

# Estimating cases for COVID-19 in South Africa

## Long-term provincial projections

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**FOR PUBLIC RELEASE**

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on behalf of the South African COVID-19 Modelling Consortium

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***The projections in this report are intended for planning purposes by the South African government.***



## About the South African COVID-19 Modelling Consortium

The South African COVID-19 Modelling Consortium is a group of researchers from academic, non-profit, and government institutions across South Africa. The group is coordinated by the National Institute for Communicable Diseases, on behalf of the National Department of Health. The mandate of the group is to provide, assess and validate model projections to be used for planning purposes by the Government of South Africa. For more information, please contact Dr Harry Moultrie ([harrym@nicd.ac.za](mailto:harrym@nicd.ac.za)).

## Context for interpreting projections

The results presented below must be interpreted carefully and considering the following points of additional context:

**Not all COVID-19 infections will be detected.** Infected individuals who may be asymptomatic or mildly ill are not likely to seek out a diagnostic test. Additionally, with laboratory and testing constraints, it is not always possible to test all individuals who seek laboratory confirmation. A meeting of epidemiologists was convened at the NICD to estimate the number of cases active in the population that were not being detected. The number of confirmed COVID-19 cases, evolution of patient under investigation criteria for COVID-19 testing, the number of contacts identified and proportion traced, and publications/reports on under-detection rates in other countries were reviewed. It was concluded that all hospitalised severe and critically ill cases would be detected while only 1 in 4 mildly ill cases would be detected. This inflation factor is applied in the model projections. The true value is unknown and is likely to vary through time and geographically. For example, it is likely that with a scale-up in testing and laboratory facilities this inflation factor will go down. The estimate may be revised for future projections. Serosurveillance studies are being planned to provide more robust estimates.

**Projections at the population level do not capture local clustering of cases.** The methods used in this report make simplifying assumptions regarding how contacts between infectious and uninfected people occur and assume that mixing is random at the provincial level. The models therefore cannot capture the differences in risk experienced by some members of society – e.g. health care workers or those living in close, confined quarters such as prisons – nor can it capture the effects of specific events – e.g. religious gatherings and funerals – on local transmission.

**Models project total need for hospital and ICU beds.** As currently formulated, the model assumes that hospital resources, including availability of general ward and ICU beds, staff, and ventilators, will be able to meet demand. This approach is intended to demonstrate the system-wide need for these resources. In reality, the demand for these resources is expected to exceed capacity. The effect, in particular on mortality, of not being able to meet ICU and ventilator demand is not taken into account in the model, nor are the effects of any rationing of these resources.

**Estimating mortality due to COVID-19.** There is considerable uncertainty when projecting mortality due to COVID-19 using mathematical models. At this early stage of the epidemic, it is unclear what proportion of people who become infected will die as well as precisely how many people will become infected over the course of the epidemic. It is also unclear how risk factors such as HIV, TB, and non-communicable diseases

will impact COVID-19 mortality in South Africa. In the model presented here, mortality has been projected using age-specific mortality from the Chinese epidemic adapted to the South African population.

It is particularly important to note that the projections over a six month period for South Africa cannot be compared to *current* mortality in other COVID-19 affected countries, as mortality would have been observed for at most three months in those countries. All countries are currently in the early phase of their epidemics, with resurgence expected in the coming months. Current model projections track observed mortality in South Africa estimating 2 deaths per million population by 4 May 2020. This rate falls below countries such as Algeria (11 per million) and Egypt (4 per million) on the same date (<https://www.worldometers.info/coronavirus/>). The mortality and case projections are also determined on the assumption that social distancing will continue after the 5-week lockdown. New national and/or geographically targeted interventions will impact the expected deaths due to COVID-19.

**Models do not account for population-wide behaviour changes in response to high levels of mortality.** The projections provided in this document are based on an assumption that after the lifting of hard lockdown measures, Level 4 restrictions are assumed to be in place for one month following which social distancing will continue at a moderate level, reducing transmission by 10-20%. No further responses to the epidemic are incorporated, either government-imposed measures such as lockdowns or natural behavioural changes induced by the severity the epidemic. In recent epidemics of severe disease, including the Ebola epidemic in West Africa, the population's response to high local mortality has played an important role in reducing the rate of epidemic growth and the ultimate number of infections and deaths. Similar dynamics have likely contributed to the decline of severe COVID-19 epidemics in countries such as Spain and Italy. The extent to which population-wide behavioural changes may influence the spread of the epidemic in South Africa, or how these changes may vary across the population, are unknown and not taken into account in the projections provided in this report.

**Projections will improve with new data.** At the time of this report, very limited data are available beyond the number of new cases confirmed through time at the national and provincial level. Additional data, in particular health system utilization data such as numbers of hospitalizations occurring in different geographic areas and duration of stay for patients requiring different types of care, will be required to further refine the model and tune it to the South African context. The uncertainty range in the projections has been generated by varying a subset of model parameters. These ranges will be modified as local data become available.

**Understanding of the virus's epidemiology is continually evolving, both locally and globally.** Important parameters about which there remains substantial uncertainty in the scientific literature include the proportion of infections that are truly asymptomatic, the relative infectiousness of these asymptomatic individuals, and the relative duration of infectiousness for these individuals, as well as the severity profile of cases in different contexts. An Appendix presented in the national long-term projection report provides a sensitivity analysis that examines the effect of varying these factors on the timing and magnitude of the expected epidemic peak.

# Note on the long term and short term projections for COVID-19

Three companion reports have been produced by the National COVID-19 Modelling Consortium to project cases and deaths for the COVID-19 epidemic in South Africa.

1. Short Term Projections: May 2020
2. Long Term National Projections
3. Long Term Provincial Projections

There are a number of key differences in the assumptions used to generate projections in the short and long term.

In the long run, it is expected that biological characteristics of the disease, its progression, severity and mortality, will be similar across the nine provinces. In order to generate long term projections, all provinces were assumed to have the same basic reproductive number ( $R_0$ ), though this number was allowed to vary stochastically.

However, in the early stages of the epidemic, the disease may have seeded differently in the provinces and in communities with varying contact behaviour. Stochastic events such as clusters of cases or sharp increases in deaths may occur that are divergent from the average pattern. Hence the differences in patterns of growth of the epidemic tend to be larger at the beginning of the epidemic, but reduce as the epidemic progresses. Thus, to provide short term projections reflective of the trends observed in reported deaths, different  $R_0$  values were estimated for each of the provinces.

These stochastic fluctuations are not expected to continue in the long run and therefore the basic reproductive number is assumed to be the same for all provinces in the long term projections. For this reason, there is a lack of congruence between the short term projections for 29 May 2020 and the long term projections for 1 June 2020 in the national and provincial reports.

The short-term projections will be updated on a weekly basis. We are planning to update the long-term projections towards the end of May, taking into account two aspects:

- additional data on the development of cases and deaths after the end of lock-down, which will give us a better estimate of the impact of Level 4 restrictions;
- better consideration of the spatial aspects of the epidemic at lower geographical scales.

Figure 1: Eastern Cape

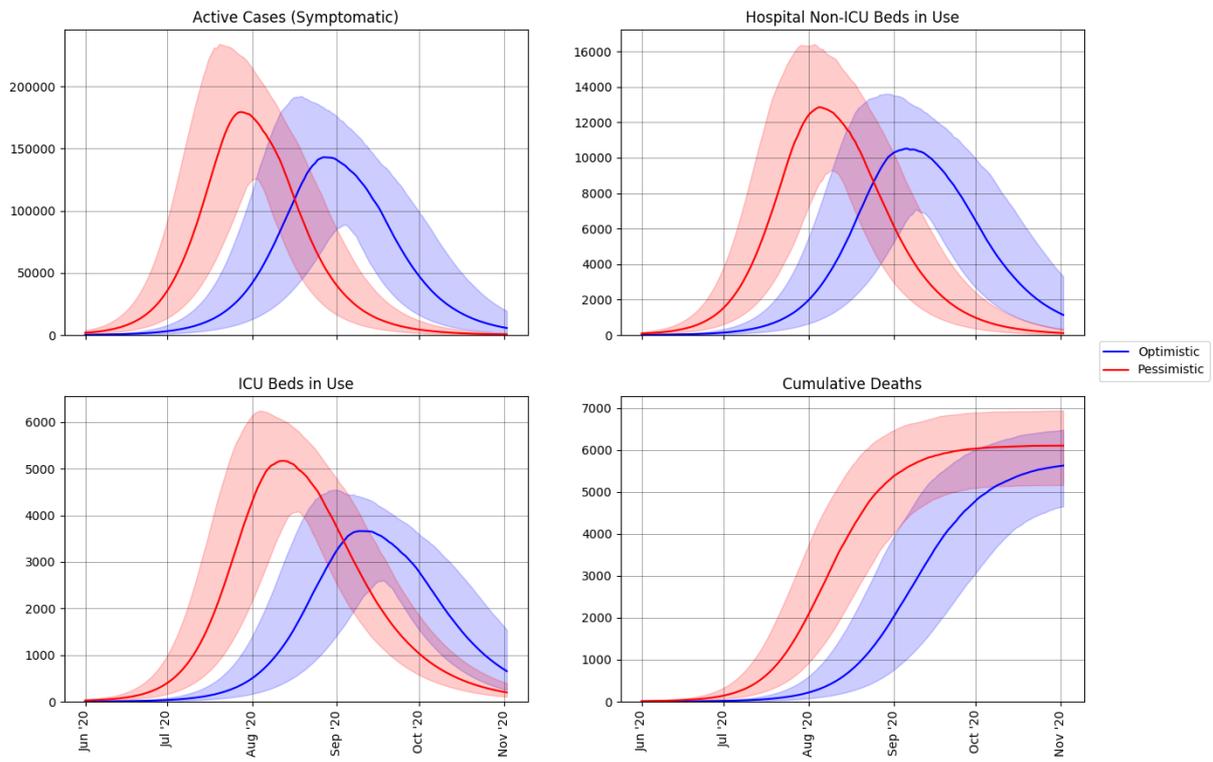


Table 1: Eastern Cape

		Cumulative Incidence		Active Cases		Cumulative Detected Cases
		Total	Symptomatic	All	Symptomatic	
Optimistic	2020-06-01	6,004 (3,704 - 10,038)	1,172 (757 - 1,905)	1,299 (674 - 2,514)	232 (121 - 456)	301 (221 - 443)
	2020-07-01	65,092 (27,826 - 154,172)	10,349 (4,568 - 24,619)	17,549 (6,709 - 45,990)	3,043 (1,157 - 7,987)	1,934 (943 - 4,322)
	2020-08-01	867,422 (291,993 - 2,219,800)	142,495 (47,707 - 391,867)	235,694 (73,284 - 634,135)	41,803 (12,809 - 115,116)	26,004 (9,159 - 74,263)
	2020-09-01	4,143,623 (2,152,894 - 5,347,512)	868,127 (387,195 - 1,314,793)	733,144 (463,942 - 826,940)	140,739 (85,627 - 175,582)	193,861 (80,577 - 332,234)
	2020-10-01	5,400,918 (4,615,859 - 5,780,044)	1,308,412 (1,011,076 - 1,540,379)	224,071 (73,992 - 486,116)	47,345 (16,077 - 98,556)	357,237 (257,849 - 431,109)
	2020-11-01	5,553,448 (5,188,830 - 5,820,218)	1,386,635 (1,164,515 - 1,579,569)	25,925 (6,544 - 96,801)	6,039 (1,568 - 20,588)	393,593 (329,162 - 450,595)
Pessimistic	2020-06-01	38,775 (21,899 - 73,196)	6,547 (3,688 - 12,475)	10,218 (5,166 - 21,431)	1,811 (895 - 3,860)	1,286 (769 - 2,213)
	2020-07-01	708,957 (305,357 - 1,641,629)	110,044 (46,067 - 270,110)	203,701 (82,372 - 506,764)	35,628 (13,738 - 92,341)	18,890 (8,231 - 44,044)
	2020-08-01	4,622,355 (3,018,318 - 5,609,656)	972,547 (534,155 - 1,366,167)	899,470 (669,291 - 1,002,341)	175,612 (125,137 - 214,788)	212,936 (106,728 - 331,635)
	2020-09-01	5,791,653 (5,410,200 - 6,041,868)	1,430,825 (1,185,200 - 1,652,484)	179,029 (69,381 - 398,351)	39,605 (16,189 - 84,746)	394,408 (314,955 - 462,862)
	2020-10-01	5,880,467 (5,649,336 - 6,073,727)	1,476,956 (1,249,026 - 1,678,575)	15,992 (5,157 - 48,862)	4,342 (1,628 - 11,662)	420,726 (356,117 - 479,874)
	2020-11-01	5,887,408 (5,675,407 - 6,075,590)	1,480,336 (1,252,407 - 1,682,372)	1,313 (403 - 4,582)	484 (191 - 1,347)	423,362 (358,295 - 481,203)

		Cumulative Admissions		Hospital Beds in Use		Cumulative Deaths
		Non-ICU	ICU	Non-ICU	ICU	
Optimistic	2020-06-01	33 (22 - 52)	12 (8.42 - 18)	12 (6.99 - 21)	3.38 (2.03 - 5.79)	3 (3 - 5)
	2020-07-01	249 (115 - 561)	80 (39 - 174)	136 (58 - 335)	33 (14 - 79)	16 (9 - 33)
	2020-08-01	3,436 (1,183 - 9,488)	1,107 (389 - 3,063)	1,976 (649 - 5,518)	500 (166 - 1,408)	216 (78 - 604)
	2020-09-01	24,160 (10,208 - 42,299)	8,875 (3,565 - 16,120)	10,277 (5,217 - 13,518)	3,256 (1,433 - 4,546)	2,015 (755 - 3,920)
	2020-10-01	41,925 (18,406 - 67,985)	17,326 (7,892 - 27,478)	6,445 (2,677 - 9,952)	2,786 (1,541 - 3,591)	4,787 (3,061 - 6,010)
	2020-11-01	45,107 (19,228 - 77,914)	19,185 (8,404 - 32,581)	1,206 (328 - 3,478)	689 (265 - 1,612)	5,618 (4,642 - 6,474)
Pessimistic	2020-06-01	162 (95 - 297)	53 (32 - 94)	85 (45 - 168)	24 (13 - 45)	11 (7 - 18)
	2020-07-01	2,520 (1,069 - 6,102)	770 (336 - 1,862)	1,541 (618 - 3,857)	400 (166 - 995)	143 (64 - 333)
	2020-08-01	26,667 (13,483 - 43,548)	9,536 (4,573 - 16,186)	12,416 (7,258 - 16,323)	4,291 (2,170 - 6,144)	2,083 (925 - 3,744)
	2020-09-01	46,399 (23,588 - 72,808)	19,262 (10,125 - 29,563)	6,181 (2,976 - 10,255)	3,735 (2,513 - 4,788)	5,372 (4,008 - 6,462)
	2020-10-01	48,514 (24,218 - 78,872)	20,586 (10,543 - 33,049)	975 (367 - 2,408)	1,030 (573 - 1,851)	6,032 (5,091 - 6,891)
	2020-11-01	48,677 (24,258 - 79,473)	20,689 (10,569 - 33,425)	116 (40 - 356)	206 (108 - 414)	6,102 (5,163 - 6,937)

Figure 2: Free State

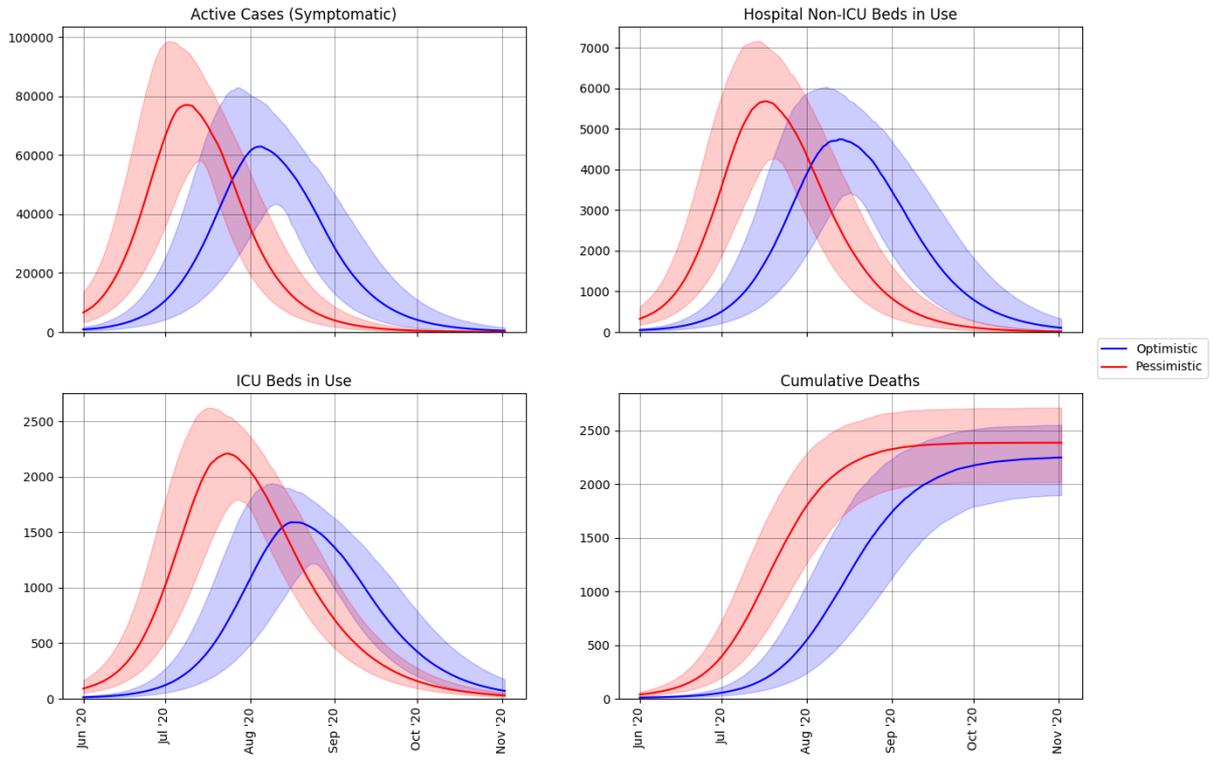


Table 2: Free State

		Cumulative Incidence		Active Cases		Cumulative Detected Cases
		Total	Symptomatic	All	Symptomatic	
Optimistic	2020-06-01	23,118 (14,326 - 38,388)	4,306 (2,708 - 7,100)	4,988 (2,600 - 9,559)	894 (468 - 1,744)	942 (632 - 1,485)
	2020-07-01	229,723 (103,237 - 485,006)	37,219 (16,931 - 82,691)	61,117 (24,628 - 142,308)	10,692 (4,280 - 25,418)	6,948 (3,362 - 15,042)
	2020-08-01	1,483,032 (781,496 - 2,078,226)	291,914 (139,771 - 481,224)	328,211 (179,902 - 383,858)	61,440 (32,445 - 80,547)	61,628 (28,667 - 110,832)
	2020-09-01	2,284,625 (1,933,739 - 2,465,995)	547,214 (418,686 - 648,883)	136,603 (60,884 - 226,032)	28,377 (12,853 - 46,449)	146,952 (104,898 - 179,988)
	2020-10-01	2,382,191 (2,220,643 - 2,499,820)	593,637 (498,454 - 676,831)	18,256 (6,006 - 51,725)	4,136 (1,384 - 11,006)	168,454 (140,957 - 193,515)
	2020-11-01	2,393,177 (2,261,945 - 2,503,103)	599,766 (507,108 - 680,300)	1,914 (518 - 6,925)	477 (137 - 1,619)	171,939 (145,302 - 195,038)
Pessimistic	2020-06-01	142,501 (82,211 - 257,429)	24,206 (13,761 - 44,680)	37,188 (19,231 - 74,243)	6,640 (3,348 - 13,580)	4,632 (2,719 - 7,992)
	2020-07-01	1,383,533 (821,648 - 1,971,581)	255,887 (136,651 - 419,783)	357,635 (206,583 - 475,336)	66,561 (35,982 - 98,138)	49,696 (25,949 - 86,666)
	2020-08-01	2,427,241 (2,194,302 - 2,564,970)	587,934 (470,958 - 687,674)	166,845 (89,008 - 259,685)	35,381 (19,376 - 53,853)	155,126 (117,923 - 188,771)
	2020-09-01	2,520,536 (2,418,675 - 2,605,986)	631,368 (534,060 - 718,878)	15,622 (6,407 - 37,015)	3,914 (1,752 - 8,584)	179,578 (151,701 - 205,229)
	2020-10-01	2,527,474 (2,436,708 - 2,608,895)	635,246 (537,476 - 721,697)	1,384 (519 - 3,849)	454 (202 - 1,070)	182,098 (154,133 - 206,799)
	2020-11-01	2,527,818 (2,437,655 - 2,609,115)	635,483 (537,680 - 722,365)	123 (46 - 369)	56 (27 - 132)	182,289 (154,239 - 207,210)

		Cumulative Admissions		Hospital Beds in Use		Cumulative Deaths
		Non-ICU	ICU	Non-ICU	ICU	
Optimistic	2020-06-01	135 (91 - 208)	45 (31 - 68)	48 (27 - 85)	12 (7.77 - 22)	10 (8 - 14)
	2020-07-01	953 (454 - 2,041)	292 (145 - 607)	506 (224 - 1,146)	121 (54 - 273)	55 (28 - 110)
	2020-08-01	8,234 (3,780 - 14,463)	2,713 (1,213 - 4,989)	3,886 (1,920 - 5,870)	1,080 (488 - 1,798)	544 (238 - 1,069)
	2020-09-01	18,148 (9,675 - 27,179)	6,937 (3,792 - 10,250)	3,485 (1,932 - 4,708)	1,360 (984 - 1,624)	1,732 (1,117 - 2,229)
	2020-10-01	20,266 (10,403 - 32,101)	8,072 (4,215 - 12,609)	792 (278 - 1,823)	424 (202 - 790)	2,172 (1,789 - 2,508)
	2020-11-01	20,507 (10,469 - 32,955)	8,208 (4,253 - 13,063)	110 (30 - 349)	74 (29 - 184)	2,245 (1,894 - 2,549)
Pessimistic	2020-06-01	636 (377 - 1,136)	198 (120 - 344)	326 (177 - 624)	90 (51 - 165)	38 (24 - 63)
	2020-07-01	6,748 (3,487 - 11,739)	2,103 (1,077 - 3,796)	3,596 (1,894 - 5,824)	1,021 (516 - 1,793)	395 (199 - 732)
	2020-08-01	19,340 (11,745 - 27,673)	7,325 (4,569 - 10,337)	4,352 (2,819 - 5,748)	2,051 (1,711 - 2,363)	1,795 (1,262 - 2,284)
	2020-09-01	21,674 (12,705 - 32,521)	8,628 (5,141 - 12,798)	835 (370 - 1,632)	706 (452 - 1,075)	2,322 (1,951 - 2,663)
	2020-10-01	21,845 (12,760 - 33,015)	8,730 (5,176 - 13,083)	110 (44 - 269)	158 (93 - 277)	2,380 (2,014 - 2,704)
	2020-11-01	21,859 (12,764 - 33,061)	8,738 (5,178 - 13,110)	13 (5.22 - 36)	30 (17 - 55)	2,384 (2,017 - 2,710)

Figure 3: Gauteng

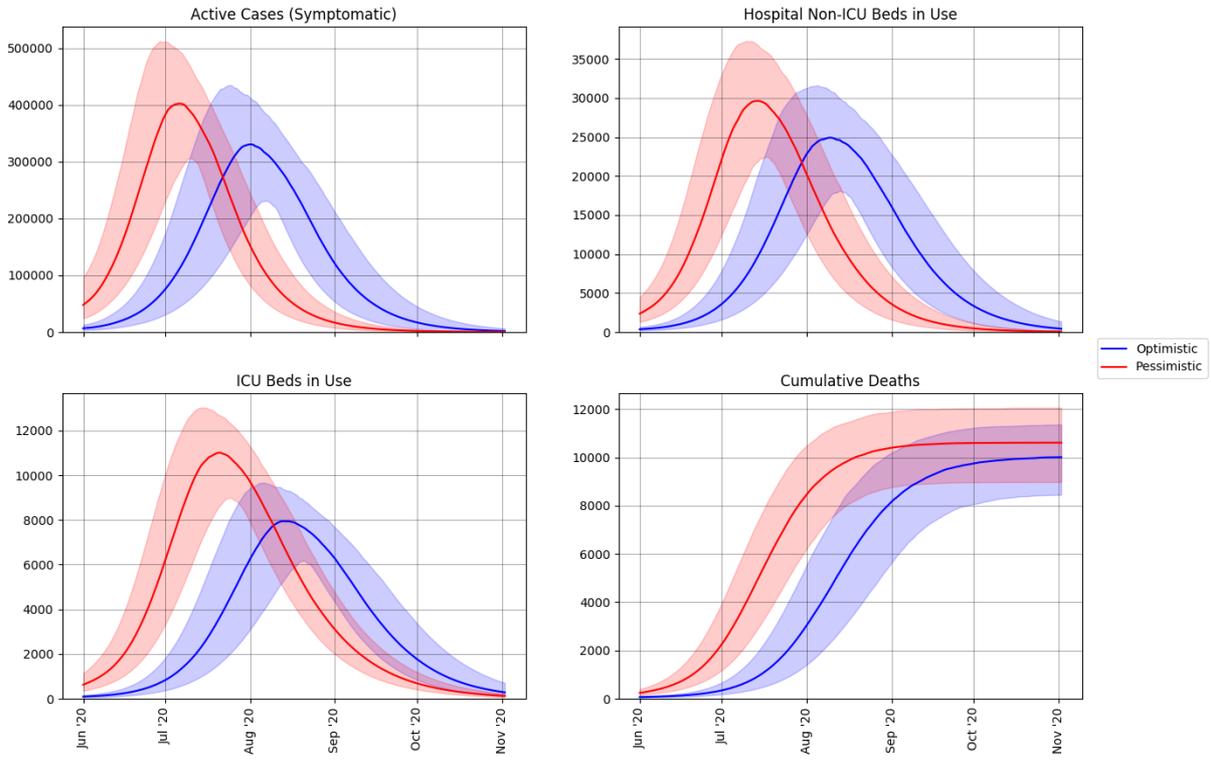


Table 3: Gauteng

		Cumulative Incidence		Active Cases		Cumulative Detected Cases
		Total	Symptomatic	All	Symptomatic	
Optimistic	2020-06-01	170,368 (105,747 - 282,048)	31,839 (20,072 - 52,337)	36,672 (19,160 - 70,017)	6,577 (3,445 - 12,794)	7,008 (4,730 - 11,001)
	2020-07-01	1,632,601 (747,900 - 3,302,804)	266,895 (123,143 - 578,167)	431,128 (177,675 - 959,159)	75,511 (30,941 - 174,447)	50,340 (24,578 - 106,405)
	2020-08-01	8,722,565 (5,057,343 - 11,414,386)	1,782,082 (922,644 - 2,697,196)	1,729,028 (1,120,632 - 1,941,739)	330,701 (203,917 - 412,244)	388,828 (194,037 - 650,076)
	2020-09-01	12,130,618 (10,573,161 - 13,007,650)	2,936,475 (2,329,017 - 3,450,646)	574,032 (251,388 - 1,027,542)	120,010 (53,113 - 210,692)	797,651 (594,031 - 960,223)
	2020-10-01	12,531,274 (11,739,430 - 13,139,603)	3,128,631 (2,631,241 - 3,562,688)	73,638 (24,478 - 209,234)	16,814 (5,664 - 44,910)	888,293 (743,922 - 1,017,137)
	2020-11-01	12,574,751 (11,885,478 - 13,151,519)	3,152,093 (2,665,010 - 3,574,570)	7,682 (2,113 - 27,458)	1,929 (563 - 6,495)	902,400 (763,140 - 1,023,642)
Pessimistic	2020-06-01	1,028,819 (599,154 - 1,825,351)	176,010 (100,757 - 320,224)	267,159 (139,739 - 522,379)	47,841 (24,315 - 95,859)	33,876 (19,992 - 57,864)
	2020-07-01	8,313,459 (5,314,527 - 11,048,411)	1,598,019 (912,363 - 2,458,866)	2,032,576 (1,303,655 - 2,442,173)	382,819 (231,327 - 511,691)	323,954 (177,197 - 526,144)
	2020-08-01	12,857,189 (11,863,880 - 13,518,597)	3,139,804 (2,564,724 - 3,638,299)	711,608 (374,513 - 1,163,063)	152,134 (82,071 - 242,856)	841,945 (659,695 - 1,005,225)
	2020-09-01	13,246,940 (12,718,638 - 13,688,777)	3,320,849 (2,808,683 - 3,776,797)	64,588 (26,949 - 151,218)	16,412 (7,522 - 35,420)	945,181 (800,261 - 1,079,312)
	2020-10-01	13,272,005 (12,797,344 - 13,700,411)	3,335,899 (2,822,539 - 3,791,980)	5,738 (2,221 - 15,708)	1,917 (881 - 4,441)	955,118 (808,476 - 1,084,030)
	2020-11-01	13,274,560 (12,803,151 - 13,701,184)	3,336,651 (2,823,387 - 3,792,918)	520 (203 - 1,525)	240 (117 - 550)	955,916 (808,915 - 1,086,608)

		Cumulative Admissions		Hospital Beds in Use		Cumulative Deaths
		Non-ICU	ICU	Non-ICU	ICU	
Optimistic	2020-06-01	1,009 (685 - 1,554)	315 (220 - 471)	354 (204 - 631)	90 (54 - 153)	62 (46 - 89)
	2020-07-01	6,979 (3,357 - 14,627)	1,979 (991 - 4,039)	3,606 (1,621 - 7,935)	831 (375 - 1,822)	342 (179 - 673)
	2020-08-01	51,980 (25,827 - 85,646)	16,190 (7,748 - 27,696)	22,832 (12,489 - 31,260)	6,260 (3,099 - 9,436)	3,036 (1,407 - 5,535)
	2020-09-01	99,488 (54,044 - 148,591)	35,463 (19,726 - 52,074)	16,099 (8,390 - 22,750)	6,268 (4,314 - 7,662)	8,162 (5,633 - 10,200)
	2020-10-01	108,212 (57,031 - 169,777)	39,829 (21,331 - 61,696)	3,345 (1,165 - 7,884)	1,763 (841 - 3,361)	9,752 (8,068 - 11,227)
	2020-11-01	109,188 (57,299 - 173,222)	40,341 (21,475 - 63,396)	453 (126 - 1,428)	299 (121 - 744)	10,010 (8,451 - 11,362)
Pessimistic	2020-06-01	4,700 (2,799 - 8,304)	1,358 (825 - 2,330)	2,361 (1,295 - 4,461)	623 (355 - 1,130)	237 (150 - 390)
	2020-07-01	43,974 (24,054 - 71,696)	12,953 (6,957 - 21,937)	22,177 (12,523 - 33,068)	6,198 (3,334 - 10,031)	2,258 (1,184 - 3,956)
	2020-08-01	105,761 (65,299 - 150,604)	37,406 (23,662 - 52,416)	20,264 (12,596 - 27,794)	9,705 (7,876 - 11,282)	8,458 (6,208 - 10,491)
	2020-09-01	115,503 (69,312 - 171,310)	42,488 (25,879 - 62,365)	3,594 (1,600 - 7,158)	3,087 (1,991 - 4,738)	10,403 (8,768 - 11,899)
	2020-10-01	116,216 (69,549 - 173,327)	42,880 (26,015 - 63,439)	470 (191 - 1,148)	683 (408 - 1,184)	10,602 (8,971 - 12,035)
	2020-11-01	116,272 (69,565 - 173,514)	42,910 (26,024 - 63,540)	55 (22 - 152)	129 (75 - 235)	10,614 (8,983 - 12,064)

Figure 4: KwaZulu-Natal

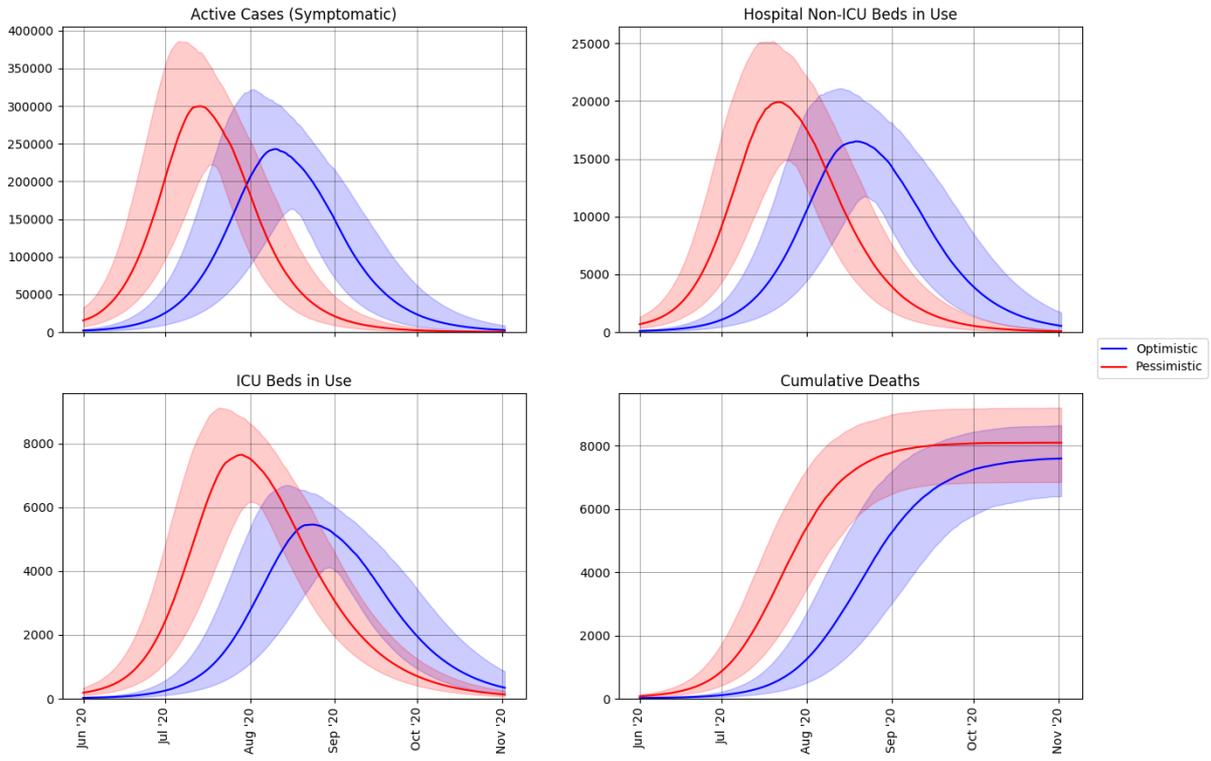


Table 4: KwaZulu-Natal

		Cumulative Incidence		Active Cases		Cumulative Detected Cases
		Total	Symptomatic	All	Symptomatic	
Optimistic	2020-06-01	53,056 (32,773 - 88,462)	9,949 (6,276 - 16,392)	11,438 (5,947 - 22,087)	2,043 (1,065 - 3,996)	2,204 (1,501 - 3,439)
	2020-07-01	548,327 (240,565 - 1,220,753)	88,158 (39,423 - 201,807)	146,620 (57,835 - 360,408)	25,454 (9,950 - 63,138)	16,137 (7,744 - 35,616)
	2020-08-01	4,607,345 (2,085,404 - 7,345,300)	856,647 (360,123 - 1,598,661)	1,123,045 (500,100 - 1,580,364)	205,905 (88,805 - 321,438)	168,275 (71,044 - 347,944)
	2020-09-01	8,705,865 (6,903,127 - 9,571,752)	2,047,353 (1,460,544 - 2,492,068)	733,166 (344,609 - 1,024,873)	148,337 (71,193 - 214,977)	525,449 (343,423 - 674,451)
	2020-10-01	9,289,833 (8,591,643 - 9,770,208)	2,307,603 (1,925,648 - 2,643,658)	107,625 (34,950 - 299,863)	23,292 (7,670 - 61,733)	642,836 (531,304 - 741,395)
	2020-11-01	9,357,400 (8,842,504 - 9,789,271)	2,344,817 (1,982,232 - 2,660,066)	11,330 (2,988 - 41,956)	2,693 (743 - 9,245)	662,374 (558,685 - 751,926)
Pessimistic	2020-06-01	333,999 (190,832 - 615,173)	56,439 (31,905 - 106,129)	87,534 (44,793 - 178,550)	15,487 (7,718 - 32,308)	10,689 (6,257 - 18,511)
	2020-07-01	4,131,140 (2,192,505 - 6,675,922)	720,839 (349,430 - 1,321,827)	1,122,535 (573,742 - 1,811,630)	204,418 (97,262 - 355,573)	131,801 (64,297 - 252,430)
	2020-08-01	9,310,134 (8,078,395 - 9,957,794)	2,204,653 (1,688,871 - 2,645,370)	883,404 (486,759 - 1,226,996)	182,265 (102,701 - 253,920)	561,173 (400,415 - 700,082)
	2020-09-01	9,845,468 (9,427,606 - 10,194,836)	2,463,375 (2,084,559 - 2,811,453)	89,005 (35,425 - 213,596)	20,800 (8,968 - 47,118)	688,708 (579,628 - 788,678)
	2020-10-01	9,889,973 (9,527,399 - 10,206,926)	2,485,396 (2,102,959 - 2,823,409)	7,778 (2,710 - 22,245)	2,315 (972 - 5,724)	702,498 (594,606 - 798,082)
	2020-11-01	9,892,277 (9,537,720 - 10,208,163)	2,487,102 (2,104,131 - 2,827,053)	659 (230 - 2,093)	273 (123 - 684)	703,510 (595,206 - 799,657)

		Cumulative Admissions		Hospital Beds in Use		Cumulative Deaths
		Non-ICU	ICU	Non-ICU	ICU	
Optimistic	2020-06-01	277 (188 - 428)	92 (64 - 137)	98 (56 - 176)	26 (15 - 44)	19 (14 - 28)
	2020-07-01	2,004 (943 - 4,388)	598 (294 - 1,269)	1,071 (466 - 2,509)	251 (110 - 578)	111 (57 - 225)
	2020-08-01	20,815 (8,563 - 41,366)	6,522 (2,653 - 13,526)	10,539 (4,452 - 19,190)	2,769 (1,111 - 5,352)	1,248 (507 - 2,731)
	2020-09-01	59,464 (30,834 - 89,870)	21,815 (11,602 - 32,828)	14,349 (8,858 - 18,175)	5,134 (4,020 - 6,005)	5,253 (3,010 - 7,191)
	2020-10-01	70,433 (34,689 - 112,937)	27,398 (13,768 - 43,217)	3,919 (1,407 - 8,509)	1,957 (942 - 3,433)	7,253 (5,801 - 8,448)
	2020-11-01	71,736 (35,037 - 117,552)	28,122 (13,967 - 45,590)	567 (156 - 1,787)	361 (143 - 900)	7,599 (6,406 - 8,649)
Pessimistic	2020-06-01	1,323 (780 - 2,390)	403 (243 - 705)	678 (366 - 1,319)	184 (103 - 340)	76 (48 - 127)
	2020-07-01	16,333 (7,838 - 31,578)	4,845 (2,329 - 9,624)	9,173 (4,348 - 17,163)	2,438 (1,138 - 4,851)	870 (419 - 1,753)
	2020-08-01	63,673 (37,757 - 91,990)	23,102 (14,063 - 33,174)	17,549 (12,380 - 22,120)	7,521 (6,175 - 8,620)	5,409 (3,472 - 7,252)
	2020-09-01	75,592 (42,706 - 115,300)	29,413 (16,927 - 44,249)	3,972 (1,776 - 7,607)	3,045 (1,936 - 4,558)	7,789 (6,485 - 8,994)
	2020-10-01	76,492 (42,989 - 117,945)	29,943 (17,099 - 45,730)	536 (208 - 1,329)	705 (408 - 1,249)	8,082 (6,835 - 9,182)
	2020-11-01	76,563 (43,007 - 118,189)	29,983 (17,111 - 45,871)	63 (24 - 179)	135 (75 - 255)	8,103 (6,856 - 9,211)

Figure 5: Limpopo

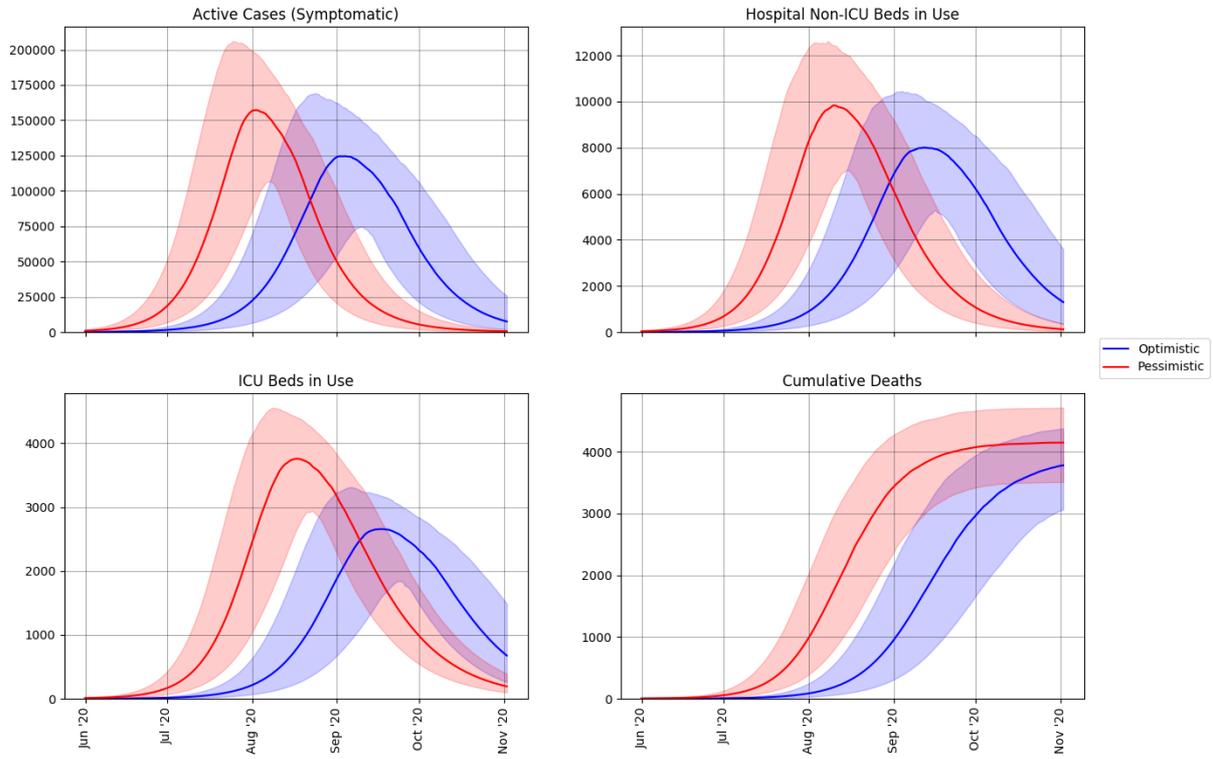


Table 5: Limpopo

		Cumulative Incidence		Active Cases		Cumulative Detected Cases
		Total	Symptomatic	All	Symptomatic	
Optimistic	2020-06-01	3,001 (1,848 - 5,027)	562 (354 - 928)	647 (335 - 1,258)	115 (59 - 226)	123 (84 - 193)
	2020-07-01	32,699 (13,906 - 78,132)	5,170 (2,265 - 12,351)	8,819 (3,358 - 23,296)	1,516 (575 - 4,008)	931 (439 - 2,124)
	2020-08-01	466,127 (149,680 - 1,343,219)	75,131 (24,298 - 222,646)	127,375 (37,572 - 394,146)	22,238 (6,530 - 69,909)	13,249 (4,530 - 40,651)
	2020-09-01	3,091,660 (1,316,801 - 4,520,289)	608,830 (226,369 - 1,067,900)	664,573 (313,051 - 782,504)	124,087 (54,772 - 162,349)	125,501 (44,532 - 254,223)
	2020-10-01	4,726,844 (3,753,533 - 5,126,045)	1,127,586 (809,043 - 1,349,625)	293,008 (100,890 - 524,745)	59,404 (21,094 - 106,100)	295,487 (191,855 - 368,817)
	2020-11-01	4,939,602 (4,581,781 - 5,185,125)	1,229,561 (1,028,509 - 1,404,305)	36,531 (9,008 - 133,695)	7,994 (2,033 - 27,227)	341,463 (283,221 - 393,314)
Pessimistic	2020-06-01	19,428 (10,942 - 36,892)	3,256 (1,822 - 6,249)	5,116 (2,584 - 10,755)	899 (442 - 1,925)	608 (353 - 1,065)
	2020-07-01	375,013 (156,104 - 930,214)	57,034 (23,313 - 148,167)	107,940 (42,124 - 289,915)	18,596 (6,946 - 51,576)	9,539 (4,069 - 22,994)
	2020-08-01	3,545,638 (1,965,816 - 4,771,530)	699,816 (324,726 - 1,125,121)	831,365 (496,189 - 945,445)	156,765 (86,132 - 199,067)	140,233 (60,553 - 249,684)
	2020-09-01	5,115,018 (4,646,212 - 5,370,431)	1,255,224 (1,008,537 - 1,454,082)	236,513 (92,087 - 485,851)	49,626 (20,267 - 99,350)	331,989 (254,185 - 398,392)
	2020-10-01	5,236,127 (5,025,314 - 5,413,683)	1,312,962 (1,110,790 - 1,495,620)	21,716 (6,784 - 67,692)	5,332 (1,879 - 14,976)	366,361 (309,802 - 418,848)
	2020-11-01	5,247,290 (5,056,535 - 5,415,491)	1,319,037 (1,116,165 - 1,499,302)	1,724 (490 - 6,324)	558 (202 - 1,691)	370,297 (313,354 - 420,957)

		Cumulative Admissions		Hospital Beds in Use		Cumulative Deaths
		Non-ICU	ICU	Non-ICU	ICU	
Optimistic	2020-06-01	14 (9.93 - 22)	4.88 (3.39 - 7.30)	5.25 (3.01 - 9.39)	1.38 (0.83 - 2.36)	2 (1 - 2)
	2020-07-01	109 (50 - 246)	32 (15 - 70)	59 (25 - 145)	13 (5.97 - 32)	7 (4 - 12)
	2020-08-01	1,564 (524 - 4,575)	461 (158 - 1,347)	896 (283 - 2,697)	212 (68 - 638)	84 (30 - 247)
	2020-09-01	14,319 (5,117 - 28,105)	4,675 (1,612 - 9,707)	6,827 (2,617 - 10,330)	1,885 (678 - 3,238)	945 (308 - 2,169)
	2020-10-01	30,947 (13,178 - 50,160)	11,621 (5,151 - 18,545)	6,210 (2,927 - 8,524)	2,320 (1,482 - 2,835)	2,963 (1,663 - 3,940)
	2020-11-01	34,821 (14,191 - 60,947)	13,664 (5,732 - 23,449)	1,376 (379 - 3,760)	710 (274 - 1,543)	3,771 (3,046 - 4,371)
Pessimistic	2020-06-01	71 (41 - 130)	21 (12 - 38)	36 (19 - 72)	9.88 (5.53 - 18)	5 (3 - 8)
	2020-07-01	1,132 (472 - 2,850)	317 (136 - 791)	686 (269 - 1,816)	167 (68 - 432)	55 (24 - 132)
	2020-08-01	16,017 (6,951 - 28,881)	5,050 (2,110 - 9,673)	8,268 (3,850 - 12,340)	2,446 (1,043 - 4,142)	983 (391 - 2,033)
	2020-09-01	35,010 (17,232 - 55,040)	13,256 (6,787 - 20,373)	6,141 (3,168 - 9,214)	3,163 (2,270 - 3,824)	3,426 (2,365 - 4,270)
	2020-10-01	37,596 (18,000 - 62,143)	14,726 (7,256 - 24,000)	1,066 (396 - 2,606)	982 (541 - 1,739)	4,072 (3,421 - 4,663)
	2020-11-01	37,796 (18,048 - 62,895)	14,844 (7,285 - 24,432)	128 (42 - 395)	201 (103 - 412)	4,147 (3,508 - 4,712)

Figure 6: Mpumalanga

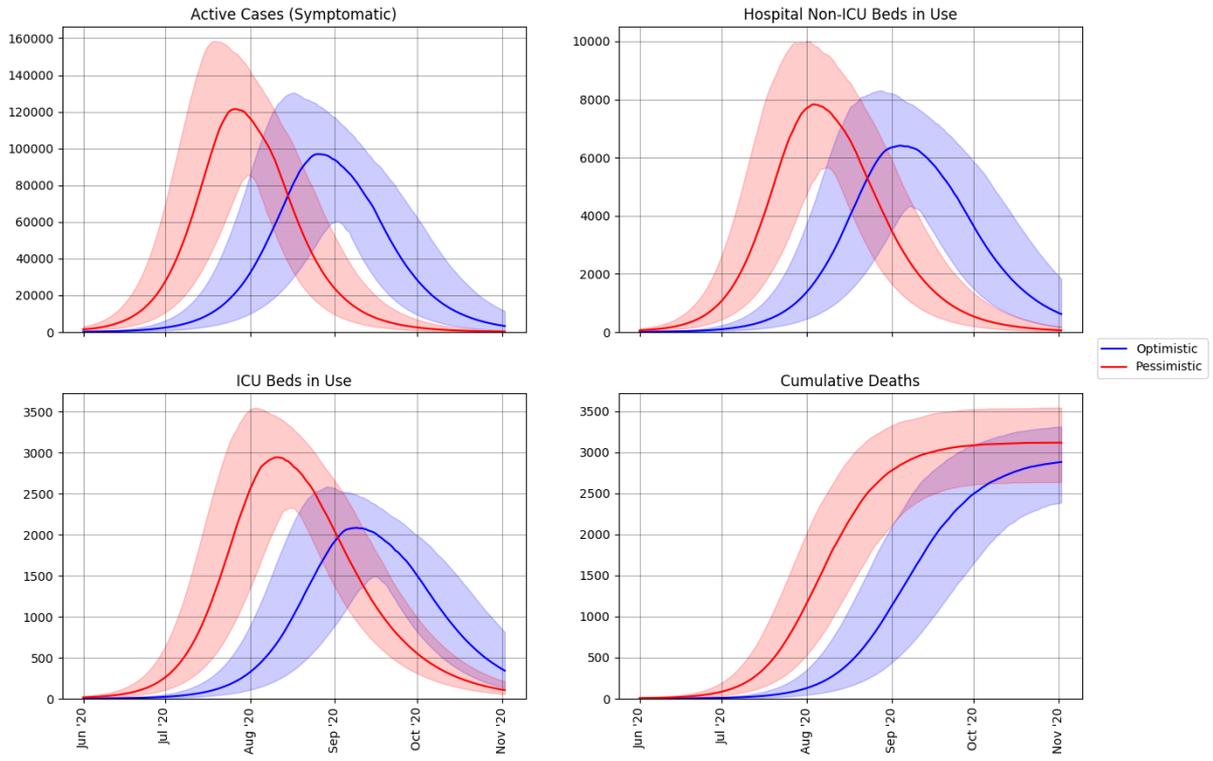


Table 6: Mpumalanga

		Cumulative Incidence		Active Cases		Cumulative Detected Cases
		Total	Symptomatic	All	Symptomatic	
Optimistic	2020-06-01	4,797 (2,956 - 8,030)	891 (558 - 1,476)	1,035 (537 - 2,009)	184 (96 - 362)	190 (127 - 301)
	2020-07-01	51,912 (22,173 - 122,843)	8,218 (3,605 - 19,550)	13,983 (5,353 - 36,590)	2,410 (917 - 6,324)	1,480 (695 - 3,368)
	2020-08-01	675,799 (231,129 - 1,666,729)	111,886 (37,825 - 299,548)	182,256 (57,750 - 469,230)	32,247 (10,052 - 85,900)	20,198 (7,138 - 56,456)
	2020-09-01	2,940,161 (1,606,287 - 3,694,403)	624,449 (293,695 - 915,188)	491,358 (323,874 - 553,312)	93,714 (60,016 - 116,956)	139,887 (60,956 - 230,755)
	2020-10-01	3,707,432 (3,205,586 - 3,957,452)	901,446 (709,735 - 1,058,263)	136,572 (44,709 - 309,781)	28,395 (9,463 - 62,332)	243,354 (178,992 - 291,743)
	2020-11-01	3,800,576 (3,559,832 - 3,982,069)	949,249 (798,255 - 1,080,980)	15,488 (3,925 - 58,266)	3,506 (908 - 12,138)	265,754 (222,450 - 303,624)
Pessimistic	2020-06-01	30,941 (17,469 - 58,523)	5,183 (2,902 - 9,923)	8,142 (4,121 - 17,055)	1,434 (707 - 3,059)	966 (558 - 1,695)
	2020-07-01	555,472 (241,537 - 1,255,331)	86,817 (36,450 - 209,028)	159,293 (64,967 - 385,292)	27,595 (10,781 - 70,124)	14,729 (6,416 - 34,093)
	2020-08-01	3,256,848 (2,212,691 - 3,871,420)	699,773 (398,850 - 954,111)	601,615 (448,021 - 670,263)	116,492 (85,088 - 142,055)	153,556 (80,008 - 230,878)
	2020-09-01	3,967,864 (3,717,872 - 4,135,586)	982,506 (817,405 - 1,132,069)	108,762 (41,864 - 246,665)	23,546 (9,536 - 52,003)	267,862 (215,517 - 312,703)
	2020-10-01	4,023,507 (3,867,355 - 4,155,053)	1,010,973 (854,696 - 1,148,262)	9,561 (3,068 - 29,268)	2,500 (932 - 6,798)	283,634 (239,949 - 323,234)
	2020-11-01	4,027,552 (3,882,658 - 4,156,477)	1,012,637 (856,715 - 1,151,047)	776 (234 - 2,717)	270 (105 - 765)	285,154 (241,319 - 324,106)

		Cumulative Admissions		Hospital Beds in Use		Cumulative Deaths
		Non-ICU	ICU	Non-ICU	ICU	
Optimistic	2020-06-01	24 (16 - 37)	7.87 (5.47 - 11)	8.67 (4.97 - 15)	2.23 (1.34 - 3.83)	2 (2 - 3)
	2020-07-01	180 (83 - 406)	52 (25 - 113)	96 (41 - 237)	22 (9.66 - 52)	10 (5 - 19)
	2020-08-01	2,456 (853 - 6,637)	712 (252 - 1,936)	1,374 (457 - 3,739)	324 (108 - 892)	128 (46 - 353)
	2020-09-01	15,935 (7,008 - 27,231)	5,305 (2,226 - 9,361)	6,348 (3,485 - 8,212)	1,921 (895 - 2,567)	1,128 (438 - 2,092)
	2020-10-01	26,275 (11,632 - 42,642)	9,788 (4,491 - 15,521)	3,646 (1,493 - 5,844)	1,500 (814 - 1,988)	2,497 (1,653 - 3,088)
	2020-11-01	28,019 (12,082 - 48,214)	10,710 (4,742 - 18,122)	659 (178 - 1,928)	360 (138 - 847)	2,879 (2,381 - 3,313)
Pessimistic	2020-06-01	117 (69 - 215)	34 (20 - 61)	60 (32 - 119)	15 (8.95 - 30)	7 (5 - 10)
	2020-07-01	1,804 (770 - 4,314)	497 (217 - 1,187)	1,078 (436 - 2,652)	261 (108 - 642)	84 (38 - 196)
	2020-08-01	17,510 (9,152 - 28,019)	5,688 (2,838 - 9,415)	7,701 (4,739 - 10,004)	2,557 (1,348 - 3,527)	1,161 (533 - 2,017)
	2020-09-01	28,934 (14,844 - 45,356)	10,818 (5,725 - 16,606)	3,500 (1,663 - 5,935)	2,034 (1,356 - 2,648)	2,779 (2,110 - 3,329)
	2020-10-01	30,094 (15,190 - 48,710)	11,471 (5,930 - 18,353)	537 (201 - 1,341)	550 (307 - 987)	3,086 (2,611 - 3,524)
	2020-11-01	30,183 (15,212 - 49,038)	11,522 (5,943 - 18,538)	63 (22 - 193)	109 (57 - 219)	3,119 (2,639 - 3,545)

Figure 7: Northern Cape

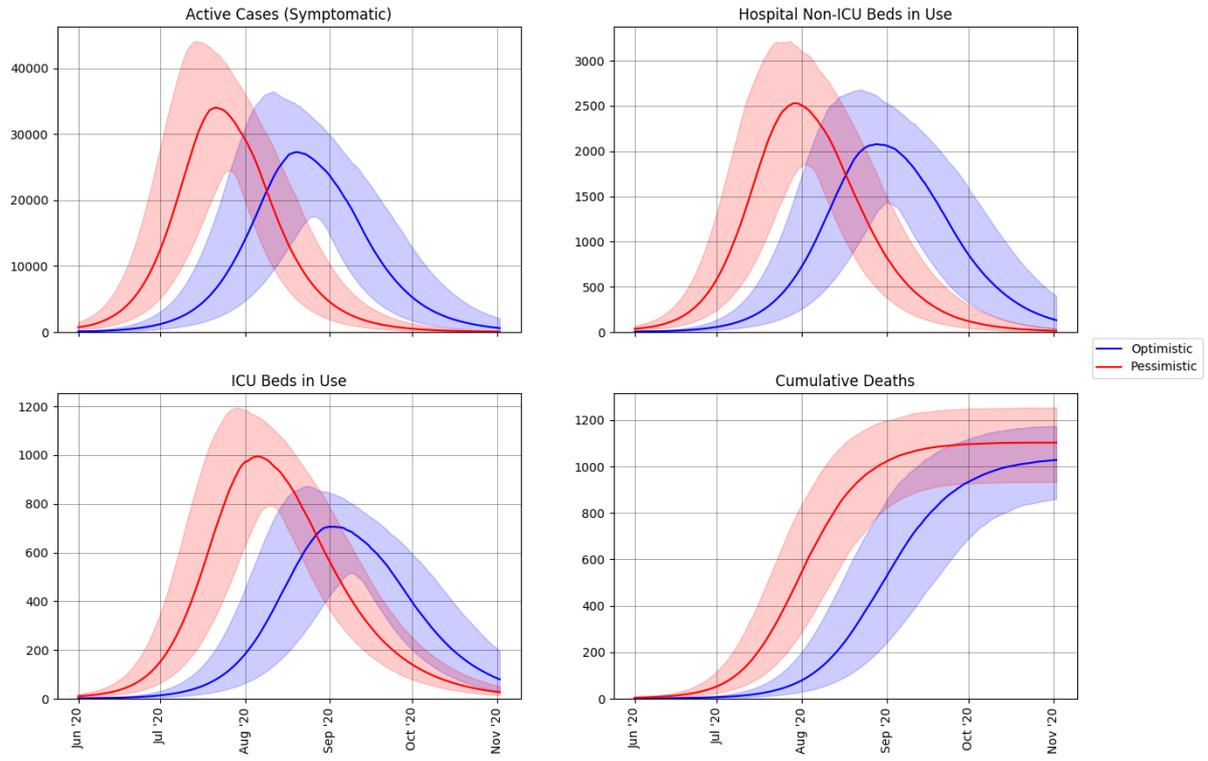


Table 7: Northern Cape

		Cumulative Incidence		Active Cases		Cumulative Detected Cases
		Total	Symptomatic	All	Symptomatic	
Optimistic	2020-06-01	2,396 (1,480 - 4,002)	445 (280 - 737)	518 (269 - 1,002)	93 (48 - 182)	98 (66 - 154)
	2020-07-01	25,635 (11,046 - 59,666)	4,071 (1,794 - 9,625)	6,898 (2,659 - 17,783)	1,200 (460 - 3,112)	747 (354 - 1,683)
	2020-08-01	294,956 (109,749 - 617,043)	50,466 (18,215 - 120,132)	78,139 (27,265 - 163,014)	14,057 (4,786 - 31,079)	9,497 (3,533 - 23,977)
	2020-09-01	897,158 (584,249 - 1,046,499)	200,202 (114,276 - 265,707)	121,233 (71,133 - 139,324)	23,664 (14,598 - 29,800)	48,703 (25,318 - 70,745)
	2020-10-01	1,030,979 (926,921 - 1,091,787)	253,662 (207,025 - 293,640)	24,395 (7,933 - 61,894)	5,290 (1,751 - 12,816)	70,687 (55,736 - 83,072)
	2020-11-01	1,047,236 (984,498 - 1,096,089)	261,831 (220,974 - 297,661)	2,664 (685 - 9,999)	640 (171 - 2,202)	74,968 (63,037 - 85,403)
Pessimistic	2020-06-01	15,376 (8,706 - 28,791)	2,577 (1,446 - 4,914)	4,049 (2,052 - 8,429)	719 (356 - 1,523)	491 (285 - 859)
	2020-07-01	248,667 (114,999 - 502,721)	40,307 (17,609 - 89,351)	70,948 (30,721 - 150,406)	12,509 (5,193 - 27,960)	7,091 (3,184 - 15,509)
	2020-08-01	975,110 (752,679 - 1,092,732)	220,278 (145,351 - 280,729)	147,298 (95,382 - 168,568)	29,177 (19,869 - 35,935)	52,403 (31,581 - 71,533)
	2020-09-01	1,097,881 (1,043,690 - 1,140,311)	273,384 (230,274 - 313,408)	19,579 (7,612 - 46,129)	4,524 (1,885 - 10,165)	76,975 (63,621 - 88,895)
	2020-10-01	1,107,510 (1,066,373 - 1,143,445)	278,394 (235,495 - 316,481)	1,723 (578 - 5,117)	503 (199 - 1,298)	79,767 (67,542 - 90,756)
	2020-11-01	1,108,328 (1,068,583 - 1,143,706)	278,681 (235,757 - 316,770)	145 (47 - 480)	58 (24 - 153)	80,068 (67,749 - 90,974)

		Cumulative Admissions		Hospital Beds in Use		Cumulative Deaths
		Non-ICU	ICU	Non-ICU	ICU	
Optimistic	2020-06-01	14 (9.54 - 21)	4.86 (3.38 - 7.27)	5.07 (2.91 - 9.05)	1.37 (0.82 - 2.35)	2 (1 - 2)
	2020-07-01	103 (48 - 231)	32 (15 - 69)	56 (24 - 136)	13 (5.89 - 31)	7 (4 - 12)
	2020-08-01	1,312 (477 - 3,206)	413 (152 - 1,028)	722 (257 - 1,727)	183 (64 - 452)	78 (29 - 201)
	2020-09-01	6,160 (3,006 - 9,814)	2,262 (1,099 - 3,662)	2,060 (1,439 - 2,530)	705 (425 - 844)	526 (241 - 854)
	2020-10-01	8,630 (3,975 - 14,002)	3,469 (1,646 - 5,505)	853 (325 - 1,586)	396 (201 - 593)	934 (690 - 1,121)
	2020-11-01	8,974 (4,064 - 15,171)	3,666 (1,700 - 6,109)	139 (37 - 420)	83 (32 - 204)	1,027 (858 - 1,173)
Pessimistic	2020-06-01	67 (39 - 123)	21 (12 - 37)	35 (18 - 69)	9.78 (5.49 - 18)	5 (3 - 8)
	2020-07-01	982 (433 - 2,199)	293 (131 - 662)	585 (246 - 1,321)	151 (65 - 349)	52 (24 - 117)
	2020-08-01	6,696 (3,786 - 10,099)	2,412 (1,364 - 3,698)	2,504 (1,827 - 3,104)	971 (631 - 1,185)	544 (287 - 836)
	2020-09-01	9,378 (4,994 - 14,589)	3,775 (2,064 - 5,767)	828 (381 - 1,497)	559 (362 - 782)	1,021 (821 - 1,198)
	2020-10-01	9,609 (5,064 - 15,267)	3,915 (2,109 - 6,155)	119 (45 - 299)	140 (79 - 251)	1,096 (927 - 1,249)
	2020-11-01	9,627 (5,068 - 15,330)	3,926 (2,111 - 6,194)	14 (5.14 - 41)	27 (14 - 53)	1,103 (933 - 1,253)

Figure 8: North West

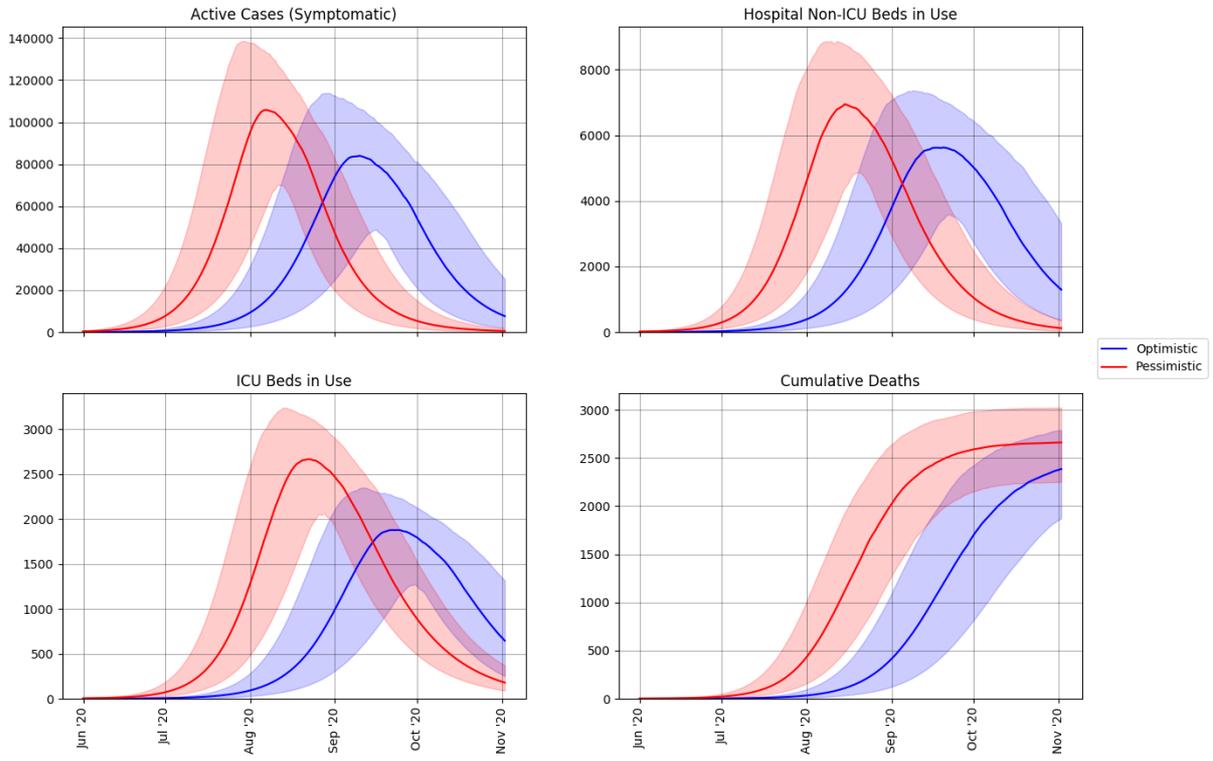


Table 8: North West

		Cumulative Incidence		Active Cases		Cumulative Detected Cases
		Total	Symptomatic	All	Symptomatic	
Optimistic	2020-06-01	1,202 (740 - 2,012)	233 (150 - 380)	259 (134 - 503)	46 (24 - 91)	58 (42 - 86)
	2020-07-01	13,131 (5,579 - 31,463)	2,082 (916 - 4,975)	3,543 (1,348 - 9,389)	610 (231 - 1,616)	383 (185 - 864)
	2020-08-01	193,750 (60,739 - 600,776)	30,923 (9,834 - 96,259)	53,338 (15,291 - 178,886)	9,302 (2,661 - 31,589)	5,445 (1,846 - 17,309)
	2020-09-01	1,659,581 (595,654 - 2,840,317)	308,737 (99,421 - 634,949)	406,047 (146,069 - 548,681)	74,201 (25,052 - 112,613)	60,892 (19,157 - 145,509)
	2020-10-01	3,098,758 (2,243,229 - 3,429,225)	725,292 (459,304 - 895,736)	269,201 (99,475 - 392,241)	54,039 (20,903 - 81,043)	184,784 (105,310 - 243,527)
	2020-11-01	3,317,024 (3,042,331 - 3,488,365)	822,483 (682,745 - 944,306)	37,325 (9,131 - 131,760)	8,134 (2,057 - 26,800)	228,303 (186,742 - 264,351)
Pessimistic	2020-06-01	7,791 (4,390 - 14,808)	1,313 (738 - 2,514)	2,052 (1,036 - 4,323)	361 (177 - 774)	253 (150 - 437)
	2020-07-01	154,688 (63,327 - 399,674)	23,280 (9,432 - 62,012)	44,576 (17,122 - 125,494)	7,692 (2,824 - 22,095)	3,896 (1,655 - 9,576)
	2020-08-01	1,955,868 (932,773 - 3,003,177)	364,033 (146,761 - 668,575)	515,757 (242,401 - 667,742)	95,183 (41,561 - 137,769)	69,035 (26,769 - 141,657)
	2020-09-01	3,403,026 (2,979,750 - 3,601,906)	820,266 (634,349 - 969,436)	224,193 (89,751 - 408,866)	46,950 (19,543 - 82,140)	214,904 (152,500 - 263,755)
	2020-10-01	3,520,575 (3,373,089 - 3,643,356)	881,919 (746,537 - 1,006,338)	21,853 (6,685 - 68,337)	5,267 (1,812 - 14,956)	246,831 (207,657 - 282,644)
	2020-11-01	3,532,081 (3,402,260 - 3,645,485)	887,927 (751,307 - 1,009,337)	1,734 (477 - 6,501)	547 (192 - 1,715)	250,518 (212,001 - 284,645)

		Cumulative Admissions		Hospital Beds in Use		Cumulative Deaths
		Non-ICU	ICU	Non-ICU	ICU	
Optimistic	2020-06-01	6.17 (4.18 - 9.57)	2.03 (1.41 - 3.03)	2.21 (1.27 - 3.95)	0.58 (0.35 - 1.00)	1 (1 - 1)
	2020-07-01	46 (21 - 104)	13 (6.56 - 29)	24 (10 - 61)	5.80 (2.52 - 13)	3 (2 - 5)
	2020-08-01	673 (222 - 2,039)	194 (66 - 588)	388 (120 - 1,218)	91 (29 - 285)	32 (11 - 98)
	2020-09-01	7,400 (2,331 - 16,710)	2,310 (713 - 5,558)	3,773 (1,209 - 7,082)	994 (310 - 2,111)	412 (123 - 1,092)
	2020-10-01	20,387 (8,482 - 33,312)	7,402 (3,201 - 12,055)	5,017 (2,722 - 6,430)	1,792 (1,249 - 2,123)	1,700 (815 - 2,422)
	2020-11-01	24,404 (9,566 - 43,031)	9,427 (3,811 - 16,252)	1,369 (385 - 3,445)	677 (266 - 1,345)	2,376 (1,856 - 2,785)
Pessimistic	2020-06-01	29 (17 - 54)	8.99 (5.38 - 15)	15 (8.26 - 30)	4.16 (2.33 - 7.83)	2 (2 - 3)
	2020-07-01	483 (200 - 1,244)	133 (57 - 338)	294 (114 - 801)	71 (28 - 188)	21 (10 - 51)
	2020-08-01	8,387 (3,225 - 17,105)	2,510 (947 - 5,486)	4,605 (1,837 - 8,040)	1,278 (485 - 2,579)	432 (159 - 1,014)
	2020-09-01	23,756 (11,406 - 37,320)	8,734 (4,377 - 13,474)	5,261 (2,934 - 7,248)	2,464 (1,908 - 2,895)	2,020 (1,272 - 2,640)
	2020-10-01	26,482 (12,221 - 44,323)	10,225 (4,866 - 16,844)	1,045 (387 - 2,466)	885 (486 - 1,518)	2,589 (2,152 - 2,981)
	2020-11-01	26,697 (12,272 - 45,137)	10,350 (4,897 - 17,301)	127 (41 - 390)	187 (94 - 387)	2,661 (2,249 - 3,022)

Figure 9: Western Cape

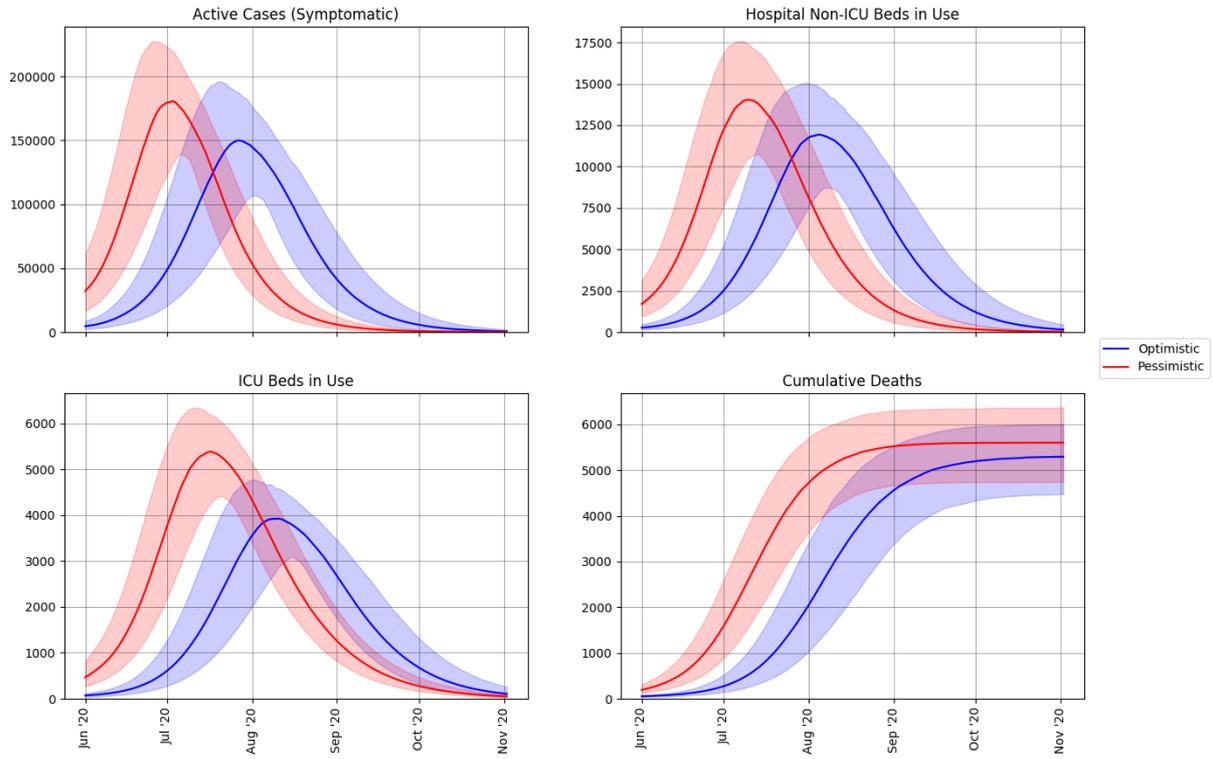


Table 9: Western Cape

		Cumulative Incidence		Active Cases		Cumulative Detected Cases
		Total	Symptomatic	All	Symptomatic	
Optimistic	2020-06-01	118,424 (73,811 - 194,803)	22,141 (13,977 - 36,267)	25,428 (13,326 - 48,113)	4,576 (2,406 - 8,850)	4,889 (3,298 - 7,669)
	2020-07-01	1,061,696 (504,603 - 2,017,362)	176,363 (83,200 - 365,573)	276,449 (118,656 - 572,355)	48,934 (20,862 - 106,092)	34,019 (16,974 - 69,148)
	2020-08-01	4,387,826 (2,859,291 - 5,364,891)	936,131 (540,326 - 1,305,811)	743,111 (568,994 - 821,623)	144,811 (106,882 - 176,296)	216,509 (118,204 - 329,212)
	2020-09-01	5,525,634 (4,948,192 - 5,880,829)	1,351,824 (1,098,815 - 1,572,057)	192,600 (83,240 - 371,003)	41,225 (17,938 - 77,411)	374,587 (294,360 - 443,712)
	2020-10-01	5,655,592 (5,311,076 - 5,923,688)	1,411,648 (1,191,787 - 1,606,367)	23,911 (8,051 - 67,283)	5,630 (1,951 - 14,897)	406,064 (341,001 - 463,135)
	2020-11-01	5,668,195 (5,357,274 - 5,927,502)	1,421,263 (1,201,161 - 1,611,002)	2,501 (704 - 8,719)	648 (193 - 2,137)	410,348 (346,976 - 465,420)
Pessimistic	2020-06-01	688,264 (407,390 - 1,182,674)	119,073 (69,102 - 211,680)	177,233 (94,667 - 333,390)	32,030 (16,576 - 61,646)	23,348 (13,861 - 39,196)
	2020-07-01	4,273,833 (3,000,968 - 5,278,574)	870,267 (537,284 - 1,214,009)	930,981 (695,490 - 1,038,210)	179,754 (123,612 - 223,038)	186,617 (109,271 - 277,938)
	2020-08-01	5,838,835 (5,461,613 - 6,104,207)	1,435,001 (1,190,521 - 1,657,139)	243,796 (128,332 - 415,272)	53,477 (29,176 - 89,506)	394,492 (318,875 - 464,533)
	2020-09-01	5,968,659 (5,740,049 - 6,165,252)	1,497,760 (1,267,401 - 1,701,195)	21,787 (9,404 - 49,727)	5,826 (2,764 - 12,155)	430,646 (364,272 - 489,968)
	2020-10-01	5,978,032 (5,764,203 - 6,169,115)	1,501,755 (1,270,870 - 1,707,222)	1,992 (812 - 5,236)	703 (339 - 1,566)	433,833 (367,229 - 493,150)
	2020-11-01	5,978,724 (5,764,961 - 6,169,509)	1,502,209 (1,271,186 - 1,707,496)	187 (77 - 520)	91 (46 - 200)	434,121 (367,384 - 493,434)

		Cumulative Admissions		Hospital Beds in Use		Cumulative Deaths
		Non-ICU	ICU	Non-ICU	ICU	
Optimistic	2020-06-01	741 (504 - 1,138)	244 (171 - 363)	261 (151 - 464)	68 (41 - 117)	51 (38 - 73)
	2020-07-01	4,934 (2,422 - 9,926)	1,482 (754 - 2,934)	2,524 (1,169 - 5,335)	611 (281 - 1,288)	273 (145 - 524)
	2020-08-01	29,613 (16,310 - 45,684)	9,991 (5,271 - 15,823)	11,748 (7,537 - 15,036)	3,558 (2,014 - 4,763)	2,046 (1,037 - 3,417)
	2020-09-01	48,659 (27,161 - 72,330)	18,427 (10,504 - 26,918)	6,286 (3,104 - 9,598)	2,672 (1,741 - 3,454)	4,553 (3,380 - 5,526)
	2020-10-01	51,627 (28,181 - 79,814)	20,010 (11,082 - 30,601)	1,197 (420 - 2,881)	673 (322 - 1,314)	5,194 (4,328 - 5,953)
	2020-11-01	51,955 (28,274 - 80,960)	20,191 (11,135 - 31,199)	158 (44 - 490)	110 (45 - 273)	5,291 (4,473 - 6,003)
Pessimistic	2020-06-01	3,379 (2,031 - 5,865)	1,033 (633 - 1,745)	1,696 (941 - 3,124)	466 (268 - 832)	191 (122 - 312)
	2020-07-01	26,023 (15,453 - 39,497)	8,342 (4,813 - 13,088)	12,247 (7,623 - 16,881)	3,774 (2,211 - 5,526)	1,595 (886 - 2,607)
	2020-08-01	51,551 (32,592 - 72,927)	19,408 (12,532 - 27,006)	8,123 (4,869 - 11,665)	4,322 (3,398 - 5,127)	4,720 (3,644 - 5,709)
	2020-09-01	54,945 (34,014 - 80,241)	21,292 (13,359 - 30,800)	1,329 (599 - 2,680)	1,256 (815 - 1,940)	5,521 (4,667 - 6,299)
	2020-10-01	55,195 (34,101 - 80,928)	21,436 (13,411 - 31,186)	173 (73 - 423)	273 (165 - 466)	5,595 (4,736 - 6,347)
	2020-11-01	55,215 (34,107 - 80,993)	21,447 (13,415 - 31,223)	20 (8.98 - 56)	51 (30 - 92)	5,601 (4,740 - 6,365)

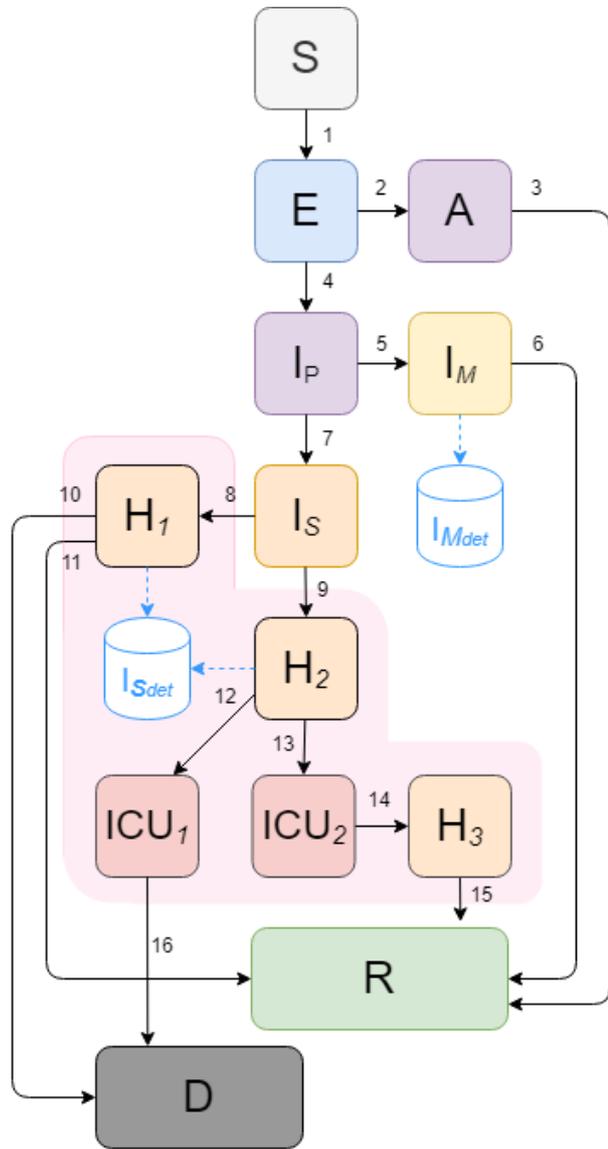
## Data sources

The model has been informed by published and pre-print academic literature, global COVID-19 case information (specifically from the European CDC, World Health Organization and China CDC), South African population statistics from Stats SA's 2019 mid-year report, expert input from members of the SA COVID-19 Modelling Consortium, and national case details from the South African National Institute for Communicable Diseases and <https://sacoronavirus.co.za/category/press-releases-and-notice/>.

## About the National COVID-19 Epi Model

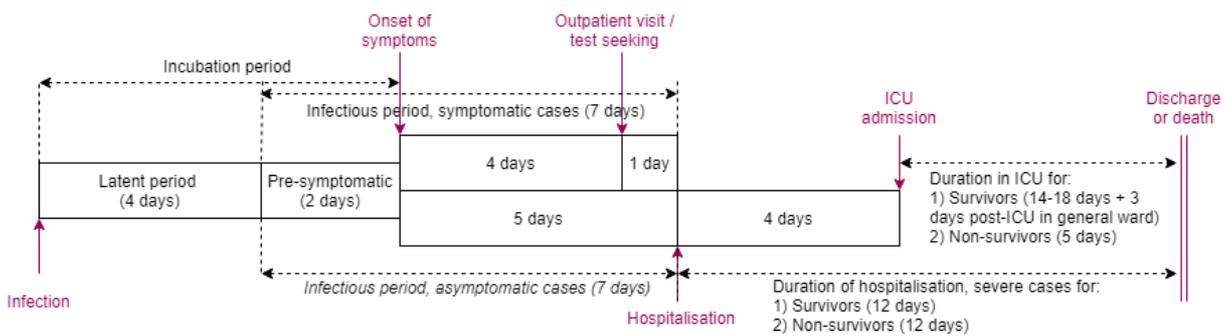
The National COVID-19 Epi Model (NCEM) is a stochastic compartmental transmission model to estimate the total and reported incidence of COVID-19 in the nine provinces of South Africa. The outputs of the model may be used to inform resource requirements and predict where gaps could arise based on the available resources within the South African health system. The model follows a generalised Susceptible-Exposed-Infectious-Recovered (SEIR) structure accounting for disease severity (asymptomatic, mild, severe and critical cases) and the treatment pathway (outpatients, non-ICU and ICU beds) as shown in Figure 4. Contributors to the NCEM include Sheetal Silal, Rachel Hounsell, Jared Norman, Juliet Pulliam, Roxanne Beauclair, Jeremy Bingham, Jonathan Dushoff, Reshma Kassanje, Michael Li, Cari van Schalkwyk, Alex Welte, Lise Jamieson, Brooke Nichols and Gesine Meyer-Rath. For more information please contact Dr Sheetal Silal ([sheetal.silal@uct.ac.za](mailto:sheetal.silal@uct.ac.za)).

# Generalised SEIR Model Structure (Disease and Treatment Pathway)



Susceptible	
Exposed (not infectious)	
Infected, asymptomatic (A)	
Infected, pre-symptomatic (Ip)	
Infected, mild	
Infected, severe, untreated	
Hospitalised	Infected, severe, general ward ( $H_1$ )
	Infected, severe, general ward pre-ICU ( $H_2$ )
	Infected, critical, high care/ICU ( $ICU_1$ & $ICU_2$ )
	Infected, severe, general ward post-ICU ( $H_3$ )
Removed (non-infectious/discharged)	
Died	
-----> Detection (laboratory confirmed cases)	

1. Force of infection
2. Latent period till asymptomatic infectiousness
3. Duration of asymptomatic infectiousness
4. Latent period till pre-symptomatic infectiousness
5. Mild cases
6. Duration of infectiousness (mild cases)
7. Severe cases
8. Hospitalisation of severe cases
9. Hospitalisation of critical cases (prior to ICU)
10. Mortality (severe, hospitalised cases)
11. Duration of hospitalisation (severe cases)
12. Progress from severe to critical (ICU admission)
13. Progress from severe to critical (ICU admission)
14. Duration of ICU stay for survivors
15. Duration of hospitalisation post-ICU
16. Mortality (critical, ICU cases)



## Key Parameter Values

	Parameter	Value*(range)	Sources
<b>Infection severity**</b>	Proportion of cases that are asymptomatic	75% (0.7, 0.8)	[1], [2], [3]
	Mild to moderate cases among the symptomatic	(95.64%, 96.78%)	[5]
	Severe cases among the symptomatic	(2.46%-3.64%)	
	Critical cases among the symptomatic	(1.16%-1.45%)	
	Proportion of cases that are fatal	(0.30%, 0.412%)	[4], [5]
<b>Timeframes &amp; treatment durations</b>	Time from infection to onset of infectiousness	4 days (2.0-6.0)	[4], [6], [7], [8], [9], [10] with input from analysis of NICD data.
	Time from onset of infectiousness to onset of symptoms	2 days (1.0-3.0)	
	Duration of infectiousness from onset of symptoms	5 days (4.0, 6.0)	
	Time from onset of mild symptoms to testing	4 days (3.0-5.0)	
	Time from onset of symptoms to hospitalisation	5 days (4.0–6.0)	
	Time from onset of symptoms to ICU admission	9 days (7.0–11.0)	
	Duration of hospital stay	12 days (8.0–14.0)	
	Duration from ICU admission to discharge	18 days (14.0–18.0)	
	Duration from ICU admission to death	5 days (4.0-7.0)	

## References

1. Inui S, Fujikawa A, Jitsu M, Kunishima N, Watanabe S, Suzuki Y, et al. Chest CT Findings in Cases from the Cruise Ship “Diamond Princess” with Coronavirus Disease 2019 (COVID-19). *Radiol Cardiothorac Imaging* [Internet]. 2020 Apr 1 [cited 2020 Mar 23];2(2):e200110. Available from: <http://pubs.rsna.org/doi/10.1148/ryct.2020200110>
2. Sutton, D., Fuchs, K., D’Alton, M. and Goffman, D., 2020. Universal screening for SARS-CoV-2 in women admitted for delivery. *New England Journal of Medicine*.
3. Day, M., 2020. Covid-19: four fifths of cases are asymptomatic, China figures indicate.
4. World Health Organization. Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19) [Internet]. 2020 [cited 2020 Mar 14]. Available from: <https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf>
5. Verity R, Okell LC, Dorigatti I, Winskill P, Whittaker C, Imai N, et al. Estimates of the severity of COVID-19 disease. *medRxiv*. 2020 Mar 13;2020.03.09.20033357.
6. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *www.thelancet.com* [Internet]. 2020 [cited 2020 Mar 14];395:497. Available from: <https://isaric.tghn.org/protocols/>
7. Gaythorpe K, Imai N, Cuomo-Dannenburg G, Baguelin M, Bhatia S, Boonyasiri A, et al. Report 8: Symptom progression of COVID-19 [Internet]. 2020 Mar [cited 2020 Mar 18]. Available from: <https://doi.org/10.25561/77344>
8. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* [Internet]. 2020 Mar [cited 2020 Mar 14];0(0). Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0140673620305663>
9. Tindale L, Coombe M, Stockdale JE, Garlock E, Lau WYV, Saraswat M, et al. Transmission interval estimates suggest pre-symptomatic spread of COVID-19. *medRxiv*. 2020 Mar 6;2020.03.03.20029983.
10. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA - J Am Med Assoc*. 2020 Mar 17;323(11):1061–9.
11. StatsSA. Mid-year population estimates 2019. Statistical release P0302. 2019.