A MATHEMATICAL EXPLORATION FOR ESTABLISHMENT OF THE NOVEL SOLUTIONS FOR MANAGEMENT OF EPIDEMICS/ PANDEMICS

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Abstract: ***The Ebola epidemic that took place in 2012 was the deadliest in modern history. Our research looks at the disease that is widespread in Kenya, taking into consideration potential triggers. Machine learning is used to forecast the outcomes of the study. It should be seen that there are a range of steps that can be achieved in the real world that can affect the rates of illness and pollution like such things as geographic lockdowns, segregation, monitoring, quarantine, foreign travel restrictions, collective exchange of surveillance progress and by putting in wide scale social initiatives.It must also be noted that most mathematical models are only as good as the data that they were built on. In order to provide broad audiences in the research world with an understanding of viral spreading patterns, a short introduction about biological systems models and the python source codes of simulation are also provided.***

Keyword: Epidemics/ Pandemics, Mathematical Exploration, Management of Epidemics, ManagingPandemic

I. Introduction

Outbreaks will devastate civilization. Yet this have learned important lessons from previous pandemics on how to cope with infectious disorders and the populations that have endured from them.When it occurs to vast quantities of individuals in a very brief amount of time, an infectious illness approaches epidemic levels. Because they existed together in groups, people also suffered from epidemics. Yet as humans continued to migrate across the globe in vast quantities, they took with them contagious diseases, and epidemics developed into epidemics, outbreaks of diseases at global rates.One of the first epidemics that we knew of was the Black Death, as the disease was named in the 13th century AD. In several cases, it has decided how persons in the future can react to large-scale outbreaks of disease. Today, some of the steps introduced to battle the disease are still used. A later disease afflicted the world.Another epidemic illness that has been prevalent in populations for decades is Smallpox. Yet as the first infectious illness to be fully removed by all human beings, it has a special role in the history of epidemics.The past of smallpox is directly linked to the history of vaccines, the procedure created by William Jenner to discourage smallpox from being transmitted by humans. Vaccination has proven very efficient in stopping and regulating the transmission of contagious disorders, but it has created debate from the early days of vaccination.Many infectious disorders were in decline by the early 1900s, but polio cases started to escalate, hitting epidemic rates by mid-century. It was a real medical detective tale to figure out that this previously rare childhood illness (also known as polio) has infected whole populations.Changes in people's way of living have been witnessed in the past two decades. The conditions for epidemics to flourish and expand are travel and commerce, rapid urbanization, inadequate access to healthcare, as well as environmental destruction and other patterns. Around the same moment, there is a continuous evolution of research and awareness regarding infectious risks, demanding a faster reaction to health emergencies. This introductory online course seeks to include the current information for handling established and evolving disease-prone diseases in the 21st century to front-line responders. Thirteen bacterial threats are the subject of this course: avian influenza, cholera, Ebola, Lassa fever, leptospirosis, meningitis, respiratory syndrome in the Middle East, pandemic influenza, epidemic, Rift Valley fever, seasonal flu, yellow fever and Zika. Via video demonstrations and self-assessments, it offers the most important science, technological and organizational expertise. We hope that you will be inspired to take part in a conversation group and express your job experiences first-hand and learn fresh feedback from other practitioners employed in the sector.

1.1 Epidemic

Epidemic is taken from the Greek meaning epi at or higher and the illustrations mean persons and is the concept used to define a situation in which an epidemic spread easily within a brief period of time to a wide number of citizens in a specific community.It is not just for contagious disorders where the word outbreak is used. It is often used for any situation that contributes to a negative rise within the population in health risks. For instance,

- Worldwide, elevated rates of obesity (often described as an "obesity epidemic"). The United States has seen a rise in the number of individuals with a BMI over the prescribed level over the last three decades.
- If the word outbreak is used in reference to infectious diseases, that is attributed to a rapid rise in cases that are normally triggered by a new infectious agent or a shift in an existing factor, such as:
- An element that is transmitted, such as transmission from animals to humans, across host groups (zoonotic diseases)
- A genetic alteration (mutation) of an infectious agent such as bacteria, viruses, fungi or parasites
- Introduction to the host community of new pathogens.
- Predictable trends may be accompanied by outbreaks and these patterns are also used to detect, anticipate, and manage the spread of infection. Seasonal influenza is a common indication of this.

When a contagious illness travels easily among multiple individuals, an outbreak happens. The extreme acute respiratory syndrome (SARS) outbreak, for instance, took the lives of almost 800 people worldwide in 2003.The Centers for Disease Control and Prevention (CDC) recognizes that a pandemic is anunexpected rise in the number of cases of disease in a specific geographic zone.An outbreak is any rise in the number of cases within that specific region which exceeds the baseline.There will be epidemics:

- If an infectious agent (such as a virus) unexpectedly becomes more widespread in a region where it has always been present,
- As the infection spreads in a region where it has not been known before.

- When individuals who have not been recently subjected to an infectious agent unexpectedly tend to get ill

Among the deadliest epidemics in American history are smallpox, cholera, yellow fever, typhoid fever, measles, and polio. Today, epidemics like HIV and drug-resistant tuberculosis.As early as Homer's "Odyssey" where the author used the word in a comparable manner to the way we now use the settlement, scholars are a credible source that recounts the use of the term plague.About 430 BC, the first recorded case of the term plague was used to describe a generalized illness. C., as it was incorporated into a medical treatise by Hippocrates.Today, in casual discussions, the term pandemic is used to describe just about everything bad that has spread across a community or country. In the mass culture, for instance, laziness, gun abuse, and drug usage are considered epidemics.

1.2 Escalation of an Epidemic to a Pandemic

When an epidemic exhibits rapid growth, the International Health Organization (WHO) will announce a pandemic, which will significantly boost the growth rate, since there are far more instances per day than the day before. The latest instance of this is the coronavirus illness (Covid-19). A community of cases of pneumonia of unknown origin was confirmed to the World Health Organization (WHO) on December 31, 2019, in Wuhan, Hubei province, China. It was eventually reported as a new virus in January 2020 and the number of cases began to escalate throughout the following months, but it was not localized in China and saw exponential development worldwide. Owing to the dramatic rise in the number of cases worldwide, a global pandemic was announced on 11 March and, internationally, at 4:22 p.m. CET, 9 December 2020, recorded 67,780,361 verified COVID-19 incidents, including 1,551,214 fatalities, reported to the World Health Organization.

1.3Preventing a Pandemic

Attempting to avoid the disease from being a pandemic is critical. This needs that organizations and states behave and plan early. A collection of measures to attempt to restrict the dissemination of an infectious agent beyond the original single cases and containment-called limited clusters of pathogens. In controlling and suppressing viruses, there are many steps which have been seen to be successful.

- **Controls:** impose boundary controls to restrict/prevent workers from travelling to and from impacted areas
- Educating the public regarding signs and risk factors, having quick access to research, documenting possible incidents during every healthcare conference, and monitoring communication with affected persons.
- **Touch monitoring** - a laborious procedure that monitors the movements of an infected individual to recognize other possible infected individuals from the moment of infection.
- **Quarantine:** isolation over a certain amount of time of the presumed infectious person from interaction with other individuals, covering the incubation period of the disease.
- **Isolation:** the person identified as contaminated is isolated from communication with others.

- **Protection:** Carry adequate protective devices for health services (PPE) or persons that are unwilling to prevent interaction with contaminated individuals.

1.4 Managing a Pandemic

If a pandemic has been detected, it is important that adequate precautions are taken to contain and restrict the dissemination of the virus. The key message at this point is to decrease the rate of infection - the number of infected individuals per infected individual. If a population's average transmission rate is greater than one, so the number of cases would begin to climb. Steps that reduce the rate of transmission to less than one would lead the overall number of infections to decrease.When the community has a substantial degree of illness, it becomes important to reduce the incidence. Actions intended to minimize the intensity of transmission are regarded as mitigation and can include:

- **Social Distancing** (cancellation of events, closure of institutions, work from home, etc.)
- **Civic education -** to improve acts such as hand washing, party avoidance, etc.
- **Economic measures:** to offer relief for people and enterprises and to improve conformity with policies of social distancing.

The goal of both these steps is to reduce the vulnerable population and to reduce the rate of transmission between them. This results in the case curve being flattened over time (see statistics below), thus reducing the peak in the number of cases that need medical treatment. This retains the health care system's capacity to provide those afflicted with adequate care and to reduce the mortality rate as far as possible. When services do not satisfy demand and health staff surpass their ability to deliver treatment, the greater the burden on the health sector, the higher the possible mortality risk. The flattening of the curve further broadens the epidemic's time scale such that every new vaccination be utilized to quickly improve tolerance in the community at any stage in the future.

1.5Epidemics and pandemics

It typically settles in intermittent epidemics during which several vulnerable individuals become compromised and become resistant to more attacks until an acute new virus has effectively developed itself in a community. The virus is spread when most of them are resistant and only returns as a new vulnerable population develops, generally made up of those born after the last pandemic. 'Epidemics and epidemics' include past epidemics of viruses, vaccine campaigns and the transmission of viruses from one continent to the next: epidemics. Respiratory infections such as influenza, colds and pneumonia are usually triggered by infectious viruses, while those spread by faecal and oral infection, such as rotavirus and nor virus, induce digestive disorders with nausea, vomiting and diarrhea.This need to revisit the nearly 10,000 years of agricultural revolution that started in the Fertile Crescent (the region between the Tigris and Euphrates rivers, in what is now Iraq and Iran) and expanded gradually to neighboring lands to learn when and how humans suffered from this acute childhood infection. They ancestors were converted from nomadic hunter-gatherers to farmers settled in developed societies through this drastic shift in lifestyle. Equally drastic were the ramifications of this transition for the bacteria that contaminated them.The transition of lifestyle was strongly linked to this onslaught. Tiny, cramped, permanent homes in crowded settlements have replaced temporary facilities, enabling airborne microbes to quickly enter their hosts; while food and water, historically obtained on a regular basis, are often processed in unsanitary environments, facilitating the transmission via the faeces and mouth of infection-causing microbes. Their similarity to the recently domesticated animals that now share their environments and are home to their microbial zoos was a crucial factor in the introduction of new microbes to early farmers.In general, viral infections are defined by the organs they invade, as infectious viruses are primarily liable for respiratory diseases, such as influenza, colds or pneumonia, and nausea, vomiting and diarrhea are those spread by fecal-oral contamination that triggers intestinal disorders. There are thousands of viruses that may trigger human epidemics, but there are just a handful that cause typical childhood diseases, such as measles, mumps, and smallpox and, until recently, smallpox.

II. Literature Reviews

Johnson et al. (2001), Geographic information systems: a method for outbreak identification and control. A framework of geographic knowledge offers an outstanding way to interpret and evaluate epidemiological details, to reveal patterns, dependencies, and interrelationships. Through multiple places, services, and sectors, you can collect, store, maintain, and incorporate vast volumes of knowledge globally. The GIS acts as a joint forum for the convergence of various practices for disease surveillance. The traditional geo-attribution of epidemiological data enables the maintenance of organized data approaches. It is quick to transform it into a detection device for some other disease until the fundamental mechanism is ready. In relation to the surrounding community and current health and social infrastructures, public health services, specific illnesses, and other health activities may be established. This data, when integrated, provides a powerful method to track and control epidemics. A GIS aims to construct realistic maps that reflect the disease or vector's magnitude. To decide how many instances fell within the spectrum, he or she may build buffers around particular characteristics and then correlate this knowledge with disease occurrence details. You may also assign the vector breeding site's region of impact, where the control operation needs to be improved. The gathering areas of the community center will be established by a geographic information system and an ideal location for a new health building can be found as well. You are able to overlay numerous pieces of data and do specific calculations. A geographic information system allows for interactive requests on a map, table or graph for information. Enables dynamic visualization of databases and charts in order to automatically represent data changes on maps. Dynamic online maps help patients pick the most relevant health facilities quickly.

Paiao et al. (2016), Cholera epidemiological model, including optimum control therapy. With quarantine care, we suggest a statistical model for cholera. In both epidemiological and statistical terminology, the model has been proven to be correct. We prove, in particular, that all model solutions are optimistic and limited; and that in a substantial category, any solution with initial conditions remains in that group all the time. Single points of disease-free and endemic break-even were seen and the primary reproductive number was determined. First, we research these equilibrium points' local asymptotic stability. The issue of optimum regulation, whose purpose is to achieve an effective quarantine procedure, is suggested and evaluated. To minimize the number of sick citizens and the accumulation of bacteria, as well as the costs associated with quarantine, we give an optimum quarantine policy. Finally, a computational simulation was carried out in 2010 at the Department of Artibonite (Haiti) of a cholera epidemic, showing the model's utility and its interpretation.

Ansumana et al. (2016),the impact of epidemics of infectious diseases on tuberculosis detection, 3 Management. The 2015 WHO Global Study on Tuberculosis reveals that 28 percent of the world's 9.6 million new cases of tuberculosis are in the WHO area of Africa. Over the past two decades, the Mano River Union (MRU) countries in West Africa (Guinea, Sierra Leone, and Liberia) have made relatively sustainable investments in TB systems. The catastrophic epidemic of Ebola virus disease in West Africa in 2014-2015 greatly impacted all aspects of UMR countries' health care services, including tuberculosis preventive and control initiatives. The spread of Ebola virus disease has also had a detrimental effect on health staff and health care supply. Most workers of all UMR countries contracted EBV in the Ebola care units during the height of the Ebola virus disease epidemic and died. In primary care centers that were not Ebola treatment centers, but national hospitals and local health units that were unable to accept Ebola virus cases, some health staff were also affected. The disruption of tuberculosis programmes in all three UMR countries owing to the Ebola virus outbreak would certainly contribute to enhanced transmission of M. Tuberculosis screening, care and preventive programmes have been impacted by the epidemic triggered by the Ebola virus outbreak. The Ebola virus outbreak has influenced the vaccination of BCG tuberculosis in children under five years of age. The epidemic of the Ebola virus epidemic was the product of a global failure and represented another 'wake-up call' for consensus within the international community, especially African governments, on new ways of thinking at national, regional and national levels. Hey, planet. Health networks that, after an epidemic, will continue to work. This is important in order to deter other outbreak prevention systems (such as those for tuberculosis, malaria and HIV) from becoming at risk of a major infection during emergency steps.

Debaeke et al. (2010), Impact of field control of sensitive and resistant sunflower cultivars on fumopsis (Diaporthehelianthi) stem ulcer epidemics. Field data were used to test Asphodel's epidemiological model effectively in relation to the major phases of foliar infection. There was a strong association between the relative humidity inside the canopy (observed), the amount of foliar injury events (simulated by Asphodel) and the final occurrence of stem lesions (observed), which clearly illustrated the key role of crop control in the production of sunflower stem ulcers.

Thellier et al. (2003),the control in particular fields of the richness of tolerance to diseases of a population. The use of a large range of genes for resistance restricts the production of polycyclic epidemics induced by airborne pathogens and decreases the possibility of virulent strains overcoming resistance. By increasing a mixture of varieties with numerous resistance genes and homogeneous agricultural traits, variability can be easily accomplished. Loss of pollen due to the existence of resistant plants among susceptible plants and tolerance induced by deadly pathogens provide processes by which diseases are minimized in cultivar mixtures. Compared to pure roles, the reciprocal influences of the specific components of the combination that deal with disease stress and abiotic stress contribute to greater output consistency. At least the efficiency of the blended goods is comparable to that derived from single cars.

Avelino et al. (2004), the effects of crop management patterns on epidemics of coffee rust. They indicate that new coffee rust management systems are required to completely incorporate crop management trends in order to control the disease in a sustainable way. Despite the huge amount of data gained in the field on epidemics and the considerable amount of modelling work performed on the disease, the consequences of crop management trends on coffee rust epidemics triggered by HemileiaVastatrix have not been well recorded. The lack of ties between many research and actual cases of development in this field is one of the key explanations for this discrepancy between epidemiological expertise and management comprehension. Quantitative examples from a study in Honduras demonstrate how coffee rust epidemics may be seriously influenced by field control, multiple shade combinations, coffee tree density, fertilization and pruning.

Ahmed et al. (2018),Numerical therapy of spatial dissemination of an epidemiological model. An implied finite difference mechanism is the suggested procedure (FD). In accordance with the qualities of positivity, the suggested system is unconditionally hierarchical. The proposed FD scheme is unconditionally convergent with a defined nonlinear event rate to the true steadies of the SIR interaction propagation method. In order to validate all details, comparison of the proposed FD map with classic finite difference plots is also carried out. A big problem today is the system that retains computational processes. Many physical structures have distinct properties that have to be retained in a numerical way. Positivity, for instance, is an essential physical property that multiple models hold. For starters, in an epidemiological model, negative values for the concentration of chemical reactions and subpopulations cannot be negative. The goal of this work is to propose a framework that preserves the numerical diagram with a given nonlinear incidence rate for solving an epidemiological reaction propagation model.

Courtois et al. (2019),unique management of epidemiology. A major problem is optimum disease management, as control is expensive and destruction is great. In this work, we concentrate on aspects of teamwork and collaboration linked to control strategies in order to complement the literature on this topic. We imagine a complex game when modelling an epidemic that affects perennial crops in space and time, in which many landowners chose whether to monitor the propagation of the epidemic within their lands. We derive information about the initial circumstances that could contribute to inefficiency and teamwork issues attributable to private management when evaluating the game cooperatively and non-cooperatively. We categories gambling conditions according to prevalence and infection intensity thresholds and concentrate on strategic activities of owners that create inefficiencies within the network.

Bakare et al. (2014),SIR disease model optimum management study. Using control words and a deterministic differential equation method, a statistical model of a SIR disease model with set recruitment and two control variables is described and evaluated mathematically and numerically. Via awareness campaigns and prevention methods, we strive to monitor susceptible and contaminated persons. By not dimensioning the equation framework for our SIR disease concept and extrapolating our replication base figure, we evaluate the model. Our aim is to minimize the overall amount of people with infection and the costs associated with the usage of awareness campaigns and medication at (0; T]. To characterize the ideal levels of the two controls, we used the maximum theory of Pontryagin. The resulting optimization system is numerically solved. The findings indicate that the optimal mix of care and educational campaign approach requires the optimal combination of

Owolabi et al. (2019),Mathematical research for an outbreak method and statistical studies. In this article, an outbreak HIV/AIDS transmission mechanism is investigated.To explain the theoretical findings, some numerical simulation outcomes obtained for various instances of fractional order γ are published. In this article, an outbreak HIV/AIDS transmission mechanism is investigated. The classical time derivative is modelled in the sense of Caputo with the nonlocal and nonsingular fractional operator of Atangana-Baleanu. Mathematical research reveals that both the condition of disease-free equilibrium and endemic equilibrium are locally asymptotically stable. The Atangana-Baleanu operator's viable numerical approximation technique is also given. To explain the theoretical findings, some numerical simulation outcomes obtained for various instances of fractional order γ are published.

Hasan et al. (2019), Using the residual power series approach to overcome the partial SIR B epidemic model. In the study of epidemiology and medical treatment of sufferers, the SIR model of uncertain parameters is a significant subject for scientists. In this work, to solve the epidemiological SIR model of micro-order, an appropriate approach based on a generalized Taylor series, named the residual energy chain method, is implemented. In Caputo's meaning, the fractional derivative is defined. The usage of the residual energy chain approach helps one to obtain, in addition to the estimated solution, the empirical solution of the SIR model in the context of a convergent energy sequence. We applied it to the partial SIR model to show the utility of the proposed methodology and contrasted the findings with the fourth-order Runge-Kutta process. The computational and graphical findings demonstrate that the approach of the residual power sequence can be treated as an alternative method for addressing certain real-life issues concerning any order of differential equations.

Garrett et al. (2001),Impact of host diversity and other elements of control on potato epidemics of late blight in the tropical highland tropics. In three highland sites near Quito, Ecuador, a field study was performed to establish if the impact of host diversity on late potato blight will be as important as studies in temperate regions have recently found. In accordance with varying planting densities and two fungicide regimens, we contrasted three potato blends and used the blends. Comparisons of care were undertaken utilizing absolute and relative measurements of host diversity consequences and incorporating a cut-off region under the disease development curve as a way of standardizing site-to-site comparisons. An assessment of the dilution effects of susceptible host tissues was given by Faba potato crops consisting of just 10 percent of potatoes. The results of host diversity between study sites were somewhat different, with host diversity having a substantial influence on disease mitigation only at the most distant commercial potato production sites. In monotypic carriers, storage density has no impact on the consequences of host diversity or late blight. The usage of potato mixture fungicides has increased the impact of host variability to mitigate late blight. The planting of Faba potatoes culminated in a small decline in potato late blight.

Avelino et al. (2007), Topography and crop conservation are major growth variables. In order to obtain a better understanding of the conditions contributing to the disease and strengthen control, we have tracked the growth of the American coffee leaf location, a disease triggered by the important fungus Mycenacitricolor, on 57 parcels of land in Costa Rica for 1 to 2 years. The characteristics of the coffee plants, the control of the yield and the atmosphere were documented during the investigation. We used partial least squares regression by axis functions (PLSS) for the analysis, which is a nonlinear extension of partial least squares regression (PLS). In regions between 1.100 and 1.550 meters above sea level, the mushrooms performed well. The slopes supported their growth, but the slopes facing east were less affected than the other slopes, likely because, especially in the rainy season, they were more open to the sun. By its impact on the shade of the coffee tree and probably the humidity conditions, the gap between seeding line, shade ratio, coffee tree height, shade form, and pruning method suggested the magnitude of the disease. Of the storey. Forest trees and fruit interspersed with coffee appeared to have conditions which were especially desirable. Fertilization, likely attributable to loosening phenomena correlated with the faster development of the coffee tree, was undesirable for the disease. Finally, a variety of wet spells interspersed with dry spells, recurrent throughout the middle of the rainy season, were crucial to the outbreak, likely because they influenced the gem's manufacturing, release and viability.

Dasaklis et al. (2012), Logistical processes and disease management. The aim of this paper is to describe the function and management of logistical operations that can help to contain outbreaks, to examine current literature objectively and to point out loopholes. A collection of suggestions are elicited by reviewing the selected literature and different study paths are proposed in the future. In conclusion, this paper offers a review of the literature on disease prevention and logistics operations to scholars and professionals with the goal of fostering greater participation in supply chain management to tackle the epidemic. A significant percentage of fatalities are compensated for by outbreaks. Following natural or man-made events, airborne or viral illnesses are often a significant cause of death. A fast response requires efficient infection management.

III.Escalation of an Epidemic to a Pandemic

When an epidemic exhibits rapid growth, the International Health Organization (WHO) will announce a pandemic, which will significantly boost the growth rate, since there are far more instances per day than the day before. The latest instance of this is the coronavirus illness (Covid-19). A community of cases of pneumonia of unknown origin was confirmed to the World Health Organization (WHO) on December 31, 2019, in Wuhan, Hubei province, China. It was eventually reported as a new virus in January 2020 and the number of cases began to escalate throughout the following months, but it was not localized in China and saw exponential development worldwide. Owing to the dramatic rise in the number of cases worldwide, a global pandemic was announced on 11 March and, internationally, at 4:22 p.m. CET, 9 December 2020, recorded 67,780,361 verified COVID-19 incidents, including 1,551,214 fatalities, reported to the World Health Organization.

3.1 Phases of the disease

Six levels have been defined by the World Health Organization to meet before announcing a pandemic. Step 1 is low risk and a full pandemic is Stage 6; the steps below can be seen:

Step 1: The virus is seen in wildlife, but there has not been an outbreak in humans.

Step 2: humans have been contaminated with a recognized livestock virus

Step 3: the appearance in humans of individual cases, isolated or limited classes of diseases; possible instances of spread from person to person, though not at the level of the population, triggering outbreaks.

Step 4: spread of infection from person to person at a pace that results in societal disease outbreaks

Step 5: in more than one region, the dissemination of the disease is now apparent in humans.

Step 6: in at least one different nation other than that seen in Stage 5, epidemics spread at the population level.

Prepare for a worldwide pandemic until you reach stage 6. To promote accountability and inform health organizations and the public, each stage includes a set of protocols to adopt. These procedures are listed in the following table.

3.2 The beginnings of compartmental models

It is important to make certain assumptions on how the virus is propagated in order to explain a statistical model for the propagation of an infectious disease. The common view is that, by interaction with a virus or bacteria, viruses are spread. The definition of unknown creatures as agents of disease goes back to Aristotle's writings (384 BC - 322 BC). With the aid of the first microscopes, Van Leeuwenhoek (1632-1723) showed the presence of microorganisms. The first expression of the germ theory of sickness emerged in 1840 by Jacob Henley (1809-1885) and was established in the late nineteenth and early twentieth centuries by Robert Koch (1843-1910), Joseph Lister (1827-1912) and Louis Pasteur (1822-1875).In the year AD 1906. Hammer proposed that the distribution of infection could depend on the number of people vulnerable and the number of people infected (Hammer, 1906). He suggested a rule of mutual action on the rate of new pathogens, and this concept has since become fundamental to fractured models. It should be remembered that the foundations have been laid for a full solution to epidemiology focused on a micro-model, not by mathematicians, but by public health doctors such as Sir R.A. Around 1900 and 1935: Hummer, A. Mackendrick, W. Carmac.

The work of Ross on malaria is an especially beneficial illustration. For his presentation of the mechanisms of malaria transmission between mosquitoes and humans, Dr. Ross received his second Nobel Prize in Medicine in 1902.Generally, it was believed that malaria could not be eradicated as long as mosquitoes remained prevalent in a community. Ross, moreover, provided a basic model of segmentation (Ross, 1911) concerning mosquitoes and humans, illustrating that it would be necessary to reduce the mosquito population below a critical amount. This was the first introduction to the notion of a fundamental number in replication, and has since become a core principle of statistical epidemiology. This conclusion was reinforced by field trials and often contributed to remarkable successes in malaria prevention.In a sequence of three papers by Kermack and McKendrick, 1927, Kermack and McKendrick, 1932, and Kermack and McKendrick, 1933, the essential partial models to explain infectious disease transmission are used. Epidemiological models are explained in the first of these papers.

The original formulation given in Kermack and McKendrick (1927) of the Kermack-McKendrick epidemic model was

$$v(t) = -x^1(t) \qquad (1)$$

$$x^1(t) = -x(t)\left[\int_0^t A(s)\, v\,(t-s)\, ds + A(t)\mathcal{Y}0\right]$$

$$z^1(t) = \int_0^t C\,(s)v(t-s)ds + C(t)\mathcal{Y}0$$

$$\mathcal{Y}(t) = \int_0^t B\,(s)v\,(t-s)ds + B(t)\mathcal{Y}0.$$

Here, $\mathcal{X}(t)$ is the number of susceptibles, $\mathcal{Y}(t)$ is the number of infectious individuals, and $\mathcal{Z}(t)$ is the number of recovered individuals. Also $\varphi\,(s)$ is the recovery rate when the age of infection is s,$\psi\,(s)$ is the recovery rate at infection age s, and

$$B(s) = e^{-}\int_0^t \psi\,(s)ds, A(s)\$ = \varphi(\$)\, B(\$).$$

There are no fatalities related to illnesses, it is believed, because the overall population size stays stable. In their study, Kermack and McKendrick did not provide the primary reproduction figure, but were able to extract the final size relationship in the model.

$$\log\frac{1-\frac{90}{N}}{1-p} = p^N \int_0^\infty A\,(s)ds, \qquad (2)$$

In which N is the total population size and p being the attack ratio

$$p = 1 - \frac{x_\infty}{N}.$$

If we define

$$S(t) = x(t), A(s) = B(s) = e^{-\gamma 8}, I(t) = \frac{N}{a}\mathcal{Y}(t),$$

The model (3) can be reduced to the system

$$S^1 = -aS\frac{I}{N} \qquad (3)$$

$$I^1 = aS\frac{I}{N} - \gamma^I$$

It is a basic model from Kermack-McKendrick. Form (3) has been regarded for several years as the Kermak - Mackendrick disease model, despite the reality that the present KermakMackendrick model is a very special situation. Dependence on the age of diagnosis, that is, the period after infection, was used in the detailed model which can be used to include a systematic approach to segmented disease models.

Exponential Growth

The transmission of an epidemic disease relies on the amount of person-to-person interaction and the possibility that the disease would be passed on to another person from an infected person. The disease will quickly continue to propagate rapidly if any infected person had interaction with two other individuals before recovery. Assuming it takes one day to recover, another day would double the number of patients. This condition is demonstrated schematically. A geometric sequence is called the series of numbers in which the ratio of any two consecutive intervals is a constant r (in this case, r = 2). The ninth phrase is represented as:

$$A(n) = A(0)r^n, \qquad (4)$$

The original entity is A. (0). If r is larger than 1, then the sequence reaches positive infinity rapidly. Between r and 1, the sequence converges. When you borrow capital, the interest is usually a geometric sequence. When annual interest is 30%, the return within five years would be as follows:

$$\frac{A(5)}{A(0)} = 1.3^5 \simeq 3.7. \qquad (5)$$

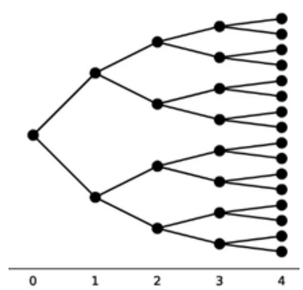

Fig1: Schematic representation of spread of epidemic disease

Extending n to a real number, we introduce the exponential function

$$x = r^t \qquad (6)$$

The differentiation of the exponential function can be calculated as follows:

$$\frac{dx}{dt} = \lim_{h\to 0} \frac{r^{t+h} - r^t}{h} = r^t \lim_{h\to 0} \frac{r^h - 1}{h} \qquad (7)$$

The special constant r that satisfies the limiting equation

$$\lim_{h\to 0} \frac{r^h - 1}{h} = 1 \qquad (8)$$

Is called Napier's constant e. with this definition of e, the differentiation of the exponential function becomes

$$\frac{d}{dt} e^t = e^t. \qquad (9)$$

Here after, we treat the form of the exponential function as

$$x(t) = Ce^{at}. \qquad (10)$$

The exponential function grows $a > 0$, and decays for $a < 0$. When $a = 0$, the function becomes constant. We have assumed that $C > 0$.The inverse function of x $t = t(x)$, is a logarithmic function written as

$$t = \log_r x, \qquad (11)$$

The foundation of the house is put here. Logarithmic function with base e, or normal logarithmic function is denoted as follow,

$$\log_e x = In\, x. \qquad (12)$$

The basic exponential function bursts whenever a>0. To determine if a breeding takes place quickly or slowly, we can determine the gestation period under the condition.

$$\frac{x(t_2)}{x(t_1)} = \frac{e^{at_2}}{e^{at_1}} = e^{a(t_2-t_1)} = 2, \qquad (13)$$

We obtain that the doubling time is a time difference that satisfies

$$a(t_2 - t_1) = In\, 2. \qquad (14)$$

Chart plots are useful in order to track the growth trends. In this figure, both linear and semi- log plots are shown. A semi-log plots on one hand with one axis on a linear scale, and on the other with another on a logarithmic scale. As predicted, as the inputs grow exponentially, the output grows linearly.

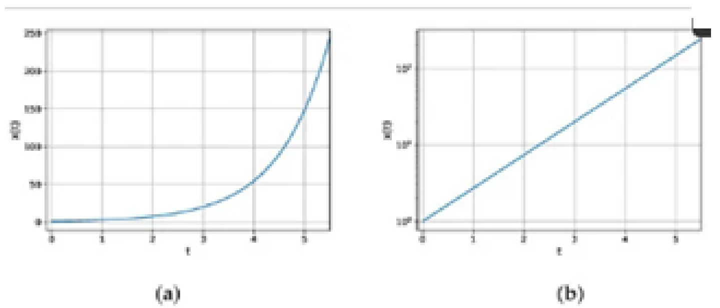

Fig 2: Exponential Growth and linear Growth

Next, we explain the differential equation. Let us the consider the case in which the increase in a variable $x(t)$ is proportional to$x(t)$, i.e.

$$\Delta x(t) = x(t + \Delta t) - x(t) = ax(t)\,\Delta t. \qquad (15)$$

The variance in the left-hand side becomes larger when the time difference Δt becomes longer, hence, Δt is the multiplied to the right-hand side. If we divide both side by Δt and take the limit of $\Delta \rightarrow 0$, the following differentiation definition is obtained:

$$\lim_{\Delta t \rightarrow 0} \frac{x(t+\Delta t)-x(t)}{\Delta t} = \frac{dx(t)}{dt} = ax(t). \qquad (16)$$

The equation, defined as the differential equation, becomes dx (t) / dt. A general solution to the differential equation shown in Equation (16) is considered, since equation (10) fulfils the differential equation. Here, C is a constant that is random and regarded as an integral constant. First, the statistical model for transmitting infectious diseases is discussed.

IV. Conclusion

Any model is only valid under the assumption of assumed, which is a separate condition from the likelihood it would be true. Thus, this analysis or all other studies that addresses epidemics may not establish specific diagnostic information and how to handle the disease is used by physicians for proper planning and decision making to work on the costs and benefits. For those researchers who are conscious of the points and pitfalls of mathematical models in biological sciences, this study may be a good illustration. This paper explored the epidemic data which could be analyzed through mathematical base for the prediction analysis and exploration of data.

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