
To better address dynamics relating to vaccine distribution, various adjustments to the original SACVI were considered. These included modifying and/or expanding the variables contained in the index, as well as adjusting the weighting structure of the index. After further research and consultation, Stats SA decided that modifying the index weights was the most effective method for improving the SACVI for uses relating to vaccine distribution.

### 2.1 Modifying the index weights

The original SACVI used an equal weight approach. This means that the four dimensions were each given the same weight (i.e. importance) of 25% (or 1/4). Furthermore, the eight corresponding indicators (two per dimension) also had the same weight of 12.5% (or 1/8) each. The figure below shows the original weight structure of the index.



However, to improve the usefulness of the index for vaccine distribution purposes, Stats SA opted to give certain indicators a higher weight than others. By adjusting the weight structure of the SACVI, more emphasis could be placed on particular indicators that correlate more directly to vaccine-related issues. Ultimately, the weights of four indicators were increased, while the other four were decreased. The illustration below shows the altered weights for the revised index



By making this change, Stats SA hopes that this tool will talk more directly to the Phase 2 requirements.

### 3 References

Department of Health (2021) COVID Vaccine Plan 03 January 2021 <https://sacoronavirus.co.za/2021/01/03/covid-19-vaccine-strategy>

Statistics South Africa (2020) SACVI Technical Report <http://www.statssa.gov.za/publications/Report%2000-80-05/SACVI%20Technical%20Report.pdf>

Schmidt, H; Weintraub, R; Williams, M A. and Buttenheim, A; Sadecki, E and Wu, H; Doiphode, A and Gostin, L O. and Shen, A (2020) Equitable Allocation of COVID-19 Vaccines: An Analysis of the Initial Allocation Plans of CDC's Jurisdictions with Implications for Disparate Impact Monitoring (February 1, 2021). Available at SSRN: <https://ssrn.com/abstract=3740041> or <http://dx.doi.org/10.2139/ssrn.3740041>

Marvel S, House J, Wheeler M, et al. (2020) The COVID-19 Pandemic Vulnerability Index (PVI) Dashboard: Monitoring county-level vulnerability using visualization, statistical modeling, and machine learning. medRxiv 2020. DOI: 10.1101/2020.08.10.20169649.