OPEN ACCESS
Freely Available Online

JOURNAL OF CURRENT VIRUSES AND TREATMENT METHODOLOGIES

ISSN NO: 2691-8862

Review

DOI: 10.14302/issn.2691-8862.jvat-20-3306

Using Human Development Indices to Identify Indicators to Monitor the Corona Virus Pandemic

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Abstract

Introduction: The Corona virus (CoVID-19) pandemic has hit the most developed countries and has thence spread to inflict other countries around the world. It is the first pandemic that appears in countries not linked to poverty and poor hygiene.

Aim: To study the relationship between human development and the pattern of the pandemic caused by the CoVID-19 and to identify development indicators that can be useful in monitoring the pandemic.

Methods: Data collected included confirmed cases of CoVID-19 by country, number of cases that recovered and cases that died and population density per million in this particular country. The data for this information was obtained from the online data on the daily reports on CoVID-19 from the different countries. Data for the Human Development index (HDI) and the ranking for each country were obtained from the most recent United Nations Development of Populations (UNDP) report for 2019. We analyzed data for 166 countries for which the HDI was available for the date of cases reported online on 27th March, 2020 at midnight.

Findings: There were significant differences by ANOVA for the confirmed cases of CoVID19 cases and total cases per one million population between the countries in the 4 tier group of Human Development. HDI was significantly correlated with confirmed cases, case density and cases that died from CoVID-19 (P<0.01) for all countries but the significance decreased by tier group. Country ranking was inversely correlated with confirmed cases of CoVID-19 (r-0.25 at P=0.001), CoVID-19 cases per million (r-0.4 at P=0.000) and cases that died from CoVID-19 (r-0.2 at P=0.03). Recovery was not inked to HDI or country ranking. The upper HDI tier groups (very high, high and medium) showed significant correlations with total cases per one million population P<0.05, but no correlation was found with confirmed cases or cases that died or recovered from CoVID-19 P>0.05.

Conclusions: Total cases of CoVID-19 per one million population seems to be a better indicator of the pandemic. The pattern of spread is closely linked to industry.

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Keywords: Corona virus, pandemic, human development, technology, internet, industry, carbon emissions

Editor: Deepak Kumar Semwal, Department of Phytochemistry, Faculty of Biomedical Sciences

Received: Apr 06, 2020 **Accepted:** Apr 10, 2020 **Published:** Apr 17, 2020

Introduction

The Human Development Index (HDI) is a statistic composite index of life expectancy, education, and per capita income indicators, which rank countries in four tiers of human development. It was originally set to minimize inequality and improve the lives of the underdeveloped and to be used as a benchmark for countries to achieve better standards of living. HDI has shown impressive improvement over the past decades as reflected by the dramatic improvements in life expectancy at birth, driven largely by sharp declines in infant mortality rates [1,2].

Sustainable development goals (SDGs) are closely linked with HDI but are used differently. While HDI is a philosophy for or a lens that overlooks development; SDGs are globally agreed tools for assessing development. SDGs comprise 17 goals, 169 targets and 232 indicators which nations seek separately according to their priority but should integrate them to complement and strengthen one another. In this sense many countries have chosen to prioritize technology and industry as means for progressing towards development, while lagging behind in other developmental indices thereby remaining in the lower tier of HDI. A classic example is the use of internet and mobile technology [3].

The recent advent of the pandemic of the Corona virus (CoVID-19) which has manifested after the emergence of Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) and Middle East Respiratory Syndrome Coronavirus (MERS-CoV), has resulted in devastating effects on the economy and health of almost every country in the world [4,5]. Research indicates that bats are the main evolutionary reservoirs and ecological drivers of corona virus diversity [6].

In order to enhance sustainability and development, it is necessary to reduce the carbon intensity of human well-being (CIWB). Technology spillovers can increase CIWB; while economic development has positive effect on CIWB, invasive technology and industry has negative effect on CIWB [7]. Therefore it is necessary to balance ecological and environmental concerns with human well-being and economic development, which is the pathway to sustainable development [8].

The hypothesis of this study is based on the bizarre nature of the pandemic of the CoVID-19 which is possibly linked to the advent of aggressive technologies. The aim of this study is to analyze the current situation of the CoVID-19 pandemic in relation to the human development index and ranking of the countries with regards development and to identify development indicators that can be useful in monitoring the pandemic.

Methods

Data collected included confirmed cases of CoVID-19 by country, number of cases that recovered and cases that died and population density per million in this particular country. The data for this information was obtained from the online data on the daily reports on CoVID-19 from the different countries (worldmeters.info).

Data for the Human Development index (HDI) and the ranking for each country were obtained from the most recent United Nations Development of Populations (UNDP) report for 2019. We analyzed data for 166 countries for which the HDI was available for the date of cases reported online on 27th March, 2020 at midnight.

The data was compiled in excel sheets and countries were classified according to their tier into the four groups of HDI.

Group I: Very high human development: HDI >0.80 (included 61 countries)

Group II: High human development: HDI 0.799 – 0.70 (included 49 countries)

Group III: Medium human development: HDI 0.698 – 0.55 (included 31 countries)

Group IV: Low human development: HDI <0.549 (includes 25 countries)

Statistical Analysis

The data was analyzed using the SSPS 20 IBM software. Descriptive analysis was used to present means and standard deviations. Correlative studies were done between the CoVID-19 confirmed cases, recovered and deaths with the HDI and ranking of countries.

Findings

The mean for the confirmed cases of CoVID-19 was significantly higher in very high HDI group (5905.1±15357.5 CoVID-19 cases) and the high HDI countries (2534.7±12222 CoVID-19 cases) compared to the medium HDI countries (104.2±231.7 CoVID-19 cases) and low HD countries (26.0±38.1 CoVID-19 cases) at P=0.045. Total cases per one million population was significantly higher in very high HDI group (138.7±381.5 CoVID-19 cases) and the high HDI countries (349.5±570.9 CoVID-19 cases) compared to the medium HDI countries (31.7±55.9) and low HD countries (1.8±2.9 CoVID-19 cases) at P=0.000. However there were no significant differences between the recovered cases and cases that died between the different HD tiers as shown in Table (1).

There were significant correlations between the confirmed cases of CoVID-19 and HDI for all countries (r0.3 at P=0.002), (Table 2). However there were no significant correlations between HDI and confirmed cases in the very high HDI countries, high HDI, medium and low HDI countries (r0.2, r0.01, r0.05, 0.01 at P>0.05) as shown in tables 3, 4, 5 and 6 respectively.

There were also significant correlations between the CoVID-19 cases per one million population for the country and HDI for all countries (r0.4 at P=0.000), (Table 2); and for very high HDI countries (r0.3 at P=0.01), high HDI countries (r0.4 at P=0.002), and medium HDI countries (r0.4 at P=0.04) but not for low HDI countries (P>0.05) as shown in tables 3, 4, 5 and 6 respectively. The significance decreased by HDI tier of country.

There were significant correlations between cases that died from CoVID-19 and HDI of all countries (r0.2 at P=0.01) but no significant correlations between cases that recovered from CoVID-19 for all the countries. However by HDI tier group of countries there were no significant correlations between HDI and cases that died or recovered from CoVID-19 P>0.05 as shown in tables 3, 4, 5 and 6.

There were also significant inverse correlations between country ranking and confirmed cases of CoVID-19 in all the countries (r-0.25 at P=0.001) and CoVID-19 cases per million (r-0.4 at P=0.000) and cases that died from CoVID-19 r-0.2 at P=0.03) as shown in table (2). However by HDI tier group of countries there were no significant correlations between country ranking and cases that died or recovered from CoVID-19 P>0.05 as shown in tables 3, 4, 5 and 6.

Discussion

This study shows that the main burden of the CoVID-19 started in countries of Central Asia and Europe rather than Africa and Latin America. The Corona virus evolution shows that this virus has shown predilection to Africa and Asia that have shared viral sequence clusters. When analyzed by region, host switching (inter-genus transmission) remained dominant in Africa and Asia, but not in Latin America. Despite fewer host-switching events in Latin America, there was a concomitant increase in virus sharing (intra-genus transmission). This suggests that viruses are still switching hosts in Latin America but preferentially move between closely related species, while in Africa and Asia viruses cross between more distantly related species. Season was also significant, with samples collected during the dry season more likely to test positive in Africa and Asia than those collected during the wet season. Age class appears to be important, as sub-adults were more likely to test positive than adults in Africa and Asia. Sex was not related to the Corona virus positivity in Asia or Latin America while males were slightly more likely to be Corona virus positive in Africa [6].

The highest burden of cases was demonstrated in the very high and high human development countries rather than medium and low human development countries. Hence it is not linked with poor hygiene or sanitation as infectious pandemics in the past. Despite the extended pandemic for close to a year in countries that are in the very high and high human development tier yet there are still no commercial vaccines available against the viruses. Multiple vaccine candidates targeting the S protein, which is responsible for viral entry, have been developed, including subunit vaccines, but none are effective [9, 10].

There was a strong positive correlation between cases per million population and all the four groups of HDI tiers and inversely with ranking in all the groups. The pattern of CoVID-19 infectivity is influenced by population density and the higher the population density the higher the cases affected. Urban areas with high population densities are more affected by CoVID-19 infestation than rural areas. Despite the precautionary

Table 1. Comparison of the Human Development groups regarding confirmed COVID-19 cases, total cases by one million population in country, recovered cases and cases that died of CoVID-19 around the world (27th March, 2020)

Human Development (HD)	HD Index	Country Rank	Confirmed CoVID-19	CoVID-19 cases per one million	Recovered CoVID-19 cases	CoVID-19 cases died
Mean for all countries (166)	0.7327 ±.14	87.97 ±53.3	2941.7 ±11633.0	138.7±381.5	713.6 ±5880.9	133.1 ±737.5
Very High HD (61)	0.88 ±.05	30.9 ±17.9	5905.1 ±15357.5	349.5±570.9	544.9 ±1732.2	264.7 ±1099.9
High HD (49)	0.7 ±0.03	87.9 ±15.7	2534.7 ±12222.0	31.7±55.9	1734.2 ±10651.2	119.6 ±561.0
Medium HD (31)	0.62 ±.04	134.5 ±10.9	104.2±231.7	3.3±3.79	6.7 ±15.7	2.29 ±5.6
Low HD (25)	0.49 ±0.05	169.6 ±10.8	26.0±38.1	1.8±2.9	1.0 ±2.6	0.40 ±1.4
F-ratio	540.8	583.5	2.734	11.201	0.676	1.537
P-value (significance)	0.000	0.000	0.045	.000	0.57	0.207

One way ANOVA test (cut off of significance at <0.05)

Table 2. Correlations between Human Development index and country rank in all countries with confirmed CoVID-19 cases, and their outcome on the 27th of March 2020

All countries		Confirmed CoVID -19 cases	CoVID-19 cases per one million	Recovered CoVID -19 cases	CoVID-19 cases died
HDI	Pearson Correlation	r0.3**	r0.4**	r0.1	r0.2*
	Sig. (2-tailed)	0.002	0.000	0.5	.040
Country Ranking	Pearson Correlation	r-0.25**	-0.4**	r-0.1	r-0.2*
	Sig. (2-tailed)	0.001	0.000	0.5	0.03

*Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).

Table 3. Correlation of Human Development index and country rank in the Very High Human Development countries with confirmed COVID-19 cases, and their outcome on the 27th of March 2020

Very High Human Development countries		Confirmed CoVID-19 cases	CoVID-19 cases per one million	Recovered CoVID-19 cases	CoVID-19 cases died
HDI	Pearson Correlation	r0.2	r0.3*	r0.2	r0.087
	Sig. (2-tailed)	0.1	0.01	0.2	0.506
Country Ranking	Pearson Correlation	r-0.2	r-0.3*	r-0.2	r-0.079
	Sig. (2-tailed)	0.07	0.01	0.2	0.546

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4. Correlation of Human Development index and country rank in the High Human Development countries with confirmed COVID-19 cases, and their outcome on the 27th of March 2020

High Human Development countries (#)		Confirmed CoVID-19 cases	CoVID-19 cases per one million population	Recovered CoVID-19 cases	CoVID-19 cases died
Human Development Index (49)	Pearson Correlation	r0.13	r0.4**	r0.1	r0.2
	Sig. (2-tailed)	0.4	0.002	0.6	0.3
Ranking (49)	Pearson Correlation	r-0.1	r-0.4**	r-0.1	r-0.140
	Sig. (2-tailed)	0.490	0.005	0.7	0.3

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table 5. Correlation of Human Development index and country rank in the Medium Human Development countries with confirmed COVID-19 cases, and their outcome on the 27th of March 2020

Medium Human Development countries		Confirmed CoVID-19 cases	CoVID-19 cases per one million	Recovered CoVID-19 cases	CoVID-19 cases died
Human Development Index (31)	Pearson Correlation	r-0.05	r0.4*	r0.3	r0.25
	Sig. (2-tailed)	0.772	0.04	.066	0.178
Ranking (31)	Pearson Correlation	r0.09	r-0.35	r-0.286	r-0.211
	Sig. (2-tailed)	0.6	0.055	0.12	0.26

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 6. Correlation of Human Development index and country rank in the Low Human Development countries with confirmed COVID-19 cases, and their outcome on the 27th of March 2020

Low Human Development countries		Confirmed CoVID-19 cases	CoVID-19 cases per one million	Recovered CoVID-19 cases	CoVID-19 cases died
Human Development Index (25)	Pearson Correlation	r0.1	r0.07	r-0.04	r-0.173
	Sig. (2-tailed)	0.7	0.7	0.85	0.407
Ranking (25)	Pearson Correlation	r-0.03	r0.02	r0.09	r0.201
	Sig. (2-tailed)	0.9	0.9	0.7	0.3

Correlation is significant <0.05 level (2-tailed).

measures to reduce population groups and intensify hygiene as a measure to reduce infectivity, the virus is spreading more in countries that apply such measures than in countries that are not stringent in applying such measures. Although strict hygiene is very important to limit spread, yet it seems that a synergistic factor in addition to poor hygiene may be influencing the pattern of spread.

Moreover the study shows that the highest density of CoVID-19 confirmed cases and total cases per million populations was in the countries with the higher tier of HDI. The accumulated findings possibly indicate that technology and industry may play a role in the pattern of spread of this unique virus, that seems to be breeding or clustering on technology by products. The development of manufacturing leads to an increase in the consumption of carbon-intensive fuels which has a negative effect on carbon intensity human well-being (CIWB) [11, 12, 13]. Also there is a positive relation between energy consumption and carbon dioxide emissions [7]. Therefore, the development of manufacturing increases carbon dioxide emissions. Hence, a possible explanation for the negative effect of manufacturing on CIWB is that the positive effect of manufacturing on human well-being is overweighed by its negative effect of carbon dioxide emission [7]. The extent to which this influences the pandemic is unclear, but it is clear that the pandemic prefers urbanized and overpopulated cities.

Scientific progress and technological innovation—from the wheel to the microchip—have driven improvements in living standards throughout history. Technological change will likely continue to be the fundamental driver of prosperity, pushing increases in productivity and hopefully enabling a transition to more sustainable patterns of production and consumption [14]. Reducing the CIWB is one of the important strategies for greater sustainability. It is important to identify socioeconomic conditions that might reduce the carbon intensity of human well-being. However, inequality can influence the balance of power and it is debatable that initiatives to curb carbon emissions will succeed since the higher tier economies are mostly those whose interests oppose climate action.

Technology innovation and spillovers are indicated by research and development (R& D) intensity and interregional R&D spillovers respectively. Through empirical analysis, increasing R&D intensity and interregional R&D spillovers can decrease the carbon intensity of human well-being [15]. It is found that R&D intensity has a nonlinear effect on the carbon intensity of human well-being without the consideration of interregional R&D spillovers. In addition, empirical results reveal that economic development has a positive effect on the carbon intensity of human well-being, while manufacturing has an opposite effect on the carbon intensity of human well-being. The use of clean energy technology has a promising effect on improving the wellbeing of communities but spillover of this technology may take some time [15].

Another competing technology that is evident in the highly developed countries is the deployment of high frequency networks and compatible devices. Worldwide internet users have increased steeply over the past decades to reach 4.13 bn in 2019. In developing countries access to technology is one half that of developed countries. The UNDP reports in 2019 [16] that 67 mobile phone subscriptions per 100 inhabitants are present in developing countries and is one half the high human development countries. With regards access to broadband, low human development countries have less than 1 subscription per 100 inhabitants, compared with 28 per 100 inhabitants in very high human development countries [16].

A study found that the bat coronavirus shared 96% of its genetic material with the virus that causes COVID-19 [17]. Bats have specialized structures for emitting echolocation calls or ultrasonic waves at 20-100 kilohertz, a frequency too high pitched for humans to hear. They use these waves to detect the size, range, position, speed and direction of a prey's flight, the waves come back to them and they can attack the prey. They live in colonies and thereby are prone to epidemics [18]. Many of the highly developed countries have installed mobile networks of 5G in many of their cities over the past year. The growth started from May 2019. These included China, South Korea, The United States of America, Japan, Germany, United Kingdom, France, Canada, Russia and Singapore. Nordic countries have also adopted these networks. Italy, Spain, Iran and Israel followed with a steep rise in deployment of mobile cell towers and compatible devices for 5G. China was the first country that installed it in over 30 cities in 2019, this was followed by the United States of America reaching 293 million subscribers in 2019. Each country has at least three major companies that control these networks. Some countries like the US adopted a Fast Plan to allow the rapid spread of this technology.

The pattern of distribution of confirmed cases in various countries has been shown to be in cities where the density cell towers that transmit the signals to the mobiles should correlate with the population density in the area. For example London has four primary mobile network operators (MNOs) and each MNO provides a separate cell Tower network to cover the country [19]. It is expected that mobile cell towers would increase with the increase in the size of the population Workday population for London local authority district correlated highly with the mobile cell towers at 0.86 and less with residential population but the correlation was high for both over the entire country. There are over 1,400,000 cell towers of which around 61% of them have been updated. The correlation increased at transport routes as mobile cell towers increased in such sites [19]. Many countries have multiple mobile network operators that compete to provide maximum coverage of the population in concern.

The link between ultrasonic waves and the CoVID-19 is not clear and there is no evidence to support such findings except the circumstantial evidence. Unlike all pandemics of viruses that hit poor communities living in bad conditions where bad hygiene or invasion by rodents are incriminated, this virus is hitting mostly countries of the upper tier and having a high HDI, except for China which does not have a high HDI but was the innovator for this new technology and was able to export it worldwide before being hit itself by the virus. The corona virus originated from bats and carries the gene of bats and is thereby possibly making the mobile cell towers its place for breeding similar to how bats choose their commode. Using planes that can constantly disinfect these towers may be considered a bizarre alternative, but the idea is to find a means for neutralizing the virus activity or changing their design so that they are not affected by climate change and high humidity. Whatever the intervention, its experimentation would be worthwhile considering the economic and human crises the world is facing. The advent of satellite orbiting cell towers that can reach phones, upgraded to become "satellite phones" is the world emerging technology for the future.

Social media chats claimed that a conspiracy that incriminates 5G mobile internet is the culprit behind the virus. The authors to this claim support their hypothesis that several cities in China where using the 5G and that one city "Wuhan" was where the CoVID-19 had started. However the evidence that links this technology with CoVID-19 is not yet proven, except that its high plasticity and links to SARS and MERS and origination from bats which use similar means of communication, deserve to be investigated [20, 21, 22, 23]. Mobile phone uses non ionizing radiation unlike X-rays and gamma rays that are ionizing radiation and have a much higher frequency that could be hazardous. On the other hand, cities with highest density of population and have highest density of cell towers are those that have the highest density of confirmed CoVID-19 cases and deaths as in the case of most of the European countries. These perplexing findings make CoVID-19 appear a victim of a technology that has caused it to mutate into a highly contagious virus. This calls for global move to advocate for technology that is friendly to the environment. Beating this pandemic may probably require a microbiologists and virologists to seek technological interventions that can act as antidotes to counter the spread of this pandemic [24].

Conclusions

Development is closely linked to CoVID-19 pandemic. HDI seemed to be an effective marker for measuring the degree of progress or improvement in the pandemic. While total cases per one million population was a more sensitive indicator for monitoring the pandemic. Monitoring the pandemic spread will be important for early identification and early intervention in countries and regions across the globe and early detection of changes in the pattern of spread of the disease [25].

The race to achieve technological lead and advantage has become so massive, intense and aggressive. These high tech industrial titans have taken it for granted that the world accepts that any high tech product is not without hazards and that this can be handled with some written precautions to please opposition. Marketing for new innovative technology products needs to be preceded by sufficient testing to prove their safety for use by the human race. The CoVID-19 pandemic is the tip of the iceberg and is a typical example of the uncontrolled behavior of technology drivers. Efforts to curb the speed of industry and technology, by introducing regulations and ceilings in order to make the world a safer place for life to continue and to flourish in development, is necessary. The study clearly shows that the pandemic the world is facing is a breed of reckless technology that needs to be curbed and regulated.

Disclosures

None

Abbreviations

HDI: human development index

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