

1	Supplementary Materials to the Manuscript “Using Hierarchical Clustering Analysis to	
2	Evaluate COVID-19 Pandemic Preparedness and Performance in 180 Countries in 2020”	
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eTable1. HCA scores and quarter scores for cases per million population.

Countries	Country Size	H.C.A.	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Aruba	Small	0.429	0.75	1	0	0.75
Albania	Small	0.633	1	1	1	0.75
Andorra	Small	0.082	0.25	0.5	0.75	0
Bahrain	Small	0.000	0.75	0.5	0.25	0.75
Bahamas	Small	0.612	1	1	0.75	0.75
Bosnia and Herzegovina	Small	0.469	1	1	0.75	0.5
Belize	Small	0.653	1	1	1	0.75
Bermuda	Small	0.776	0.75	0.75	1	1
Barbados	Small	0.918	1	1	1	1
Brunei	Small	0.878	0.75	1	1	1
Bhutan	Small	0.918	1	1	1	1
Comoros	Small	0.918	1	1	1	1
Cape Verde	Small	0.531	1	1	0.75	0.75
Costa Rica	Small	0.469	1	1	0.5	0.75
Cyprus	Small	0.714	1	1	1	0.75
Djibouti	Small	0.755	1	0.75	1	1
Dominica	Small	0.898	1	1	1	1
Denmark	Small	0.592	0.75	0.75	1	0.75
Eritrea	Small	0.918	1	1	1	1
Estonia	Small	0.694	0.75	1	1	0.75
Fiji	Small	0.918	1	1	1	1
Faeroe Islands	Small	0.653	0.5	1	0.75	1
Georgia	Small	0.551	1	1	1	0.25
Gambia	Small	0.898	1	1	1	1
Greenland	Small	0.898	1	1	1	1
Guam	Small	0.469	0.75	1	0.75	0.5
Guyana	Small	0.796	1	1	1	1
Hong Kong	Small	0.837	1	1	1	1
Croatia	Small	0.510	1	1	1	0.5
Ireland	Small	0.653	0.75	0.5	1	0.75
Iceland	Small	0.633	0.5	0.75	1	0.75
Jamaica	Small	0.898	1	1	1	1
Kuwait	Small	0.265	1	0.5	0.5	0.75
Lebanon	Small	0.653	1	1	1	0.75
Lesotho	Small	0.918	1	1	1	1
Lithuania	Small	0.571	1	1	1	0.5

Luxembourg	Small	0.143	0.5	0.75	0.75	0.25
Latvia	Small	0.735	1	1	1	0.75
Monaco	Small	0.673	0.75	0.75	1	0.75
Moldova	Small	0.347	1	0.75	0.75	0.75
Malta	Small	0.571	0.75	1	1	0.75
Mauritius	Small	0.918	1	1	1	1
Panama	Small	0.163	1	0.75	0.25	0.75
Puerto Rico	Small	0.592	1	1	0.75	0.75
Palestine	Small	0.551	1	1	0.75	0.75
Qatar	Small	0.163	0.75	0	0.5	1
Singapore	Small	0.551	1	0.5	1	1
Solomon Islands	Small	0.918	1	1	1	1
San Marino	Small	0.143	0	0.25	1	0.5
Suriname	Small	0.673	1	1	0.75	1
Slovak Republic	Small	0.653	1	1	1	0.5
Slovenia	Small	0.490	0.75	1	1	0.25
Eswatini	Small	0.776	1	1	1	1
Seychelles	Small	0.898	1	1	1	1
Timor-Leste	Small	0.918	1	1	1	1
Trinidad and Tobago	Small	0.837	1	1	1	1
United States Virgin Islands	Small	0.612	1	1	0.5	1
Vanuatu	Small	1.000	1	1	1	1
United Arab Emirates	Medium	0.089	1	0	0.75	0.75
Austria	Medium	0.378	0.25	0.75	0.75	0.25
Azerbaijan	Medium	0.622	1	0.75	0.75	0.75
Burundi	Medium	1.000	1	1	1	1
Belgium	Medium	0.044	0.25	0	0.75	0
Benin	Medium	1.000	1	1	1	1
Burkina Faso	Medium	1.000	1	1	1	1
Bulgaria	Medium	0.600	1	1	0.75	0.5
Belarus	Medium	0.378	1	0	0.75	0.75
Botswana	Medium	0.911	1	1	1	1
Central African Republic	Medium	0.933	1	1	1	1
Switzerland	Medium	0.156	0	0.5	0.75	0.25
Congo	Medium	0.956	1	1	1	1
Cuba	Medium	1.000	1	1	1	1
Czech Republic	Medium	0.311	0.75	0.75	0.75	0
Dominican Republic	Medium	0.422	1	0.75	0.5	1

Ecuador	Medium	0.467	0.75	0.5	0.75	1
Finland	Medium	0.756	0.75	0.75	1	1
Gabon	Medium	0.756	1	0.75	0.75	1
Guinea	Medium	0.978	1	1	1	1
Greece	Medium	0.733	0.75	1	1	0.75
Guatemala	Medium	0.689	1	1	0.75	1
Honduras	Medium	0.533	1	0.75	0.75	1
Haiti	Medium	0.956	1	1	1	1
Hungary	Medium	0.600	1	1	1	0.5
Israel	Medium	0.022	0.5	0.5	0	0.75
Jordan	Medium	0.689	1	1	1	0.5
Kyrgyz Republic	Medium	0.622	1	1	0.5	1
Cambodia	Medium	0.978	1	1	1	1
Laos	Medium	1.000	1	1	1	1
Liberia	Medium	1.000	1	1	1	1
Libya	Medium	0.644	1	1	0.75	0.75
Sri Lanka	Medium	0.956	1	1	1	1
Mongolia	Medium	1.000	1	1	1	1
Mauritania	Medium	0.889	1	1	1	1
Malawi	Medium	1.000	1	1	1	1
Namibia	Medium	0.756	1	1	0.75	1
Nicaragua	Medium	0.956	1	1	1	1
Netherlands	Medium	0.222	0.5	0.5	0.75	0.25
Norway	Medium	0.667	0.25	0.75	1	1
New Zealand	Medium	0.956	0.75	1	1	1
Oman	Medium	0.178	1	0.25	0.25	1
Papua New Guinea	Medium	1.000	1	1	1	1
Portugal	Medium	0.200	0.5	0.5	0.75	0.5
Paraguay	Medium	0.600	1	1	0.75	0.75
Romania	Medium	0.311	0.75	0.75	0.75	0.5
Rwanda	Medium	1.000	1	1	1	1
Senegal	Medium	0.978	1	1	1	1
Sierra Leone	Medium	1.000	1	1	1	1
El Salvador	Medium	0.733	1	1	0.75	1
Serbia	Medium	0.356	0.75	0.5	0.75	0.25
South Sudan	Medium	0.978	1	1	1	1
Sweden	Medium	0.000	0.5	0	0.75	0.5
Syria	Medium	1.000	1	1	1	1

Togo	Medium	1.000	1	1	1	1
Tajikistan	Medium	0.933	1	1	1	1
Tunisia	Medium	0.800	1	1	1	0.75
Taiwan	Medium	0.756	1	1	1	1
Uruguay	Medium	0.956	0.75	1	1	1
Zimbabwe	Medium	1.000	1	1	1	1
Afghanistan	Large	0.962	1	0.75	1	1
Angola	Large	1.000	1	1	1	1
Argentina	Large	0.340	1	0.75	0	0.25
Australia	Large	0.849	0.75	1	1	1
Bangladesh	Large	0.943	1	0.75	1	1
Bolivia	Large	0.642	1	0.75	0.25	1
Brazil	Large	0.245	1	0.5	0	0.5
Canada	Large	0.623	0.75	0.5	1	0.75
Chile	Large	0.245	0.75	0	0.25	0.75
China	Large	0.792	0.75	1	1	1
Cote d'Ivoire	Large	1.000	1	1	1	1
Cameroon	Large	0.962	1	1	1	1
Democratic Republic of Congo	Large	1.000	1	1	1	1
Colombia	Large	0.377	1	0.75	0	0.5
Germany	Large	0.547	0.5	0.75	1	0.5
Algeria	Large	0.962	1	1	1	1
Egypt	Large	0.962	1	1	1	1
Spain	Large	0.170	0.25	0.5	0.5	0.25
Ethiopia	Large	1.000	1	1	1	1
France	Large	0.302	0.5	0.5	0.75	0
United Kingdom	Large	0.302	0.5	0.5	1	0.25
Ghana	Large	0.962	1	1	1	1
Indonesia	Large	0.981	1	1	1	1
India	Large	0.849	1	1	0.75	1
Iran	Large	0.604	0.5	0.75	0.75	0.75
Iraq	Large	0.642	1	0.75	0.5	0.75
Italy	Large	0.340	0	0.5	1	0
Japan	Large	0.962	1	1	1	1
Kazakhstan	Large	0.698	1	0.75	0.25	1
Kenya	Large	0.981	1	1	1	1
South Korea	Large	0.792	0.75	1	1	1
Morocco	Large	0.774	1	1	0.75	0.75

Madagascar	Large	0.981	1	1	1	1
Mexico	Large	0.717	1	0.75	0.75	1
Mali	Large	1.000	1	1	1	1
Myanmar	Large	0.981	1	1	1	1
Mozambique	Large	1.000	1	1	1	1
Malaysia	Large	0.868	1	1	1	1
Niger	Large	1.000	1	1	1	1
Nigeria	Large	1.000	1	1	1	1
Nepal	Large	0.830	1	1	1	0.75
Pakistan	Large	0.962	1	0.75	1	1
Peru	Large	0.226	1	0.25	0	0.75
Philippines	Large	0.925	1	1	0.75	1
Poland	Large	0.528	1	0.75	1	0
Russia	Large	0.547	1	0.5	0.75	0.5
Saudi Arabia	Large	0.679	1	0.5	0.75	1
Sudan	Large	1.000	1	1	1	1
Somalia	Large	1.000	1	1	1	1
Chad	Large	1.000	1	1	1	1
Thailand	Large	0.925	1	1	1	1
Turkey	Large	0.660	0.75	0.5	1	0.5
Tanzania	Large	1.000	1	1	1	1
Uganda	Large	1.000	1	1	1	1
Ukraine	Large	0.547	1	0.75	0.75	0.25
United States	Large	0.000	0.5	0.25	0	0
Uzbekistan	Large	0.943	1	1	1	1
Venezuela	Large	0.906	1	1	0.75	1
Vietnam	Large	0.981	1	1	1	1
Yemen	Large	1.000	1	1	1	1
South Africa	Large	0.623	1	0.75	0.25	1
Zambia	Large	0.981	1	1	1	1

eTable2. HCA scores and quarter scores for fatality.

Countries	Country Size	H.C.A.	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Aruba	Small	0.676	1	0.75	0.75	0.75
Albania	Small	0.408	1	0.75	0.75	0.5
Andorra	Small	0.324	1	0.25	0	0.75
Bahrain	Small	0.859	1	1	1	0.75
Bahamas	Small	0.239	1	0	0.25	0.5
Bosnia and Herzegovina	Small	0.282	1	0.25	0.75	0.25
Belize	Small	0.310	1	0	0.25	0.5
Bermuda	Small	0.141	1	0.25	0	0
Barbados	Small	0.211	1	0.25	0	0.25
Brunei	Small	0.592	1	1	0.75	0.5
Bhutan	Small	0.915	1	1	1	1
Comoros	Small	0.620	1	0.75	0.75	0.75
Cape Verde	Small	0.676	0.75	0.5	1	0.75
Costa Rica	Small	0.775	1	1	1	0.75
Cyprus	Small	0.676	1	1	0.75	0.75
Djibouti	Small	0.746	1	1	1	0.75
Dominica	Small	0.915	1	1	1	1
Denmark	Small	0.408	1	0.25	0.25	0.75
Eritrea	Small	0.915	1	1	1	1
Estonia	Small	0.507	1	0.75	0.75	0.75
Fiji	Small	0.380	1	1	0.5	0
Faeroe Islands	Small	0.915	1	1	1	1
Georgia	Small	0.718	1	1	1	0.75
Gambia	Small	0.183	0.25	0.5	0.75	0.25
Greenland	Small	0.915	1	1	1	1
Guam	Small	0.606	1	0.75	1	0.5
Guyana	Small	0.042	0	0	0.25	0.25
Hong Kong	Small	0.620	1	1	0.75	0.5
Croatia	Small	0.521	1	0.75	0.75	0.75
Ireland	Small	0.127	1	0.25	0	0.25
Iceland	Small	0.859	1	1	1	0.75
Jamaica	Small	0.577	1	0.75	1	0.5
Kuwait	Small	0.831	1	1	1	0.75
Lebanon	Small	0.648	1	0.75	1	0.75
Lesotho	Small	0.563	1	1	0.75	0.5
Lithuania	Small	0.493	1	0.75	0.25	0.75

Luxembourg	Small	0.648	1	0.75	0.75	0.75
Latvia	Small	0.577	1	1	0.75	0.75
Monaco	Small	0.592	1	0.75	0.75	0.75
Moldova	Small	0.408	1	0.75	0.75	0.5
Malta	Small	0.746	1	1	1	0.75
Mauritius	Small	0.423	1	0.75	0.75	0.5
Panama	Small	0.535	1	0.75	0.75	0.5
Puerto Rico	Small	0.197	1	0.25	0.25	0.5
Palestine	Small	0.803	1	1	1	0.75
Qatar	Small	0.915	1	1	1	1
Singapore	Small	0.915	1	1	1	1
Solomon Islands	Small	0.915	1	1	1	1
San Marino	Small	0.000	0.5	0	0	0
Suriname	Small	0.437	1	0	0.75	0.5
Slovak Republic	Small	0.746	1	1	1	0.75
Slovenia	Small	0.296	1	0.25	0	0.5
Eswatini	Small	0.606	1	1	0.75	0.5
Seychelles	Small	0.915	1	1	1	1
Timor-Leste	Small	0.915	1	1	1	1
Trinidad and Tobago	Small	0.380	1	0.25	0.25	0.5
United States Virgin Islands	Small	0.535	1	0.25	0.75	0.75
Vanuatu	Small	1.000	1	1	1	1
United Arab Emirates	Medium	1.000	1	1	1	1
Austria	Medium	0.694	1	0.75	0.75	0.75
Azerbaijan	Medium	0.806	0.75	1	0.75	0.75
Burundi	Medium	0.887	1	0.75	1	1
Belgium	Medium	0.000	0.75	0.25	0	0.25
Benin	Medium	0.790	1	1	0.75	0.75
Burkina Faso	Medium	0.387	0.75	0.75	0.5	0.5
Bulgaria	Medium	0.339	0.75	0.75	0.5	0.5
Belarus	Medium	0.952	1	1	1	0.75
Botswana	Medium	0.887	0.75	0.75	1	1
Central African Republic	Medium	0.839	1	1	0.75	0.75
Switzerland	Medium	0.452	1	0.75	0.5	0.75
Congo	Medium	0.629	1	0.75	0.75	0.75
Cuba	Medium	0.613	0.75	0.75	0.75	0.75
Czech Republic	Medium	0.726	1	0.75	0.75	0.75
Dominican Republic	Medium	0.661	0.75	0.75	0.75	0.75

Ecuador	Medium	0.097	0.75	0.75	0.25	0
Finland	Medium	0.532	1	0.75	0.5	0.75
Gabon	Medium	0.919	0	1	1	1
Guinea	Medium	0.984	1	1	1	1
Greece	Medium	0.468	0.75	0.75	0.75	0.5
Guatemala	Medium	0.403	0.25	0.75	0.5	0.5
Honduras	Medium	0.452	1	0.75	0.75	0.5
Haiti	Medium	0.565	1	0.75	0.75	0.5
Hungary	Medium	0.161	0.75	0.25	0	0.5
Israel	Medium	0.935	1	1	1	1
Jordan	Medium	0.935	1	1	1	0.75
Kyrgyz Republic	Medium	0.726	1	1	0.75	0.75
Cambodia	Medium	1.000	1	1	1	1
Laos	Medium	1.000	1	1	1	1
Liberia	Medium	0.161	1	0.5	0.25	0
Libya	Medium	0.710	1	0.75	0.75	0.75
Sri Lanka	Medium	1.000	1	1	1	1
Mongolia	Medium	1.000	1	1	1	1
Mauritania	Medium	0.500	0.75	0.5	0.75	0.5
Malawi	Medium	0.500	1	0.75	0.75	0.5
Namibia	Medium	0.952	1	1	1	0.75
Nicaragua	Medium	0.306	0.5	0	0.75	0.5
Netherlands	Medium	0.129	0.75	0.25	0	0.75
Norway	Medium	0.710	1	0.75	0.75	0.75
New Zealand	Medium	0.839	1	1	0.75	0.75
Oman	Medium	0.935	1	1	1	0.75
Papua New Guinea	Medium	0.887	1	1	1	0.75
Portugal	Medium	0.613	1	0.75	0.75	0.75
Paraguay	Medium	0.758	0.75	1	0.75	0.5
Romania	Medium	0.339	1	0.75	0.5	0.5
Rwanda	Medium	0.952	1	1	1	1
Senegal	Medium	0.758	1	1	0.75	0.5
Sierra Leone	Medium	0.468	1	0.75	0.5	0.5
El Salvador	Medium	0.565	1	1	0.75	0.5
Serbia	Medium	0.823	1	1	0.75	0.75
South Sudan	Medium	0.758	1	1	0.75	0.5
Sweden	Medium	0.113	0.75	0.25	0.25	0.25
Syria	Medium	0.290	0.75	0.75	0.5	0

Togo	Medium	0.613	1	0.75	0.75	0.5
Tajikistan	Medium	0.984	1	1	1	1
Tunisia	Medium	0.565	0.75	0.75	0.75	0.5
Taiwan	Medium	0.839	0.75	1	0.75	0.75
Uruguay	Medium	0.790	1	0.75	0.75	0.75
Zimbabwe	Medium	0.516	0	0.5	0.75	0.5
Afghanistan	Large	0.754	1	0.75	0.75	0.75
Angola	Large	0.585	0.75	0.5	0.75	0.75
Argentina	Large	0.785	0.75	0.75	1	0.75
Australia	Large	0.862	1	1	1	0.75
Bangladesh	Large	0.877	0.75	0.75	1	1
Bolivia	Large	0.569	1	0.75	0.75	0.5
Brazil	Large	0.646	1	0.5	0.75	0.75
Canada	Large	0.538	1	0.5	0.5	0.75
Chile	Large	0.846	1	1	1	0.75
China	Large	0.431	0.75	0.5	0.5	0.5
Cote d'Ivoire	Large	1.000	1	1	1	1
Cameroon	Large	0.892	1	0.75	1	1
Democratic Republic of Congo	Large	0.723	0.75	0.75	1	0.75
Colombia	Large	0.708	1	0.75	0.75	0.75
Germany	Large	0.738	1	0.75	0.75	1
Algeria	Large	0.523	0.75	0.25	0.75	0.75
Egypt	Large	0.508	0.75	0.75	0.5	0.5
Spain	Large	0.400	0.75	0.25	0.5	0.75
Ethiopia	Large	0.969	1	0.75	1	1
France	Large	0.277	0.75	0.25	0.25	0.75
United Kingdom	Large	0.292	0.75	0.25	0.25	0.75
Ghana	Large	0.985	0.75	1	1	1
Indonesia	Large	0.554	0.75	0.5	0.75	0.75
India	Large	0.908	1	0.75	1	1
Iran	Large	0.400	0.5	0.5	0.5	0.5
Iraq	Large	0.646	0.75	0.75	0.75	1
Italy	Large	0.215	0.75	0.25	0.25	0.5
Japan	Large	0.785	0.75	0.75	0.75	1
Kazakhstan	Large	1.000	1	1	1	1
Kenya	Large	0.892	1	0.75	1	1
South Korea	Large	0.954	1	0.75	1	1
Morocco	Large	0.862	0.75	0.75	1	1

Madagascar	Large	1.000	1	1	1	1
Mexico	Large	0.215	1	0.25	0.25	0.25
Mali	Large	0.631	1	0.5	0.75	0.75
Myanmar	Large	0.846	1	0.75	1	1
Mozambique	Large	1.000	1	1	1	1
Malaysia	Large	0.985	1	0.75	1	1
Niger	Large	0.523	0.75	0.5	0.5	0.5
Nigeria	Large	0.908	1	0.75	1	1
Nepal	Large	1.000	1	1	1	1
Pakistan	Large	0.938	1	0.75	1	1
Peru	Large	0.754	1	0.75	0.75	0.75
Philippines	Large	0.631	0	0.5	1	1
Poland	Large	0.754	1	0.75	0.75	1
Russia	Large	1.000	1	1	1	1
Saudi Arabia	Large	1.000	1	1	1	1
Sudan	Large	0.323	0.25	0.5	0.5	0.5
Somalia	Large	0.754	1	0.75	0.75	0.75
Chad	Large	0.492	1	0.5	0.5	0.5
Thailand	Large	0.938	1	0.75	1	1
Turkey	Large	0.846	1	0.75	1	1
Tanzania	Large	0.662	1	0.75	0.75	0.75
Uganda	Large	1.000	1	1	1	1
Ukraine	Large	0.862	0.75	0.75	1	1
United States	Large	0.677	0.75	0.5	0.75	1
Uzbekistan	Large	1.000	1	1	1	1
Venezuela	Large	0.954	1	0.75	1	1
Vietnam	Large	0.862	1	1	1	0.75
Yemen	Large	0.000	1	0	0	0
South Africa	Large	0.846	1	0.75	1	0.75
Zambia	Large	0.908	1	0.75	1	1

eTable3. Correlations between RAND and HCA scores.

Country Size		Overall	Demographic	Health Care	Public Health	Disease Dynamics	Political Domestic	Political International	Economic
Small	Cases	-0.45	-0.35	-0.54	-0.35	-0.22	-0.33	-0.34	-0.52
	Fatality	-0.12	-0.27	-0.13	0.04	0.10	-0.21	-0.33	-0.04
Medium	Cases	-0.66	-0.54	-0.63	-0.58	-0.34	-0.59	-0.47	-0.73
	Fatality	-0.15	-0.03	-0.13	-0.09	-0.09	-0.21	-0.34	-0.14
Large	Cases	-0.68	-0.58	-0.66	-0.58	-0.06	-0.63	-0.63	-0.70
	Fatality	-0.10	-0.08	-0.12	-0.05	-0.10	-0.09	-0.24	-0.17

eTable4. Correlations between WHO-JEE and HCA scores.

Country Size		Ready Score	Prevent	Detect	Respond	Other
Small	Cases	-0.64	-0.55	-0.63	-0.72	-0.54
	Fatality	0.05	0.06	0.17	0.06	-0.14
Medium	Cases	-0.69	-0.70	-0.62	-0.66	-0.69
	Fatality	-0.06	0.00	-0.05	-0.12	-0.07
Large	Cases	-0.69	-0.70	-0.62	-0.66	-0.69
	Fatality	-0.06	0.00	-0.05	-0.12	-0.07