"Impact of HRM's total LOCKDOWN Decision and enforcing Social Distancing, Isolations & Quarantine during COVID-19"

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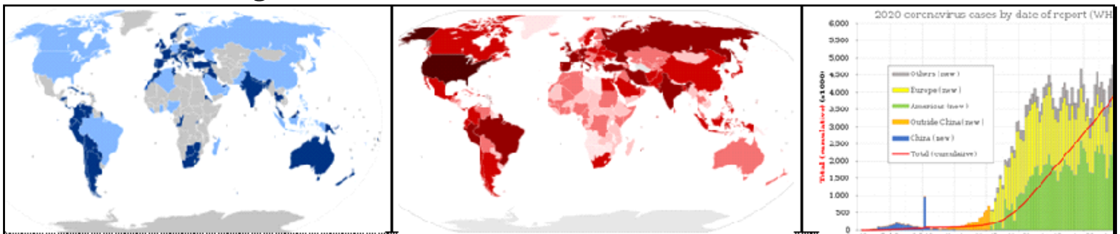
ABSTRACT

The COVID-19 is an infectious disease attributable to severe acute respiratory syndrome corona virus 2 (**SARS-CoV-2**). The virus is thought to be natural and has an animal derivation, through spill over contagion. It was first identified in December 2019 in Wuhan, China, and has since spread globally, resulting in an ongoing pandemic. Human-to-human spread was confirmed by the WHO and Chinese authorities by 20 January 2020. At present the corona virus COVID-19 is affecting 213 countries and territories around the World. As of 13th.July 2020 in India total cases are 879,487 in which deaths 23,194, recovered 554,429; active cases 301,864 and serious critical 8,944. Total test were carried out are 11,806,256. Apparently, until 25 May 2020, more than 5.4 million cases were reported across 188 countries and territories, resulting in more than 344,000 deaths. More than 2.16million people have had been recovered. Based on Johns Hopkins University statistics, the global death-to-case ratio is 6.4% (344,760/5,400,608) as of 25 May 2020. This research studies provides an overview of worldwide curfews, quarantines, and similar restrictions (known as stay-at-home orders, shelter-in-place orders, (shutdowns / lockdowns) related to the COVID-19 pandemic. The steps were taken towards to prevent further spread of the severe acute respiratory syndrome corona virus 2 (SARS-CoV-2), which causes COVID-19. States and territories around the India as well as around the World had enforced lockdowns of varying degrees. Some included total movement control while others have had only essential businesses were allowed to remain open. Schools, Colleges, and Universities have had closed either on a nationwide or local basis in 177 countries, affecting approximately 98.6 percent of the world's student population. All types of recreational venues and most public places have been affected. India is unique among the world's major nations in having implemented a total lockdown for such a protracted duration in the wake of the corona virus pandemic. This research study summaries that how these infectious diseases grow exponentially with the inverse of time, so these could be days months or even years with the Infectious rate, and at the end describes up-coming do's and don'ts.

KEY WORDS*: - *COVID-19, Corona virus, Lockdown, Susceptible, Infectious, & Quarantine.

BACKGROUND

On 31 December 2019, health authorities in China reported to the World Health Organization (WHO) a cluster of viral pneumonia cases of unknown cause in Wuhan, Hubei, and an investigation was launched in early January 2020. On 30 January, the WHO declared the outbreak a Public Health Emergency of International Concern (PHEIC) 7,818 cases confirmed globally, affecting 19 countries in five WHO regions. Several of the early cases had visited Huanan Seafood Wholesale Market and so the virus is thought to have a zoonotic origin.



National and Sub-National Lockdowns. Confirmed cases of by Country. Epidemic curve.

Figure (1):- Initial MAP before COVID-19 in BLUE and after in RED at of as of 25th. May 2020.

The virus that caused the outbreak is known as SARS – CoV-2, a newly discovered virus closely related to bat corona viruses, pangolin corona viruses, and SARS-CoV. The scientific consensus is that COVID-19 has a natural origin. The probable bat-to-human infection may have been among people processing bat carcasses and guano in the production of traditional Chinese Medicines. Epidemiology has become an important issue for modern society. The relationship between mathematics and epidemiology has been increasing. For the mathematician, epidemiology provides new, and exciting branches, while for the epidemiologist, mathematical modeling offers an important research tool in the study of the evolution of diseases.

Table [1]:- Infectious Disease around the World [14]

Disease/group of diseases	Important aspects	Special considerations for models
Macroparasites e.g. parasitic worms	Variable parasite load, concurrent infections with different species, environmental reservoirs, water-borne transmission, intermediate hosts	Individual parasite load is important for morbidity (health impact of disease) and transmission, environmental and intermediate host reservoirs of infection
Vector-borne diseases, e.g. Malaria, Dengue	Insect vectors, environmental factors (climate, land use, etc) affect vector numbers and interactions with humans	Incorporate two species - host and vector - into model Effect of environmental variables on model parameters
Measles	Affects children especially Widespread immunisation programs, herd immunity	Age-structured models, Immunization leads to stochastic ("random") effects in small infected populations becoming important
Seasonal influenza	Age-structure, immunisation, prior partial immunity, differences between strains, virus evolution	Phylogenetic methods (relationships between strains), immunological dynamics
Sexually Transmitted Infections (STIs), e.g. HIV	Risk grouping, partnerships	Internal host dynamics, partnership models.
COVID19, SARS - emerging diseases and outbreaks	**Zoonotic infection, global interconnectedness & rapid travel, contact tracing, isolation, and quarantine, the incubation period**	**Up to date data, accurate data collection efforts**
Low-prevalence, emerging and drug-resistant bacterial infection e.g. MRSA	Resistance to one or more antibiotics, evolutionary adaptations	Stochastic effects more dominant in low infected numbers

The SIR model, developed by Ronald Ross, William Hamer, and others in the early twentieth century [1], consists of a system of three coupled nonlinear ordinary deferential equations. Theoretical papers by Kermack and McKendrick, between 1927 and 1933 about infectious disease models, have had a great influence on the development of mathematical epidemiology models [2 & 3]. Modeling in real-time has particular challenges, not least the speed at which data needs to be gathered and processed to inform models. The authors especially highlight that data on the effect of control measures can be lacking due to the hectic circumstances of the most severely hit areas. On 24 March 2020, the Government of India under Prime Minister Narendra Modi ordered a nationwide lockdown for 21 days, limiting movement of the entire 1.3 billion population of India as a preventive measure against the COVID-19 pandemic in India. The lockdown were placed when the number of confirmed positive corona virus cases in India was approximately 500. As the end of the first lockdown, period approached, state governments and other advisory committees recommended extending the lockdown.

INTRODUCTION

The virus is thought to be natural and has an animal origin, through spillover infection. The actual origin is unknown, but the first known cases of infection happened in China. By December 2019, the spread of infection was almost entirely driven by human-to-human transmission. A study of the first 41 cases of confirmed COVID - 19, published in January 2020 in *The Lancet*, revealed the earliest date of onset of symptoms as 1 December 2019. Official publications from the WHO reported the earliest onset of symptoms as 8 December 2019. Human-to-human transmission was confirmed by the WHO and Chinese authorities by 20 January 2020 [13]. Many organizations require that when opportunities to improve are identified or if preventive action is to be taken the required, action plans are needed to developed, implemented, and monitored to reduce the likelihood of nonconformities and to take advantage of the opportunities for improvement. Additionally, a thorough preventive action process will include the application of controls to ensure that the preventive actions are efficient. In some settings, corrective actions were used as an encompassing term that includes remedial actions, and corrective actions.

Figure (2):- A National Centre for Disease Control, in Delhi as of 24 May 2020.

A common misconception is that the purpose of preventive action is to avert the occurrence of a similar potential problem. This process is all part of corrective action because it is a process of determining such similarities that should take place in the event of a discrepancy. Preventive act is any proactive methodology used to determine potential discrepancies before they occur and to ensure that they do not happen (thereby including, for example, preventive maintenance, management review, or other common forms of risk avoidance). Corrective and preventive actions include stages for investigation, action, review, and further action is required. It can be seen that both fit into the PDCA (plan-do-check-act) philosophy as determined by the Deming-Shewhart cycle [12]. Preventive action includes the prediction of problems and attempts to avoid such occurrences (fail-safe) through self-initiation and analysis related to the processes or products. Imagine one infected individual in a population where everyone else is susceptible. There are two possibilities: (i) this person is the index case in what will become a large epidemic, or (ii) there is no epidemic, and this person causes only a few sporadic infections before the disease goes extinct. We are still considering our simple disease example - *when people recover after an infectious period, they are immune, means once they recovered they will be recovered for the rest of their individual life.*

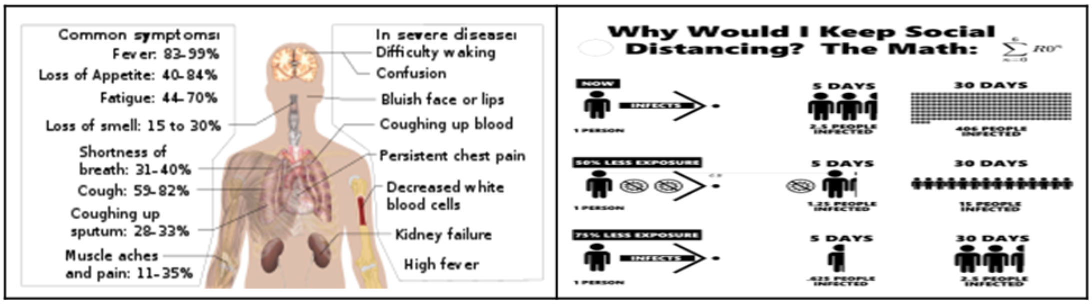


Figure [3]:- Symptoms of COVID-19; Fever, cough, fatigue, shortness of breath, loss of smell; sometimes no symptoms at all Diagnostic Method**: RRT-PCR testing,** CT scan [5 & 6].

The death-to-case ratio reflects the number of deaths divided by the number of diagnosed cases within a given time interval. Since this is real outbreak data the data points don't neatly follow the SIR Model prediction they were for example influenced by measurement errors. This means that, we can not match every single data point exactly, and there is some subjectivity involved, what the "BEST" fit looks like. Other measures include the case fatality rate (CFR), which reflects the percent of diagnosed individuals who die from a disease, and the infection fatality rate (IFR), which reflects the percent of infected individuals (diagnosed and undiagnosed) who die from a disease [7].

METHODOLOGY

This research focuses on compartmental modeling using the SIR model, a cornerstone of infectious disease modeling as a means through which to clear the basics of interpreting infectious disease models. The differential equations for the SIR model which give the rate of change of the proportion in each class (negative values reflect flows out of a class, whereas positive values reflect flows into the class).

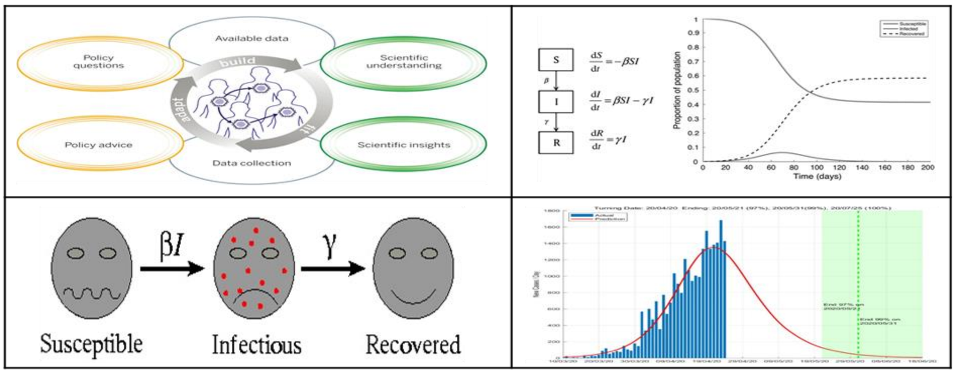


Figure (4):- Modeling for public health, with purpose, Flow between the classes in the SIR model [4].

This is a steady-state model with no one dying or being born, to change the total number of people. In this model once someone recovers they are immune and can't be infected again. In this etivity there is sufficient data to fix unique values for both parameters. More sophisticated models allow re-infections. The model also assumes that disease is passed from person to person. The SIR model can't be used for diseases that spread other ways, such as by insect bites. At the beginning of the epidemic, the number of susceptible (blue) people decreases as the number of infected (green) people increases. Gradually the number of recovered (red) people increases, as shown in Figure (5). To run this model, we need to know the following: initial population, S (initial number of people who are susceptible), initial number of infected people, I is the Infection rate [8 & 9].

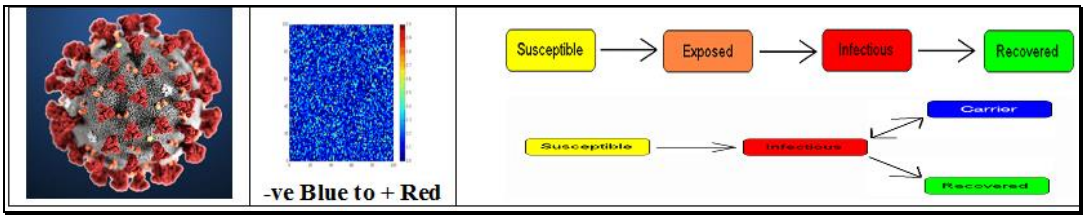


Figure (5):- Blue represents number of susceptible people. At the beginning of the epidemic, the number of susceptible (blue) people decreases as the number of infected (green) people increases. Gradually the number of recovered (red) people increases.

RESULTS and DISCUSSIONS

The SIR Model is a simple mathematical model of epidemics. An epidemic is when the number of people infected with a disease is increasing in a population. ***S***, ***I***, and ***R*** stand for ***S - Susceptible***. These are people that are not infected with the disease yet. However, they are not immune to it either and so they can become infected with the disease in the future. ***I –Infected*** or infectious. These are people that are infected with the disease and can transmit the disease to susceptible people. ***R – Recovered***. These are people who have had recovered from the disease and were immune, so they can no longer be infected with the disease as shown below in Figure (6).

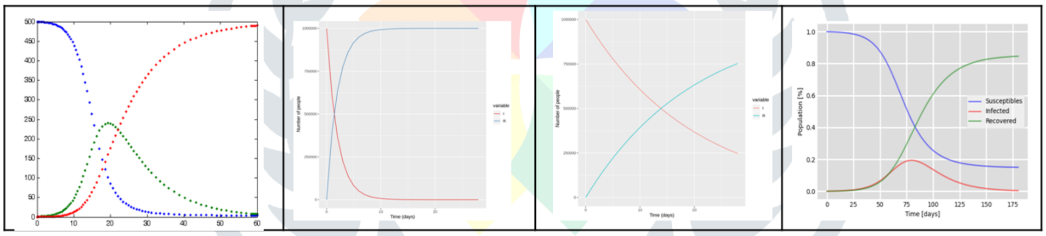
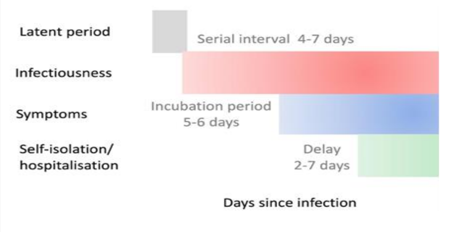


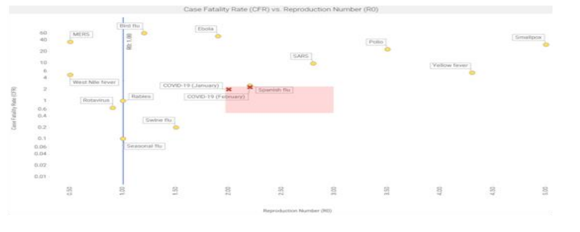
Figure (6):- SIR model, Infected in Red Colours, and Recovered in Blue Colour over Time (days).

In this particular model, after the epidemic is over, all of the people have been infected, and recovered. This is not always the case; sometimes, susceptible people remain uninfected. The results are shown initial numerically solving the SIR model, showing how the proportion of susceptible number, infected, and recovered individuals in the population is predicted to change over time in the above Figures (5 & 6). Epidemiologists model infectious diseases in compartment models; for example, the SEIR model where people transition from susceptible (**S**) to exposed (**E**) to infected (**I**) to removed (**R**), with ***S+E+I+R* = N**, where and **R** can be recovered or died, and N is the total population size. The **reproduction number (R_0)** is the average number of people infected by a person with an infection. This could be a crucial parameter in describing an epidemic. If the effective reproduction number Re = R0*(S/N) is bigger than 1, the disease considered to be spreading. Conversely, if the time-varying reproduction number R_t could be reduced over time, the disease should be contained [10 & 11].

Here we consider the reproduction number **R_0** as the product of *D*O*T*S*, where: **D** = duration (number of days someone is infectious), **O** = opportunities for transmission (number of person-person greetings / day), **T** = probability of transmission **S** = susceptibility (proportion of population susceptible). The objective of any public health response during a pandemic is to slow or stop the spread of the virus by employing mitigation strategies that reduce R_t. Testing and isolating infected people, Reducing opportunities for transmission (e.g., via social distancing, school closures), Changing the duration of infectiousness (e.g., through antiviral use), Reducing the number of susceptible individuals (e.g., by vaccination). For COVID-19, without intervention, **D** is (number of days someone is infectious) could be approximate for the one to two weeks, before isolation termed as quarantine. [12].



Infection and transmission timeline of COVID-19. Based on supplement to: Anderson et al. Lancet 2020.



R0 vs CFR for a number of viruses. Most estimates for COVID-19 put the case fatality rate (CFR) below 2% and the reproductive number (R0) between 2 and 3.

Figure (7):- The reproductive number (R_0) vs. case fatality rate (**CFR**) for a number of viruses.

This includes ~ 5-6 days incubation until symptoms and often an additional ~2-5 days before isolation. Flu is slightly shorter e.g., ~3 days. Sexual Transmission Dieses STDs can be several months. **O** (number of person-person greetings/day) could be modeled as ~5-10 people/day (person-person greetings) under usual behavior. **T** (probability of the virus being transmitted in an interaction) is approx. 1/3. This is high compared to Flu and **SARS**. **S** (proportion of population susceptible) should be high i.e., 95-100%. Initial interpretation is based on early Wuhan data, where ~95% of the initial population were still susceptible up to the end of January, showing $\boldsymbol{R_0}$ = 2 to 3 in uncontrolled outbreaks for COVID-19, compared with Flu where $\boldsymbol{R_0}$ = ~1.2. Similarly, the initial focus of public health experts with COVID-19 has been on suppression i.e. reducing R_0 to below 1 by isolating infected people, reducing case numbers, and maintaining this situation until a vaccine could be available. The current focus was on mitigation i.e. reducing R_0 to slow spreading, but not to below one.

Opportunity parameter: to get R_t below one, that needed for everybody in the population to cut inter actions by one-half to two-thirds. This could be achieved by initiatives such as working from home (**WFH**), school closures, reducing social dinners, etc. Measures such as hand-washing, reducing contacts with others, and cleaning surfaces can reduce the Transmission probability. One challenging aspect of COVID-19 is its long incubation period, where infectious people may be asymptomatic and can still infect others. Figure 2 shows the transmission timeline for COVID-19. The ~5-6 day delay between infection and symptoms is a particularly vicious behavioral strategy that the virus has evolved to further its infectiousness. In a study on 181 confirmed cases, COVID-19 had an estimated incubation period of approx. 5.1 days (95% confidence interval is 4.5 to 5.8 days)**[11]** . This analysis shows 97.5% of those who develop symptoms will do so in 11.5 days (95% confidence interval is 8.2 to 15.6 days).

Another problem with COVID-19 is its fatality rate. The **Case fatality rate (CFR)** measures the risk that someone who develops symptoms will eventually die from the infection. For COVID-19, on best available data, when we adjust for unreported cases and the various delays involved, we're probably looking at a fatality risk of probably between maybe 0.5 and 2 percent for people with symptoms." By comparison, the CFR for Flu is ~0.1%. A SIR model has an equilibrium point if a triple $E^* = (S^*, I^*, R^*)$. If the equilibrium point has the infectious component equal to zero ($I^* = 0$), this means that the pathogen suffered extinction and E^* is called Disease Free equilibrium (DFE). If $I^* > 0$ the disease persists in the population, and E^* is called Endemic Equilibrium (EE). When $R_0 < 1$, each infected individual produces, on average, less than one new infected individual, and therefore, predictable that the infection will be cleared from the population. If $R_0 > 1$, the pathogen could be able to invade the susceptible population. It should be possible to prove that for the Endemic Equilibrium to be stable, R_0 must be greater than one, and or else the Disease Free Equilibrium could be stable. This threshold behavior could be useful, once we should determined which control measures, and at what magnitude, would be most effective in reducing R_0 below one, providing important guidance for public health initiatives.

RECOMMENDATIONS

People are managed with supportive care, which may include fluid therapy, oxygen support, and supporting other affected vital organs. The CDC recommends those who suspect they carry the virus wear a simple face mask. Extracorporeal membrane oxygenation. (ECMO) has been used to address the issue of respiratory failure, but its benefits are still under consideration. Personal hygiene and a healthy lifestyle and diet have been recommended to improve immunity. Supportive treatments may be useful in those with mild symptoms at the early stage of infection. The recommended gear is a PPE gown, respirator or facemask or, eye protection, and medical gloves. When available, respirators (instead of face masks) are preferred. N95 respirators are approved for industrial settings, but the FDA has authorized the masks for use under an emergency use authorization (EUA). They are designed to protect from airborne particles like dust but effectiveness against a specific biological agent is not guaranteed for off-label uses. When masks are not available, the CDC recommends using face shields or, as a last resort, homemade masks.

Figure (8):- The U.S. Centers for Disease Control and Prevention (CDC) recommends four steps to put on personal protective equipment (PPE).

Typically, a COVID-19-related quarantine lasts for 14 days, but this length may vary if directed by health care provider or the local health department. We could still connect with friends and family via computer, and phone. However, it's important you do not break quarantine for 14 days or until approved by our health care provider or the health department. While in quarantine, it is important that we take our temperature daily and record any symptoms on a health log. If we develop a fever (above 100.4 °F) or need medical treatment or other assistance while in quarantine, we need to **call our local health department**, whose staff could help determine if we should leave the premises to seek medical attention.

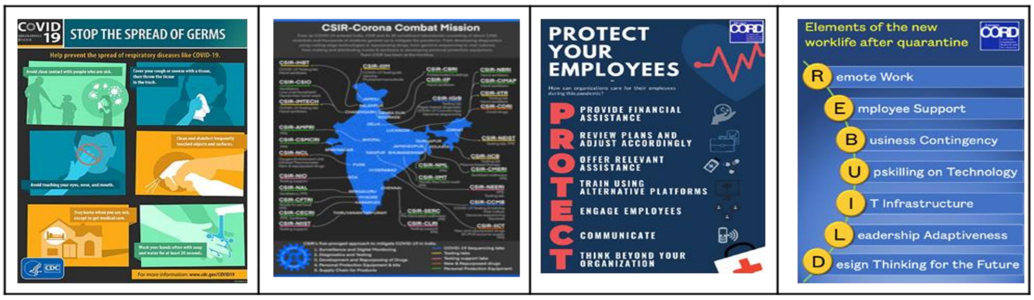


Figure (9):- The POSTER for HRM & Personnel departments to ensure to display and follows at work places around the world concerning to the prevention of personal protective equipment (PPE).

Human resource professionals could help businesses to do their part in slowing the spread of the disease by good hose keeping and providing HR managers can innovate with work schedules and assignments by allowing flexible scheduling parameters likes, spread out the density of employees throughout a workday vs. everyone working a standard eight-hour shift. Have teams work via teleconferencing and internet meetings. Avoid or postpone group face-to-face celebrations, especially ones with food being served. Allow or expand eligible positions for remote working environments. Postpone all work-related travel. Reframe the "how," e.g., would anything be lost through video/teleconferencing vs. face-to-face? For employers, the Occupational Health and Safety Administration [14] (OSHA, Law, and Regulations) provide rules and guidance for managing potentially ill employees who are at work as some instructional new POSTERS showed in Figure (9) must be display in and round work place. Employees who have little or no sick leave are now being considered for eligibility under the Family and Medical Leave Act since the incubation period for COVID-19 is 14 days. Disinfect surfaces with alcohol-based disinfecting/cleaning solutions, using gloves when at work. **Limits that apply to you during your time in quarantine: Do not** leave your quarantine location for any non-essential reason. **Do not** use public transportation or go to shopping centre. **Do not** have friends or family with you in your isolation room or apartment unless they have been approved by your health care provider. **Do** wear a face mask if you need to use a shared bathroom, go to a health care appointment, etc. Monitor your symptoms **related to COVID-19 include:** fever (above 100.4 °F), cough, shortness of breath.

CONCLUSIONS

In this research, we have had applied mathematical and statistical tools to study the transmission dynamics of infectious diseases, with equal interest in basic science and policy-focused analysis. The preliminary data being analyzed and results are interpreted in the graphical forms. When someone with existing respiratory problems is infected with COVID-19, they might be at greater risk for severe symptoms. The **preventive action** is a change implemented to address a weakness in a management system that is not yet responsible for causing nonconforming product or service. Social distancing measures are more effective when the infectious disease spreads via one or more of the following methods: droplet contact (coughing or sneezing), direct physical contact (including sexual contact), indirect physical contact (e.g., by touching a contaminated surface), airborne transmission (if the microorganism can survive in the air for long periods).

Finally, as per our Prime Minister Narendra Modi, India will definitely get back its economic growth, and reforms undertaken during the lockdown will help the economy in the long run. His comments came a day after global rating agency Moody's downgraded India's credit rating to just a notch above the junk status on growth concerns. "On the one hand, we have taken tough steps to fight the virus, and on the other, we have taken care of the economy. We have to save the lives of citizens while also stabilize the economy and speed up growth", Modi said while addressing top industry body CII's annual session. A comprehensive review of various studies, were published in the renowned Lancet journal [1]. In the meantime, said that physical distancing of two meters or more could prevent person-to-person transmission of COVID-19. It also found that face masks and eye protection may decrease the risk of infection too. The systematic review of existing evidence was commissioned by the World Health Organization, and formed the Committee to justify the findings and develop the vaccine as soon as possible.

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