

## Supplement 1

### Discovery Health Medical Scheme

Discovery Health is a South African private medical insurance organisation that provides administration and managed care services to the largest medical scheme in South Africa open to all South African's, the Discovery Health Medical Scheme, as well as to closed employer linked medical schemes.

The following Discovery client Schemes were included in the analysis:

Discovery Health Medical Scheme (DHMS), Multichoice Medical Aid Scheme, UKZN Medical Aid Society, Malcor Medical Scheme, Anglovaal Group Medical Scheme, Bankmed, SAB Medical Aid Scheme, Glencore Medical Aid, Remedi Medical Aid Scheme, Tsogo Sun Group Medical Scheme, Lonmin Medical Scheme, LA Health and Retail Medical Scheme.

### Supplementary Table 1. Vitality fitness point categories and defined physical activity subgroups

Activity band	Points per month
Low	≤ 400
Moderate	401 – 999
High	≥ 1 000

### Supplementary Table 2. Vitality fitness point reward criteria

FITNESS POINTS YOU CAN EARN				
	50	100	200	300
Workout activities	Online workouts (30+ min)	myrun (2.5km) Health clubs (30+ min)*** Round of golf Run/Walk For Life		myrun (5km) parkrun Run/Walk For Life 5km+
Steps	5 000 – 9 999 steps*	10 000+ steps**		
Speed workouts		30+ min		
Light workouts at 60 – 69% of max heart rate		30+ min*		
Moderate workouts at 70 – 79% of max heart rate			30 – 59 min	60+ min
Vigorous workouts at 80%+ of max heart rate				30+ min

#### Earn speed workout fitness points by:

Gym workout for more than 30 minutes.

Running at an average of 5.5+ km/hr

Swimming at an average of 1.5+ km/hr

Cycling at an average of 10+ km/hr

#### Heart rate target tip:

Calculate your maximum heart rate by subtracting your age from 220.

Use this [easy guide](#) for more info.

FITNESS POINTS YOU CAN EARN: 65 YEARS +				
	50	100	200	300
Workout activities	Online workouts (30+ min)	myrun (2.5km) Health clubs Round of golf; Run/Walk For Life		myrun (5km) parkrun Run/Walk For Life 5km+
Steps	5 000 – 7 499 steps*	7 500+ steps		
Speed workouts		30+ min		
Light workouts at 60 – 69% of maximum heart rate		30 – 59 min	60+ min	
Moderate workouts at 70 – 79% of maximum heart rate				30+ min
Vigorous workouts at 80%+ of maximum heart rate				30+ min

**TIMED AND VERIFIED RACE EVENTS POINTS**

Claim your Vitality points online or via the Discovery app. Remember to attach your proof of race completion with a race certificate or other supporting documentation.

	300	600	1 500	3 000
walking/running event	5 – 9km	10 – 20km	21 – 41km	42km+
swimming event	0.5 – 1km	1.1 – 3km	3.1 – 5.9km	6km+
cycling event	25 – 49km	50 – 99km	100 – 179km	180km+

We also recognise our duathletes and triathletes with the full set of points per event discipline for example, earn 9 000 points for a full Iron man.

**FITNESS POINTS FOR ENDURANCE AND HIGH PERFORMANCE ATHLETES**

	50	100	200	300	450	600
Workout activities	Online workouts (30+ min)	myrun (2.5km) Health clubs Round of golf Run/Walk For Life		myrun (5km) parkrun Run/Walk For Life 5km+		
Steps	5 000 – 9 999 steps*	10 000+ steps**				
Speed workouts		30+ min				
Light heart rate workouts at 60 – 69%		30 – 89min*		90 – 119 min	120 – 179 min	180+ min
Moderate heart rate workouts at 70% – 79%			30 – 59min	60 – 89 min		
Endurance heart rate workouts at 70%+					90 – 119 min	120+ min
Vigorous heart rate workouts at 80%+				30 – 89 min		

**Earn speed workout fitness points by:**  
 Running at an average of 5.5+ km/hr  
 Swimming at an average of 1.5+ km/hr  
 Cycling at an average of 10+ km/hr

**Heart rate target tip:**  
 Calculate your maximum heart rate by subtracting your age from 220.  
 Use this [easy guide](#) for more info.

### Supplementary Table 3. List of co-morbidities associated with increased risk of severe COVID-19 outcomes

The following list of comorbidities (presented in alphabetical order) has been adapted from the Prescribed Minimum Benefits Chronic Disease List (CDL) and the Centers for Disease Control and Prevention (CDC) list of conditions associated with increased risk of severe COVID-19 (<https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html>).

Number	Category	Conditions
1	Cancer	<ul style="list-style-type: none"> <li>• Cancer</li> </ul>
2	Cardiovascular disease	<ul style="list-style-type: none"> <li>• Cardiac failure</li> <li>• Cardiomyopathy</li> <li>• Coronary artery disease</li> <li>• Dysrhythmias</li> <li>• Peripheral arterial disease</li> <li>• Cerebrovascular disease (including stroke)</li> </ul>
3	Chronic renal disease	<ul style="list-style-type: none"> <li>• Chronic renal disease</li> </ul>
4	Chronic respiratory disease	<ul style="list-style-type: none"> <li>• Asthma</li> <li>• COPD</li> <li>• Bronchiectasis</li> </ul>
5	Diabetes mellitus	<ul style="list-style-type: none"> <li>• Diabetes Mellitus 1</li> <li>• Diabetes Mellitus 2</li> </ul>
6	HIV	<ul style="list-style-type: none"> <li>• HIV</li> </ul>
7	Hypertension	<ul style="list-style-type: none"> <li>• Hypertension</li> </ul>
8	Liver disease	<ul style="list-style-type: none"> <li>• Alcoholic liver disease</li> <li>• Fatty liver disease</li> <li>• Cirrhosis</li> </ul>
9	Neurological disorders	<ul style="list-style-type: none"> <li>• Epilepsy</li> <li>• Parkinson's disease</li> <li>• Dementia (any cause, including Alzheimer's disease)</li> </ul>
10	Overweight / obesity	<ul style="list-style-type: none"> <li>• BMI &gt;25</li> </ul>
11	Severe mental disorders	<ul style="list-style-type: none"> <li>• Bipolar mood disorder</li> <li>• Schizophrenia</li> </ul>
12	Solid organ transplant	<ul style="list-style-type: none"> <li>• History of Kidney, liver, heart, or lung transplant</li> </ul>

Prior COVID-19 infection feature is categorised as the following: none, 0-89 days, 90-179 days, or 180+ days prior to test date.

Surveillance week is the week of the testing date of the patient and is an important feature since the positivity rate changes significantly by calendar week.

**Supplementary Table 4. Sensitivity analysis results limited to symptomatic COVID-19 admissions**

		COVID-19 Tests	Hospitalizations	Hospitalizations VE (95% CI)
Low	Not Vaccinated	3,083	926	
	J&J Dose1 0to3	4	1	-
	J&J Dose1 4to6	3	1	-
	J&J Dose1 7to9	5	1	-
	J&J Dose1 10to13	4	0	-
	J&J Dose1 14to20	4	0	-
	J&J Dose1 21to27	7	2	-
	J&J Dose1 28+	108	18	39.3 (11.3 - 58.4)
	Moderate	Not Vaccinated	3,289	926
J&J Dose1 0to3		4	0	-
J&J Dose1 4to6		3	0	-
J&J Dose1 7to9		4	0	-
J&J Dose1 10to13		3	0	-
J&J Dose1 14to20		7	0	-
J&J Dose1 21to27		8	0	-
J&J Dose1 28+		111	17	47.1 (18.8 - 65.6)
High		Not Vaccinated	3,128	949
	J&J Dose1 0to3	3	0	-
	J&J Dose1 4to6	5	1	-
	J&J Dose1 7to9	1	0	-
	J&J Dose1 10to13	6	2	-
	J&J Dose1 14to20	5	2	-
	J&J Dose1 21to27	4	0	-
	J&J Dose1 28+	130	11	69.7 (48.1 - 82.3)

**Supplementary Table 5. Vaccine effectiveness estimates against COVID-19 infection to assess observational bias**

		Infection VE (1- Risk Ratio) (95% CI)
Low activity	Not Vaccinated	Reference
	J&J Dose1 0 - 3 days	-
	J&J Dose1 4 - 6 days	-
	J&J Dose1 7 - 9 days	-
	J&J Dose1 10 -13 days	-
	J&J Dose1 14 - 20 days	-
	J&J Dose1 21 - 27 days	48.0 (9.7 - 70.1)
	J&J Dose1 28+ days	39.8 (34.0 - 45.1)
Moderate activity	Not Vaccinated	
	J&J Dose1 0 – 3 days	-
	J&J Dose1 4 – 6 days	-
	J&J Dose1 7 – 9 days	-
	J&J Dose1 10 – 13 days	-24.0 (-106.7 - 25.6)
	J&J Dose1 14 – 20 days	39.0 (-4.9 - 64.5)
	J&J Dose1 21 – 27 days	42.5 (7.6 - 64.2)
	J&J Dose1 28+ days	36.3 (31.3 - 41.0)
High activity	Not Vaccinated	
	J&J Dose1 0 – 3 days	-
	J&J Dose1 4 – 6 days	-23.5 (-107.2 - 26.4)
	J&J Dose1 7 – 9 days	-31.7 (-101.2 - 13.8)
	J&J Dose1 10 – 13 days	-0.5 (-51.1 - 33.1)
	J&J Dose1 14 – 20 days	51.0 (16.8 - 71.1)
	J&J Dose1 21 – 27 days	24.3 (-9.4 - 47.6)
	J&J Dose1 28+ days	41.2 (37.5 - 44.7)

**Supplementary Table 6. Distribution of number of negative tests by individuals in the study**

Activity Band	Number of negative tests		
	1	2	3
Low	27,874	5,191	1,362
Moderate	32,819	5,934	1,353
High	42,873	7,092	1,447

**Supplementary Table 7. Number of test and admissions per region**

Region	All COVID-19 Tests			Admissions		
	Low activity n (%)	Moderate activity n (%)	High activity n (%)	Low activity n (%)	Moderate activity n (%)	High activity n (%)
Eastern Cape	1,819 (3.4)	2,126 (3.4)	3,045 (3.8)	30 (3.0)	30 (3.0)	31 (3.1)
Free State	1,265 (2.4)	1,487 (2.4)	1,915 (2.4)	34 (3.4)	31 (3.1)	27 (2.7)
Gauteng	29,703 (55.2)	34,664 (55.3)	42,983 (53.8)	534 (54.2)	560 (56.9)	557 (56.2)
KwaZulu-Natal	5,874 (10.9)	6,393 (10.2)	7,007 (8.8)	118 (12.0)	108 (11.0)	64 (6.5)
Limpopo	585 (1.1)	711 (1.1)	948 (1.2)	17 (1.7)	18 (1.8)	21 (2.1)
Mpumalanga	1,077 (2.0)	1,373 (2.2)	1,684 (2.1)	21 (2.1)	27 (2.7)	26 (2.6)
North West	1,009 (1.9)	1,165 (1.9)	1,696 (2.1)	21 (2.1)	34 (3.5)	42 (4.2)
Northern Cape	243 (0.4)	316 (0.4)	386 (0.5)	3 (0.3)	5 (0.5)	4 (0.4)
Western Cape	10,042 (18.7)	11,837 (18.9)	16,739 (20.9)	158 (16.0)	142 (14.4)	168 (17.0)
Unknown	2,154 (4.0)	2,649 (4.2)	3,549 (4.4)	50 (5.0)	30 (3.1)	51 (5.2)

**Supplementary Table 8. Sensitivity analysis results of single GLM model**

Study population	Baseline comparator	1- Odds of COVID-19 admission (%)	p-value
Vaccinated amongst all activity groups	Unvaccinated amongst all activity groups	63.4	<0.001
High activity	Low activity	36.0	<0.001
High activity and vaccinated	Low activity and not vaccinated	91.5	<0.001

**Supplementary Table 9. Sensitivity analysis results of Bayesian modelling**

Study population	Baseline comparator	1- Odds of COVID-19 admission (%)	p-value
Vaccinated amongst all activity groups	Unvaccinated amongst all activity groups	70.6	<0.001
High activity	Low activity	36.9	<0.001
High activity and vaccinated	Low activity and not vaccinated	95.6	<0.001

