Big data analytics in healthcare: Fuelled by wearables and apps, medical research takes giant leap forward

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Driven by specialised analytics systems and software, big data analytics has decreased the time required to double medical knowledge by half, thus compressing healthcare innovation cycle period, shows the much discussed Mary Meeker study titled Internet Trends 2017.

The presentation of the study is seen as an evidence of the proverbial big data-enabled revolution, that was predicted by experts like McKinsey and Company. "A big data revolution is under way in health care. Over the last decade pharmaceutical companies have been aggregating years of research and development data into medical data bases, while payors and providers have digitised their patient records," the McKinsey report had said four years ago.

Representational image. Reuters

The Mary Meeker study shows that in the 1980s it took seven years to double medical knowledge which has been decreased to only 3.5 years after 2010, on account of massive use of big data analytics in healthcare. Though most of the samples used in the study were US based, the global trends revealed in it are well visible in India too.

"Medicine and underlying biology is now becoming a data-driven science where large amounts of structured and unstructured data relating to biological systems and human health is being generated," says Dr Rohit Gupta of MedGenome, a genomics driven research and diagnostics company based in Bengaluru.

Dr Gupta told *Firstpost* that big data analytics has made it possible for MedGenome, which focuses on improving global health by decoding genetic information contained in an individual genome, to dive deeper into genetics research.

"While any individual's genome information is useful for detecting the known mutations for diseases, underlying new patterns of complicated diseases and their progression requires genomics data from many individuals across populations — sometimes several thousands to even few millions amounting to exabytes of information," he said.

All of which would have been a cumbersome process without the latest data analytics tools that big data analytics has brought forth.

The company that started work on building India-specific baseline data to develop more accurate gene-based diagnostic testing kits in the year 2015 now conducts 400 genetic tests across all key disease areas.

What is Big Data

According to Mitali Mukerji, senior principal scientist, Council of Scientific and Industrial Research when a large number of people and institutions digitally record health data either in health apps or in digitised clinics, these information become big data about health. The data acquired from these sources can be analysed to search for patterns or trends enabling a deeper insight into the health conditions for early actionable interventions.

Big data is growing bigger

But big data analytics require big data. And proliferation of Information technology in the health sector has enhanced flow of big data exponentially from various sources like dedicated wearable health gadgets like fitness trackers and hospital data base. Big data collection in the health sector has also been made possible because of the proliferation of smartphones and health apps.

The Meeker study shows that the download of health apps have increased worldwide in 2016 to nearly 1,200 million from nearly 1,150 million in the last year and 36 percent of these apps belong to the fitness and 24 percent to the diseases and treatment ones.

Health apps help the users monitor their health. From watching calorie intake to fitness training — the apps have every assistance required to maintain one's health. 7 minute workout, a health app with three million users helps one get that flat tummy, lose weight and strengthen the core with 12 different exercises. Fooducate, another app, helps keep track of what one eats. This app not only counts the calories one is consuming, but also shows the user a detailed breakdown of the nutrition present in a packaged food.

For Indian users, there's Healthifyme, which comes with a comprehensive database of more than 20,000 Indian foods. It also offers an on-demand fitness trainer, yoga instructor and dietician. With this app, one can set goals to lose weight and track their food and activity. There are also companies like GOQii, which provide Indian customers with subscription-based health and fitness services on their smartphones using fitness trackers that come free.

Dr Gupta of MedGenome explains that data accumulated in wearable devices can either be sent directly to the healthcare provider for any possible intervention or even predict possible hospitalisation in the next few days.

The Meeker study shows that global shipment of wearable gadgets grew from 26 million in 2014 to 102 million in 2016.

Another area that's shown growth is electronic health records. In the US, electronic health records in office-based physicians in United States have soared from 21 percent in 2004 to 87 percent in 2015. In fact, every hospital with 500 beds (in the US) generate 50 petabytes of health data.

Back home, the Ministry of Electronics and Information Technology, Government of India, runs Aadhar-based Online Registration System, a platform to help patients book appointments in major government hospitals. The portal has the potential to emerge into a source if big data offering insights on diseases, age groups, shortcomings in hospitals and areas to improve. The website claims to have already been used to make 8,77,054 appointments till date in 118 hospitals.

On account of permeation of digital technology in health care, data growth has recorded 48% growth year on year, the Meeker study says. The accumulated mass of data, according to it, has provided deeper insights in health conditions. The study shows drastic increase of citations from 5 million in 1977 to 27 million in 2017. Easy access to big data has ensured that scientists can now direct their investigations following patterns analysed from such information and less time is required to arrive at conclusion.

“If a researcher has huge sets of data at his disposal, he/she can also find out patterns and simulate it through machine learning tools, which decreases the time required to arrive at a conclusion. Machine learning methods become more robust when they are fed with results

analysed from big data," says Mukerji.

She further adds, "These data simulation models, rely on primary information generated from a study to build predictive models that can help assess how human body would respond to a given perturbation," says Mukerji.

The Meeker also study shows that Archimedes data simulation models can conduct clinical trials from data related to 50,000 patients collected over a period of 30 years, in just a span of two months. In absence of this model it took seven years to conduct clinical trials on data related to 2,838 patients collected over a period of seven years.

As per this report in 2016 results of 25,400 number of clinical trial was publically available against 1,900 in 2009.

The study also shows that data simulation models used by laboratories have drastically decreased time required for clinical trials. Due to emergence of big data, rise in number of publically available clinical trials have also increased, it adds.

Big data in scientific research

The developments grown around big-data in healthcare has broken the silos in scientific research. For example, the field of genomics has taken a giant stride in evolving personalised and genetic medicine with the help of big data.

A good example of how big data analytics can help modern medicine is the Human Genome Project and the innumerous researches on genetics, which paved way for personalised medicine, would have been difficult without the democratisation of data, which is another boon of big data analytics. The study shows that in the year 2008 there were only 5 personalised medicines available and it has increased to 132 in the year 2016.

In India, a Bangalore-based integrated biotech company recently launched 'Avestagenome', a project to build a complete genetic, genealogical and medical database of the Parsi community. Avestha Gengraine Technologies (Avesthagen), which launched the project believes that the results from the Parsi genome project could result in disease prediction and accelerate the development of new therapies and diagnostics both within the community as well as outside.

MedGenome has also been working on the same direction. "We collaborate with leading hospitals and research institutions to collect samples with research consent, generate sequencing data in our labs and analyse it along with clinical data to discover new mutations and disease causing perturbations in genes or functional pathways. The resultant disease models and their predictions will become more accurate as and when more data becomes available."

Mukerji says that democratisation of data fuelled by proliferation of technology and big data has also democratised scientific research across geographical boundaries. "Since data has been made easily accessible, any laboratory can now proceed with research," says Mukerji.

"We only need to ensure that our efforts and resources are put in the right direction," she adds.

Challenges with big data

But Dr Gupta warns that big-data in itself does not guarantee reliability for collecting quality data is a difficult task.

Moreover, he said, "In medicine and clinical genomics, domain knowledge often helps and is almost essential to not only understand but also finding ways to effectively use the knowledge derived from the data and bring meaningful insights from it."

Besides, big data gathering is heavily dependent on adaptation of digital health solutions, which further restricts the data to certain age groups. As per the Meeker report, 40 percent of millennial respondents covered in the study owned a wearable. On the other hand 26 percent

and 10 percent of the Generation X and baby boomers, respectively, owned wearables.

Similarly, 48 percent millennials, 38 percent Generation X and 23 percent baby boomers go online to find a physician. The report also shows that 10 percent of the people using telemedicine and wearable proved themselves super adopters of the new healthcare technology in 2016 as compared to 2 percent in 2015.
Collection of big data.

Every technology brings its own challenges, with big data analytics secure storage and collection of data without violating the privacy of research subjects, is an added challenge. Something, even the Meeker study does not answer.

“Digital world is really scary,” says Mukerji.

“Though we try to secure our data with passwords in our devices, but someone somewhere has always access to it,” she says.

The health apps which are downloaded in mobile phones often become the source of big-data not only for the company that has produced it but also to the other agencies which are hunting for data in the internet. "We often click various options while browsing internet and thus knowingly or unknowingly give a third party access to some data stored in the device or in the health app,” she adds.

Dimiter V Dimitrov a health expert makes similar assertions in his report, 'Medical Internet of Things and Big Data in Healthcare'. He reports that even wearables often have a server which they interact to in a different language providing it with required information.

“Although many devices now have sensors to collect data, they often talk with the server in their own language,” he said in his report.

Even though the industry is still at a nascent stage, and privacy remains a concern, Mukerji says that agencies possessing health data can certainly share them with laboratories without disclosing patient identity.

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