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FLATTENING THE EPIDEMIC CURVE OF CORONA OUTBREAK: BEYOND THE REALM OF EPIDEMIOLOGICAL MATHEMATICS

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ABSTRACT

COVID-19 is an ongoing pandemic of a corona virus disease having affected over a million people across 200 countries and territories of the globe in the year 2019-20. It is a highly contagious viral infection apparently similar to previous outbreaks of group of corona virus diseases i.e. severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) in few years back. It is a highly infectious viral disease which mainly spreads through contact or by droplet infection or through contact with contaminated surfaces; and its common symptoms are fever, cough and shortness of breath. The present and most accepted technique for the diagnosis of Covid-19 disease is based on the principle of polymerase chain reaction (PCR) technique and yet everyday newer techniques are being developed to enhance and improve the rate of COVID-19 case detection. Presently, there is no vaccine/antiviral treatment for it; but yet many medical agencies of various countries have started working on it and as of now many are suggesting and testing out various previous developed treatment methods and antiviral drugs (for other diseases) as clinical trial experiments. Otherwise precautions that are being taken is to prevent its transmission by methods like social distancing, hand washing, use of personal protective equipments (PPE) and practicing good hygiene, etc. Controlling the pandemic is the only solution to solve this problem and various methodologies are being proposed, one such methodology is 'Flattening the epidemic curve of corona outbreak."An epidemic curve for disease is a statistical approach i.e. done through plotting and studying the progression of positive infected cases of the particular disease in a particular region or territory. It is plotted between two criterions i.e. total number of infection cases and time period (considering the available health care facilities of the area.). From an analytical aspect it means the idea or proposal of slowing down the spread of virus so that a lesser number of people may need to seek medical treatment at any given period of time.COVID-19 is a global emergency and different countries and regions of the world are adopting their own unique strategies to control it. This review focuses on the various aspects of "flattening the curve" and how the word is coping with this struggle.

KEYWORDS (Covid-19, Epidemic curve, Pandemic, rRT-PCR, Social Distancing).

INTRODUCTION

COVID-19 or more commonly known as the corona virus disease is the ongoing pandemic of the globe in year 2019-20. The outbreak started in Wuhan, Hubei province, China, in December 2019[1], since then has spread worldwide. The disease is a very severe respiratory illness, caused by severe acute respiratory syndrome corona virus 2 (SARS-CoV-2).[2] Similar outbreaks associated with different strains of the corona virus disease have taken place named severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) in the years 2002[3] and 2012[4] respectively. The World Health Organization (WHO) declared the outbreak to be a Public Health Emergency of International Concern on 30 January 2020 and recognized it as a pandemic on 11 March 2020.[5]

The most common symptoms at onset of COVID-19 illness are fever, cough, and fatigue, while other symptoms include sputum production, headache, haemoptysis, diarrhea, dyspnoea, and lymphopenia.[6,7,8,9] The symptoms of COVID-19 infection appear after an incubation period of approximately 5.2 days.[10] The duration and presentation of symptoms maybe unique to each patient depending on many underlying factors but they are more severe in older age groups and with co morbidities, while patients with allergic diseases, asthma, and chronic obstructive pulmonary disease (COPD) are also at risk.[11,12] Death is mostly due to complications like acute respiratory distress syndrome, severe pneumonia, sepsis or septic shock. The current standard diagnostic technique is through real-time reverse transcription polymerase chain reaction (rRT-PCR) from

a nasopharyngeal swab or CT scan.[13] Also, the World health organization i.e. WHO has published several testing protocols for the disease.[14] Development of new diagnostic techniques is being worked upon everyday by different medical agencies for better efficacy and convenience.

At present there is no specific treatment for the deadly virus. There are no special or specific drugs/ medications. Neither any vaccine has not been developed nor is any previous antiviral drug effective for the treatment. Instead, treatment is being done on the basis of treating individual symptoms with suitable drugs and management of critical patients in intensive care units and in isolation. Timely rRT-PCR test is done on the patient to know the prognosis of viral disease and further treatment options. Developing a vaccine is a difficult and lengthy process it comprises of various steps from clinical trials to approvals and various other steps like funds and research facilities. As of now many countries are claiming to have already started clinical trials of the vaccine. The only preventive measures presently are to control its transmission. The virus mainly spreads through contact with small i.e. droplet infection or through physical contact with contaminated objects or surfaces (the viability of virus is different on different materials). Different strategies and suggestions to prevent infection by the corona virus have been proposed; like 'social distancing', 'hand washing', 'use of personal protective equipment' and 'self isolation'. Other preventive strategies are regular disinfection of surfaces, maintaining respiratory hygiene, etc. Also at the mass level the various regulatory authorities have imposed lockdowns of the regions, quarantine of regions, travel restrictions, etc.

EPIDEMIOLOGICAL CURVE
An epidemiological curve in a disease outbreak is used to study or visualize the onset of a disease outbreak. The study about the disease outbreak is carried out by analyzing and plotting a statistical graph, named as an epidemic curve or epidemiological curve. Rather than a curve is more of a histogram which shows the relation between number of cases and time period with taking into consideration the present available healthcare facilities of the region/territory being studied. The shape of each epidemiological curve is unique in each region of outbreak but a similar pattern maybe observed (depending upon the disease's peculiar characteristics like its incubation period and source. With the help of it we can comment upon factors like magnitude, trend pattern, incubation period, area of distribution, time period, frequency of new cases, etc (related to the disease outbreak). It is plotted in three cases or are of three types i.e. Point source outbreaks (epidemics), Continuous common source epidemics, and Propagated (or progressive source) epidemic.[15] For plotting epidemic curve the perquisite required is information about total cases in a region, available healthcare facilities, and time/date since the first case. A sample computerized

epidemic curve is shown in Fig.1. It can be plotted either manually or using computerized technology.
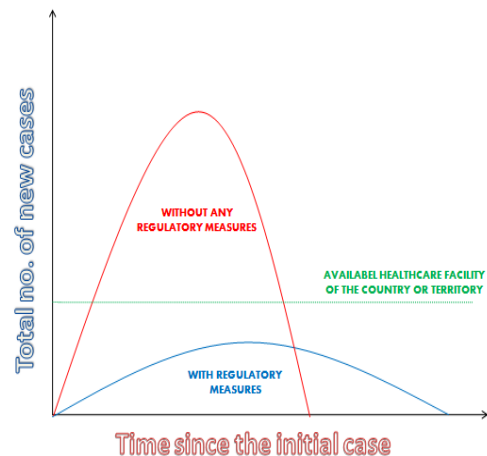

Fig 1: Epidemiologic Curve.

FLATTENING THE EPIDEMIOLOGICAL CURVE OF CORONA OUTBREAK
The Flattening of the epidemiological curve of corona outbreak is the common and main aim of all the medical and regulatory administrations of all the affected countries and territories across the world. It is directly related to the pressure on the healthcare facilities and systems of the country. An epidemiological curve for a disease is plotted between two criterions i.e. total number of infection cases and time period (considering the available health care facilities). It may be predicted from the curve itself how much more hospitalization beds, intensive care units ,medical equipments, medications/drugs, health care workers will be needed for the management of the infected patients. The epidemic curve of COVID-19 disease are based on the 'SEIR' model, which tracks and assesses the individuals into four groups/stages i.e. susceptible (S), exposed (E), infectious (I) and recovered (R).[16] Thus, the epidemic curve model keeps track of the number of individuals in each of these four stages at any given time in a particular area in order to provide and suggest further management for the pandemic control.

SOUTH KOREA: A SUCCESSFUL ATTEMPT IN FLATTENING OF THE EPIDEMIC CURVE
In South Korea essential measures were taken at the very beginning of the disease outbreak in which resulted in flattening of the epidemic curve of Covid-19, thus controlling the disease spread to a lot of extent. The South Korean model of flattening the epidemic curve is one such successful model worldwide. The country was previously very well aware of a viral disease outbreak because of the MERS outbreak in May 2015 to July 2015.[17] The main reasons for success of flattening of the epidemic curve are the strategies employed by the Korean government and the primary being enabling of mass testing of people and availability of testing kits; this enabled to know areas with infected individuals and need

of health care facilities and prevention of spread to other territories. Further development of isolation centers, availability of personal protective equipment at hospitals contributed too along with social distancing norms. Also the healthcare facilities focused more on treating the patients with severe symptoms to prevent mortality cases and patients with mild symptoms were isolated at their homes itself. The uniqueness about the Korean model is that the Korea's Centers for Disease Control and Prevention (KCDC) developed a tracing system with several organizations of the country which takes about a few minutes to analyze and trace the movement of the infected individuals, and informs the local health care authorities and nearby citizens are also informed if they come in contact. It is also known as the COVID-19 Smart Management System (SMS).[18] All these strategies resulted in a flattened epidemic curve.

FAILURE OF ATTEMPT OF FLATTENING OF EPIDEMIC CURVE IN MAJOR DEVELOPED COUNTRIES

The superpower country US was initially unsuccessful in flattening the epidemic curve of Covid-19. The country did not impose any lockdown or social distancing norms in order to hold back its falling economy from a potential economical crisis. This lack of social distancing led to the mass community spread of the virus making US on top charts of Covid-19 disease mortality numbers. Also, the authorities didn't impose a lockdown initially as some authorities believed that the viral disease is not the leading cause of death in the country and there is no as such data to support that it might be as claimed by the National Center for Health Statistics.[19] As the death toll increased US was also forced to impose a nationwide lockdown, but till then community spread had already begun and the toll numbers of infection as well as mortality were high. This lead to a very unsuccessful attempt in flattening the epidemic curve of Covid-19.

SCENARIO IN INDIA

The initial cases of the Covid-19 were reported in the territory of Kerala on 30 January, and 01 and 02 February and they were students who had returned from the city of Wuhan, China.[20, 21] Further cases were reported in territories of Delhi and Maharashtra and have widespread in the whole nation since then. To control the pandemic of Covid-19 disease in India the government of India proposed the strategy of complete lockdown of the nation on 24 March 2020.[22] and all the transport services, institutions, industries were closed only services related to food supply, banks, emergency healthcare facilities were exempted. The practice of mass social distancing was being employed as the main solution to tackle the problem refraining people to come out of their homes. At present the lockdown has been extended to about four times of total. As compared to the huge population count of India, the numbers are quiet low, in terms of positive cases as well as death counts. According to the George Institute of Global Health, India its said the the virus maybe spreading in a community

and the real number of cases is actually growing much faster than the official numbers shown[23], all this due to very low rates of testing among the population. Also the government claims there is no as such community spread in the country.[23] Thus, it cannot be predicted yet what will be the shape of the epidemic curve once the lockdown norms are uplifted.

CONCLUSION

The only thing that can be concluded from the present scenario of the Covid-19 outbreak is that it's of utmost importance to flatten the epidemic curve and that can only be achieved through mass testing and isolation of infected individuals along with implementation of preventive measures for which though there are many initiatives taken by the authorities of the various countries with 'social distancing', 'hand washing', and 'use of personal protective equipment' of the utmost importance. A flattened epidemiological may only be achieved by successful if these are followed. Each country or province across the world are preparing and setting up their own unique plans to achieve so; taking into consideration their country's medical facilities, medical costs, disaster management plans and funds, number of healthcare workers, economy, food resources and essential goods, etc. To conclude, the only way to eradicate the Covid-19 disease for now is its prevention in order to flatten the curve; as at present time it cannot be predicted when we will have a vaccine or cure for it.

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