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A Review on COVID19 Mortality rates, along with Co-morbidities, Country's Demographic Structure and its response

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Abstract: *The novel coronavirus has been a great threat to all health systems around the world.An unusual occurrence of an increased rate of pneumonia casesin Wuhan city of China is identified as SARS-CoV2(Severe acute respiratory syndrome – Coronavirus) or COVID 19. The virus started to spread globally due to the migration of infected persons. Considering the severity of this pandemic, the World Health Organisation declared a Public health emergency of International concern on January 30th, 2020. After the epidemic outbreak in china, an increased positive cases was reported from countries like Italy, America (US), Spain, Brazil, India, Japan, etc. Despite the availability of an advanced health care system, most of the developed countries struggling hard to control this pandemic. A country's demographic structure, effective preventive measures in response to the pandemic, person's immunity,co-morbid conditions,plays a vital role in determining changes in mortality rate.*

Key Word: *COVID19 or SARS CoV2, Demography, mortality rates, Co-morbidities*

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I. Introduction:

The year 2020 created a major threat to health care systems across the globe due to the incidence of Severe Acute Respiratory Syndrome-Coronavirus 2 (SARS – CoV2). In the year 2019 on 31stDecember, there is an unusual increase of 27 viral pneumonia cases in Wuhan city, Hubei province in China. Throat swab collected from thesuspected cases and identified as coronavirus as a causative organism by the Chinese Centre of Disease Prevention and Control and later it was termed as COVID 19 (Coronavirus Disease 2019) by World Health Organisation.(1) The SARS – CoV2 virus belongs to the β type of coronavirus family. The β Coronavirus with zoonotic origin contributes the previous outbreaks like Severe Acute Respiratory Syndrome (SARS) 2002 – 2003 in China and Middle East Respiratory Syndrome(MERS)in 2011.(2) On further epidemiological investigations, it has been found that positive cases has a history of exposure to local Huanan Seafood Market.(3)This seafood market is well known for its trade in fish, other seafood products, and also some live wild animals kept available for sale. Meanwhile, Chinese health authorities were taking various steps to identify other sources of infection for COVID 19.

Most of the zoonotic spread is from Bats (Rhinolopid bats) which serves as the natural hosts, virus harbors in them,but bats don't infect humans unless the virus undergoes mutation process. Similarly in SARS and MERS epidemic, shows a history of Zoonotic transmission from Civet and Camel which acts as an intermediate host. In SARS-CoV2 the intermediate hosts are suspected to be Pangolin mammals.(4) Pangolin mammals are listed in endangered species which is commonly seen in China and other Southeast Asian regions, used as a food source, their scales used in making Chinese traditional medicines.(5) The coronavirus poses a genome of single-stranded RNA known to produce Respiratory, Enteric, Hepatic, and Neurogenic diseases. Although the virus has a zoonotic origin, the disease spreads in a double fold from the infected persons. The virus takes it spread through various modes of transmission by direct contact with the infected person, their respiratory secretion while coughing, sneezing or other body fluids, inhalation of infected droplets, indirect contact with the surface used by the infected person (according to WHO).(6)

PATHOGENESIS:

The entry of a virus in a Human body undergoes primary replication in the mucosa of the upper respiratory tract like nose, mouth, larynx later gets trapped in the lower respiratory tract (terminal bronchus, alveoli, air sac) the virus binds with Angiotensin-converting enzyme2 receptors (ACE2). ACE 2 receptors commonly seen in the lungs, heart, blood vessels, brain, kidneys, intestines, and testis.(7)(7)(7)(7)(7). The Novel Coronavirushas its affection in lung tissue causing various respiratory symptoms like cold, cough, shortness of breath, fever, pneumonia, acute respiratory distress syndrome. It also produces other non-respiratory symptoms such as renal failure, heart failure, diarrhea, impaired fertility.(4,8) The pathogenesis of novel coronavirus 2019 is explained in fig(1).

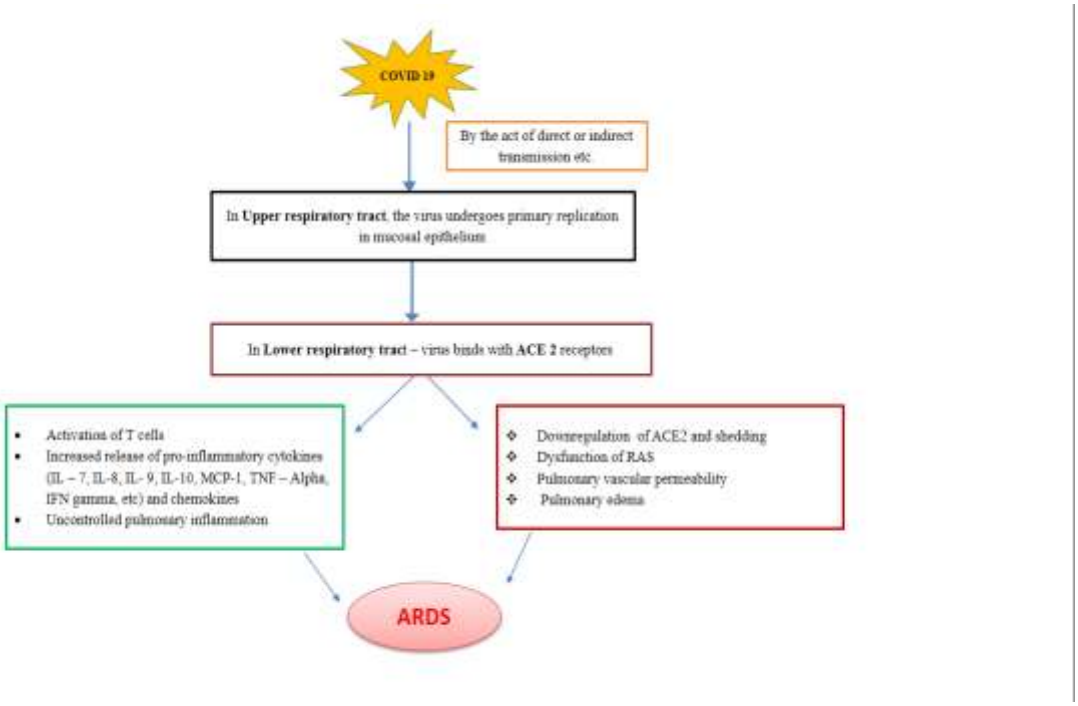

Fig. 1, Pathogenesis of SARS-CoV2, ACE – *Angiotensin-converting enzyme*, RAS – *Renin-angiotensin system*, IL – *Interleukins*, MCP – *Monocyte chemoattractant protein*, TNF –*Tumour necrosis factor*, IFN – *Interferons*, ARDS – *Acute Respiratory Distress Syndrome*

SARS CoV2 virus structure has an outer layer of spikes coated with glycoprotein,which directly clings with ACE2 receptors in the lungs and causes severe damage. Indeed ACE2 is the main component in protection against lung injury, due to combination of SARS-CoV2 with ACE2 it causes severe lung injury. (9,10). On the attack of SARS CoV2 in the lower respiratory tract,it leads to ACE downregulation and shedding, dysfunction of the renin-angiotensin mechanism causing vascular permeability, and leads to pulmonary edema followed by severe lung injury.(4) On the other note it has been found that due to replication of the virus to host cells, T cells get activated producing the increased release of pro-inflammatory cytokines, pyroptosis, leading to severe pulmonary inflammation which is also one of the causes for mortality.(11)

CLINICAL FEATURES:

A recent study in Wuhan, China among COVID 19 patients and with laboratory findings reported the symptoms of Novel Coronavirus are Fever (98%), Cough (76%), Myalgia (44%), Dyspnoea (55%) are most common symptoms, with mild symptoms of Headache (8%), Haemoptysis (5%), Diarrhoea (3%), Leucopenia, Lymphopenia. Abnormal CT chest findings bilateral chest involvement with multiple lobular, subsegmental areas of consolidation for ICU patients, and bilateral ground-glass opacity of non-ICU patients, elevated plasma levels.(12) The complications were pneumonia, severe acute respiratory distress syndrome, sepsis, cardiac failure, acute kidney failure.

COVID19 WITH CO-MORBID CONDITIONS:

Co-morbid is a condition in which people have an underlying non-communicable diseases such as Diabetes, Respiratory problems, Cancer, Cardiovascular disease, and several other health problems. People with co-morbidities have a low immune system against COVID 19 either because of its previous health conditions or due to drugs used for treatment. The Increased case fatality rate is seen among patients with Diabetes is 7.3 %, 10.5% for cardiovascular disease,6.3% for chronic respiratory disease, 6.0% for hypertension, 5.6 % for cancer according to China CDC (13).

It has been known that globally prevalence of Diabetes is around 9.3% for adults (20 – 79 Years), one in two people has diabetes, and sadly half of the population remains undiagnosed for diabetes.(14) Diabetic patients have a higher risk of developing infections due to decreased production of cytokines (interferon) (15), Impaired glucose metabolism, oxidative stress alters cytokines leading to the late inflammatory response (16). The recent study highlighted that SARS coronavirus enters the pancreas with its ACE 2 as its receptor damage islets of the pancreas causing acute diabetes.(17). In this current pandemic,patients with diabetes show poor

prognosis with lower levels of Lymphocytes and Haemoglobin, significant pathological changes in CT chest, a requirement of mechanical ventilation is seen most commonly in the management of Diabetic patients than with Non-Diabetic patients.(18,19).

A recent study in China concluded that 35.5% of COVID 19 positive patients had Cardiovascular disease(CVD) whichincludes Hypertension, Coronary Heart Disease, Cardiomyopathy, 27.8% had Myocardial injury with elevated Troponin T (TnT) levels.(20). 12% had an acute myocardial injury in COVID19 positive patients (12). Unfortunately, SARS CoV2 not only worsens the existing cardiac conditions but also creating heart problems by direct attack of SARS CoV2 in the heart causing myocardial injury (MI) (21), MI by cytokine storm (12) aggravates symptoms of hypoxia, arrhythmias, etc. It should be noted that SARS CoV2 also presents with a feature of severe cardiac outcomes like myopericarditis with minimal respiratory symptoms (22). Hence COVID19 patients with underlying cardiovascular diseaseand elevated TnT levels have a high risk of mortality than in patients with underlying Cardiovascular disease and normalTnT levels.(20).

Focusing on another set of immunocompromised populations, Cancer patients are more susceptible to such opportunistic infections. Cancer patients with lymphocytopenia, hematological malignancies, under chemotherapy have a high risk of developing Pneumonia, other community respiratory viruses causing impaired airflow to the lungs.(23). Hence postponing anticancer treatments and operative procedures for stable cancer patients to prevent nosocomial transmission is advisable.(24)

COVID19 MORTALITY WITH DEMOGRAPHIC CHARACTERISTICS AND POPOULATION STRUCTURE:

The Case fatality rate (CFR) is seen high among elderly patients for instance inChina the CFR for 40-49 years aged is 0.4%, it has been increased to 14.8% for 80 years and above (13). In Italy, the CFR is about 0.7% for 40-49 years, 27.7% of 80 years above, and 96.9% in 60 years and above.(25) A Recent study in Nembro, Lombardy, the most affected area in northern Italy reported an increased number of deaths among 75 years of age with co-morbidities, and a shortage of health care services.(26) A study in New York City (USA) recorded a minimal mortality rates in younger people, aged 40 – 49 years (8.2% Males, 2.5% Female). with an increased deaths in 65 years of age, 60.6% for 80 yearsof age in Males, 48.1% in Females, which is considerably high in men than in females (19).

A country's demographic profiles, population density, age structure determines fluctuations in COVID19 mortality rates. In Table(1):China and India are low and middle-income countries, whereas Italy and the USA are developed countries(27), both China and India have a younger population compared to Italy's elderly population and the USA is of middle containing considerable younger population with increased elderly groups.(28) A Country with an older population (Italy) should take more intensive measures against higher mortality rates for vulnerable groups. For example, COVID 19 outbreak in Korea affected the younger age groups with 4.5% CFR fall into 80 years of age which is lowest compared to Italy. Alsolower than expected number of cases reported in Africa despite of its trade links to China, due to its younger age structure.(25)

Categories	**CHINA**	**ITALY**	**INDIA**	**USA**
Population[1] Aged under 15years	17.8 %	13.2%	26.6 %	18.6%
Population Age (15 –24 years)	12.0%	9.6%	18.1%	13.3%
Population Age (25-64 years)	52.0%	54.2%	48.9%	52.0%
Population Age (above 65 years)	11.5%	23.0%	6.4%	16.2%
Total population	1.4 billion	60.6 million	1.4 billion	329.1 million
COVID 19 DATA Total confirmed[2]cases	84,229	2,36,305	3,08,916	2,049,633
Total No of Deaths	4,638	34,223	8,884	114,703
No. of recovered cases[3]	78,367	1,73,085	1,59,597	842,329

Table 1: Source: (**1**). Population data, World population prospects 2019 for China, Italy, India, USA (29)

(2). Johns Hopkins Coronavirus resource center(30) – 13th June 2020,(**3)**. Worldometer's COVID 19 Data – 13th June 2020 (31)

It has been assumed, in high-income countries despite its advanced health care facilities reported the highest mortality rates due to its elderly population, than in lower-income countries with young age structure and limited health care resources.(25,32) Hence Countries demographic profile, age structure determines Mortality rates, and updating COVID 19 Data with demographic characteristics will help policymakers to focus on vulnerable groups and provide facilities accordingly.(33)

COUNTRIES RESPONSE TOWARDS COVID19 PANDEMIC:

China, a developing country managed to tackle this pandemic in its unique way withits huge population, and set an echo of lessons for other countries at this pandemic. Early case diagnosis and implementing preventive measure is one of the main criteria to control any disease outbreaks. Since COVID 19 emerged in China before their largest Lunar New Year Holiday, which is one of the most important holidays celebrated by Chinese people by returning to their homes, Overcrowding in public places, etc, such conditions favor spread of virus even faster.(34) Hence China canceled their traditional Lunar New Year celebration. Due to the non-availability of specific vaccination, antiviral drugs for this pandemic, China implemented its traditional Public health outbreak responses like self-isolation, social distancing, and quarantine. Other measures like Shutdown of Wuhan seafood market, complete shutdown for high-risk zone, rapid construction of hospitals, active mobilization of health care professionals, military medical units. (13,34,35)

Italy, one of the most developed countries equipped with advanced health care facilities, its been adversely affected by this pandemic. Considering the severity of COVID 19 and its management of cases, the Italian government initiated an order to increase ICU surge capacities for critically ill patients with mechanical ventilators by creating 482 ICU beds over 1st 18 days. Implementing containment measures, transforming critically ill patients to specific areas, emergency resource allotments funding, human resources, etc.(36)

India's 1st case reported from Kerala, a student returned from Wuhan, China on January 30th, 2020. Since then few cases start to rise with the migration of people from high-risk countries.The Central Government of India'searly initiatives of strict lockdown measures made a decrease in positive cases about 62% (37) or either testing protocol followed by India might different from other countries.The observed Transmission pattern of disease, travel from high-risk countries(stage 1), person to person (stage 2),community transmission (stage 3). To restrict community transmission, The Central Government of India took various preventive measures like complete lockdown,Janta curfew (voluntary lockdown), home quarantine, personal hygiene, social distancing, equip hospitals with management services, etc.(38) The developing country with inadequate health care facilities and its huge population, there will be an increase in positive cases of COVID 19(32), and it's been challenging situation for India to fight against this pandemic. However certain conditions like immunization scheme with BCG,MMR vaccines may found to protect children, the high-risk group from SARS CoV2 by providing immunity after vaccination,(39)and young population of a country favors India to control the disease. India stood unique with its practice in the traditional system of medicine, Ayurveda, Siddha, Unani, Yoga, Homoeopathy. Implementing various preventive measures through the traditional system as per the Ministry of AYUSH,(40,41) India is advisable.

II. Conclusion

SARS CoV2 or COVID 19, pandemic is a major threat to all health systems across the world. The current pandemic createdincreased mortality rates not only in developing countries but also in developed countries. Several risk factors like underlying health conditions, other co-morbidities, age,etc, make the population more susceptible to suffer from this disease. A country's demographic profile provides enough information about how to reinforce or enhance the preventive measures based on the nature of the population. Providing COVID 19 data with social and demographic features helps to group the vulnerable population, thus helps in framing Health policies and guidelines based on their available resources like Human resources, funding, traditional methods,etc are important and also highlight the respective country's initiatives uniquely.

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