Recurring columns in the following dataframes
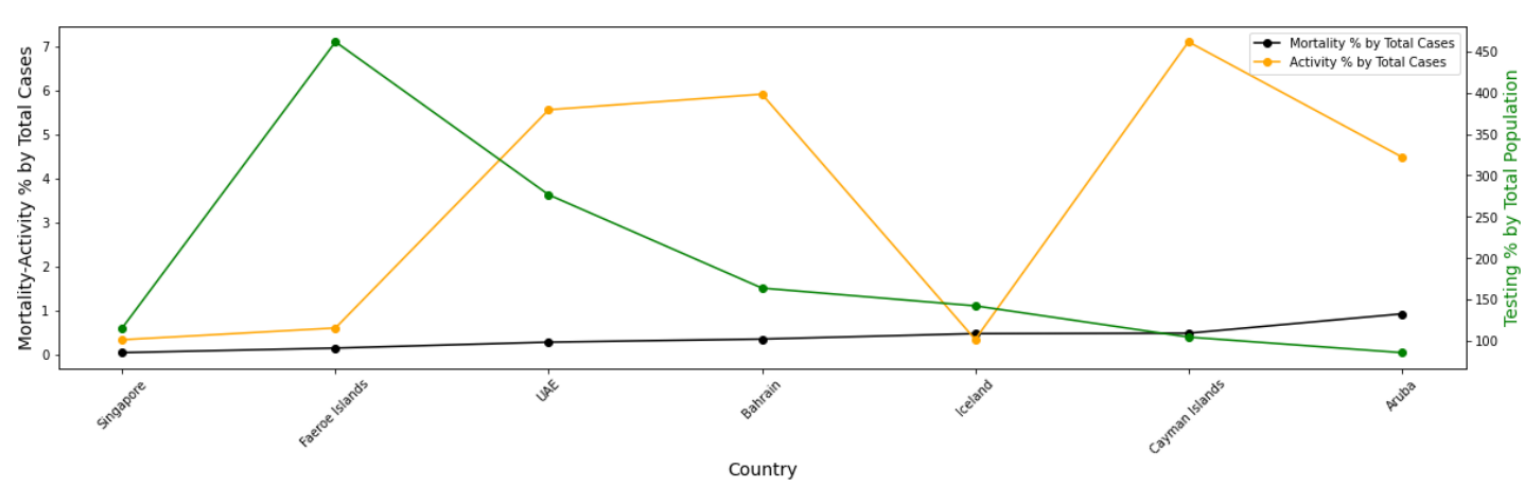
- **Total_cases:** Total number of cases in a given country as of today
- **Case_by_population%:** Derived by (Total number of Cases/Tota population) * 100
- **Death_by_case%:** Derived by (Total number of deaths as of today/Total number of Cases) * 100. Depicts death to infections proportion in percent.
- **Test_by_population%:** Derived by (Total number of tests as of today/Total population) * 100. Importtant to note that this could exceed 100% as this data is not recorded as 1 record per person, rather it is 1 record per test. So 1 person who has taken 10 tests = 10 tests, not 1.
- **Activity_by_case%:** Derived by (Active cases as of today/Total number of Cases) * 100. Depicts how much percent of overall cases is active today.
- **Recovery_by_pop%:** Derived by (Total recovered cases as of today/Total population) * 100
- **Recovery_by_case%:** Derived by (Total recovered cases as of today/Total number of Cases) * 100. Denotes the rate of covid recovery proportion to infections.

Top 7 countries that have gained control over the pandemic

	Countries	Total_cases	Death_by_case%	Case_by_pop%	Test_by_pop%	Active_by_case%	Recovery_by_pop%	Recovery_by_case%	Total_population
0	Singapore	59759	0.048528	1.016563	115.672275	0.341371	1.012599	99.610101	5878534
1	Faeroe Islands	657	0.152207	1.341446	461.359414	0.608828	1.331237	99.238965	48977
2	UAE	339667	0.286751	3.409131	276.585744	5.566040	3.209602	94.147209	9963447
3	Bahrain	109604	0.356739	6.309150	163.862498	5.919492	5.913173	93.723769	1737223
4	Iceland	6026	0.481248	1.758897	142.408808	0.348490	1.744303	99.170262	342601
5	Cayman Islands	408	0.490196	0.616370	104.652990	7.107843	0.569538	92.401961	66194
6	Aruba	7319	0.929089	6.837375	85.862823	4.495150	6.466500	94.575762	107044

- The above data is filtered by countries with date to case proportion percent below 1% and countries with over 70% testing rate and activity rate of below 9%
- Singapore is by far the best in exercising control over the pandemic despite the high population density of the country
- It is important to take testing as a condition as it shows the reliability of the data, meaning that without a good testing system, the records available are potentially only from serious cases or deaths

Top 11 Countries with highest share of Cases by Population

	Countries	Total_cases	Death_by_case%	Case_by_pop%	Test_by_pop%	Active_by_case%	Recovery_by_pop%	Total_population
0	Andorra	10312	1.027929	13.333161	232.849330	5.159038	12.508243	77341
1	Gibraltar	4190	1.980907	12.438771	498.474098	2.792363	11.845035	33685
2	Montenegro	66234	1.286348	10.544884	38.992223	12.016487	9.142116	628115
3	Czechia	1055415	1.671570	9.844242	62.674995	9.167863	8.777182	10721140
4	San Marino	3187	2.227800	9.380427	106.972774	7.216818	8.494481	33975
5	Slovenia	175795	2.085952	8.455288	40.438879	7.963821	7.605551	2079113
6	USA	27799946	1.725802	8.368739	98.489955	34.823654	5.310011	332187983
7	Luxembourg	52022	1.153358	8.229246	311.602126	4.938295	7.727949	632160
8	Portugal	770502	1.889288	7.569920	75.224378	16.595285	6.170653	10178469
9	Panama	328476	1.683837	7.540754	40.255119	7.700715	6.833088	4356010
10	Lithuania	187991	1.589438	6.965565	73.974475	22.708534	5.273074	2698862

- Andorra has the most significant share of population infected by Covid, making it the worst hit country in the whole world in terms of infections - see "Case_by_pop%"
- Given the the high proportion of Cases to its population, its Mortality to Total Cases proportion is still lower than median the median Mortality by Case which is around 1.6% - See "Death_by_case%"
- Also given the high proportion of Cases, the recovery suggests most of the population that has been infected, has also recovered, the rest of the 1% are either active cases or deaths - See "Recovery_by_population%"
- The average Testing by population percentage for all countries on this list is much higher than the global median of 18% potentially implying that countries with higher mortality demand for greater resources.
- Most of the countries on the list are also in Europe which could imply that the abundance of testing could be related to economic standing of the country

Top 11 Countries with lowest share of Cases by Population

	Countries	Total_cases	Death_by_case%	Case_by_pop%	Test_by_pop%	Active_by_case%	Recovery_by_pop%	Total_population
0	Vanuatu	1	NaN	0.000321	0.150891	0.000000	0.000321	311483
1	Laos	45	NaN	0.000613	1.458000	8.888889	0.000559	7339714
2	Tanzania	509	4.125737	0.000838	NaN	59.921415	0.000301	60759167
3	Micronesia	1	NaN	0.000864	NaN	0.000000	0.000864	115757
4	Samoa	2	NaN	0.001004	NaN	0.000000	0.001004	199219
5	Western Sahara	10	10.000000	0.001650	NaN	10.000000	0.001320	606208
6	Vietnam	2091	1.673840	0.002136	1.562902	27.546628	0.001512	97872490
7	Solomon Islands	18	NaN	0.002582	0.645571	22.222222	0.002008	697057
8	Cambodia	478	NaN	0.002835	2.514522	4.393305	0.002711	16859623
9	Taiwan	935	0.962567	0.003921	0.698838	7.807487	0.003578	23843157
10	Fiji	56	3.571429	0.006219	3.046282	0.000000	0.005997	900409

- With only 1 total case in the whole country, Vanuatu is the country with lowest share of Covid cases with virtually no deaths of course.
- All countries on this list also have low to no testing resources. Given the observation from the previous data, this can be attributed to the remoteness of these countries from manufacture units and low economic resources.
- We can see that population doesn't play a role in the spread as Vietnam and Tanzania are fairly populated countries that are witnessing low rates of infections.
- Tanzania, Western Sahara and Fiji see a fairly high percentage of mortality by cases with greater than median death to infection proportion. Could this be attributed to remoteness?

Top 15 Countries with highest share of Mortality by Infections

	Countries	Total_cases	Total_deaths	Death_by_case%	Case_by_pop%	Test_by_pop%	Active_by_case%	Recovery_by_pop%	Total_population
0	Yemen	2131	615	28.859690	0.007051	0.057585	4.129517	0.004725	30223299
1	Western Sahara	10	1	10.000000	0.001650	NaN	10.000000	0.001320	606208
2	Mexico	1946751	168432	8.651954	1.500295	3.806915	13.721323	1.164630	129757842
3	Sudan	27717	1835	6.620486	0.062330	NaN	13.818234	0.049591	44468017
4	Syria	14611	961	6.577236	0.082281	NaN	36.698378	0.046673	17757441
5	Ecuador	259783	15086	5.807154	1.458981	5.142362	9.353576	1.237789	17805785
6	Isle of Man	436	25	5.733945	0.511089	34.354340	1.146789	0.475923	85308
7	Egypt	170780	9751	5.709685	0.164998	0.966145	16.354960	0.128592	103504169
8	Montserrat	18	1	5.555556	0.360433	18.622347	22.222222	0.260312	4994
9	Bolivia	230731	10929	4.736685	1.960360	5.234367	21.163173	1.452630	11769828
10	Afghanistan	55420	2419	4.364850	0.140451	0.681035	8.783833	0.121984	39458475
11	Liberia	1956	84	4.294479	0.038132	1.307745	5.214724	0.034506	5129518
12	Bulgaria	226061	9482	4.194443	3.268534	21.409104	9.760640	2.812407	6916282
13	Mali	8192	339	4.138184	0.039763	0.708320	21.520996	0.029560	20602133
14	Tanzania	509	21	4.125737	0.000838	NaN	59.921415	0.000301	60759167

- Although some of the countries on the list aren't seeing a lot of cases, the number of deaths given the low infection rate, is significantly high.
- We can see that most of the countries on the list are under-developed or developing nations with a potential lack of resources to tackle the pandemic
- The above point can be supported by the fact that these countries have a well below median testing percentage of 18%
- Mali, Sudan and Liberia are among the top ten poverty ridden countries in the world according to UN index 2021
- European developed countries and independents such as Bulgaria, Montserrat and Isle of Man share, although not ideal, but above median testing percentages.

Top 15 Countries with lowest share of Mortality by Infections

	Countries	Total_cases	Total_deaths	Death_by_case%	Case_by_pop%	Test_by_pop%	Active_by_case%	Recovery_by_pop%	Total_population
0	Singapore	59747	29	0.048538	1.016380	115.674734	0.354830	1.012281	5878409
1	Mongolia	2174	2	0.091996	0.065673	35.958885	28.794848	0.046702	3310339
2	Bhutan	861	1	0.116144	0.110842	63.140109	0.696864	0.109941	776782
3	Faeroe Islands	657	1	0.152207	1.341473	460.521480	0.608828	1.331264	48976
4	Burundi	1730	3	0.173410	0.014293	0.743716	55.144509	0.006386	12103942
5	St. Barth	360	1	0.277778	3.638201	86.083881	31.111111	2.496210	9895
6	UAE	336142	956	0.284404	3.373862	274.784719	5.691940	3.172229	9963121
7	Eritrea	2401	7	0.291545	0.067137	0.662508	25.531029	0.049801	3576259
8	Maldives	17101	56	0.327466	3.130228	81.005751	12.999240	2.713072	546318
9	Thailand	23903	80	0.334686	0.034193	1.742130	20.537171	0.027056	69907131
10	Bahrain	108807	387	0.355676	6.263856	163.130944	5.634748	5.888625	1737061
11	Malaysia	251604	923	0.366846	0.771360	16.429592	20.741324	0.608540	32618241
12	Seychelles	1695	7	0.412979	1.716995	5.267476	29.085546	1.210507	98719
13	Réunion	10507	47	0.447321	1.168469	10.985742	6.576568	1.086397	899211
14	St. Vincent Grenadines	1340	6	0.447761	1.205524	28.894787	65.671642	0.408439	111155

- Majority of the above countries share a significantly higher than median testing rate
- Singapore, one of the world's wealthiest economies, has managed to keep the covid-19 deaths under control. Could this be attributed to availability of resources, experience from the SARS outbreak or regulatory strictness or a combination of all?
- Bahrain, despite a high rate of infections, has kept its mortality to cases rate significantly low. Its worth analyzing what their measures were to curb the dangers of the pandemic. Or could it just be due to demographics and age distribution?

Top 15 Countries with highest share of activity by Total infections

	Countries	Total_cases	Active_cases	Death_by_case%	Case_by_pop%	Test_by_pop%	Active_by_case%	Recovery_by_pop%	Total_population
0	Martinique	6553	6410	0.686708	1.747061	25.245876	97.817793	0.026127	375087
1	Cyprus	31959	29688	0.669608	2.635311	112.224731	92.894020	0.169618	1212722
2	Serbia	411855	376165	1.008607	4.725401	31.168257	91.334329	0.361827	8715768
3	France	3360235	3044371	2.385161	5.140970	71.877554	90.599943	0.360634	65361889
4	Belgium	728334	656835	2.948098	6.267691	74.601037	90.183213	0.430508	11620451
5	Ireland	204940	177824	1.830780	4.122406	64.738506	86.768810	0.469971	4971369
6	Guadeloupe	9351	6953	1.668271	2.336780	31.088098	74.355684	0.560267	400166
7	Mayotte	11447	8415	0.594042	4.135611	32.057762	73.512711	1.070844	276791
8	French Polynesia	18222	13245	0.740863	6.463994	9.349060	72.686862	1.717630	281900
9	Lesotho	9718	6669	2.130068	0.451452	2.443222	68.625232	0.132026	2152608
10	St. Vincent Grenadines	1340	880	0.447761	1.205524	28.894787	65.671642	0.408439	111155
11	Uganda	39883	25116	0.819898	0.085568	1.814150	62.974200	0.030981	46609475
12	Tanzania	509	305	4.125737	0.000838	NaN	59.921415	0.000301	60759167
13	Honduras	156606	90849	2.419448	1.566021	3.985790	58.011187	0.619664	10000251
14	Wallis and Futuna	9	5	NaN	0.080957	10.812269	55.555556	0.035981	11117

- The above are the countries who are facing their worst surge of cases now. Sort of like the late covid bloomers
- Martinique for example, has nearly 100% of its cases showing up only now, a year since the emergence of this global pandemic.
- Some of these countries like the European ones, have already had it quite bad since the start, however, they have only now reached the peak of 90% and above and witnessed their worst phase.

- Evidently, most of these countries have also put in place mass testing as a result of the surge
- Hence it is also possible that the recency of the emergence of testing resources completely biases the Activity information, meaning that the cases that couldn't be accounted for before are no accounted for, causing a bias in the Activitiy data. However, in the measurement of when a certain country has reached its covid peak, many other factors are considered that are not in the scope of this data.
- It is note worthy that some of these countries have a significantly low to no testing percentages and these countries are unfortunately rather in the poverty ridden spectrum of economies.

Top 15 Countries with lowest share of activity by Total infections

	Countries	Total_cases	Active_cases	Death_by_case%	Case_by_pop%	Test_by_pop%	Active_by_case%	Recovery_by_pop%	Total_population
0	Vanuatu	1	0	NaN	0.000321	0.150891	0.000000	0.000321	311483
1	Samoa	2	0	NaN	0.001004	NaN	0.000000	0.001004	199219
2	Marshall Islands	4	0	NaN	0.006730	NaN	0.000000	0.006730	59434
3	Greenland	30	0	NaN	0.052789	30.585958	0.000000	0.052789	56830
4	Fiji	56	0	3.571429	0.006219	3.046282	0.000000	0.005997	900409
5	Micronesia	1	0	NaN	0.000864	NaN	0.000000	0.000864	115757
6	Tajikistan	13308	0	0.676285	0.137662	NaN	0.000000	0.136731	9667186
7	Singapore	59747	212	0.048538	1.016380	115.674734	0.354830	1.012281	5878400
8	Iceland	6025	28	0.481328	1.758636	141.922678	0.464730	1.741599	342595
9	Faeroe Islands	657	4	0.152207	1.341473	460.521480	0.608828	1.331264	48976
10	Nepal	272349	1753	0.751609	0.924640	7.145325	0.643659	0.911739	29454586
11	Grenada	148	1	0.675676	0.131157	17.979121	0.675676	0.129384	112842
12	Saudi Arabia	370987	2515	1.727823	1.055646	36.269409	0.677921	1.030250	35143120
13	Bhutan	861	6	0.116144	0.110842	63.140109	0.696864	0.109941	776782
14	Djibouti	5959	42	1.057224	0.597855	11.104311	0.704816	0.587321	996730

- The spectrum of activity ranges from 0% to approximately 98%
- Activity percent is definitely a strong indicator of how well a country is tackling the novel virus. While many countries are at their peaks now, few others, such as the ones from this list are on their journey to recovery
- The first seven countries on this list have recovered with 0 cases running in the moment
- Singapore for instance, is only seeing about 200 active cases, which is only a near 0 fraction of the approximately 60,000 total cases that it has suffered
- While lowest on the mortality proportion, well above median on their testing proportion and near 0 on their activity to case proportion, Singapore might just be the country that has best handled the crisis, this is also considering the fact that it was among the first hit countries and has >1m population.
- Not considering the population and timeline of the Covid emergence, Faroe Islands has also curbed the novel virus relatively well and might deserve the runner up tag.
- With nearly 10 million in population, UAE and Bahrain can also be complimented for their efficacy in curbing the virus, although they still have around 5% case activity.

Top 10 Countries with highest share of Testing by Population

	Countries	Total_cases	Total_tests	Death_by_case%	Case_by_pop%	Test_by_pop%	Active_by_case%	Recovery_by_pop%	Total_population
0	Gibraltar	4190	167911	1.980907	12.438771	498.474098	2.792363	11.845035	33685
1	Faeroe Islands	657	225545	0.152207	1.341473	460.521480	0.608828	1.331264	48976
2	Luxembourg	52022	1969824	1.153358	8.229246	311.602126	4.938295	7.727949	632160
3	UAE	336142	27377134	0.284404	3.373862	274.784719	5.691940	3.172229	9963121
4	Bermuda	694	167587	1.729107	1.116887	269.705650	1.296830	1.083091	62137
5	Denmark	202887	14666045	1.111456	3.495235	252.659236	2.972591	3.352488	5804674
6	Andorra	10312	180088	1.027929	13.333161	232.849330	5.159038	12.508243	77341
7	Falkland Islands	53	6940	NaN	1.496752	195.989833	28.301887	1.073143	3541
8	Channel Islands	3939	335975	2.107134	2.252917	192.161405	10.129474	1.977236	174840
9	Bahrain	108807	2833684	0.355676	6.263856	163.130944	5.634748	5.888625	1737061
10	Malta	19182	642152	1.490981	4.337248	145.197191	12.543009	3.728559	442262

- All the countries on the list have well above 100% testing rates.
- How can the percent exceed the total population? The testing rate doesn't account for 1 record of test per person, meaning that if the same person gets tested twice or 10 or 100 times, it isn't recorded as 1 test for that person but 2, 10 or 100 respectively.
- It is still a reliable measure to depict the availability of testing resources
- Majority of the above countries have good economic standing to be able to pursue/establish great number of testing resources. However, some of them like Andorra, Gibraltar, Luxembourg etc. have also seen an overwhelming surge of the virus through the year, potentially requiring them to seek desperate measures such as mass testing and they have the resources to do so.

Top 10 Countries with lowest share of Testing by Population

	Countries	Total_cases	Total_tests	Death_by_case%	Case_by_pop%	Test_by_pop%	Active_by_case%	Recovery_by_pop%	Total_population
0	Yemen	2131	17404	28.859690	0.007051	0.057585	4.129517	0.004725	30223299
1	Vanuatu	1	470	NaN	0.000321	0.150891	0.000000	0.000321	311483
2	Niger	4643	76283	3.596812	0.018773	0.308440	10.208917	0.016182	24731865
3	Madagascar	19360	114282	1.472107	0.068846	0.406399	3.021694	0.065752	28120614
4	Haiti	11969	49333	2.055310	0.104195	0.429464	21.271618	0.079890	11487111
5	Papua New Guinea	900	43728	1.000000	0.009945	0.483197	5.000000	0.009348	9049734
6	Angola	20163	176910	2.370679	0.060222	0.528388	5.267073	0.055622	33481109
7	Cameroon	31394	149000	1.509843	0.116512	0.552982	4.519972	0.109487	26944833
8	Solomon Islands	18	4500	NaN	0.002582	0.645571	22.222222	0.002008	697057
9	Eritrea	2401	23693	0.291545	0.067137	0.662508	25.531029	0.049801	3576259
10	Macao	48	4369	NaN	0.007331	0.667311	4.166667	0.007026	654717

- Also with the highest covid related mortality, surpassing its runner up by nearly 20%, Yemen has also not been able to put together resources to aid its population. This could potentially be due to the poverty that it experiences, alongside being a critical point in the war zone, deviating focus from the pandemic.
- Vanuatu, whilst the supposed country with the least number of cases, the data can be considered completely faulty due its lack of testing resources.
- It is surprising to see Macao on the list as its neighboring Hong Kong has a well above median testing percentage of 94% and tends to rank quite close to Hong Kong in per capita economic standing as well. However, they seem to not need testing resources as many others since, like Vanuatu, they haven't seen covid related deaths.

Note: *There isn't any mention of recovery through this study as it is possible that the data is faulty and only considering recovery of admitted patients and not of all those who tested positive. It is uncertain whether the records of non-critical covid patients is automatically updated to a "recovered" status after 2 weeks in all countries, causing potential errors in analysis*

Statistics for main numeric columns

	Case_by_pop%	Recovery_by_pop%	Test_by_pop%	Active_by_case%	Death_by_case%
min	0.000321	0.000301	0.057581	0.000000	0.048528
max	13.384880	12.583235	505.103162	97.817793	28.879512
median	1.052622	0.603693	17.978962	9.473941	1.680672
mean	2.105880	1.631270	40.786759	16.807139	2.094922

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  'median': 28050.0,
  'mean': 497919.32}}
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- The minimum, maximum, median and mean statistics for important numeric columns
- The analysis in this study only considers median for most columns instead of mean
- Median can be a better averaging statistic to look at in very skewed data as in most of the columns in this dataset

In Summary

- There seems to be high correlation between testing rates and economic standing of countries
- There is also high correlation between testing rates and total case percentage
- Testing rate is an important measure although not recorded in the form of 1 record per person, leading to above 100% sometimes, high testing rates is a good indicator of resource availability and it is safe to say that countries with low to no testing don't show accurate infection rate like perhaps in the case of Vanuatu.
- Countries with low activity rates, given high testing are on their journey to recovering from the pandemic, such as Singapore, Faroe islands etc.
- For certain countries, like Yemen, despite their low levels of infection for now, it may be tougher than for most to be able to provide with care for badly hit covid patients due to not just lack of resources but also due to being at critical war points.
- Recovery data may not necessarily be up to date as many countries do not automatically update the status of their uncritical or mild covid patients to "recovered" in two weeks thus meaning that a lot of the data, especially for countries with lack of testing, is solely about recovery of critical patients.
- An additional column with data about vaccination and economy of the country may give a much narrower perspective on the standing of countries in the journeys to recovery from the pandemic.
- The above analysis includes 215 countries and their data and excludes China and New Zealand