

### Supplementary Materials

**Table S1:** Characteristics of 40 SARS-CoV-2 whole-genomes from the Southern Province of Zambia

Patient ID.	Sex	Age	C <sub>T</sub> Value	Virus name (GISAID Accession ID)	Collection Date	District	Lineage	Covid-19 Wave
1	Female	17	20.3	hCoV-19/Zambia/SP113/2021 EPI_ISL_6768069	2 February 2021	Choma	B.1.351	Second
2	Male	19	18	hCoV-19/Zambia/SP87/2021 EPI_ISL_6764745	15 February 2021	Namwala	B.1.351	Second
3	Male	38	18.4	hCoV-19/Zambia/SP10/2021 EPI_ISL_6760707	28 January 2021	Mazabuka	B.1.351	Second
4	Male	16	22.3	hCoV-19/Zambia/SP11/2021 EPI_ISL_6760905	3 February 2021	Kalomo	B.1.351	Second
5	Male	34	16.7	hCoV-19/Zambia/SP30/2021 EPI_ISL_6760973	5 February 2021	Namwala	B.1.351	Second
6	Female	17	16.8	hCoV-19/Zambia/SP128/2021 EPI_ISL_6760998	18 February 2021	Choma	B.1.351	Second
7	Male	23	18.2	hCoV-19/Zambia/SP32/2021 EPI_ISL_6761015	15 February 2021	Namwala	B.1.1.7	Second
8	Male	57	19.2	hCoV-19/Zambia/SP37/2020 EPI_ISL_6761027	1 December 2020	Pemba	B.1.1.7	Second
9	Female	44	26.4	hCoV-19/Zambia/SP172/2021 EPI_ISL_6761052	2 September 2021	Chikankata	B.1.1.7	Third
10	Female	23	20.1	hCoV-19/Zambia/SP250/2021 EPI_ISL_6761088	26 June 2021	Choma	AY.116	Third
11	Female	5	28.7	hCoV-19/Zambia/SP252/2021 EPI_ISL_6761100	19 August 2021	Choma	AY.116	Third
12	Male	-	19.5	hCoV-19/Zambia/SP253/2021 EPI_ISL_6762977	17 June 2021	Choma	AY.116	Third
13	Male	44	29.2	hCoV-19/Zambia/SP251/2021 EPI_ISL_6761106	8 September 2021	Choma	AY.116	Third
14	Unknown	0	14.3	hCoV-19/Zambia/CHAZ-CHS1777/2022 EPI_ISL_12363645	Unknown	Chikankata	BA.1	Fourth
15	Male	20	20.5	hCoV-19/Zambia/CHAZ-CHS1778/2022 EPI_ISL_12363646	28 February 2022	Livingstone	BA.2	Fourth
16	Male	0	23	hCoV-19/Zambia/CHAZ-CHS1780/2022 EPI_ISL_12363647	Unknown	Chikankata	BA.1	Fourth
17	Male	46	24.4	hCoV-19/Zambia/CHAZ-CHS1781/2021 EPI_ISL_12363648	21 December 2021	Livingstone	BA.1	Fourth
18	Female	33	26.3	hCoV-19/Zambia/CHAZ-CHS1782/2022 EPI_ISL_12363649	6 April 2022	Choma	BA.2	Fourth
19	Male	32	17.9	hCoV-19/Zambia/CHAZ-CHS1787/2022 EPI_ISL_12363652	5 January 2022	Chikankata	BA.1	Fourth
20	Female	0	28.9	hCoV-19/Zambia/CHAZ-CHS1788/2022 EPI_ISL_12363653	Unknown	Chikankata	BA.1	Fourth

21	Male	17	15	hCoV-19/Zambia/CHAZ-CHS1789/2021 EPI_ISL_12363654	12 December 2021	Livingstone	BA.1	Fourth
22	Female	30	28.9	hCoV-19/Zambia/CHAZ-CHS1794/2021 EPI_ISL_12363658	14 December 2021	Kazungula	BA.2	Fourth
23	Female	52	17.4	hCoV-19/Zambia/CHAZ-CHS1796/2021 EPI_ISL_12363660	7 December 2021	Livingstone	BA.1	Fourth
24	Female	23	22	hCoV-19/Zambia/CHAZ-CHS1798/2021 EPI_ISL_12363661	30 December 2021	Chikankata	BA.1.1	Fourth
25	Male	48	11	hCoV-19/Zambia/CHAZ-CHS1799/2021 EPI_ISL_12363662	28 December 2021	Chikankata	BA.1	Fourth
26	Female	23	28.8	hCoV-19/Zambia/CHAZ-CHS1801/2021 EPI_ISL_12363663	13 December 2021	Livingstone	BA.1.14	Fourth
27	Male	0	28.8	hCoV-19/Zambia/CHAZ-CHS1802/2021 EPI_ISL_12363664	13 December 2021	Livingstone	BA.1	Fourth
28	Male	-	20.5	hCoV-19/Zambia/CHAZ-CHS1807/2021 EPI_ISL_12363667	14 December 2021	Kazungula	BA.1	Fourth
29	Male	40	17.9	hCoV-19/Zambia/CHAZ-CHS1809/2022 EPI_ISL_12363668	20 January 2022	Livingstone	BA.1	Fourth
30	Male	19	25.4	hCoV-19/Zambia/CHAZ-CHS1813/2022 EPI_ISL_12363669	28 February 2022	Livingstone	BA.2	Fourth
31	Male	49	17.3	hCoV-19/Zambia/CHAZ-CHS1815/2022 EPI_ISL_12363670	5 January 2022	Chikankata	BA.1.1	Fourth
32	Female	0	24	hCoV-19/Zambia/CHAZ-CHS1816/2022 EPI_ISL_12363671	Unknown	Chikankata	BA.1	Fourth
33	Male	45	23.7	hCoV-19/Zambia/CHAZ-CHS1817/2021 EPI_ISL_12363672	14 December 2021	Kazungula	BA.1.1	Fourth
34	Male	39	15.2	hCoV-19/Zambia/CHAZ-CHS1818/2021 EPI_ISL_12363673	14 December 2021	Livingstone	BA.1	Fourth
35	Male	39	28.6	hCoV-19/Zambia/CHAZ-CHS1819/2021 EPI_ISL_12363674	14 December 2021	Kazungula	BA.1.1	Fourth
36	Male	25	-	hCoV-19/Zambia/CHAZ-CHS1838/2022 EPI_ISL_12363681	Unknown	Namwala	BA.1	Fourth

37	Male	48	-	hCoV-19/Zambia/CHAZ-CHS1908/2021 EPI_ISL_13053875	28 December 2021	Choma	BA.1	Fourth
38	Female	-	-	>hCoV-19/Zambia/CHAZ-CHS1909/2022 EPI_ISL_13053241	Unknown	Chikankata	BA.1	Fourth
39	Male	19	-	>hCoV-19/Zambia/CHAZ-CHS1979/2022 EPI_ISL_13053876	28 February 2022	Livingstone	BA.2	Fourth
40	Male	46	-	hCoV-19/Zambia/CHAZ-CHS1980/2021 EPI_ISL_13053244	21 December 2021	Livingstone	BA.1	Fourth

**Table S2:** Nucleic acid and amino acid mutations observed in the 36 SARS-CoV-2 genomes obtained from the Southern Province of Zambia

No.	Position	Genome Region	Number of Mutations	Reference Nucleotide	Sample Nucleotide	AA Change	Frequency	Mutation Type
1	174	<b>5'UTR</b>	4	G	T	174	6	extragenic
2	210			G	T	210	4	extragenic
3	222			C	T	222	1	extragenic
4	241			C	T	241	31	extragenic
5	343	<b>NSP1</b>	3	.	C	V26	2	Insertion
6	478			C	T	I71I	1	Synonymous
7	670			T	G	S135R	5	Missense
8	913	<b>NSP2</b>	5	C	T	S36S	3	Synonymous
9	926			T	C	F41L	2	Missense
10	940			G	A	K45K	1	Synonymous
11	1059			C	T	T85I	6	Missense
12	2692			A	T	T629T	2	Synonymous
13	2790	<b>NSP3</b>	42	C	T	T24I	5	Missense
14	2832			A	G	K38R	20	Missense
15	2903			A	G	I62V	1	Missense
16	3037			C	T	F106F	39	Synonymous
17	3177			C	T	P153L	3	Missense
18	3267			C	T	T183I	3	Missense

19	4150	T	C	V477V	2	Synonymous
20	4181	G	T	A488S	4	<b>Missense</b>
21	4184	G	A	G489S	5	<b>Missense</b>
22	4255	G	T	P512P	2	Synonymous
23	4276	C	T	Y519Y	2	Synonymous
24	4321	C	T	A534A	5	Synonymous
25	4540	C	T	Y607Y	2	Synonymous
26	4576	A	T	T619T	2	Synonymous
27	4579	T	A	L620L	3	Synonymous
28	4655	C	T	R646W	1	<b>Missense</b>
29	5161	T	A	F814L	1	<b>Missense</b>
30	5230	G	T	K837N	6	<b>Missense</b>
31	5260	T	A	T847T	1	Synonymous
32	5386	T	G	A889A	22	Synonymous
33	5388	C	A	A890D	3	<b>Missense</b>
34	5866	C	T	F1049F	1	Synonymous
35	5953	G	A	L1078L	2	Synonymous
36	5986	C	T	F1089F	3	Synonymous
37	6106	T	C	Y1129Y	1	Synonymous
38	6402	C	T	P1228L	4	<b>Missense</b>
39	6513	GTT	.	S1265	21	Deletion
40	6568	C	T	D1283D	1	Synonymous
41	6954	T	C	I1412T	3	<b>Missense</b>
42	6968	C	T	L1416L	1	Synonymous
43	7069	A	G	E1450E	1	Synonymous
44	7071	G	T	G1451V	1	<b>Missense</b>
45	7086	C	T	T1456I	2	<b>Missense</b>
46	7124	C	T	P1469S	4	<b>Missense</b>
47	7252	G	C	L1511F	1	<b>Missense</b>
48	7292	T	C	G1524G	1	Synonymous

49	7787			G	C	A1690P	1	Missense
50	7923			C	T	S1735F	1	Missense
51	8035			G	T	M1772I	2	Missense
52	8290			C	T	L1857L	1	Synonymous
53	8393			G	A	A1892T	22	Missense
54	8499			C	T	A1927V	2	Missense
55	8723	NSP4	9	A	C	I57L	1	Missense
56	8986			C	T	D144D	4	Synonymous
57	9053			G	T	V167L	4	Missense
58	9344			C	T	L264F	5	Missense
59	9424			A	G	V290V	3	Synonymous
60	9474			C	T	A307V	1	Missense
61	9534			C	T	T327I	5	Missense
62	9866			C	T	L438F	5	Missense
63	10029			C	T	T492I	31	Missense
64	10181	NSP5	7	A	G	I43V	1	Missense
65	10198			C	T	D48D	2	Synonymous
66	10323			A	G	K90R	6	Missense
67	10447			G	A	R131R	5	Synonymous
68	10449			C	A	P132H	27	Missense
69	10691			A	G	I213V	4	Missense
70	10892			A	G	T280A	1	Missense
71	11083	NSP6	9	G	T	L37F	1	Missense
72	11109			C	T	A46V	1	Missense
73	11201			A	G	T77A	4	Missense
74	11286			TGTCTGGTT	.	L105	22	Deletion
75	11288			TCTGGTTTT	.	S106	14	Deletion
76	11332			A	G	V120V	4	Synonymous
77	11537			A	G	I189V	20	Missense

78	11653			C	T	L227L	2	Synonymous
79	11713			T	C	S247S	1	Synonymous
80	11941	<b>NSP7</b>	1	C	T	V33V	1	Synonymous
81	12406	<b>NSP8</b>	4	C	T	N105N	1	Synonymous
82	12452			C	T	<b>P121S</b>	2	<b>Missense</b>
83	12473			C	T	K127K	1	Synonymous
84	12557			A	C	<b>I156L</b>	2	<b>Missense</b>
85	12786	<b>NSP9</b>	2	C	T	<b>T34I</b>	1	<b>Missense</b>
86	12880			C	T	I65I	5	Synonymous
87	13195	<b>NSP10</b>	2	T	C	V57V	22	Synonymous
88	13339			T	A	<b>N105K</b>	2	<b>Missense</b>
89	13592	<b>NSP12b</b>	11	C	T	<b>T42I</b>	2	<b>Missense</b>
90	13756			A	G	<b>I97V</b>	1	<b>Missense</b>
91	14408			C	T	<b>P314L</b>	40	<b>Missense</b>
92	14676			C	T	P403P	3	Synonymous
93	15240			C	T	N591N	22	Synonymous
94	15279			C	T	H604H	3	Synonymous
95	15451			G	A	<b>G662S</b>	4	<b>Missense</b>
96	15714			C	T	L749L	5	Synonymous
97	15939			T	C	D824D	1	Synonymous
98	15960			C	T	A831A	1	Synonymous
99	16176			T	C	T903T	3	Synonymous
100	16406	<b>NSP13</b>	6	T	G	<b>V57G</b>	2	<b>Missense</b>
101	16466			C	T	<b>P77L</b>	4	<b>Missense</b>
102	16636			G	T	<b>A134S</b>	1	<b>Missense</b>
103	17280			G	T	V348V	1	Synonymous
104	17410			C	T	<b>R392C</b>	5	<b>Missense</b>
105	17999			C	T	<b>T588I</b>	4	<b>Missense</b>
106	18163	<b>NSP14</b>	2	A	G	<b>I42V</b>	27	<b>Missense</b>

107	19220			C	T	A394V	4	Missense
108	19684	NSP15	8	G	T	V22L	1	Missense
109	19803			C	T	R61R	4	Synonymous
110	19884			C	T	Y88Y	1	Synonymous
111	19955			C	T	T112I	5	Missense
112	19999			G	T	V127F	1	Missense
113	20055			A	G	E145E	5	Synonymous
114	20094			A	G	K158K	2	Synonymous
115	20132			C	T	A171V	2	Missense
116	20741	NSP16	23	A	G	Q28R	1	Missense
117	21082			GA	CT	E142L	2	Missense
118	21110			C	T	T151I	4	Missense
119	21512			A	C	N285T	4	Missense
120	21517			AG	CA	R287Q	4	Missense
121	21520			G	C	V288L	4	Missense
122	21523			GTT	TCG	V289S	4	Missense
123	21528			T	C	I290I	4	Synonymous
124	21532			A	T	S292C	4	Missense
125	21534			.	A	S292	2	Insertion
126	21535			G	.	S292	1	Deletion
127	21536			.	TC	D293	1	Insertion
128	21537			T	A	D293E	1	Missense
129	21537			T	.	D293	1	Deletion
130	21539			T	A	V294D	2	Missense
131	21542			T	.	L295	1	Deletion
132	21543			TGTT	AACG	V296T	1	Missense
133	21543			TGTTA	.	L295	1	Deletion
134	21547			AA	CT	N297L	1	Missense
135	21547			AA	.	V296	1	Deletion

136	21549			C	G	N297K	1	Missense
137	21550			A	.	N297	1	Deletion
138	21551			A	T	N298I	1	Missense
139	21614	Spike	82	C	T	L18F	1	Missense
140	21618			C	G	T19R	9	Missense
141	21618			C	T	T19I	5	Missense
142	21633			TACCCCCTG	.	L24	5	Deletion
143	21762			C	.	A67	22	Deletion
144	21764			A	.	A67	22	Deletion
145	21765			TACATG	.	H69	3	Deletion
146	21767			CATG	.	I68	22	Deletion
147	21801			A	C	D80A	6	Missense
148	21846			C	T	T95I	26	Missense
149	21987			G	A	G142D	9	Missense
150	21987			GTGTTTATT	.	G142	22	Deletion
151	21993			ATT	.	Y145	3	Deletion
152	22029			AGTTCA	.	E156	4	Deletion
153	22139			G	C	V193L	1	Missense
154	22161			A	G	Y200C	1	Missense
155	22193			.	T	I210	16	Insertion
156	22194			ATT	.	N211	2	Deletion
157	22195			T	G	N211K	16	Missense
158	22197			TA	GC	L212C	16	Missense
159	22200			T	G	V213G	5	Missense
160	22201			.	AGC	S214	16	Insertion
161	22202			.	A	V213	1	Insertion
162	22203			.	A	R214	1	Insertion
163	22204			T	A	R214R	16	Synonymous
164	22206			A	G	D215G	6	Missense



165	22286	CTTGCTTTA	.	L242	4	Deletion
166	22289	G	T	A243S	1	Missense
167	22293	T	C	L244S	1	Missense
168	22481	A	C	T307P	1	Missense
169	22511	AA	TT	N317F	1	Missense
170	22535	T	C	S325P	1	Missense
171	22539	TT	AA	I326K	1	Missense
172	22542	T	C	V327A	1	Missense
173	22578	G	A	G339D	27	Missense
174	22599	G	A	R346K	5	Missense
175	22669	T	C	Y369Y	1	Synonymous
176	22673	TC	CT	S371L	22	Missense
177	22674	C	T	S371F	5	Missense
178	22679	T	C	S373P	27	Missense
179	22686	C	T	S375F	27	Missense
180	22688	A	G	T376A	5	Missense
181	22775	G	A	D405N	5	Missense
182	22786	A	C	R408S	5	Missense
183	22813	G	T	K417N	31	Missense
184	22882	T	G	N440K	7	Missense
185	22898	G	A	G446S	16	Missense
186	22917	T	G	L452R	4	Missense
187	22969	AA	GG	T470A	1	Missense
188	22992	G	A	S477N	21	Missense
189	22995	C	A	T478K	24	Missense
190	23012	G	A	E484K	6	Missense
191	23013	A	C	E484A	20	Missense
192	23040	A	G	Q493R	20	Missense
193	23048	G	A	G496S	15	Missense
194	23055	A	G	Q498R	20	Missense

195	23063			A	T	N501Y	29	Missense
196	23075			T	C	Y505H	19	Missense
197	23202			C	A	T547K	22	Missense
198	23271			C	A	A570D	3	Missense
199	23403			A	G	D614G	40	Missense
200	23525			C	T	H655Y	27	Missense
201	23599			T	G	N679K	27	Missense
202	23604			C	G	P681R	29	Missense
203	23604			C	A	P681H	5	Missense
204	23664			C	T	A701V	6	Missense
205	23709			C	T	T716I	3	Missense
206	23854			C	A	N764K	27	Missense
207	23948			G	T	D796Y	27	Missense
208	24130			C	A	N856K	22	Missense
209	24183			C	T	T874I	1	Missense
210	24410			G	A	D950N	4	Missense
211	24424			A	T	Q954H	27	Missense
212	24469			T	A	N969K	26	Missense
213	24503			C	T	L981F	21	Missense
214	24506			T	G	S982A	3	Missense
215	24821			G	T	A1087S	1	Missense
216	24872			G	T	V1104L	2	Missense
217	24914			G	C	D1118H	3	Missense
218	24942			A	G	D1127G	1	Missense
219	25000			C	T	D1146D	27	Synonymous
220	25352			G	T	V1264L	3	Missense
221	25469	ORF3a	9	C	T	S26L	4	Missense
222	25546			C	T	L52F	4	Missense
223	25563			G	T	Q57H	6	Missense

224	25584			C	T	T64T	27	Synonymous
225	25587			C	T	L65L	5	Synonymous
226	25665			C	T	Y91Y	1	Synonymous
227	25904			C	T	S171L	6	Missense
228	26058			C	T	D222D	1	Synonymous
229	26060			C	T	T223I	5	Missense
230	26270	Envelope	5	C	T	T9I	27	Missense
231	26296			C	A	L18I	1	Missense
232	26392			A	T	S50C	1	Missense
233	26438			T	C	L65P	2	Missense
234	26456			C	T	P71L	6	Missense
235	26530	Membrane	7	A	G	D3G	19	Missense
236	26577			C	G	Q19E	25	Missense
237	26709			G	A	A63T	24	Missense
238	26767			T	C	I82T	4	Missense
239	26858			C	T	F112F	4	Synonymous
240	26997			T	G	C159G	1	Missense
241	27059			C	T	Y179Y	4	Synonymous
242	27193	3'UTR	1	T	C	27193	1	extragenic
243	27209	ORF6	4	A	G	H3R	1	Missense
244	27259			A	C	M19M	27	Synonymous
245	27382			GAT	CTC	D61L	5	Missense
246	27384			T	C	D61D	1	Synonymous
247	27638	ORF7a	2	T	C	V82A	4	Missense
248	27752			C	T	T120I	4	Missense
249	27807	ORF7b	9	C	T	L17L	20	Synonymous
250	27873			.	G	E39	1	Insertion
251	27874			C	A	T40N	1	Missense
252	27874			C	T	T40I	4	Missense

253	27875			.	C	T40	1	Insertion
254	27879			C	.	C41	1	Deletion
255	27880			A	T	H42L	1	Missense
256	27882			G	.	H42	1	Deletion
257	27883			C	T	A43V	1	Missense
258	27921	ORF8	9	A	T	I10F	1	Missense
259	27972			C	T	Q27*	3	SNP_stop
260	27998			C	T	D35D	1	Synonymous
261	28048			G	T	R52I	3	Missense
262	28079			G	C	V62V	1	Synonymous
263	28111			A	G	Y73C	3	Missense
264	28248			GATTTC	.	D119	4	Deletion
265	28253			C	T	F120F	1	Synonymous
266	28253			CA	TC	I121L	5	Missense
267	28271	3'UTR	2	A	T	28271	27	extragenic
268	28273			A	.	28273	7	extragenic
269	28280	Nucleocapsid	20	GAT	CTA	D3L	3	Missense
270	28310			C	T	P13S	1	Missense
271	28311			C	T	P13L	26	Missense
272	28362			GAGAACGC	.	E31	26	Deletion
273	28461			A	G	D63G	4	Missense
274	28881			G	T	R203M	2	Missense
275	28881			GG	TT	R203I	2	Missense
276	28881			GGG	AAC	RG203KR	30	Missense
277	28887			C	T	T205I	6	Missense
278	28916			G	T	G215C	4	Missense
279	28977			C	T	S235F	3	Missense
280	28985			G	T	G238C	1	Missense
281	29014			T	C	T247T	1	Synonymous

282	29095			C	T	F274F	1	Synonymous
283	29144			C	T	E290E	1	Synonymous
284	29192			T	C	F307L	2	<b>Missense</b>
285	29304			C	T	P344L	5	<b>Missense</b>
286	29402			G	T	D377Y	4	<b>Missense</b>
287	29433			A	G	K387R	2	<b>Missense</b>
288	29510			A	C	S413R	5	<b>Missense</b>
289	29545	3'UTR	4	C	T	29545	2	extragenic
290	29734			GAGGCCAC GCGGAGTAC GATCGAGTG	.	29734	4	extragenic
291	29736			G	T	29736	1	extragenic
292	29742			G	T	29742	4	extragenic