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# Predictive Analytics: How Big Data Will Improve Outcomes and Efficiencies in Diagnosing and Treating Patients

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Chase Spurlock, PhD, and Michael Fleming, MD

When making a diagnosis, doctors have traditionally (and logically) relied on personal data directly from patients—their lab tests, examinations, and medical histories. But what if insights from *population* data were able to help doctors predict a potential diagnosis months or even years earlier and be used to monitor these patients after a diagnosis is made?

A growing body of research in the exciting field of predictive and prescriptive analytics suggests that if you input large datasets—drawn from millions of healthcare claims or electronic medical records, for example—sophisticated algorithms can identify patterns that deliver meaningful diagnostic information for patients with a wide range of conditions. These technologies can be used to uncover hidden risks in a population by detecting disease, correcting misdiagnosis, and monitoring disease progression. When patients are diagnosed earlier—and correctly—they will be able to start the right treatment plan sooner.

Chase Spurlock, PhD

The power of this approach was demonstrated in a series of pilot studies by IQuity, a data analytics company, using proprietary algorithms to analyze healthcare claims for 20 million people in New York. Focusing on multiple sclerosis (MS), the trial included analysis of 4 billion data points, identifying patients who'd been correctly diagnosed with MS as well as those who'd been misdiagnosed. With high levels of accuracy, the approach was able to predict MS *at least 8 months* before it would typically be diagnosed using traditional methods.

While these pilot studies to date have centered on analyzing claims and social determinants data, predictive analytics can be enriched using a variety of resources. Real-time patient information can be integrated to fuel predictions, including data from Fitbits and mobile apps that monitor weight, blood pressure, and sleep patterns. When this level of personal data is layered on top of healthcare claims, electronic medical records, or other data representative of geographic, socioeconomic, and lifestyle factors, machine learning tools can offer doctors a more comprehensive view of a patient's health outlook than has ever been seen before.

Michael Fleming, MD

## Detection and Monitoring

Early diagnosis can lead to better patient outcomes and deliver substantial cost savings. Healthcare spending tends to accelerate prior to a definitive disease diagnosis, and it also peaks in patients who experience adverse events or exacerbations of disease (relapses or flares), particularly in the case of inflammatory

diseases such as MS. Predictive platforms analyze multiple, longitudinal datasets from hundreds (or potentially thousands) of patients to build tools that find patterns in these patient journeys to facilitate early diagnosis and predict negative outcomes. Use of these analytic approaches can also help monitor diagnosed patients, assessing how their disease status progresses in real time, whether the condition is getting better or worse and how the patient is responding to a particular treatment. Giving doctors these alerts allows for early intervention, which can make a real difference in helping a patient avoid complications or long-term physical damage and, in some cases, will extend life.

Imagine the benefit of being able to anticipate a patient having a serious adverse drug event, allowing time to prepare for side effects and to avoid unnecessary hospitalization costs. Additionally, an analytics strategy can profile patients for possible reduced drug adherence, providing doctors and other caregivers with the opportunity to immediately engage with patients and, if necessary, revise their treatment plans.

### Data Integrity and Ethics

Data integrity is essential to every aspect of healthcare analytics to ensure the credibility of the field and to lend credence to the compelling insights these technologies are poised to deliver. This involves technical considerations to ensure accuracy and completeness of the raw data but also extends to a much broader corporate responsibility to individual patients whose data serves as the basis for the creation of new analytics tools.

Data science teams stand at the intersection of innovation and ethical-use cases. The types of data that are now available not only come from clinical interactions but from other sources as well. Data can have many different origins, making data ownership for patients and consumers difficult to manage, let alone understand. Even though many of the datasets that are used are presented in aggregate or de-identified form, there remains a growing call for more transparency to understand how data is being collected and shared and for what purpose it's being used. A recent example of a political outcome of these discussions was the passage of the European General Data Protection Regulation (GDPR) this past May, which sought to strengthen individual awareness of how vendors are collecting and storing information for future use.

We find that most patients with established disease are willing to share their information and experiences so that their journey can benefit future patients. While the topics of privacy and data security are important, it's vital that we temper future legislation to avoid stifling innovation and hindering the translation of new analytical tools into clinical practice.

### Clinical Application

As predictive analytics becomes increasingly available for real-world applications, medical professionals diagnosing and treating patients will encounter multiple data elements apart from classical clinical data. When new data is woven into the patient narrative, this information needs to be crafted into a framework that doctors will understand and recognize as credible. It's important that an alert not only state that a patient likely has a certain disease, but also includes a detailed rationale as to why the analysis is making a specific prediction.

The onus is certainly on data analytics providers to offer proven, evidence-based solutions worthy of doctors' consideration, and when those solutions are forthcoming, we hope medical professionals will greet them with an open mind. Doctors remain a patient's most important partner in medical diagnosis and ongoing care, using their training, experience, and instincts to weigh all available data on a patient's condition. Predictive analytics, however, has the potential to become a powerful new tool in giving doctors more quality data to work with, helping them better achieve the "Triple Aim" of improving the experience of patient care, improving the health of populations, and reducing the cost of care.

*Chase Spurlock, PhD, is founder and CEO of IQuity, a Nashville-based data analytics company that works with stakeholders to predict, detect and monitor disease to lower the cost of healthcare and improve outcomes by finding and fixing autoimmune disease.*

*Michael Fleming, MD, is past president of the American Academy of Family Physicians and the Louisiana Academy of Family Physicians. He is founding director, chairman and chief medical officer for Antidote Education Company, which offers continuing education for healthcare providers.*

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