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DIFFERENT METHODS TO HANDLE PANDEMICS AND EPIDEMICS

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Abstract

The purpose of this research paper, is to find out how a country or society can be prepared for and handle an epidemic or a pandemic. In 2020, when COVID-19 hit India, the whole country was unprepared. India was among the worst hit countries in the world. The country saw around 100,000 cases per day at peak and the country proclaimed success in its ability to handle cases though it didn't have sufficient beds to handle the patients. In 2021, the country had around 400,000 cases per day with around 3000 deaths and the whole country was in disarray. This clearly indicates that the current form of data capture and communication is inadequate to handle problems of this magnitude [1].

This study aims to determine how governing bodies can better handle and prepare for deadly outbreaks. The information was collected from various websites including WHO and statistics from local bodies within the country. The results prove that we need to communicate detailed, correct and live information, obtained fromvarious diagnostic tools and imageryvia the media depictingthe seriousness of the outbreak. This will help the governing bodies to enact tough laws, stack medicine and supplies and build infrastructure to support public health.This could also play a massive role in predictingfuture trends.

Introduction

The topic of epidemics and pandemics are not often discussed in modern society. The Spanish Flu occurred over a whole century ago killing over 50 Million people while COVID-19 has been described as a black swan event taking 4 Million lives. Modern society has short lived memory. Media coverage of the pandemic peaked during March 2020 (at 10% of total news articles compared to the number of new cases) and dropped to an all- time low in June 2020 (at 4% of total news articles compared to the number of new cases). This proves that modern society has short lived attention and has taken the pandemic very lightly despite paramount urgency [2].

This research paper speaks about what steps are already in process, but also recommends the future of how governments should taketougher stands in order to protect interest of its weakest and most vulnerable population.

1. Media and communication

Communication plays a big role in combating pandemics and epidemics. It refers to the real-time exchange of information, advice and opinions between health experts or officials and people who face a threat to their survival, health or economic or social well-being. Its ultimate goal is that everyone at risk is able to take informed decisions to mitigate the effects a disease outbreak and take protective and preventive action. Communication also plays a huge role in slowing down the amount of deaths caused by pandemics and epidemics. Effective risk communication not only saves lives and reduces illness (by informing people on how to protect their health), it also enables countries and communities to preserve their social, economic and political stability in the face of emergencies [3].

Now, with access to social media, the internet, radios, newspapers, television news channels, etc; communication is a lot easier. People in poorer countries can also communicate with each other and spread detailed information more effectively.

To prove this point, the Black Death killed around 75 – 200 Million people from 1346 to 1353, whereas during the peak of the HIV and AIDS pandemic, around 35 Million people lost their lives. Evidently, the deaths caused by the HIV – AIDS Pandemic is much lower than that of Black Death.This shows the drastic impact of having better communication.

2. Tools For Diagnostics

The direct detection of viruses in clinical and other samples include microscopy, antigen detection such as ELISA, and molecular detection of the viral genomic material by PCR. Popular molecular diagnostic techniques including qPCR or RT-qPCR also allow quantification of viral loads. While these techniques are highly sensitive for the detection of specific viruses in a sample, they can only identify viral sequences that match a pre-defined search image that matches the designed PCR primers. Thus, these established diagnostic tests frequently yield negative results when a patient presents a clinical phenotype, but no virus is detected. This can be either because an uncommon variant of a known pathogen is present in the sample, or because a novel virus is the causative agent of the disease. Notably, the difference between these two possibilities is continuous, reflecting increasing evolutionary distances along the viral phylogeny. Bioinformatic approaches allow PCR panels to be designed that capture an increasingly diverse array of viruses, but these assays will always remain limited to detecting viruses within a known range, and cannot extrapolate to identify completely novel ones. This may be resolved by untargeted (shotgun) sequencing of isolated viruses or complete sample DNA (metagenomics). Variants of known viruses may be detected by aligning the reads derived from the sample to the reference sequence of the known virus that was originally used for designing the primers. If enough high-quality reads span the regions where the primer sequences should anneal with the target, specialized variant detection tools can call the variant with a high degree of confidence, and new PCR primers can be designed to capture them. For example, a recent PCR-based investigation of the widespread human gut-associated bacteriophage Cross - Assembly Phage, designed globally applicable primers by screening an alignment of sequencing reads from a range of publicly available metagenomes and identifying highly variable regions of the appropriate size (1000–1400 nucleotides) that were flanked by conserved regions which could be targeted by primers, and were present in ≥90% of all metagenomic samples (<10% gaps). These

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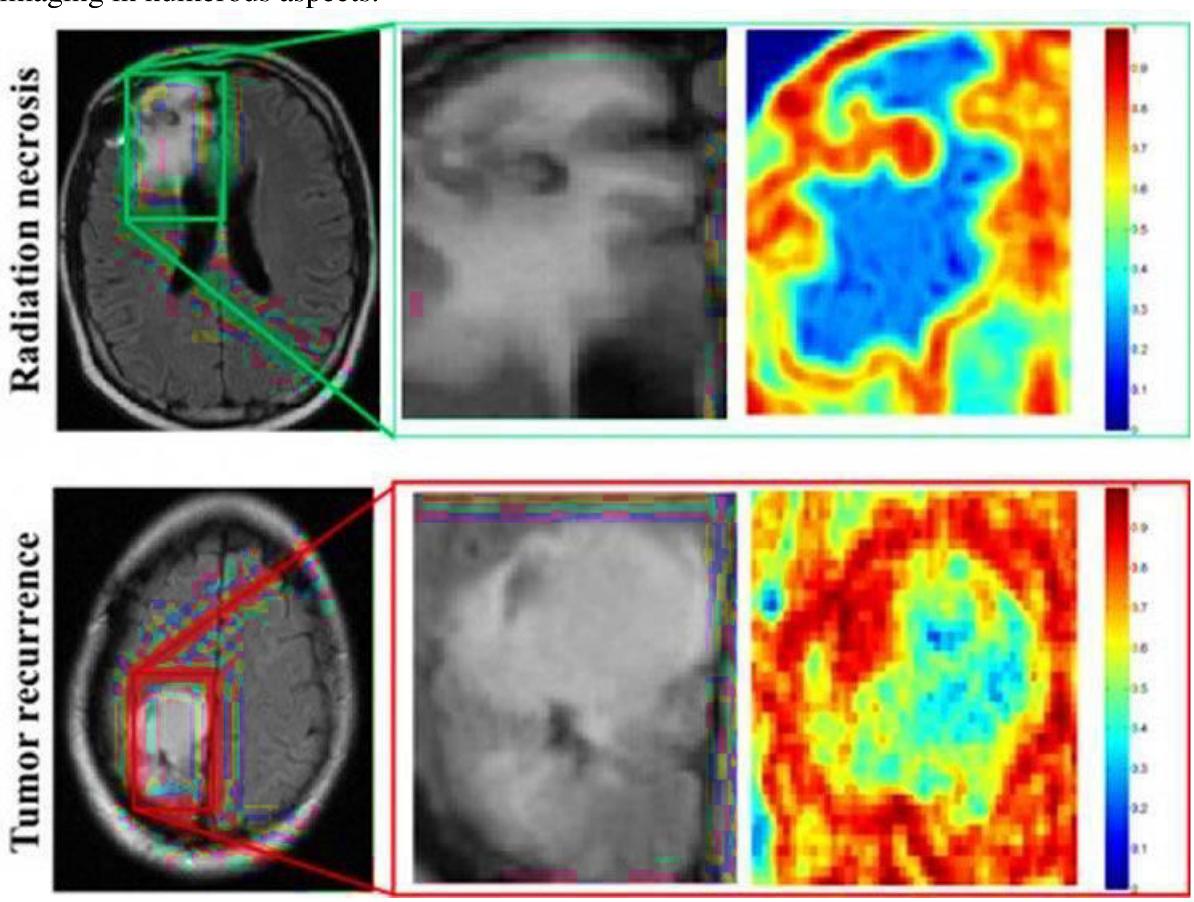
primers allowed a range of collaborating laboratories to independently detect Cross - Assembly Phage in samples from 62 different localities on six continents.

3. Medical ImageAnalysis

Popular imaging techniques include Magnetic Resonance Imaging (MRI), X-ray, computed tomography, mammography, and so on. Various techniques are utilized to tackle the difference in modality, resolution, and dimension of these depictions. Many more are being developed to boost the image quality, extract information from images more efficiently, and come up with the most clear cut interpretation. The deep-learning based algorithms increase the diagnostic accuracy by learning from the previous examples before recommending greater treatment solutions. The most common image-processing techniques specialize in enhancement, segmentation, and denoising that enables deep analysis of organ anatomy, and detection of numerous disease conditions. The most promising applications aim to identify tumors, artery stenosis, organ delineation, and so on . Different techniques and frameworks contribute to medical imaging in numerous aspects.

Image 1



MRI scans of patients with radiation necrosis (above) and cancer recurrence (below) are displayed in the left column. Close-ups in the middle column show the areas are indistinguishable on routine scans. Radiomic descriptors unearth fine variations displaying radiation necrosis, in the top right panel, has much less heterogeneity, displayed in blue, compared to cancer recurrence, in the lower right, which has a much higher degree of heterogeneity, depicted in red.[4]

Hadoop, a famous analytical framework, employs MapReduce to seek out the optimal parameters for tasks like lung texture classification. It applies machine learning methods, support vector machines (SVM), content-based medical image indexing, and wavelet analysis for solid texture classification.

This shows how multiple programs and apps can work together using data from observations and external inputs, to get very detailed understandings on diseases. This would help us learn about the threats that these diseases impose on us and would help us be prepared by the time the next outbreak hits.

4. Predicting the future for pandemics and epidemics

Knowing what the next pandemic will look like is not as easy as you think. Historically, flu pandemics have all differed slightly. There were always different strains of the virus(6 variants of COVID-19) and outbreaks hit some places and peopleharder than others. What we need isa way to separate things that arespecific to a particular flu outbreak in order to clearly identify and understand solutions to the flu. For example, it is likely that social interactions areimportant in spreading flu. During the2009 pandemic in Hong Kong, there arelots of infections in busy places like schools. But we also know that childrenhad less immunity to this virus thanadults. So what kind of behaviour isactually important for epidemics? What sort of data should we becollecting before an outbreak if we wantto predict how infections might spread? These questions play a crucial role in finding out the types of potential future outbreaks. A study was conducted by Adam Kucharski and his team. They built a mathematicalmodel of the Hong Kong outbreak. Usingdata on social behaviour and immunity, they tried to predict different people's riskof getting flu.They created over 100models in total covering a whole rangeof behaviours. The most accurate ones showed that if they wanted to predictinfection patterns,they would need data on physical contact. They would also need to know who is more prone than others to a virus or flu. They know our risk of flu infectiondrops when we leave our childhood and
enter our twenties; but it increasesagain when people become parents. Thisapproach was powerful because it wasn'tlimited to one location. Once they knewwhich kinds of behaviour were important, they could put in data from any country. For example, Hong Kong residentstypically had physical contact witharound five other people each day. The UK is similar but in Italy the average is 10. It was a promising start, but topredict epidemics they don't just need toknow how many contacts people have. They need to know where they travel and wherethe infection might spread.So, they invited UK residents to download a specifically designed phone app. This allowed them to collect data on age, occupation and overall health. It also tracked their movements and allowed them to track other social information that was useful in getting important data for the study. They analysed the data of over 50,000 people. These people were school children, pensioners, healthcare workers, etc. Basically, the app was being used by society at large. With such data andour growing insights into how behaviourshapes epidemics, we will be able to studyflu pandemics in a whole new level of detail. We can look at how quickly theymight spread and which groups might be most at risk. We can also see thepotential effects of control measureslike school closures or vaccination campaigns and we will be able to do all ofthis before the next outbreak hits [5].

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Case Study - Summary

COVID 19 has been one of the deadliest outbreaks we have ever been exposed to. We were underprepared when the virus came to our country and hence, it took many lives. But what if we were prepared? How could things have been done differently? And most importantly, what next steps can we take for our country?

In this conclusion, we will see how these techniques can be best put to use altogether. The population of India is 1.4 Billion. Out of this, 469.3 Million people use smartphones (most users being from major cities). This could play to our advantage. The government could collaborate with phone companies to promote using an application that records data on age, occupation and overall health. It must track the user movements and must track proximity to other people along with other social information via GPS and control towers. It should track this information as we know that movements and proximity play an important role in the transfer of viruses. For privacy issues, residents of the country must be given codes that maybe given by the telephone company. Thus, the customer information can be with the telephone company.

The result of this will be more accurate statistics for the government, making there be less corruption in the government system and resulting in better decisions; There willbe more customer information for telephone companies as well. Also, this will allow authorities to track those who travel the most and those who can be potential COVID-19 patients. This also will result in more accurate COVID-19 testing, better prediction for pandemic hotspots, etc. The media will come in use in promoting the app and spreading important information regarding new strains, statistics, etc. all found by diagnostic tools and imaging analysis companies working together.

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