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Factors Affecting Covid Virus Disease -2019(Covid-19) Based On the Cases From Different Countries

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ABSTRACT
The novel coronavirus (COVID-19) that was first reported at the end of 2019 has impacted almost every aspect of life as we know it[1]. After claiming nearly five hundred thousand lives globally, the COVID-19 pandemic is showing no signs of slowing down. While the UK, USA, Brazil and parts of Asia are bracing themselves for the third wave, second wave—or the extension of the first wave—it is imperative to identify the primary social, economic, environmental, demographic, ethnic, cultural and health factors contributing towards COVID-19 infection and mortality numbers to facilitate mitigation and control measures[2].

KEYWORDS: Age, COVID – 19,Enviromental factors, Genetics,Lifestyle changes ,Population density, Vaccination

I. INTRODUCTION

The novel coronavirus (COVID-19) was widely reported to have first been detected in Wuhan(Hebei province, China) in December 2019. After the initial outbreak, COVID-19 continuedto spread to all provinces in China and very quickly spread to other countries within and outsideof Asia[3].

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, has passed the first peak in the majority of countries in the world. Scientists, health officials and citizens have tried to anticipate and explain why the epidemic initially (i.e., before novel interventions) unfolded differently among countries; now we have the relevant data with sufficient global reach and temporal length to conduct statistical analyses. Existing studies that examine some of the factors that may contribute to differences among countries together are generally applied to metrics such as mortality, daily and cumulative case numbers, or effective reproduction number . These metrics are time varying and sensitive to reporting and testing differences, and are therefore not easily comparable across countries. For instance, decreasing testing would allow the reported cases to drop, making raw case reporting incomparable across countries. Our goal is to use a diverse and comprehensive set of demographic, social, and environmental-climatic factors to begin explaining differences in the initial dynamics of COVID-19 across countries[4].

II. DIFFERENT FACTORS

2.1 ENVIRONMENTAL FACTORS

Currently, due to the prevalence of COVID-19 in most parts of the world, one of the primary concerns is the relationship between environmental factors such as rising summer temperatures and the rapid prevalence of coronavirus . One study observed the relationship between the numbers of positive daily SARS-CoV-2 cases with three environmental factors: maximum relative humidity, maximum temperature, and maximum wind speed in four cities in China and five cities in Italy. In this study, the relationship between the prevalence of the COVID-19 with maximum air humidity and wind speed was negligible and statistically not significant. Although, in most cases, with increasing humidity and wind speed, the prevalence has decreased. The association between COVID-19 prevalence and maximum ambient temperature was negligible to moderate. Also, with increasing temperature in most of the studied cities, the prevalence of the disease has decreased . The study by Chin et al. reported the resistance of the SARS-CoV-2 at 4 °C for a long time, but at 70 °C, its resistance was 5 min. In general, heat, high or low pH, and sunlight make it easier to kill the coronavirus . However, the results of a study also showed that the virus is stable at different pHs of 3–10, at room temperature . A new study of 24,139 positive SARS-CoV-2 cases was conducted in 26 regions in China. Its results show

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that with a 1 °C increase of the minimum ambient air temperature, the cumulative number of cases decreases by 0.86%[5].

Relative humidity (RH) affects all infectious droplets with respiratory viruses, independent of their source (respiratory tract or aerosolized from any fluid) and location (in the air or settled on surfaces). RH, therefore, affects all transmission routes but has the most pronounced effect on airborne transmission.Indoor humidity measurement in New York and the Midwest showed a vapor pressure of below 10 mb or indoor RH of below 24% in winter, a value that favours the stability of winter viruses .It is postulated that the low humidity and high temperature environment would promote the viability of SARS-CoV-2 in the droplets and impaired ciliary clearance and innate immune defense, for robust access to the deep lung tissue and rapid transmission between infected Individuals .The known case-fatality data for COVID-19 in the European countries (mainly Mediterranean), which have four seasons per year, show a high case fatality in Italy, Spain, France, and Greece. On the other hand, the Nordic countries, where the winter season is more extensive (up to 8 months of rain and snow) have shown a fatality rate of less than 1%[6].

2.2 CLIMATIC CHANGES

Climate was also considered as another environmental factor. It was initially thought that the virus is a sensitive RNA virus that is vulnerable to heat, and it will not cause a similar picture of the disease in warm countries as it does in cold ones. First cases of COVID-19 were identified in November–December 2019, pointing to the role of lower temperatures in the transmission of the virus. At the beginning of the pandemic, about 0.6% mortality rates were reported for Latin America. This was attributed to geographic/climatic cause, since these countries are located in the tropical zone. The increased temperature is thought to reduce the transmission of COVID-19 for a certain degree[7].Climate change can both facilitate zoonotic spillovers and have an effect on transmission chains. On the direct side, climate can facilitatea pathogen's survival, development and be integrated in pandemic forecasting models. However, it is unlikely that in thiscontext climate will have a critical role inmassively promoting the appearance ofnew spillover events. On the indirect side,instead, the effects of climate are much wider and far more complex[8].

2.3 GENETICS

Morbidity and mortality due to COVID19 rise dramatically with age and co-existing health conditions, including cancer and cardiovascular diseases. Human genetic factors may contribute to the extremely high transmissibility of SARS-CoV-2 and to the relentlessly progressive disease observed in a small but significant proportion of infected individuals, but these factors are largely unknown. In this study, we investigated genetic susceptibility to COVID-19 by examining DNA polymorphisms in *ACE2* and *TMPRSS2* (two key host factors of SARS-CoV-2) from ~81,000 human genomes. We found unique genetic susceptibility across different populations in *ACE2* and *TMPRSS2*. Specifically, *ACE2* polymorphisms were found to be associated with cardiovascular and pulmonary conditions by altering the angiotensinogen-ACE2 interactions, such as p.Arg514Gly in the African/African-American population. Unique but prevalent polymorphisms (including p.Val160Met (rs12329760), an expression quantitative trait locus (eQTL)) in *TMPRSS2*, offer potential explanations for differential genetic susceptibility to COVID-19 as well as for risk factors, including those with cancer and the high-risk group of male patients

These observations beg the question of how much of the variation in COVID-19 disease severity may be explained by genetic susceptibility. Human genetic factors may contribute to the extremely high transmissibility of SARS-CoV-2 and to the relentlessly progressive disease observed in a small but significant proportion of infected individuals; yet, these factors are largely unknown. Development of new preventive and/or therapeutic strategies for COVID-19 will be greatly facilitated by systematic identification of host genetic pathways and DNA polymorphisms (variants) which modulate the risk of infection and severe illness, including the overexuberant immune response to the virus that often portends a poor outcome[9].

2.4 LIFESTYLE CHANGES

From the perspective of prevention, a healthy lifestyle is crucial . Lifestyle has been defined diversely and comprehensively in research and is still being studied. According to Park (2019), lifestyle can be classified according to people's life patterns, and can be defined as a complex concept that involves a person's consciousness of life, values, and character . Drinking, smoking, exercise, nutrition, and stress are also elements of lifestyle according to the WHO's definition of the term . Previous studies have highlighted the importance of healthy lifestyles as

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they are crucial in maintaining and improving physical and mental health and improving the quality of life .Previous research linking COVID-19 and lifestyle patterns illustrated that an individual's lifestyle is a crucial factor for preventing infectious diseases .

However, most research has been conducted on lifestyle changes for certain age groups, and the number of studies on lifestyle for all age groups is insufficient . To prepare for future problems with infectious diseases or pandemics, it is necessary to conduct a comparative analysis before and after infectious diseases break out and take suitable measures. Additionally, among studies related to infectious diseases, there is insufficient research on the changes in lifestyles of people before and after COVID-19, and there are few studies on how infectious diseases affect lifestyles, mental health, and quality of life. Therefore, this study summarizes these factors using basic data[10].

COVID-19 is a global burden which continues to redefine daily lifestyle-related habits in a significant manner as the pandemic progresses through its different phases. Public health recommendations and government measures taken to abate infection have indirectly impacted food availability, dietary quality, normal daily activities, access to recreational public settings, social activities, work and financial security . These factors compound over time to radically change lifestyle-related behaviours, especially daily eating, activity and sleep behaviours that are known to be independent risk factors for metabolic complications such as obesity, diabetes and cardiovascular disorders[11].

2.5 POPULATION DENSITY

One would think that the rate of spread will be proportional to the density of population. This was not the case with SARS-CoV-2, as we can see some of the world's heavily populated spots (e.g., Gaza strip, Egypt, India, Bangladesh, Indonesia) with lower than expected cases. One would argue that these countries were not first hit by the disease and had time to prepare. Clearly, after a while, they are still underprepared, and people are not displaying high regard to protective etiquettes, such as social distancing, and wearing masks. Within this context, it is interesting to see that two countries with similar population counts have shown different fatality rates. Sweden and Jordan are two countries with an approximately similar population of 10 million; however, Jordan is more densely populated than Sweden with the latter being five times the area of Jordan. However, Sweden had 10 times the fatality rate in Jordan. It was noticed that despite the higher density of population in Jordan, Sweden had adopted more lax procedures than Jordan in combating the spread of COVID-19. This may be one of the factors that contributed to the wide variability in disease outcomes between both countries[6].

Our previous study conducted with data from Japan suggested that the population density, which is somewhat indicative of social distancing, was more significant than the meteorological factors. The effect of population density on the morbidity rate was also discussed in a case study of Iran. These studies suggested that several cofactors introduce uncertainty. When discussing the effects of policies, a multi-city analysis representing different countries may be imperative. In multi-country analyses, the number of conducted tests may add uncertainty because this number depends on medical resources and regional policies. The residents living in areas with high population density, such as big or metropolitan cities have a higher probability to come into close contact with others and consequently any contagious disease is expected to spread rapidly in dense areas[12].

Since coronavirus (SARS-COV-2) transmits via human contact the common perception is that Covid-19 spread rapidly in dense areas whereas the probability of getting infected is low in areas with low population density. However, after analyzing Covid-19 infection and death rates of 913 urban counties in the United States a recent investigation by researchers at the Johns Hopkins Bloomberg School of Public Health claims that the infection rate is not linked with population density whereas death rate is inversely related to population density except for metropolitan areas where higher infection and higher mortality rates have been noted. The inverse mortality relation with density has been attributed by the authors on the availability of better healthcare systems at higher density locations. A very recent study by the researchers from the London school of economics and IZA – Institute of Labor Economics, based on urban Covid-19 cases in the US concluded that the timing of the outbreak depends on population density with denser regions led an early breakout but both Covid-19 infection and death rates are unrelated with urban population density .

India is a large country with a total population of more than 1.3 billion. It has diverse demographic features. On the other hand as of 10th September 2020, India is the second maximum Covid-19 affected country by the total number of

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infected people after the USA. The Covid-19 pandemic situation in India thus allows us to cross-check the recent findings on the impact of population density on Covid-19 spread and related mortality.

In India, a major part of total infections and mortality have, at least apparently, been attributed to metropolitan cities such as Mumbai, Delhi, Bangalore, Ahmedabad, Chennai, and Kolkata. The infection and death rates appear to be much lower at remote districts. However, because of the large population of the metropolitan cities, the total infections and mortality are normally higher in those places. Moreover, a strong presence of media lead reporting the Covid-19 cases in metropolitan cities in greater detail which might give a false impression that only these cities are dominantly contributing Covid-19 infection and related death.Our findings suggest that till 10th September 2020 Covid-19 infections and mortality in India are moderately correlated with population density; on the average both the infected and the death cases are higher for large population density[13]

2.6 AGE AND SEX

Early reports from China showed that COVID-19 affected elderly more with those older than 60 years being the most vulnerable to this infection . Reports from China and Italy suggested high mortality rates, due to COVID-19 in older male patients who had multiple metabolic comorbidities .The influence of sex is evident, since more men are affected by the infection. Studies suggest that there are many differences between men and women in the immune response to COVID-19 infection and inflammatory diseases. Women, compared to men, are less susceptible to viral infections based on a different innate immunity, steroid hormones and factors related to sex chromosomes. Testosterone is immunosuppressive in nature, in contrast to the immune-enhancing hormone, estrogen . The presence of two X chromosomes in women enhances the immune system even if one is inactive. The immune regulatory genes encoded by X chromosome in female sex causes lower viral load levels, and less inflammation when compared to male, while a number of CD4 + T cells is higher with improved immune response. In addition, women generally produce higher levels of antibodies which remain in the circulation longer . In Iceland, women and children less than 10 years were found to be less susceptible to COVID-19 infection [6].

2.7 VACCINATION

The COVID-19 pandemic is expected to continue to impose enormous burdens of morbidity and mortality while severely disrupting societies and economies worldwide. Governments must be ready to ensure large-scale, equitable access and distribution of a COVID-19 vaccine if and when a safe and effective one becomes available. This will require sufficient health system capacity, as well as strategies to enhance trust in and acceptance of the vaccine and those who deliver it[14].

The spread of SARS-CoV-2, the causative agent of COVID-19, has resulted in an unprecedented global public health and economic crisis. The outbreak was declared a pandemic by the World Health Organization on 11 March 2020, and development of COVID-19 vaccines has been a major undertaking in fighting the disease. As of December 2020, many candidate vaccines have been shown to be safe and effective at generating an immune response, with interim analysis of phase III trials suggesting efficacies as high as 95%. At least two vaccine candidates have been authorized for emergency use in the USA, the UK, the European Unionand elsewhere, with more candidates expected to follow soon. For these COVID-19 vaccines to be successful, they need to be not only be proven safe and efficacious, but also widely accepted[15].

Vaccination, along with sanitation and clean drinking water, are public health interventions that are undeniably responsible for improved health outcomes globally. It is estimated that vaccines have prevented 6 million deaths from vaccine-preventable diseases annually .By 2055, the earth's population is estimated to reach almost 10 billion , a feat that in part is due to effective vaccines that prevent disease and prolong life expectancy across all continents. That said, there is still much to be done to ensure the financing, provision, distribution, and administration of vaccines to all populations, in particular those which are difficult to reach, including those skeptical about their protective value and those living in civil disruption[16].

III. CONCLUSION

There are many population characteristics that influence greatly the infection outcomes, namely: Age, sex, genetic makeup, social lifestyle factors, population density, and numbers of elderly care facilities. Machine learning is emerging as an important tool to predict the dynamics of spread of COVID-19 and identify the key factors driving

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infection and mortality rates.From existingdata we studied about the effects of gender, lifestyle, age, genetics, climate changes and vaccination, genetics separately. These factors may potentially impact infection and death rates of COVID-19. We run several supervised machine learning techniques to identify and rank the key factors correlating with infection and fatality counts. Population density, testing rate, airport traffic, high age groups emerge as significant, while ethnicity, gender, healthcare index, homeless and GDP have little orno impact on pandemic spread and mortality.It is postulated that the low humidity and high temperature environment would promote the viability of SARS-CoV-2 .Morbidity and mortality due to COVID19 rise dramatically with age and co-existing health conditions, including cancer and cardiovascular diseases. Human genetic factors may contribute to the extremely high transmissibility of SARS-CoV-2. So here ,we studied about the factors affecting the covid virus based on the cases from the different countries.

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