White Paper

Vaccine Development, Distribution, and Deployment: the Role of Data

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Background

COVID-19 has played havoc with lives and economies, the world over. [1]As of 03 February, the number of COVID cases in the world totals 103 million with 2.24 million deaths. The numbers for India stand at 10.8 million cases with 155,000 deaths.[1] The virus has taken a huge toll on human life.

[2]The World Economic Situation and Prospects 2021, produced by the United Nations Department of Economic and Social Affairs (UN DESA), said the world economy was hit by a once-in-a-century crisis, a Great Disruption unleashed by the COVID-19 pandemic in 2020. The global economy shrank by 4.3 per cent last year, over two-and-a-half times more than during the global financial crisis of 2009. The modest recovery of 4.7 per cent expected in 2021 would barely offset the losses of 2020.[2]

Further to the above, and as per the UN, India's economy is projected to grow at 7.3 per cent in 2021, even as it has been estimated to contract by 9.6 per cent in 2020 as lockdowns and other efforts to control the COVID-19 pandemic slashed domestic consumption.

The humongous challenges thrown up by the pandemic have accelerated the urgent need to develop vaccines to combat this challenge. The development, procurement, distribution and deployment of vaccines is, in itself, a mammoth task that relies on research, trials, logistics and application, involving systems that demand efficacy. The past few months have seen hectic processes in this regard, globally and in India, where vaccination has begun with healthcare workers, of whom more than 2 million have been targeted. One element's role in this entire process has been paramount: the role of data.

[3]Big Data have contributed and are expected to continue contributing toward facilitating the discovery, development, production, and delivery of rationally designed vaccines. Further, enabling to identify predictive biomolecular signatures of response to vaccination, vaccination will shift from the classical "one-size-fits-all" paradigm to a personalized approach. Moreover, Big Data can be used to track the success of vaccination campaigns, in term of vaccination coverage rate, as well as the rare/very rate vaccine- related adverse events, for which "classical epidemiological studies" would be statistically underpowered.[3] This, though, is just the beginning of the ongoing "Big Data revolution."

Introduction

For almost a year now, the pandemic has dominated headlines in India and around the world. The initial focus was on incidents, transmissions, virulence, fatality rate and so on. In more recent times, the focus has shifted to the development of vaccines, safety, efficacy et cetera.

The country has also shifted focus to the role of data in managing the vaccination phase of this pandemic - how data is collated, analysed and extrapolated, as well as data incompleteness, inaccuracies, privacy and standardization. India has begun, with its vaccination program, the arduous journey of digitization of health care provision.

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[1] https://github.com/CSSEGISandData/COVID-19
[2] https://www.business-standard.com/article/economy-policy/india-estimated-to-contract-by-9-6-in-2020-grow-at-7-3-in-2021-un-121012600304_1.html
[3] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5845111/

Centre for the Digital Future at the India Development Foundation, in collaboration with other researchers and institutions, aims to explore the use of real-time and other novel datasets to address research questions raised by experts.

This project is supported by Facebook's Data for Good initiative. Under the aegis of this project, a number of round tables have been and are being organized, the most recent one being: Vaccine development, procurement, distribution and deployment: The role of data. This paper is based on the discussions during the Round Table.

Data's role for vaccine development

So, how is data useful in the development of vaccines? Before this question is addressed, it is more important to focus on the question of how to use the data available as effectively as possible. For this, capture of the required data, and only this, is paramount, based on which iteration and deciphering is easier, enabling the matter at hand to be addressed quicker. Lean data collection is the principle that should be followed not just in vaccine development but in all of digital healthcare.

During the roundtable, Dr Gagandeep Kang, Professor of Microbiology, Wellcome Trust Research Laboratory, Division of Gastrointestinal Sciences, Christian Medical College (CMC), highlighted the need for efficient collection of select quality data, especially during a pandemic when the need to act fast is dire; in other words, necessity of scale rather than depth is essential; what also needs to be avoided or minimized is the duplication of efforts that cause wastage of time and effort.

One good example of selective data capture is the Solidarity Trial by the WHO.[4] This trial is an international clinical trial to help find an effective treatment for COVID-19, launched by the World Health Organization and partners. It is one of the largest international randomized trials for COVID-19 treatments, enrolling almost 12,000 patients in 500 hospital sites in over 30 countries. The Solidarity Trial evaluating the effect of drugs on 3 important outcomes in COVID-19 patients: mortality, need for assisted ventilation and duration of hospital stay.[4] Several Indian hospitals that were a part of this trial decided to focus on relevant data capture at the patient's level.

Hence, to summarize: the capture of data should be easy, efficient, and standardized, and should serve the end purpose (in other words, it should be valuable). Possibly, data should be generated automatically as a sequence of activity, which brings us to the next vital point -- electronic data capture.

"The shift towards electronic data capture during clinical trials, especially applicable to vaccine development for COVID-19, is significant. In fact, the quick emergence of results from diverse trials held could be attributed to a system that captures select, quality data needed efficiently and quickly," adds Dr Kang.

Another example relevant to electronic data capture (and brought up during the course of the discussion), exercised in many countries, was of hybrid clinical trials; during these, electronic data capture ensured the capture of the data needed, and its quality, in a quick and efficient manner.

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[4] https://www.who.int/emergencies/diseases/novel-coronavirus-2019/global-research-on-novel-coronavirus-2019-ncov/solidarity-clinical-trial-for-covid-19-treatments

In India, however, the challenge remains that we don't actively have real time data capturing platforms; multiples sources of data exist, and absence of unification of these sources is a challenge, in addition. Having said this, and keeping in mind India's diversity and size, it should be easier for pattern recognition if digitization of this data is done properly. In fact, the answer could possibly lie in understanding that one curve representing the output of select data is a series of aggregated curves, with the possibility of use of both elements – the local curve for local intervention and the aggregated curve to track the trajectory of the pandemic for the entire country. This point was brought up by Dr. Kang during the course of the discussion.

Another major challenge pertains to the uptake of data. Dr Sangita Reddy, Joint Managing Director, Apollo Hospitals Enterprises and Former President FICCI opines: "Systems and human resources need to be in place for the same; the objective should be clear, and a motivation to support data uptake should be obvious. For the smooth and efficient uptake of data, it was also suggested that concerned resources should be equipped with the necessary skill sets and systems, which (systems) should be user friendly. Besides this, value needs to be attached to the task of uptaking data – not only at the individual level, but at the macro level. Use of NLP/voice recognition et cetera could be considered to accelerate the processes of data uptake."

Data for vaccine distribution and deployment

After vaccine development, the next set of challenges lie in the distribution and deployment of vaccines, especially in a country like India, with such expanse and diversity. Logistics will and do play a crucial role in the distribution of the COVID-19 vaccine to the approximately 1.3 billion people the country houses. Here too the data can simplify the process to a large extent – to whom has the vaccine to be administered to, how does it need to be transported including routes, how does it need to be stored, among many other aspects.

[5]India's vaccine management is currently taken care of by the electronic Vaccine Intelligence Network (eVIN), implemented in 32 states. Although it has improved the supply chain, the latest available audit of eVIN shows certain bottlenecks. Thus, data science and IoT can help eVIN identify and resolve bottlenecks to ensure a continuous vaccine supply. IoT can also be used to monitor storage temperatures and alert fluctuations, as a rise in temperature can make the vaccine unstable and lead to wastage.[5]

The fact is that the major learning from the pandemic has been: better and prior use of technology. Dr Randeep Guleria, Director, AIIMS, mentions an important point: "In order to enable primary health care to reach rural India or remote parts of the country, technology could play a vital role (telemedicine and such). Hence, technology should be seen as a supplementing element rather than as a replacement of human capabilities. Many activities can be enhanced via technology (quality enhancement and sustenance, reduced time consumption, minimization of efforts, and such)."

For the transformation of the health care sector, it is paramount that the health care sector is empowered, for which sharing of data for research is vital – of course, with due permissions from the concerned patients.

[5] https://analyticsindiamag.com/a-data-driven-approach-to-covid-19-vaccine-distribution-in-india/

The way forward

India has now begun a journey, in all seriousness, towards creating a national health care platform; one such example: [6]the National Digital Health Mission, (which) aims to develop the backbone necessary to support the integrated digital health infrastructure of the country. It will bridge the existing gap amongst different stakeholders of Healthcare ecosystem through digital highways.[6]

So, whether it is the NDHM or any other platform, the idea is to build a scalable and inclusive platform for delivery of quality health care.

The linkage of this platform to a unique way of identification like via the Aadhar Card would be essential in ensuring efficacy of deployment. As Mr R S Sharma, Former Chairman, TRAI, comments: "Data will be crucial in recording every vaccination administered, efficacy, adverse effects if any, and so many other vital parameters. The uniqueness and correctness of this data can be ensured only when the health stack is linked with a unique personal identification system. This data can serve research well, henceforth."

Going forward, digital health and digital technology, across all phases, would be strongly interwoven with each other in order to maximize the outputs for improvisation, crucial for overcoming the pandemic, as well as the better handling of similar such pandemics in the future.

[6]https://ndhm.gov.in/

Compiled by: Sarah Berry, Head – Communications, Centre for The Digital Future.

The Round Table, supported by Facebook's Data for Good initiative, witnessed the participation of four eminent panelists:

- Shri R S Sharma, Former Chairman TRAI,

- Dr Randeep Guleria, Director AIIMS,

- Dr Sangeeta Reddy, Joint Managing Director, Apollo Hospitals Enterprises and Former President FICCI and

- Dr Gagandeep Kang, Professor of Microbiology, Wellcome Trust Research Laboratory, Division of Gastrointestinal Sciences, Christian Medical College (CMC)

The session was moderated by Prof Shubhashis Gangopadhyay, Research Director, IDF; Vice Chairman, Centre for The Digital Future (CDF); and Dean, Indian School of Public Policy (ISPP).

About IDF: IDF is powered by the belief that rigorous research should inform debates, discussions and decisions on matters of public policy. Over the past 16 years of IDF's journey, the organization has worked with over 80 partners including Governments, multilaterals, corporates and civil society organisations. IDF's research is based along four pillars: fostering an innovation economy; using technology for developmental objectives; enhancing India's human capital; and measuring the efficacy of development policies. More info on: www.idfresearch.org

About CDF: CDF was launched on 30th October, 2019, with a vision to conduct actionable research on the impact of digitization on the economy and society. The inquiries are analytical, without any pre-determined bias, multi-dimensional and evidence-based and provides policy and regulatory insights that enable the transition to an optimal digital economy and society. The Centre was established and incubated as an entity by the India Development Foundation (IDF), a private non-profit research organisation set up as a Trust in 2003. More info on: www.cdfresearch.org