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Review Article

Sub-continental Atmosphere and Inherent Immune System may have Impact on Novel Corona Virus' 2019 (nCovid-19) Prevalence in South East Asia

***Khalil I[1], Barma P[2]**

Pandemic enveloped RNA Novel Corona Virus' 2019 (SARS-CoV-2) appears as a beating reed which induce overwhelming outbreak all over the world since November 2019 to till date. Inherent Immunity developed by traditional food habit, exposure to various antigens and vitamin D induced sunlight exposure. Meteorological parameters are the important factors which influencing the severe acute respiratory syndrome (SARS) like infectious disease. Aim of this review to enhance our knowledge and explore the association among build up immunity, weather parameters and Corona virus disease (COVID-19) death. In this review we emphasize role of meteorological factor included degree of sun exposure and effect of temperature on enveloped lipid bi-layer structure of Novel corona virus. These meteorological factors and inherent immunity may have impact on SARS-CoV-2 incidence among South East Asian including Bangladeshi. In summary, this study suggests that temperature-humidity variation, inherent immunity and lower life expectancy of South East Asia may be important.

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Key words: Enveloped RNA virus, Novel Corona Virus (SARS-CoV-2), Meteorological, Temperature, Humidity, Corona virus disease (COVID-19)

Introduction

The mischievous weapon of nature, against which the world is fighting together. Most unpredictable virus, which is concern all of us now, the novel (new) corona virus. The disease has been named "Corona virus disease 2019" (abbreviated "COVID-19") [31]. Infection of Corona virus among vertebrate species of animal including humans was discovered approximately 70 years ago (1949)[32]. But nomenclature of corona virus was done in the year 1968 according to its morphological structure which is "corona-like". "Corona" is a Latin word which synonym in English is "Crown-like" and it has three genera according to their serological behavior from genera I to III [23, 28, 33]. Corona viruses are classified into Corona viridae family which possess single-stranded, positive-sense messenger RNA (mRNA) genome enveloped by lipid bi-layer like other viruses (e.g. Flaviviridae, Togaviridae, Arteriviridae)[2,10,21,22]. It has mainly six serotypes- SARS-CoV2, MERS-CoV, SARS-CoV, Serotype 229E, Serotype OC43, Serotype NL63, Serotype HUK1 through which disease transmission occur. The most important virulent serotypes are SARS-CoV which causes severe acute respiratory syndrome, MERS-CoV which is responsible for Middle East respiratory syndrome and the main trigger of outbreak is SARS-CoV2 which is main cause of COVID-19. Like SARS virus, Corona virus also binds with several proteins through ACE-2 receptor[2, 10, 15, 26].

Behind the pandemic outburst of any situation there must be some effective factors which plays the powerful role and ensures how severe it will be. Mainly global climate is an important variable but not only climate there are also multiple factors equally responsible when a pandemic attack of a diseases occurred, such as human population densities, human culture related factors, causative viral genetic evolution and mechanism of pathogenesis[4,11,19,25]. To date extensive researches has been aimed by many researchers especially in china and north western countries trying to prove their hypothetical analysis that temperature and humidity may affect the transmission of COVID-19[20].

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When level of population are at higher density, there is expectation of virus spreading faster than in less crowded areas. In laboratory plug the normal summer temperature and relative humidity of Tokyo (28°C and 85%, respectively) into Equation R=3.968 - 0.0383 Temperature - 0.0224 relative Humidity the transmission of the COVID-19 in Tokyo will be seriously reduced in March 2020. Using the daily R values from January 21 to 23, 2020 as proxy of non-intervened transmission intensity, found within a linear regression structure for 100 Chinese cities, high temperature and high relative humidity significantly reduce the transmission of COVID-19[36,37].

Another factors which can protect human body from any kind of microorganism is innate immune system which enhanced by proper dietary habit with sufficient supplementation. According to historical review of SARS outbreak in southern china it is clearly noticed through much authentic evidence that SARS followed cross-transmission from wild species to humans because of giving extensive preference of wild animals not only as food but also as traditional medicines[7]. Besides this the many parts of China including southern region are suffering from dietary lacking of trace element selenium which acts as antioxidant[13]. In the meantime due to lack of sunlight then the dew or snow in cold weather, that's why deficiency of vitamin D impede the serum vitamin D level and deficiency of rich antioxidant selenium also influence the reduction of serum vitamin D level and ultimately suppressed the immune system[13,29].

Problem Statement

With regards of several historical evidence of pandemic outbreak of this viral family keeps the researchers in a great dilemma due to its frequent mutation capability of SARS-CoV-2 mutated 380 times on 27 number proteins within two months which is producing many research gap[10]. That's why the term Novel (new) writes down before it. Field Survey work became very difficult due to the self and social isolation for prevention of the disease outbreak.

Aim of Study

Aim of this review is to enhance our knowledge and to build up society to be more powerful against this new challenge. Knowledge about SARS-CoV-2 including its outbreak nature could be helpful to evaluate the factual pathogenesis and discover the antidote.

Methods

We need to conclude the review by analyzing the several published article, papers, report which will build a concept for the spreading factor of COVID-19. In that case we have to assume global position of individual country, regarding temperature, humidity and previous history pattern of outbreak of pandemic viruses with their relation and habitual nature as well as inherent immunity of the South East Asian populations. Moreover we like to privilege about apparently lower life expectancy of South East Asia which would be positive reason for reducing death rate associated with COVID-19 infection. The relevant data represents the idea of its genera, origin, characteristics, pathogenesis, mutation pattern etc. which will be collected by numerous literature reviewing from renown authentic sources like PubMed database, Research gate article, Google Scholar publication and NCBI journals, National and International newsletter. The defined search period from 30 November 2019 to 31 March 2020 was selected to compare studies regarding the first outbreaks and findings. Given the nature of the review, no ethical approval was required[18].

Novel Corona Virus 2019 (nCovid-19) Syndrome

According to World Health Organization (WHO) - A persons who will be affected by COVID-19, must developed some common feature primarily fever (in 88% of cases), dry cough (68% of cases), sputum/phlegm production (33% of cases) and shortness of breathe (20% of cases). Some people also experience fatigue (38% of cases), headache or sore throat (13% of cases) and less frequently diarrhea (8% of cases) as associated symptoms[3, 6]. Then the case becomes worse from mild to moderate to severe within 2-14 days (incubation period of COVID-19) sometimes it may vary within 0-27 days[6]. But about 80% cases recover from mild stages[3, 34]. But this international health organization clearly indicate this disease is life threaten for older people (80 plus) age and the persons with pre-existing medical co-morbidities (such as cardiovascular disease, chronic respiratory disease or diabetes)[3, 15,16].

The main route of transmission of corona due to close proximity to one another: within about 6 feet. Primarily it spreads through respiratory droplets of an infected individual through coughs or sneezes, those droplets can land in the mouth or nose of someone through inhalation, possibly infect that person. According to the Centers for Disease Control and Prevention (CDC), USA transmission of disease among people may also be possible by touching a virus contaminated surface or object and then spreading into their own mouth, nose or possibly eyes by their own contaminated hand. According to expert's human to human close contact is the most effective route[38].

Effect of Sub-continental Atmosphere on Corona Outbreak

Climate Change Institute, University of Maine, USA conducted a study where they evaluate the relationship between Novel corona virus out break and Sub-Continental atmosphere and analyzed the world temperature map according to their prediction Novel Corona Virus out breaking follow the same out lines. According to this map (Figure 1) through March 10, 2020, major community transmission has occurred in a consistent east and west pattern and the new epicenters of disease were all roughly along the 30-50^{o} N' zone; to South Korea, Japan, Iran, and Northern Italy[8]. After the unexpected emergence of a large outbreak in Iran and Northwestern Countries like United States, Spain, and France (Figure 1). Remarkably, at the same time, COVID-19 failed to spread significantly to countries immediately south such as Mayanmar, Mongolia and south of China. The number of patients and reported deaths in Southeast Asia is much less when compared to Northwestern regions (Figure 1) [8, 32].

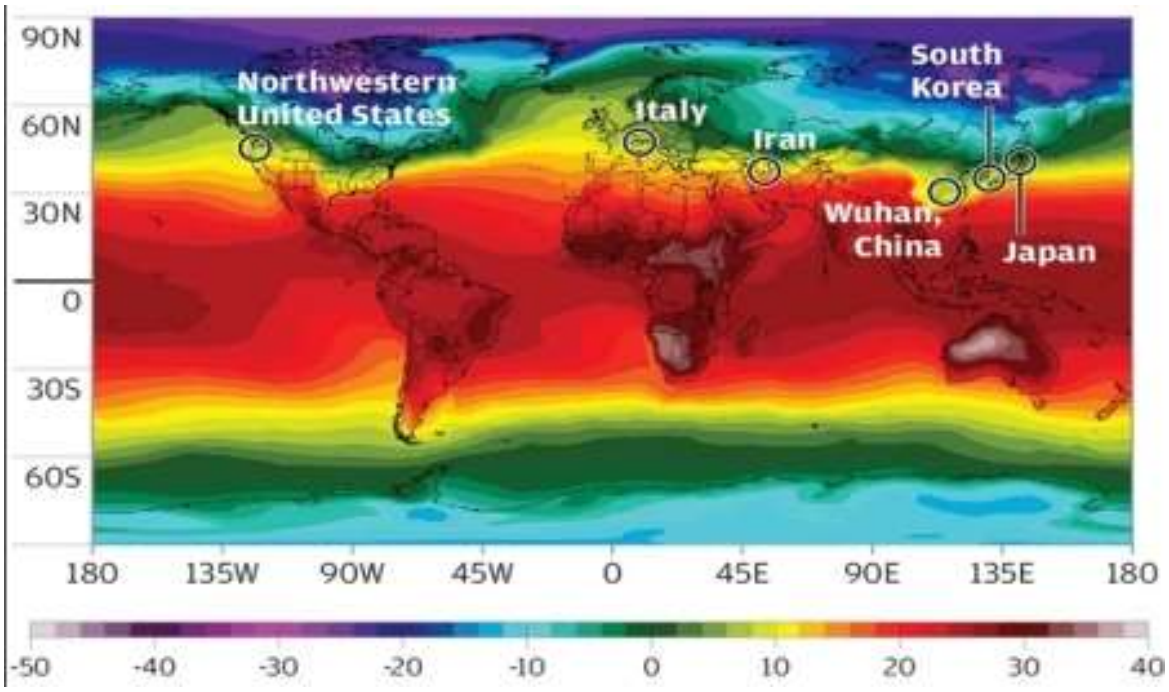

Figure 1: World temperature map November 2018-March 2019.

Color gradient indicates 2-meter temperatures in degrees Celsius. Black circles represent countries with significant community transmission (>10 deaths as of March 10, 2020). Image from Climate Re-analyzer (https://ClimateReanalyzer.org), Climate Change Institute, University of Maine, USA[12.]

Arrival of seasonal flu mainly occurs during winter when temperature and humidity remains lower. Some people now closely believed that in 2003 when SARS virus outbreak occurred then also the cooler atmosphere in china. And now Chinese atmospheric temperature and humidity increasing due to coming of spring and summer, corona virus outbreak in china become under

controlled but the virus spreading remarkably with sharply increasing the number of active cases and death incidence in Europe and the US[29]. Because the extra-ordinary cellular criteria of enveloped viruses that their oily coat make them more susceptible to heat, so in colder environment and low humidity by transforming their oily coat as rubber-like shield as it cools. This was already evidenced in case of SARS-CoV-2 can survive for up to 72 hours on hard surfaces like plastic and stainless steel at temperatures of between 21ºC-23ºC (70-73ºF) and in relative humidity of 40% as well as other corona viruses can survive for more than 28 days at 4°C. But COVID-19 behavior pattern indifferent atmosphere is still considered as a hypothetical issue[27]. But according to another meteorologist named Marr it was quoted that there must be a window zone between 40% and may be up to 80% in where viruses cannot survive he suggested that probably in range of 70-80% humidity[1].

Experimental Model Analysis

To prove this meteorological effect on COVID-19 a study was carried out from 20 January, 2020 to 29 February, 2020 in Wuhan, China through a generalized additive model which was applied to explore the impact of temperature, humidity and diurnal temperature on daily mortality of COVID-19. They formulated a core model for their study after establishing the core model, they also considered the lag effects of weather conditions on death of COVID-19 and tested the potentially lagged effects, i.e., single day lag (from lag 0 to lag 5) and multiple-day average lag (from lag 01 to lag 05)[9]. They were plotted the exposure and response correlation curves between weather variables and COVID-19 mortality by means of a spline function in the Generalized Additive Models (GAM) Sensitivity analysis test was also done by this team by changing the distribution frequency (df) of the disciplined smoothing connector function from 2 to 9 for calendar time and from 3 to 8 for temperature and humidity. Statistical analysis of this study was followed two-tailed distribution where level of significance were 5% and confidence level 95% (CI) in daily mortality rate of virus by increasing per 1 unit weather[14]. For statistical calculation they used R software (version 3.5.3) with the GAM fitted by the "mgcv" package (version 1.8-27). During their one month observation period they succeed to prove that about 2,299 COVID-19 deaths in Wuhan, which means there were approximately 56 deaths of COVID-19 per day when temperatures ranged from 1.8°C to 18.7°C, and DTR (Diurnal temperature) ranged from 2°C to 17.5°C. Average temperature and DTR during this period were 7.44°C and 9.15°C, respectively. They also described that relative humidity and absolute humidity were 59-97% with an average 82.24% and $4.27 g/m^3$-$11.63 g/m^3$ with an average $6.69 g/m^3$, respectively[37]. The mean concentrations of PM2.5, PM10, NO2, SO2, O3, and CO were $44.68 \mu g/m^3$, $52.56 \mu g/m^3$, $23.02 \mu g/m^3$, $7.29 \mu g/m^3$, $73.76 \mu g/m^3$ and $0.91 mg/m^3$ respectively[18].

Accu-Weather Meteorologist and Senior Weather editor Jesse Ferrell explained about only one variable which is absolute humidity of atmosphere. According to him due to this particular variable's effects countries with warmer and more humid climates, like Singapore, Malaysia, Thailand, and other southeast Asian countries saw a lower and slow growth rate of pandemic viruses than the cooler and lower humid countries like states, including Italy, South Korea, and, in the U.S., New York and Washington state experiencing higher and rapid growth rates of viruses. So researchers assumed that this kind of weather patterns was similar to original hotspots of Hubei and Hunan with mean temperatures between 3ºC and 10º C (37.4 and 50º F) in February and March and earlier this month a similar phenomenon was also noticed that many of the COVID-19 hotspots all existed in a "temperate zone" between 30º and 50º degrees North latitude[1].

Recent Death Statistics of Novel Corona Pandemic

According to last update, March 30, 2020, 23:28 GMT among 199 Countries and Territories around the world have reported. There are currently 7,24,592 confirmed cases and 34,017 deaths from the corona virus (COVID-19) outbreak as of March 30, 2020[5, 6]. Since December 2019 after Wuhan, China outbreak, Analysis of Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Corona virus-Infected Pneumonia in Wuhan, China was performed to understand the clinico-pathological profile of nCovid-19 through an observational study[6].

Death Statistics of Corona patient in Wuhan, China up to February, 2020: (Table I).

Table I: Fatality rate According to Age[6]

Age (Years)	Fatality rate (%)
80+	14.8%
70-79	8.0%
60-69	3.6%
50-59	1.3 %
40-49	0.4%
30-39	0.2%
20-29	0.2%
00-9	0.0%

Mean ratio of fatality rate above 80 years age group and 70-79 years age group = (14.8% + 8.0%) ÷ 2 = 11.4%. Mean ratio of rest 6 category age group = (3.6+1.3+0.4+0.2+0.2+0) ÷ 6 = 0.95%.

So, According to comparison of recent outbreak data between the northern and southern countries collected in March 27, 2020 it is clearly evidenced that incidence rate and mortality rate of novel Corona virus is more higher in north western countries like United states, Italy, China, Spain, Iran than South Asian countries like Bangladesh, India, Pakistan, Thailand, Nepal etc[32]. Though these countries are more civilized and rich than southern countries but they have to suffer more due to their low temperature and humidity[6].

Prospect of Corona Outbreak in Bangladesh

Since December 2019 Corona Virus outbreak turns pandemic in nature. Though Bangladesh is closely connected with China, corona outbreak is not prevalent in relation to China or Others developing countries in the world. Is it true or Bangladesh is still unknown about his own situation? There are couple of publish article which mentions then COVID -19 outbreak rate is higher in developed countries than developing ones. Due to vital systematical limitation particularly in Southeast Asia and Africa, may be the main reason that actual data cannot be recorded as well as poor detection system or perhaps are unable to detect COVID-19 due to their low economic profile. To detect influenza like viruses this test is named as RT-PCR(real time reverse transcriptase polymer chain reaction) needs expert manpower and specialized laboratory facilities, that only done in one Laboratory of the Institute of Epidemiology Disease Control and Research (IEDCR), Mohakhali, Dhaka, Bangladesh. That's why unfortunately Bangladesh cannot detect viruses like influenza which require special costly test due to lack of both facilities. It may be another reason for Bangladesh that the actual number of cases isn't publishes. According to CDC USA Health care system capacity, Protective measure as well as implementation of Social Distancing also important factor of outburst COVID-19[30]. But some researchers explained that due to high temperature, humidity and boosted inherent immunity Bangladeshi people as well as South East Asian countries are less affected by any pandemic diseases[30]. Besides all those reasons Bangladeshis should follow the World Health Organization(WHO) and CDC guidelines like maintenance social distance, personal hygiene and using Personal Protective Equipment (PPE) and using facial mask at this crucial time sincerely[30].

Review Analysis

After reviewing all related literature we revealed that COVID-19 outbreak correlation depends upon several parameters, like genomic characteristics of virus, mutation, replication, cellular adaptation capability on different temperature and humidity. Pattern of pathogenesis, spreading factor and how it acts against human body's immune system must be assessed as an analytical unit.

Statistical data of Corona patient mortality in Wuhan, China up to 20 February, 2020, here data shows Mean ratio of fatality rate above 80 years age group and 70-79 years age group = (14.8% + 8.0%) ÷ 2 = 11.4%. Mean ratio of rest 6 category age group = (3.6+1.3+0.4+0.2+0.2+0) ÷ 6 = 0.95%, which is much lower than 80±5 age group (Table I)[6]. In addition here we may include according to published report on life expectancy rate is lower in South East Asia including Bangladesh then Central Asia and other western countries. Life expectancy in South East Asia including Bangladesh (2019-2020) is average 72.72, which is less than 80±5 of age[17, 35, 39]. According to literature above findings that are the lower life expectancy of South East Asia rather positively influences to reduce death rate of Covid-19. Massachusetts Institute of Technology (MIT) scientists explained that warm, humid weather may be linked to COVID-19 transmission because of absolute humidity ("expressed as grams of water vapor or moisture") per cubic meter volume of air "in warmer country

absolute humidity levels above 10g/m^3, the spread of the cases appears to be slower than at places with absolute humidity levels less than 10g/m^3,,[12]. Until March 22, 2020, 90% percent of spreading of SARS-CoV-2 (Corona) transmission has recorded in with temperature 3-7° Celsius and low humidity only 4 to 9g/m^3. The scientists analyzed outbreak prevalence ratio differs on Northern and Southern hemisphere due to climatic zone[24]. As well as climatic zone also influence of body's immunity by maintaining serum level of vitamin D which is variable in northern zone (lower) to southern zone (higher) due to low sunlight exposure[29].

Conclusion

We conclude our discussion with attention that linked of COVID-19 transmission rates is low in South East Asia including Bangladesh due to warm and humid climate, booster immunity and low life expectancy. We have to think one more possible hypothesis that "Spread of air born transmission slower through the temperature at or above 23ºC (73ºF) and absolute humidity levels above 10g/m^3 ranged 70-80% humidity".

Recommendations

For Research

Need Field side survey especially in South East Asia for study Inherent Immunity, Sun Exposure Vitamin D association with corona virus and Need more data about Meteorological effect on COVID-19, which will be beneficial for effective study.

For People

WHO, CDC or other Disease Control authorities suggest so many essential things, here we highlight about the pay attention to boost up the immunity by increasing vitamin D up taking from natural sources.

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