African Covid-19 Vulnerability Index (ACVI) Calculation

The African Covid-19 Vulnerability Index (ACVI) is replicated from the Covid-19 Community Vulnerability Index (CCVI). The purpose of the index is to identify the geographic regions less resilient to the impacts of Covid-19. The index is built off the Centres for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI). As defined by SVI, social vulnerability refers to the resilience of communities when confronted by external stresses on human health, stresses such as natural or human-caused disasters, or disease outbreaks.

The methods and calculations used in the ACVI are taken from the CCVI methodology and SVI data documentation respectively.

Themes and Indicators

The ACVI is calculated for various African countries covering four themes:

- Epidemiological factors
- Healthcare systems
- Demographics
- Water, Sanitation and Hygiene (WASH)

Calculating the ACVI

The ACVI consists of rankings of areas within the same administrative levels against each other. For example, in South Africa provinces are ranked against provinces, districts ranked against districts and local municipalities ranked against local municipalities.

Step 1

If the dataset is available in the number of people, then it needs to be divided by the total population to calculate the percentage of the population.

B	C	D	E	F
name	age 65+ (elderly) population	Total population	% elderly population	
Abaqulusi	15814	243795	6	
Alfred Duma	24036	356274	7	
Alfred Nzo	68448	867864	8	
Amahlathi	8390	101826	8	
Amajuba	32902	531327	6	
Amathole	75397	880790	9	
Ba-Phalaborwa	9033	168937	5	
Beaufort West	5028	51080	10	
Bela-Bela	6235	76296	8	
Bergrivier	7347	67474	11	
Big Five Hlabisa	7264	116622	6	

Step 2

Separate dataset according to administrative level for each theme. Each theme will contain data for each administrative level. For example, the demographics theme will have a separate dataset for provinces, districts and local municipalities.

A	B
name	% elderly
Eastern Cape	8
Free State	9
Gauteng	9
KwaZulu-Natal	7
Limpopo	8
Mpumalanga	7
North West	8
Northern Cape	10
Western Cape	9

Step 3

The value of each area (province) is ranked against each other to achieve a ranking between 0-1. The =PERCENTRANK.INC function is used, and the decimal place is defined at 4.

```
=PERCENTRANK.INC(B$2:B$10,B2,4)
```

A	B	C
name	% elderly	pecentile rank % elderly
Eastern Cape	8	0.5000
Free State	9	0.6250
Gauteng	9	0.7500
KwaZulu-Natal	7	0.1250
Limpopo	8	0.2500
Mpumalanga	7	0.0000
North West	8	0.3750
Northern Cape	10	1.0000
Western Cape	9	0.8750

Step 4

Repeat step 3 for each indicator in the theme.

A	B	C	D	E
name	% elderly	pecentile rank % elderly	population density	pecentile rank population density
Eastern Cape	8	0.5000	41.3	0.3750
Free State	9	0.6250	21.8	0.1250
Gauteng	9	0.7500	737.0	1.0000
KwaZulu-Natal	7	0.1250	117.2	0.8750
Limpopo	8	0.2500	46.1	0.5000
Mpumalanga	7	0.0000	56.6	0.7500
North West	8	0.3750	35.6	0.2500
Northern Cape	10	1.0000	3.2	0.0000
Western Cape	9	0.8750	47.7	0.6250

Step 5

SUM the percentile ranks for each indicator.

A	B	C	D	E	F
name	% elderly	pecentile rank % elderly	population density	pecentile rank population density	sum of percentile rank
Eastern Cape	8	0.5000	41.3	0.3750	0.8750
Free State	9	0.6250	21.8	0.1250	0.7500
Gauteng	9	0.7500	737.0	1.0000	1.7500
KwaZulu-Natal	7	0.1250	117.2	0.8750	1.0000
Limpopo	8	0.2500	46.1	0.5000	0.7500
Mpumalanga	7	0.0000	56.6	0.7500	0.7500
North West	8	0.3750	35.6	0.2500	0.6250
Northern Cape	10	1.0000	3.2	0.0000	1.0000
Western Cape	9	0.8750	47.7	0.6250	1.5000

Step 6

Calculate the percentile rank for the SUM column calculated in Step 5.

```
=PERCENTRANK.INC(F2:$F$10,F2,4)
```

A	B	C	D	E	F	G
name	% elderly	pecentile rank % elderly	population density	pecentile rank population density	sum of percentile rank	percentile ranking of sum
Eastern Cape	8	0.5000	41.3	0.3750	0.8750	0.5000
Free State	9	0.6250	21.8	0.1250	0.7500	0.1250
Gauteng	9	0.7500	737.0	1.0000	1.7500	1.0000
KwaZulu-Natal	7	0.1250	117.2	0.8750	1.0000	0.6250
Limpopo	8	0.2500	46.1	0.5000	0.7500	0.1250
Mpumalanga	7	0.0000	56.6	0.7500	0.7500	0.1250
North West	8	0.3750	35.6	0.2500	0.6250	0.0000
Northern Cape	10	1.0000	3.2	0.0000	1.0000	0.6250
Western Cape	9	0.8750	47.7	0.6250	1.5000	0.8750

Step 7

Once calculations from step 1 to step 6 are completed for each theme, combine the result of Step 6 for all themes together.

A	B	C	D	E
name	epidemiological	healthcare	demographic	WASH
Eastern Cape	0.5	0.5	0.5	0.75
Free State	0.75	0.625	0.125	0.25
Gauteng	0.25	0.375	1	0
KwaZulu-Natal	1	0.375	0.625	0.75
Limpopo	0	0.875	0.125	1
Mpumalanga	0.125	1	0.125	0.625
North West	0.5	0.75	0	0.5
Northern Cape	0.25	0.125	0.625	0.25
Western Cape	0.875	0	0.875	0

Step 8

SUM the values of all the themes

A	B	C	D	E	F
name	epidemiological	healthcare	demographic	WASH	sum of themes
Eastern Cape	0.5	0.5	0.5	0.75	2.25
Free State	0.75	0.625	0.125	0.25	1.75
Gauteng	0.25	0.375	1	0	1.625
KwaZulu-Natal	1	0.375	0.625	0.75	2.75
Limpopo	0	0.875	0.125	1	2
Mpumalanga	0.125	1	0.125	0.625	1.875
North West	0.5	0.75	0	0.5	1.75
Northern Cape	0.25	0.125	0.625	0.25	1.25
Western Cape	0.875	0	0.875	0	1.75

Step 9

Calculate the percentile rank for the SUM of themes column calculated in Step 8. This is calculate value in the Vulnerability score.

```
=PERCENTRANK.INC(F$2:F$10,F2,4)
```

A	B	C	D	E	F	G
name	epidemiological	healthcare	demographic	WASH	sum of themes	percentile rank of themes
Eastern Cape	0.5	0.5	0.5	0.75	2.25	0.875
Free State	0.75	0.625	0.125	0.25	1.75	0.25
Gauteng	0.25	0.375	1	0	1.625	0.125
KwaZulu-Natal	1	0.375	0.625	0.75	2.75	1
Limpopo	0	0.875	0.125	1	2	0.75
Mpumalanga	0.125	1	0.125	0.625	1.875	0.625
North West	0.5	0.75	0	0.5	1.75	0.25
Northern Cape	0.25	0.125	0.625	0.25	1.25	0
Western Cape	0.875	0	0.875	0	1.75	0.25

Step 10

Rate the Vulnerability score using the IFS function. This is the Vulnerability rating.

```
=IFS(G2<0.2, "Very Low",AND(G2>=0.2, G2<0.4),"Low",AND(G2>=0.4, G2<0.6),"Moderate",AND(G2>=0.6, G2<0.8),"High",G2>=0.8,"Very High")
```

A	B	C	D	E	F	G	H	I
name	epidemiological	healthcare	demographic	WASH	sum of themes	percentile rank of themes	ranking	
Eastern Cape	0.5	0.5	0.5	0.75	2.25	0.875	Very High	
Free State	0.75	0.625	0.125	0.25	1.75	0.25	Low	
Gauteng	0.25	0.375	1	0	1.625	0.125	Very Low	
KwaZulu-Natal	1	0.375	0.625	0.75	2.75	1	Very High	
Limpopo	0	0.875	0.125	1	2	0.75	High	
Mpumalanga	0.125	1	0.125	0.625	1.875	0.625	High	
North West	0.5	0.75	0	0.5	1.75	0.25	Low	
Northern Cape	0.25	0.125	0.625	0.25	1.25	0	Very Low	
Western Cape	0.875	0	0.875	0	1.75	0.25	Low	