

Will Big Data Fundamentally Change Our Approach to the Next Pandemic?

The future of big data's impact in healthcare is large and looming, and it will be here sooner than you think.

Big Data...Hero at Large?

The current COVID-19 pandemic has forced a rethink of drug discovery and healthcare management. Over the first half of 2020, we have seen an unprecedented speed of candidate drug evaluation for the treatment of COVID-19 and the development of vaccines directed against SARS-CoV-2. According to the latest data from the WHO, 18 biopharma companies, and at least 38 vaccine candidates from early research through Phase II/III trials, are involved in addressing the COVID-19 pandemic.

Several advances in medicine and drug discovery have been brought to bear on this crisis. One that holds great promise is in big data. Big data arrived with the promise of changing or improving several aspects of our lives, including healthcare. But some have expressed skepticism about the unfulfilled expectations of big data in healthcare, given the complexities and nuances of disease pathogenesis, diagnosis, and patient needs that rely on physician intuition and human interaction. However, now could very well be the time to take a step back and appreciate how big data might be harnessed to help address healthcare crises or expedite drug development in the future.

What We Mean by Big Data

For the purpose of this discussion, we use the term big data to encompass a wide range of massive and diverse datasets, including the “-omics” (genomics, proteomics, etc), imaging, bioactivity, biochemical, and patient data, as well as the set of analysis tools AI uses in analyzing and extracting patterns and insights from these datasets. These big data applications make in silico approaches, such as

scientific experiments and research conducted through computer modeling/simulation possible.

Big Data's Impact On the Discovery to Commercialization Continuum

As we recently stated in a previous publication, “big data is disrupting the drug discovery process with the datasets, tools, and new forms of partnerships and competition. It's made possible cross-disciplinary datasets and sophisticated analysis tools...” Big data is being employed in many healthcare areas, such as hypothesis generation and synthetic arms for clinical trials, biomarker candidates for new therapies, and patient selection for personalized medicine. But the application of approaches enabled by big data to in silico drug discovery and to vaccine development have particular relevance in the age of COVID-19.

Drug Discovery

The repurposing of existing drugs to help prevent infection and manage symptoms is a major component of the global attempt to control the COVID-19 pandemic. Big data application on existing drug databases combined with analysis of the SARS-CoV-2 virus and data from earlier coronavirus outbreaks (SARS and MERS) are identifying potential candidates for therapeutic interventions. These drugs could reduce infections and help improve outcomes in patients with COVID-19, with the advantages of expeditious availability and known safety profiles.

Vaccine Development

Even before COVID-19, big data approaches to vaccinology have been incorporated into many facets of the development process, including data mining of pathogens for unique immunosignatures, in silico screening of candidate molecules, and bioinformatics-aided analyses to control variables in vaccine production, distribution, and delivery. And now, techniques such as T-cell epitope prediction, reverse vaccinology and machine learning, and automated literature research are facilitating SARS-CoV-2 vaccine development at an un-



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precedented pace through systematic evaluation of existing data.

Quo Vadis, Big Data?

The significance and urgency of the global pandemic is an undeniable stimulus for speed. Although we are only seeing some of the potential of big data in addressing the current pandemic, the availability of tools grounded in big data may actualize a medical just-in-time reality for new drugs and vaccines in the future. Outside of a crisis, the impact of big data on the drug discovery process will be measured through greater efficiency, personalization of medicine, and cost effectiveness. There are hurdles that still need to be overcome, for example data size, proper linkage, accuracy, and quality gaps, but the chance to fundamentally alter how we approach target identification, compound selection, patient identification, drug trials, and more is simply too great an opportunity to ignore. The future of big data's impact in healthcare is large and looming, and it will be here sooner than you think. **PV**

Note: Thanks to Lisa Green and David Bonnyay for their contributions to this article.

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