Covid-19

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Corona Pandemic- One size does not fit all

"Blessed are the Meek, for They Will Inherit the Earth" (Matthew 5:5).

Corona virus -COVID-19- started its journey in an industrial city of China sometimes in late 2019. Within a short span of 3 to 4 months it has enveloped the entire earth with its foot print, thus qualifying it to be designated as a pandemic attack by a tiny microorganism that can multiply only when it can find a human cell as a host , a springboard for jumping to its next victim. It is said that a virus is agnostic about the socio-economic profiles of its victims; it does not care as to what economic strata as person belongs, to what god a person kneels. At the same time credible evidence is there that age, sex and existing conditions do have a bearing on the survival probability of a corona infected person. For example, a study[1] of 6839 corona deaths in New York City shows that 72.3% of them belonged to the age group 65 and above, 75% had underlying conditions like Diabetes, Lung Disease, Cancer, Immunodeficiency, Heart Disease etc. 62% of the victims were males. In another study of 44,000 cases from China, deaths were at least five times more common among confirmed cases with diabetes, high blood pressure or heart or breathing problems[2].

So, there are factors that create an enabling conditions for COVID-19 to thrive and kill its victims. But rate of incidence of corona cases and consequent deaths also varies between countries. One Indian internal medicine expert has stated why incidence of corona is relatively low in India. He has identified 3 factors for a virus' spread — the "agent or the virus itself, the host and the environment". According to him India's relatively higher temperature and humidity slows down the march of the virus[3].

It has also been reported that a US government study has also confirmed the role of ambient temperature and humidity in killing the virus on surfaces and air[4].

Even after controlling all the above noted factors there is cultural a dimension that also determines how the virus would affect a given society. David Kelvin, a Canadian microbiologist has pointed out that the practice of Italians greeting "each other with an embrace and kisses" increases the probability pf passing the virus "on a more dangerous dose of COVID-19."[5]

Religious faith also sometimes determines a society's willingness to accept scientific approach to handling of any epidemic disease. For example, only 72.2% of children aged 19 to 35 months in the United States were fully vaccinated in 2015[6].

A major global survey published in June 2019, covering 140,000 people aged 15 and older in more than 140 countries found people in higher-income countries were among the least confident in vaccine safety — particularly in North America and Europe. Meanwhile, vaccine trust was highest in countries where preventable diseases still spread, such as Bangladesh and Rwanda.[7]

The above brief review of various plausible determining factors for country wide variations in incidence of corona virus and subsequent death provides a possible direction to further research that would help

countries to identify deficiencies in their health infrastructure and attitudinal bottlenecks of the people at large to contain and minimize the effect of a virus like corona , in current time as well as in future. Pending that it may not be irrelevant to look at available data that provides some clues to the factor that are driving the variations in country wise impact of corona virus. Our aim is to carry out a descriptive statistical analysis without trying to build any model for conducting statistical hypothesis.

Data and Study Variables: For this article we have used data that are available in public domain and put out by multilateral organizations like World Bank, World Health Organization., Worldometer and Pew Research Centre. Main data on COVID-19 is collected from Worldometer, a reference website. Pew Research Centre brought out a report in October 2017 analyzing religious change and its impact on societies around the world. Covering 199 countries and territories around the world, the study identified countries which favor a specific religion either as an official government sponsored religion or by according a special status to one specific religion over all other faiths. Income data is taken from World Bank website. Expenditure on health data is taken from WHO website. (the further details are available in a table given at the end).

Intensity of infection of a virus can be estimated by the number of virus afflicted persons with symptoms. But a corona infected person may not show any symptom for several days, extending up to 14 days. These pre-symptomatic cases cannot be detected unless a country either carries out a random tests of enough size or for all citizen or at least of all persons in selected age groups. It is also possible that many persons with COVID-19 symptoms remain un-documented because many covid-19 infected persons with mild symptoms recover without hospitalization. So, the number of cases reported by a country may also depend on the number of tests carried out by that country. However, we consider the number of reported cases as the primary variable of study. To account for the effect of population size we have taken normalized variables- that is cases/tests/deaths per million of population.

Regarding health infrastructure we have considered the “government expenditure on health as percentage of government expenditure / GDP” as the discriminating variable across countries. To convert this numerical variable to a categorical variable, we have divided countries into 4 groups based on their percentile ranks; 4 groups based on 25 percentile, Median, 75% and maximum amount. The corresponding groups are named as Lower, Lower Middle, Upper Middle and High spenders.

Regarding “Religious Status” variable, every country is put into one of the three categories- (1) Having official State Religion, (2) Having a preferred religion, (3) No official religion. Countries which have declared atheism as official doctrine, we have designated “Capitalist Communism” as its state religion. China, Vietnam. Incidentally, Russia has a preferred state religion- Christianity.

Analysis:

Country Coverage: This study is based on 123 countries having a total population of 7.2 billion as on 2019. The latest US Census Bureau estimates world population at 7.58 billion as on June 2019, a coverage of 95% of world population[8]

Income Group: The total number of cases of these countries was 2,32,37,82 or around 2.3 million. If we had included cases of all countries which have reported COVID-19 cases, this number would have been 2.33 million. So, analysis that follows would be representative of the world scenario. Top ten countries

in terms of number of cases accounted for 1.8 million cases, that is 78.26 percent of total cases covered. The income group wise profile of COVID-19 and its proximate determinants is given in the table below.

Table 1: Income Group-wise COVID-19 Cases, Deaths and Tests

Income Group	% of Population	%of Total Cases	% of Total Deaths	% of Total Tests@	Average Number of cases per million of population	Average Number of deaths per million	Average Number of Tests per million@	Death rate per identified cases (%)
High	16.3	79.5	87.2	71.2	1703	99	21097	5.8
Upper Middle	37.1	17.7	11.1	22.4	257	9	3542	3.5
Lower Middle	40.1	2.6	1.6	6.3	95	2	1375	2.1
Lower	6.5	0.2	0.1	0.1	15	1	206	6.7
Total	100%	100%	100%	100%	776	44	10367	5.7

@China has not reported total number of tests.

Table 2: Income Group -wise Determining Factors

Income Group	Share of Age Group 65 and above in Total Population (%)	Average Share of Public Expenditure on Health as % Govt Expenditure	Average Share of Public Expenditure on Health as % GDP	Definition of Income Group in Terms Gross National Income in US$
High	15.33	9.6	3.8	Greater than 12055
Upper Middle	9.71	8.0	2.4	3896-12055
Lower Middle	6.10	5.7	1.5	996-3895
Lower	2.88	6.4	1.4	Less than or equal to 995
Total	10.47	8.0	2.7	

The descriptive details of various measures of incidence of COVID-19 across income groups and its covariates given above leads to one conclusion – the richer countries with higher proportion of older people are more likely to fall prey to COVID-19 and once infected most likely to die also. The best possible health infrastructure does not provide any protection against these silent and invisible killer.

A sharper picture emerges if one looks at the top ten countries in terms of incidence of COVID-19. The following table gives the relevant details.

Table 3: Top Ten Countries in terms of Number of Cases

Sr. No	Country	Cases per million	Deaths per million	No of Tests per million	Death as % cases	Per Capita Income relative to world average	Govt. Expenditure on Health as % of Total Govt Expenditure	Govt. Expenditure on Health as % of GDP	Share of persons above 65 in Total Population
1	USA	2232	118	11245	5.3	3.50	17.92	6.80	15.4
2	Spain	4158	441	19896	10.6	2.28	14.56	5.97	19.4
3	Italy	2910	384	21598	13.2	2.39	13.39	6.52	23.0
4	France	2325	296	7103	12.7	2.58	9.06	5.11	19.7
5	Germany	1715	54	20629	3.1	3.07	3.64	1.60	21.5
6	UK	1682	228	6783	13.6	2.63	18.74	7.65	18.5
7	China	57	3	Not available	5.3	0.98	4.65	1.50	10.6
8	Turkey	976	22	7101	2.3	1.64	4.79	1.62	8.2
9	Iran	963	60	3931	6.2	1.22	20.94	4.05	5.4
10	Belgium	3208	471	12597	14.7	2.89	7.55	3.94	18.6

One obvious outlier in this group most affected countries is Germany. Despite having a high share of older people and a moderate level of public expenditure on health it could achieve much better performance in containing death rate of affected persons. The fact that Germany conducted tests of relatively larger number of persons may not be a good explanation because Spain and Italy also have tested a similar proportion of its people. So, the cultural dimension of a geography may provide some clues. This aspect of COVID-19 cases is dealt latter in this write-up.

Health Infrastructure:

The quality of health infrastructure of a country is positively correlated with the government allocation of resources for this purpose. Many physical indicators like number of doctors per million people etc. would depend more on government initiative than on private one. To establish the relationship between quality of health infrastructure and other COVID-19 related measures we have converted two numerical indicators of Government health expenditure into qualitative measures based on their percentile ranks. The resulting 4 quality levels are based on quartiles. These 4 levels in ascending order are Low, Lower Middle, Upper Middle, High. The tables below are expected to provide some clues about the importance this factor in determining the intensity of COVIS-19 in different countries.

Table 4 : Percentage Distribution of Total COVID-19 Cases and Total Population of Countries

by Income Group and Govt. Exp on Health

Income Group	Health Expenditure as % Govt. Expenditure	Share in Total Cases	Share in Death	Share in Population	Remark
High	4th Quartile	59.4%	65.4%	10.7%	
High	3rd Quartile	9.6%	15.7%	1.8%	
High	2nd Quartile	2.8%	2.8%	0.7%	
High	1st Quartile	7.6%	3.4%	3.10%	
Upper Middle	4th Quartile	4.4%	3.44%	4.2%	
Upper Middle	3rd Quartile	2.8%	1.92%	4.5%	
Upper Middle	2nd Quartile	6.2%	2.45%	7.2%	
Upper Middle	1st Quartile	4.4%	3.30%	21.2%	China is included here
Lower Middle	4th Quartile	0.0%	0.0%	0.1%	
Lower Middle	3rd Quartile	0.3%	0.1%	1.7%	
Lower Middle	2nd Quartile	1.0%	0.8%	9.8%	
Lower Middle	1st Quartile	1.4%	0.6%	28.4%	India is included here
Lower	4th Quartile	0.0%	0.00%	0.4%	
Lower	3rd Quartile	0.1%	0.05%	1.6%	
Lower	2nd Quartile	0.0%	0.00%	1.8%	
Lower	1st Quartile	0.1%	0.04%	2.6%	

It is obvious that, the countries in highest income bracket with high rate of government expenditure on health suffered disproportionately more due to COVID-18 pandemic. This group of countries accounting for 10.7 percent of the world population recorded 65.4% of death due to COVID-19. Both China and India, two countries that account for near about 40% of world population and both spending relatively much less than their peer countries in their respective income groups account for only 4 % of the share of cases and 3 % of total deaths. In China, a plausible reason for this could be that the government at a early stage could segregate the district where the virus first struck. In India, demographic profile of the population as well as peoples' inherent immunity due to their constant exposure to highly un-hygienic living conditions could be one factor. I believe people intuitively understand this- the fact that migrant workers are risking their lives to go out of their metropolitan workplaces to remote villages without any worthwhile medical facilities only corroborates what our data is showing above. It is the rich who should be more scared of COVID-19 than the poor.

Age Structure:

Table 5: Distribution (% share) of **Total Cases**

by Income Group and Grouping of Countries by their share of people with age 65 and above

Income group	Share (%) of Age Group 65 and above in Total Population of a Country				
	4th Quartile (above 16.5)	3rd Quartile (between 8.5 and 16.5)	2nd Quartile (between 4.6 and 8.6)	1st Quartile (less than 4.6)	Total
High	43.6	34.8	0.0	1.1	79.5
Upper Middle	0.6	5.8	11.1	0.1	17.6
Lowe Middle	0.0	0.4	1.7	0.6	2.7
Lower	0.0	0.0	0.0	0.2	0.2
Total	44.2	41.0	12.8	2.0	100.0

Table 6: Distribution (% share) of **Total Deaths**

by Income Group and Grouping of Countries by their share of people with age 65 and above

Income group	Share (%) of Age Group 65 and above in Total Deaths due to COVID-19 of a Country				
	4th Quartile (above 16.5)	3rd Quartile (between 8.5 and 16.5)	2nd Quartile (between 4.6 and 8.6)	1st Quartile (less than 4.6)	Total
High	62.0	25.1	0.0	0.1	87.2
Upper Middle	0.4	3.3	7.4	0.0	11.1
Lowe Middle	0.0	0.1	1.3	0.2	1.6
Lower	0.0	0.0	0.0	0.1	0.1
Total	62.4	28.5	8.7	0.4	100.0

Table 7 : For comparison purpose we give below the **distribution of population** by the above two attributes

Income group	Share (%) of Age Group 65 and above in Total Population of a Country				
	4th Quartile (above 16.5)	3rd Quartile (between 8.5 and 16.5)	2nd Quartile (between 4.6 and 8.6)	1st Quartile (less than 4.6)	Total
High	9.1	6.4	0.0	0.8	16.3
Upper Middle	0.5	24.3	11.6	0.7	37.1
Lowe Middle	0.0	1.0	31.2	7.9	40.1
Lower	0.0	0.0	0.0	6.5	6.5
Total	9.6	31.7	42.8	15.9	100

The following chain of hypothesis emerges from the data presented above:

a) the prosperity results in longer life span of people of high-income countries

b) better health infrastructure increases survival probabilities of older people with heightened co-morbidities
c) when a new virus like COVID-19 emerges on the horizon, these are the people who are most likely to succumb to the new killer.
d) in the low-income countries with rickety health infrastructure expected life span is shorter
e) high child mortality and un-hygienic environment of living for the poor masses create a built-in capability to survive in a hostile environment.

Blessed are the poor for whom poverty is an enabling condition that better prepares them to face the vagaries of nature; otherwise they would have died young. Cursed are the rich who are shielded by their wealth from various known morbidities but make them ill-prepared to face an unknown one.

Societal Culture

Wikipedia defines culture as "an umbrella term which encompasses the social behavior and norms found in human societies, as well as the knowledge, beliefs, arts, laws, customs, capabilities, and habits of the individuals in these groups" [9]. As mentioned above forms of greeting a person through hugging vs handshake vs bowing reflects "culture" of a group of persons. Religious beliefs or faiths provide the overarching framework of culture of most of the countries, even in 21st century. Such beliefs do matter in the mundane task combating a pandemic. In many Islamic Societies, women cannot go out without wearing burqa or hijab, a kind of mask. Wearing mask or covering face with simple clothes has been made mandatory in many countries reeling under COVID-19. So, women are much better protected in a conservative Islamic society. An obvious testable hypothesis would be that women to men infection ratio would be much less in an Islamic country that a non-Islamic one.

Religion could be another major factor in determining the intensity COVID-19 infection in social groups opposed to vaccination. Many low-income or lower-middle income countries have implemented universal immunization policy. But in many developed countries it is legally permitted by parents to deny vaccination to their children invoking religious sanction against vaccination. For example, in USA, 45 states and Washington D.C. have allowed religious exemptions for people who have religious objections to immunizations. 15 states now allow philosophical exemptions for those who object to immunizations because of personal, moral or other beliefs. The Wellcome Trust survey cited above found that some of the world's top anti-vaccine countries are in Europe. In France 1 in 3 persons disagreed that vaccine is safe. Till a few years back many Catholics were opposed to vaccination because "genetic source material made to develop most vaccines come from aborted fetuses". It may be noted that more than 80% of Italian citizens were Catholics. In Spain around 68% are roman Catholics.

Thus, religion can be considered another factor that may affect the progress of COVID-19 in any country. When a state declares a religion as a state religion or a preferred religion, the world view of that religion would guide, direct and probably compel any citizen to be incompliance with the edicts of that religion. The following table may not confirm or reject, prima facie, the role of religion in creating a relatively smooth passage of the onward march of COVID-19 across the globe, but it should ignite a more structured examination of the issue. We may point out here that countries which have Christianity as an official religion belong to either High or Upper-Middle Income group. The shares of countries in these two income groups among all countries with Christianity as declared religion are respectively 41.4% and 50.3% respectively. So, there is confounding effect between these two factors, namely income status

and religious status. It is neither attempted nor possible to disentangle the impact of these two factors on intensity of COVID-19 spread in different countries[10, 11].

Table 8: Distribution of Countries by Religion and effect of COVID-19

Official State/ Official Preferred Religion	Percentage of Population	Percentage of Covid-19 Cases	Percentage of Covid-19 Deaths
Buddhism	1.28	0.02	0.01
Capitalist Communism	21.36	3.57	2.88
Christianity	8.08	25.84	38.78
Islam	12.84	9.27	5.16
Judaism	0.12	0.57	0.10
Multiple	3.92	0.58	0.43
None	52.40	60.15	52.64
Grand Total	100.00	100.00	100.00

Note: Capitalist Communism is taken as state religion for China and Vietnam as atheism(or rather no organized religion) is declared as state policy.

The table above clearly points out that if you are a citizen of a country with high per capita income, have Christianity as State religion you have a higher risk of getting infected by COVID-19 , even though you are living in a country with best possible health care infrastructure. One caveat is due here. It has been reported that incidence of COVID-19 among poor African Americans are much higher as compared to US average. More data will be needed to address such intra-country issues.

Concluding Observations:

Governments across the world have reacted to the COVID-19 pandemic in a way that reminds me of what Bertrand Russel famously said- "Collective fear stimulates herd instinct, and tends to produce ferocity toward those who are not regarded as members of the herd"[12]. Only one solution – that is Lockdown and Social Distancing – has been offered by our medical experts and their political bosses without any effort to calibrate its implementation with due regard to social differentiation in terms of prosperity, access to habitable shelter, presence of co-morbidities. A government which in normal times cannot organize delivery of adequate nutrition to millions of children is taking upon itself to feed hundreds of thousands of migrant wage laborer because they were not allowed to return to their home villages. The irony of such policies is that while migrants would have financed their own journey if they could proceed to their home before imposition of Lockdown, now they will have to be provided with shelter and food at government's cost.

This essay has ben written to highlight the fact that COVID-19 does not affect all countries and even all social groups within a country equally. Of late, politicians across democracies are taking help of Data Science to understand voter's behavior - who is more likely to vote in their favors and who are on fence etc. The electoral strategy is based on such data analysis. But we are yet to see any country that has used Data Science to calibrate its response to COVID-19. For example, in India there are many large industries which are in a relatively segregated place. Most of its workers are residents in the campus. Irrespective of the goods produced there, it is madness to impose complete Lockdown in such places. Many University campuses are also far away from large habitations. It should be possible to work out

modalities of functioning of such campuses with appropriate precautionary measures. These are only few examples.

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Table: Sources of Data

Data	Source	Coverage	Internet
Coronavirus cases, Deaths, Tests	Worldometers	128 countries which had reported more than 100 cases till 17th April 2020	from https://www.worldometers.info/coronavirus/ accessed on 19th April.
Classification of countries by Income Group	World Bank	123 countries out of 128 noted above, for which full data available.	https://datahelpdesk.worldbank.org/knowledgebase/articles/906519
Expenditure on Health as % GDP	World Health Organization	As above	https://apps.who.int/nha/database
State Religion	Pew Research Centre	As above	https://assets.pewresearch.org/wp-content/uploads/sites/11/2017/09/29162845/Appendix-A.pdf

Age structure of Population	World Bank /Wikipedia	As above	https://en.wikipedia.org/wiki/List_of_countries_by_age_structure
World Population as on June 2019	World Population Review		