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Supplementary Material: Associations between socioeconomic and public health indicators and the case-fatality rate of COVID-19 in sub-Saharan Africa

Supplementary table 1. Country specific data

Country	HDI	Population density	Political stability	CVD mortality rate	CRD mortality rate	DM prevalence (%)	Handwashing facilities (Share of population)	Hospital beds p. 1,000	Median age	Aged ≥ 65 years (%)	Share of female population	Population size in millions
Angola	0.581	23.89	-0.31	276.04	45.18	3.94	26.66	0.5	16.8	2.40	50.96	32.86
Burundi	0.433	423.06	-1.64	293.06	54.64	6.05	6.14	0.8	17.5	2.56	50.79	11.89
Benin	0.545	99.11	-0.34	235.84	47.78	0.99	11.03	0.5	18.8	3.24	50.12	12.12
Burkina Faso	0.452	70.15	-1.18	269.04	31.64	2.42	11.87	0.4	17.6	2.40	50.13	20.90
Botswana	0.735	4.04	1.01	237.37	46.28	4.81	-	1.8	25.8	3.94	50.57	2.35
Central African Republic	0.397	7.47	-2.18	435.72	79.17	6.10	16.60	1	18.3	3.65	50.68	4.82
Cote d'Ivoire	0.538	76.39	-0.96	303.74	42.18	2.42	19.35	0.4	18.7	2.93	49.34	26.37



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Cameroon	0.563	50.885	-1.55	244.66	52.79	7.20	2.73	1.3	18.8	3.16	49.95	26.54
Dem. Rep. of Congo	0.480	35.87	-1.80	318.94	62.67	6.10	4.47	0.8	17	3.02	50.11	89.56
Congo	0.574	15.40	-0.89	344.09	56.90	7.20	47.96	1.6	19	3.40	49.98	5.51
Comoros	0.554	437.35	-0.14	261.51	37.04	11.88	15.57	2.2	20.4	2.96	49.56	0.86
Cape Verde	0.665	135.58	0.88	182.21	20.37	2.42	-	2.1	25.7	4.46	50.17	0.55
Eritrea	0.459	44.30	-0.71	311.11	52.24	6.05	-	0.7	19.3	3.60	49.94	3.54
Ethiopia	0.485	104.95	-1.27	182.63	33.34	7.47	7.96	0.3	19.8	3.52	50.07	114.96
Gabon	0.703	7.85	-0.17	259.96	33.57	7.2	-	6.3	23.1	4.45	48.63	2.22
Ghana	0.611	126.71	0.09	298.24	32.97	4.97	41.04	0.9	21.1	3.38	50.17	31.07
Guinea	0.477	51.75	-0.83	336.71	58.07	2.42	17.45	0.3	19	3.13	49.86	13.13
Gambia	0.496	207.56	0.11	331.43	47.46	1.91	7.87	1.1	17.5	2.33	50.50	2.41
Guinea Bissau	0.480	66.19	-0.56	382.47	59.98	2.42	6.40	1	19.4	3.00	50.80	1.96
Equatorial Guinea	0.592	45.19	-0.19	202.81	39.65	7.78	24.64	2.1	22.4	2.84	44.64	1.40
Kenya	0.601	87.32	-1.12	218.63	40.37	2.92	24.65	1.4	20	2.68	50.30	53.77
Liberia	0.480	49.12	-0.22	272.50	32.44	2.42	1.18	0.8	19.2	3.05	49.55	5.05
Lesotho	0.527	73.56	-0.25	405.12	100.44	3.94	2.11	1.3	22.2	4.50	51.45	2.14
Madagascar	0.528	43.95	-0.25	405.99	71.33	3.94	50.54	0.2	19.6	2.92	50.13	27.69
Mali	0.434	15.19	-2.15	268.02	62.48	2.42	52.23	0.1	16.4	2.51	49.96	20.25
Mozambique	0.456	37.72	-0.74	329.94	40.48	3.30	12.22	0.7	17.7	3.15	51.16	31.25
Mauritania	0.546	4.28	-0.54	232.34	34.26	2.42	15.95	0.4	20.3	3.13	49.60	4.64
Mauritius	0.804	622.96	0.82	224.64	34.86	22.02	-	3.4	37.4	10.94	50.54	1.27
Malawi	0.483	197.51	-0.26	227.34	36.91	3.94	8.70	1.3	18.1	2.97	50.64	19.12
Namibia	0.6646	3.07	0.53	243.81	51.47	3.94	44.60	2.7	22	3.55	51.35	2.54

Niger	0.394	16.95	-1.40	238.33	48.31	2.42	8.97	0.3	15.1	2.55	49.86	24.20
Nigeria	0.539	209.58	-1.93	181.01	25.97	2.42	41.94	0.5	18.1	2.75	49.33	206.13
Rwanda	0.543	494.86	0.11	191.37	45.20	4.28	4.61	1.6	20.3	2.97	50.96	12.95
Sudan	0.510	23.25	-1.67	431.38	37.45	15.67	23.43	0.8	19.7	3.54	50.02	43.84
Senegal	0.512	82.32	0.05	241.21	44.58	2.42	20.85	0.3	18.7	3.00	50.87	16.74
Sierra Leone	0.452	104.70	-0.09	325.72	46.63	2.42	19.27	0.4	19.1	2.53	50.48	7.97
Somalia	-	23.50	-2.38	365.76	58.31	6.05	9.83	0.9	16.8	2.73	50.19	15.89
South Sudan	0.433	-	-2.55	280.77	52.61	10.43	-	-	19.2	3.44	49.90	11.19
Sao Tome and Principe	0.625	212.84	0.51	270.11	94.47	2.42	41.34	2.9	18.7	2.88	50.20	0.21
Eswatini	0.611	79.49	-0.37	333.43	68.22	3.94	24.09	2.1	21.5	3.16	51.57	1.16
Seychelles	0.796	208.35	0.68	242.64	28.29	10.55	-	3.6	36.2	8.60	50.72	0.09
Chad	0.398	11.83	-1.34	280.99	51.41	6.10	5.81	0.4	16.7	2.48	49.94	16.42
Togo	0.515	143.36	-0.80	280.03	44.87	6.15	10.47	0.7	19.4	2.83	50.15	8.27
Uganda	0.544	213.75	-0.64	213.33	38.72	2.50	21.22	0.5	16.4	2.16	50.26	45.74
Zambia	0.584	22.99	-0.10	234.49	40.68	3.94	13.93	2	17.7	2.48	50.38	18.38
Zimbabwe	0.571	42.72	-0.92	307.84	59.22	1.82	36.79	1.7	19.6	2.82	51.29	14.86

CVD: cardiovascular disease; CRD: Chronic respiratory disease; DM: Diabetes mellitus

Supplementary table 2. Spearman rank correlation of the socioeconomic, public health indicators and demographic characteristics

$r_{(s)}$ p-value n	Population density	Political stability index	Diabetes mellitus prevalence	CVD death rate	CRD death rate	Hand-washing facilities	Hospital beds	median age_	age65	population
HDI	0.13 0.403 44	0.65 <.0001 45	0.17 0.271 45	-0.39 0.008 45	-0.29 0.056 45	0.47 0.003 38	0.71 <.0001 44	0.64 <.0001 45	0.32 0.030 45	-0.34 0.020 45
Population density	1 45	0.29 0.057 45	-0.04 0.802 45	-0.31 0.041 45	-0.29 0.051 45	-0.15 0.347 39	0.14 0.362 45	0.12 0.428 45	-0.10 0.520 45	-0.10 0.50 45
Political stability index	0.29 0.057 45	1 46	-0.09 0.562 46	-0.30 0.040 46	-0.30 0.044 46	0.12 0.477 39	0.50 0.000 45	0.55 <.0001 46	0.24 0.115 46	-0.55 <.0001 46
Diabetes mellitus prevalence	-0.04 0.802 45	-0.09 0.562 46	1 46	0.03 0.820 46	-0.08 0.576 46	-0.12 0.460 39	0.38 0.011 45	0.33 0.023 46	0.42 0.004 46	-0.10 0.495 46
CVD death rate	-0.31 0.041 45	-0.30 0.040 46	0.03 0.820 46	1 46	0.62 <.0001 46	0.00 0.983 39	-0.15 0.336 45	-0.17 0.261 46	0.04 0.772 46	-0.05 0.727 46
CRD death rate	-0.29 0.051 45	-0.30 0.044 46	-0.08 0.576 46	0.62 <.0001 46	1 46	0.02 0.900 39	-0.07 0.642 45	-0.26 0.081 46	-0.07 0.629 46	-0.10 0.474 46
Handwash facilities	-0.15 0.347 39	0.12 0.477 39	-0.12 0.460 39	0.00 0.983 39	0.02 0.900 39	1 39	0.02 0.920 39	0.15 0.358 39	-0.06 0.729 39	0.09 0.566 39
Hospital beds	0.14	0.50	0.38	-0.15	-0.07	0.02	1	0.5729	0.402	-0.62

	0.362 45	0.000 45	0.011 45	0.336 45	0.642 45	0.920 39		<.0001 45	0.006 45	<.0001 45
median age	0.12 0.428 45	0.55 <.0001 46	0.33 0.023 46	-0.17 0.261 46	-0.26 0.081 46	0.15 0.358 39	0.57 <.0001 45	1 46	0.70 <.0001 46	-0.54 <.0001 46
age65	-0.10 0.520 45	0.24 0.115 46	0.42 0.004 46	0.04 0.772 46	-0.07 0.629 46	-0.06 0.729 39	0.40 0.006 45	0.70 <.0001 46	1 46	-0.40 0.005 46
population	-0.10 0.50 45	-0.55 <.0001 46	-0.10 0.495 46	-0.05 0.727 46	-0.10 0.474 46	0.09 0.566 39	-0.62 <.0001 45	-0.54 <.0001 46	-0.40 0.005 46	1 46

CVD: cardiovascular diseases; CRD: chronic respiratory diseases; age65 – proportion of population older 65 years

Supplementary table 3.

	Obs.(n)	Crude RR (95%CI)	p-value
CFR_L **			
HDI	115	0.76 (0.59 to 0.97)	0.030
Population density	115	0.90 (0.70 to 1.15)	0.388
Political stability index	115	0.94 (0.89 to 0.99)	0.028
Diabetes Mellitus prev.	115	1.55 (0.96 to 2.49)	0.071
CVD death rate	115	1.45 (0.91 to 2.33)	0.120
CRD death rate	115	1.10 (0.81 to 1.50)	0.541
Handwashing facilities	100	1.01 (0.92 to 1.11)	0.822
Hospital beds per 1,000	115	0.86 (0.74 to 0.99)	0.040

Obs.: Observations; RR: Rate ratio; 95%CI: 95% Confidence interval; HDI: Human development index; CVD: cardiovascular disease; CRD: chronic respiratory disease

**observations with less than 2000 COVID-19 cases in a time period were excluded from analyses.

HDI increase by 0.10; Population density increase 100 people per km²; Political instability index increase by 0.2; Diabetes mellitus increase by 5%; CVD increase by 100 per 100,000; CRD increase by 20 per 100,000;

Handwashing facilities increase by 10%; Hospital beds increase by 1 per 1,000.

Supplementary table 4. COVID-19 data of 46 sub-Saharan African countries per time period

Country	cases1 _L	deaths1	CFR1 _L	cases2 _L	deaths2	CFR2 _L	cases3 _L	deaths3	CFR3 _L	cases4 _L	deaths4	CFR4 _L	cases5 _L	deaths5	CFR5 _L
Angola	45	4	8.88	1527	92	6.02	10763	241	2.23	7751	162	2.09	8391	226	2.69
Burundi	19	1	5.26	389	0	0	206	0	0	1114	2	0.17	2449	3	0.12
Benin	319	3	0.94	1617	36	2.22	809	4	0.49	1448	27	1.86	3691	31	0.83
Burkina Faso	751	52	6.92	453	3	0.66	1365	13	0.95	8716	71	0.81	2097	26	1.23
Botswana	23	1	4.34	886	2	0.22	6926	28	0.40	16600	269	1.62	23982	484	2.01
Central African Republic	179	1	0.55	4462	60	1.34	238	2	0.84	110	0	0	1685	34	2.01
Cote d'Ivoire	1700	30	1.76	15015	83	0.55	4117	18	0.43	8735	55	0.62	16875	112	0.66
Cameroon	2579	165	6.39	15463	243	1.57	4379	27	0.61	8973	88	0.98	43339	716	1.65
Dem. Rep. of Congo	1024	67	6.54	8429	183	2.17	2154	77	3.57	11992	373	3.11	6750	79	1.17
Congo	287	16	5.57	3377	61	1.80	1715	15	0.87	2681	35	1.30	3087	23	0.74
Comoros	11	1	9.09	388	6	1.54	164	0	0	2525	136	5.38	766	3	0.39
Cape Verde	246	3	1.21	2612	34	1.30	6511	67	1.02	5082	40	0.78	11990	112	0.93
Eritrea	39	0	0	246	0	0	206	0	0	1835	7	0.38	1428	7	0.49
Ethiopia	239	5	2.09	22579	673	2.98	76857	969	1.26	42663	646	1.51	120364	1783	1.48
Gabon	661	12	1.81	7262	41	0.56	1099	6	0.54	2435	17	0.69	12108	71	0.58
Ghana	4263	32	0.75	36740	229	0.62	8199	62	0.75	23126	254	1.09	20683	206	0.99
Guinea	2146	20	0.93	5784	33	0.57	4496	22	0.48	2338	11	0.47	7869	73	0.92
Gambia	20	1	5	1215	83	6.83	2449	39	1.59	553	23	4.15	1692	32	1.89
Guinea Bissau	726	6	0.82	1326	27	2.03	361	10	2.77	359	4	1.11	969	21	2.16
Equatorial Guinea	439	12	2.73	4382	71	1.62	271	2	0.73	522	6	1.14	2080	22	1.05
Kenya	672	51	7.58	25764	497	1.92	36052	832	2.30	39456	447	1.13	61610	1232	1.99

Liberia	199	26	13.06	1038	56	5.39	205	0	0	514	3	0.58	161	0	0
Lesotho	0	0	0	742	30	4.04	1225	14	1.14	7413	241	3.25	1393	41	2.94
Madagascar	171	2	1.16	12915	176	1.36	4137	73	1.76	2137	46	2.15	19652	503	2.55
Mali	704	65	9.23	1863	60	3.22	1109	18	1.62	1500	205	4.55	5932	166	2.79
Mozambique	91	0	0	2178	20	0.91	11499	104	0.90	30832	471	1.52	25638	236	0.92
Mauritania	8	6	75	6490	152	2.34	1308	11	0.84	8971	262	2.92	1890	27	1.42
Mauritius	332	10	3.01	12	0	0	108	0	0	141	0	0	653	7	1.07
Malawi	56	4	7.14	4602	162	3.52	1293	19	1.46	21471	828	3.85	6749	140	2.07
Namibia	16	0	0	2933	52	1.77	10262	93	0.90	20957	266	1.26	15902	354	2.22
Niger	821	61	7.42	337	8	2.37	85	1	1.17	3369	102	3.02	709	20	2.82
Nigeria	4399	226	5.13	42178	776	1.83	17513	165	0.94	75658	672	0.88	25671	228	0.88
Rwanda	284	0	0	1856	12	0.64	3082	35	1.13	11229	202	1.79	9201	100	1.08
Sudan	1363	146	10.71	10531	669	6.35	3196	378	17.21	15544	678	4.36	4827	575	11.91
Senegal	1709	35	2.04	9466	234	2.47	4533	61	1.34	13052	484	3.70	11932	317	2.66
Sierra Leone	307	40	13.02	1609	29	1.80	465	5	1.07	1404	5	0.35	304	0	0
Somalia	1054	61	5.78	2173	32	1.47	1002	20	1.99	633	89	14.06	9506	556	5.84
South Sudan	156	6	3.84	2314	41	1.77	485	13	2.68	1654	26	1.57	6032	29	0.48
Sao Tome and Principe	208	9	4.32	670	6	0.89	84	2	2.38	377	4	1.06	979	16	1.63
Eswatini	172	2	1.16	3064	83	2.70	2767	35	1.26	10201	527	5.16	2276	25	1.09
Seychelles	11	0	0	115	0	0	32	0	0	1355	10	0.73	5298	28	0.52
Chad	322	60	2.57	322	16	2.57	603	25	4.14	1950	33	1.69	1380	39	2.82
Togo	174	12	6.89	886	15	1.69	1456	37	2.54	2967	17	0.57	7684	44	0.57
Uganda	121	0	0	1162	19	1.63	1312	153	1.16	25457	161	0.63	2524	23	0.91
Zambia	267	7	2.62	7818	273	3.49	8869	77	0.86	45679	683	1.49	29459	228	0.77
Zimbabwe	36	4	11.11	4613	151	3.27	3882	113	2.91	26021	1173	4.50	3867	145	3.74

CFR_L: COVID-19 case fatality rate with lag

