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DATA SCIENCE- A NEW SURVEILLANCE TOWARDS THE INDICATION OF A FUTURE PANDEMIC?

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Abstract

Pandemics and epidemics can cause sudden, widespread morbidity and mortality as well as convivial, political, and economic disruption.The main objective of the following research paper is to provide is pellucid analysis and methods of how data science can be utilized in the engenderment of an algorithm that can be habituated to detect a further pandemic or epidemic as a component of '*How data science techniques can be utilized for handling epidemic and pandemic*' domain. The research paper provides an elaborated study for identically tantamount. The research for the following was done over a period of a fortnight and we must conclude from the study below that imageries of data science and its use in the detection can possibly foster life in case of a future pandemic and how political institutions must work along and be yare in advance to cope up with the situation with the engenderment of vigorous strategies.

Keywords:- *Epidemic/pandemic prevention, predictive analysis, public, algorithms, future, technology*

Introduction

Pandemics and epidemics are a constant threat to public health ecumenical. In the past few decades, several major outbreaks of various such pandemics that are inclusive of the 2009 influenza pandemic, the 1957 Spanish flu and the 2019 COVID-19, etc. These have been potent reminders of the desideratum for a robust surveillance systems and timely replications.The following research paper highlights the detection phase prior to its outbreak and involves the engenderment of data science algorithms that will detect the pandemic in the future itself & surveillance systems.Data science is a field of science that deals with the utilization of scientific methods, process, algorithms and systems to extract cognizance and insights from structured and unstructured data. These algorithms are sums of simple analytics that can take place essentially centered around estimating the transmissibility while keeping in mind sundry factors such as population size, the size of the country's economy and its healthcare infrastructure.

Theory

Regimes around the world, perpetually put efforts in amending their healthcare systems by investing a high quantity of their budget in healthcare. However, the emergence of a pathogen up brings a major public health concern, by incrementing the possibility of an epidemic/pandemic.An efficacious response to such an outbreak is dependent on the timely intervention of the accumulation, visualization and analysis of outbreak data by the regime as the intricacy of such data increases with timeowing the diversity in types of data, questions and available methods to address them. Data science is an interdisciplinary field that utilizes scientific methods, processes, algorithms and systems to extract cognizance and insights from structured and unstructured data, and apply erudition and actionable insights from data across a broad range of application domains.(1) Firms can utilize astronomically immense data analytic techniques to deal with extreme uncertainties such as those caused by the current COVID-19 pandemic. A Predictive analysis is concerned with what may transpire in the future (what impact will the outbreak have on the economy?, the degree at which the outbreak shall effect the population, how efficaciously can the current healthcare system deal with the degree of the outbreak?, how frequently may the RNA/DNA structure vary to lead in formation of incipient variants of the pathogen?, the prognostication of how long will the outbreak last, etc...) and is generally considered as the utilization of 'statistical techniques to analyze current and historical facts to make presages about future events and/or behavior'. We may classify the predictive analytic techniques into 3 main categories as explained in the table below. That is inclusive of a structured and an unstructured data. Analyzing both structured and unstructured data becomes a consequential source for understanding patterns in data.(2)

Table 1, Main methods of predictive analysis, https://onlinelibrary.wiley.com/doi/10.1111/1467-8551.12441

Methods Category	Brief Description	Applications
Statistical Inference	Utilize statistical approach to analyze a substantial amount and a high dimensional structured dataset.	Resource allocation; credit risk evaluation; churn prediction.
Machine Learning	Utilize machine learning algorithms to build complex models on profoundly and astronomically immense datasets to prognosticate future outcomes.	Capacity planning; risk profiling; customer segmentation; demand forecasting, sale forecasting, churn prediction, fault detection
Methods for unstructured data analysis	Quantify unstructured data to find and expound patterns in human behavior.	Predict customer or user behavior; recommendation; monitor product or service quality; real-time interaction.

Established population-surveillance systems typically rely on health-cognate data from laboratories, notifications of cases diagnosed by clinicians and syndromic surveillance networks. In the past two decenniums, data from online news sites, news-aggregation accommodations, convivial networks, web searches and participatory longitudinal community cohorts have aimed to fill this gap. Data-aggregation systems, including ProMED-mail, GPHIN, HealthMap and EIOS which use natural language processing and machine learning to process and filter online data, have been developed to provide epidemiological insight.

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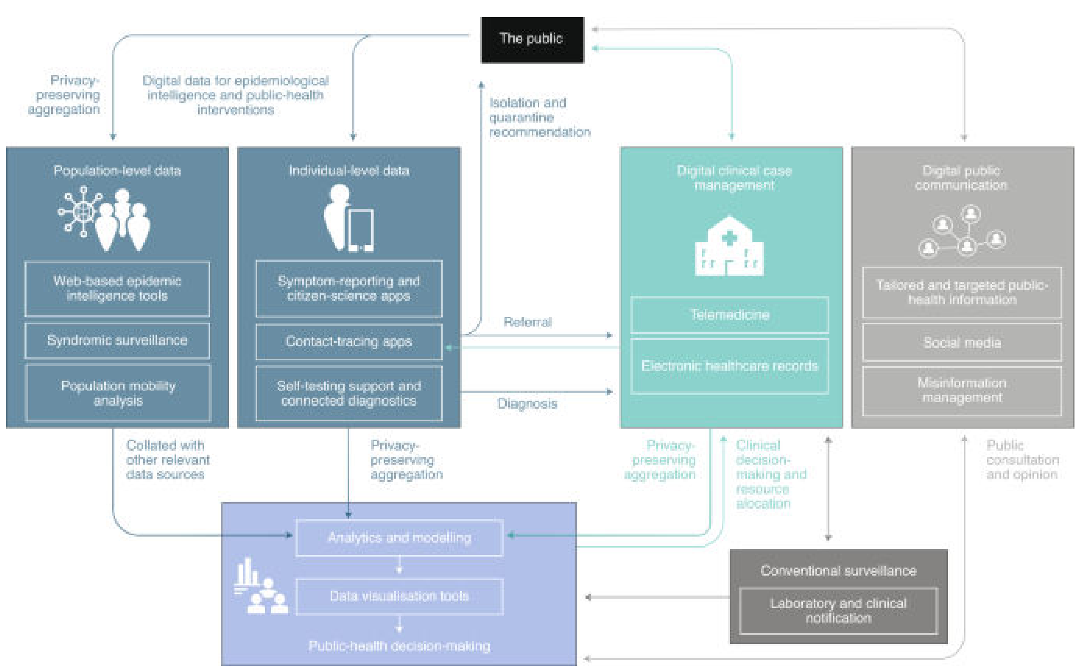
Early and expeditious case identification is crucial during a pandemic for the isolation of cases and opportune contacts in order to minimize onward spread and understand key risks and modes of transmission. Digital technologies can supplement clinical and laboratory notification, through the utilization of symptom-predicated case identification and widespread access to community testing and self-testing, and with automation and expedition of reporting to public-health databases. (3) Digital technologies join a long line of public-health innovations that have been at the heart of disease-aversion-and-containment strategies for centuries. Public health has been more gradual to take up digital innovations than have other sectors, with the first WHO guidelines on digital health interventions for health-system fortifying published in 2019. (4)
Digital technologies cannot operate in isolation and need to be incorporated into the existing public healthcare systems. Digital data sources, like any data source, need to be integrated and interoperable, such as with electronic patient records. Analysis and the usage of these data will depend on the digital infrastructure and readiness of public-health systems, spanning secondary, primary and user friendly systems. The logistics of distribution to ascertain population impact are often given too diminutive attention and can lead to over-fixate on the individual technology and not its efficacious operation in a system. The coordination of interventions is withal a challenge, with multiple symptom-reporting sites in a single country, which perils fragmentation. Looking ahead, there is a desideratum for a systems-level approach for the vision of the ideal fit-for-purport digital public-health system that links symptom-tracking apps, expeditious testing and case isolation, contact tracing and monitoring of aggregated population-mobility levels, access to care and long-term follow-up and monitoring, with public communication. Figure 1 below provides a flow of information in a digitally enabled and integrated public health system during an outbreak of an infection disease that may lead to an epidemic/pandemic.

Fig. 1, Flow of information in a digitally enabled and integrated public health system during an outbreak of an infection disease that may lead to an epidemic/pandemic



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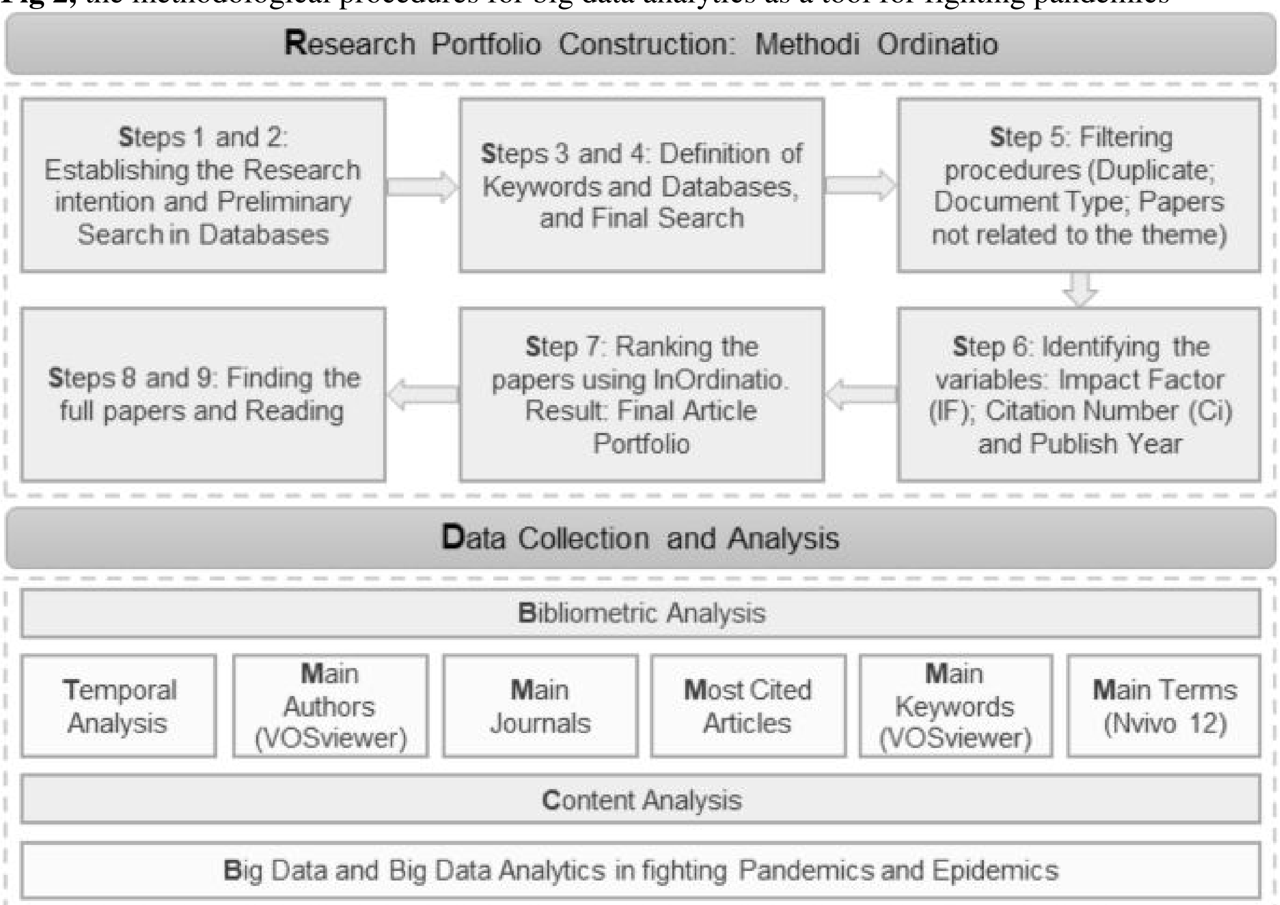
Enabling an early outbreak detection and authentic time disease surveillance avails in detecting the widespread of the disease afore its emergence. Currently AI is utilized to ingest and fuse near authentic time data from varied sources- including news aliments, gregarious media, public health data, clinical health data and digital health implements- to monitor outbreaks, gauge incipient hotspots, and quantify the progress and astringency of the virus. However in the near future, AI models can prognosticate the spread down of a pandemic/epidemic to a country level, engendering an implement that can avail appraise local policy decisions. AI driven platforms would provide bellwethers and health officials with tailored alerts and authentic time circumstantial cognizance of emerging threats. (5)

Experimental

The methodological procedures for big data analytics as a tool for fighting pandemics were divided into two components: (3.1) construction of the research portfolio, which will be the source of data amassment and analysis; and (3.2) data accumulation and analysis procedures, as shown in Fig. 2, and described in the sequence. (6)

Fig 2, the methodological procedures for big data analytics as a tool for fighting pandemics



A paramount initial step in amassing data as a component of a field investigation is determining the mode of data accumulation (e.g., self-administered, mailed, phone or in-person interview, online

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survey) The mode in part dictates the format, length, and style of the survey or questionnaire. Factors to consider when deciding on data amassment methods include the following:

- **The feasibility of reaching participants through different modes.**

What type of contact information is available? Do participants have access to phones, mailing addresses, or computers?

- **Replication rate.**

Mailed and Internet surveys traditionally yield lower replication rates than phone surveys; however, replication rate for phone surveys additionally has declined during the past decennium.

- **Sensitivity of questions**.

Certain sensitive topics (e.g., sexual demeanors) might be better for a self-administered survey than a phone survey.

- **Length and intricacy of the survey.**

For example, for a long survey or one with intricate skip patterns, an interviewer-administered survey might be better than a self-administered one.

- **Control over plenaries and authoritatively mandate of questions.**

Interviewer-administered surveys provide more control by the interviewer than self-administered ones.

- **Cost (e.g., interviewer time).**

A mixed mode of survey administration (e.g., mailed survey with phone follow-up) might be less extravagant to conduct than a phone-only survey, but it additionally increases study intricacy. (7)

RESULT

The focus of the public health replication shifts during the course of an epidemic or outbreak, and so do the analytics. We identify four main stages :The detection stage commences with the first case and ends with the first intervention activities (e.g. patient isolation, contact tracing, vaccination) and involves surveillance systems and mostly qualitative risk assessments. Next, the early replication is the initial part of the intervention during which the first simple analytics can take place, essentially centered around estimating transmissibility. This blends into the intervention stage, where more involute analytics may be involved to apprise orchestrating (e.g. vaccination strategies), which ends once the last reported case has recuperated or died. The post-intervention stage is for edifications to be learned, for amending preparedness for the next epidemic and for training and capacity building. (8)

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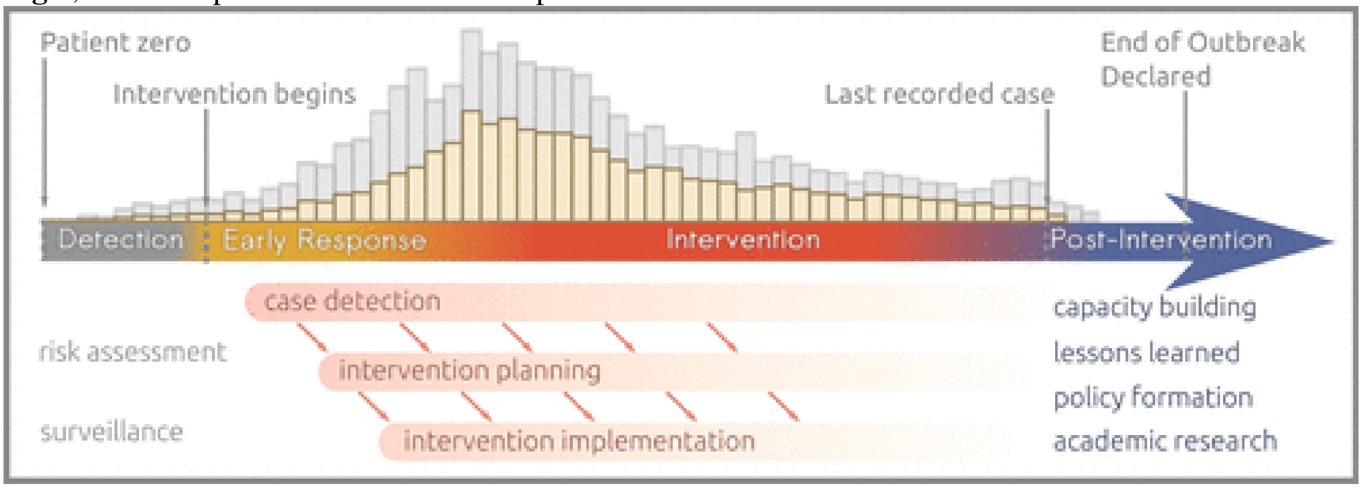
Fig 2, Different phases of an outbreak response



DISCUSSION

The following research study, provided an overview on ways of accumulating different forms of data for the detection of a future pandemic. Outbreak analytics is embedded within a broader public health information context that commences with disease surveillance systems, followed by risk assessment and management, the epidemiological replication itself, and culminates with the engenderment of actionable information for decision making. A component of the challenge that this incipient field will face in the coming years pertains to the seamless integration of data analytics pipelines within subsisting workflows. As responders can allocate only inhibited time to data analysis, analytics resources should engender simple, interpretable results, highlighting the most pressing issues that need addressing and monitoring all germane designators to apprise the replication.

CONCLUSION

Despite huge technological advances over the past few centuries, infectious diseases still threaten health worldwide. The probability of the expeditious, unexpected spread of an infectious pathogens across the world has become much higher, due to the increasing globalization admits countries from all around the globe. Expeditious urbanization, an incrimination in international peregrinate and trade, and the modification of agriculture and environmental changes have incremented the spread of vector populations, putting more people in peril and uncertainty. To avert the spread of outbreaks, we require to ken which diseases are where, what rate they're spreading at, and how they're spreading. This involves pulling together erudition from hospitals, GPs, and community health workers across different locations. Piecing together the spread of a disease across a region often requires communication between sites, which only transpires if people are concretely concerned. This can be a non-nugatory task when electronic notes are not always taken and are often not interoperable.

The future of public health is liable to be increasingly digital, and apperceiving the paramount of digital technology in this field and in pandemic preparedness orchestrating has become imperative. Key stakeholders in the digital field, such as technology companies, should be long-term partners in preparedness rather than being partners only when emergencies are perpetual. Viruses ken no borders and, increasingly, neither do digital technologies and data. There is a clamant desideratum for alignment of international strategies for the regulation, evaluation and utilization of digital technologies to reinforce pandemic management and future preparedness for COVID-19 and other infectious diseases.

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