CHAPTER 8

HOW DATA WILL IMPROVE HEALTHCARE WITHOUT ADDING STAFF OR BEDS

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Few other industries are as complex, comprehensive, and fascinating as healthcare. Three major forces are impacting the sector today: cost, which is skyrocketing at a time when governments are facing budgetary pressures; access, with 5.8 billion people unable to receive affordable healthcare across the world; and quality, which global providers have struggled to consistently offer.

A key ingredient to address all of these challenges is healthcare *data*, which exists in abundance. Today, hospitals are producing 50 petabytes of data per year.[1] This includes clinical notes, lab tests, medical images, sensor readings, genomics, and operational and financial data. Yet 97% of this information goes unanalyzed or unused. Too often, important patient data is siloed in different departments, devices, medical records or even hospitals and, as a result, the care team lacks a fully informed clinical picture.

The wealth of untapped data has created a path for *precision health*—an emerging approach to healthcare that is integrated, highly personalized to each patient, and that reduces waste and inefficiency.

More effectively integrating data and analytics across the care pathway can better support medical professionals and care providers with insights that enable predictive, individualized, and efficient care. Below I've outlined key examples of how the effective utilization of data is improving healthcare outcomes.

Improving the quality of imaging diagnosis

A staggering 90% of all healthcare data comes from imaging technology. Hospitals store hundreds of millions of digital images, and their numbers are growing as imaging scanners such as MRIs and CTs become better at capturing thinner and thinner slices of the body, and as 3D and 4D imaging become the norm.

Humans alone cannot analyze and convert that much data into useful information. Artificial Intelligence (AI)-powered medical imaging systems can help radiologists diagnose earlier and treat patients with emerging or serious conditions sooner.

Let's look at the potential of harnessing data derived from the oldest form of medical imaging, the X-ray. Just like first impressions with people, the first clinical image taken helps set the path going forward. Chest X-rays represent 40% of the 3.6 billion imaging procedures performed worldwide every year.[2] But X-ray "reject rates", the number of images that cannot be used due to poor image quality or patient positioning, can approach 25%.[3]

To address this, software engineers have developed an application that helps clinicians pinpoint the root causes of rejected images.

The app was piloted at the University of Washington Medical Center and has automated a process that once required 230 mouse clicks and nearly seven hours of work.[4] Reducing these reject rates saves time and resources while putting patients on the right path sooner.

X-rays also provide the first indicator of a potentially collapsed lung, clinically known as a pneumothorax, a life-threatening condition that strikes nearly 74,000 Americans each year,[5] which can be deadly if not diagnosed quickly and accurately.[6] A pneumothorax occurs when air leaks into the space between the lung and chest wall. This air pushes on the outside of the lung and makes it collapse. It can be caused by trauma, cigarette smoking, drug abuse, certain lung diseases, or by complications from surgery.

Today, patients who present with symptoms associated with this condition receive a chest X-ray, which can take anywhere between two and eight hours for a radiologist to read.[7] Clinicians are looking for ways to read chest X-rays faster and in a more prioritized manner to enable a quicker diagnosis.

A new X-ray algorithm uses data to identify potential pneumothorax cases at the point-of-care to enable prioritization of image review. Through simple red and green lights that flag critical cases, technologists taking the scan know whether this is a patient whose images need to be read immediately. When a suspected pneumothorax condition is identified, the point-of-care notification alerts the clinical team, enabling prioritization of image review and potentially changing the trajectory of the patient.

Helping doctors make clinical decisions across specialties

According to the International Agency for Research on Cancer, an estimated 18.1 million new cancer cases were diagnosed globally in 2018, and 9.6 million people died from the disease.[8] In oncology, speeding up diagnosis, improving accuracy, and enabling more individualized treatments offers great clinical potential for doctors, researchers, and patients.

Yet, reports show that the process of preparing for, conducting, and documenting tumor board meetings is frequently suboptimal and non-standardized,[9] with each specialist aggregating data in a silo. As a result, clinicians can develop perspectives based on an incomplete view of a patient, and meetings are spent switching back and forth between different systems and portable technologies used across each discipline. These inconsistencies and inefficiencies can lead to wasted time, decreased engagement, and could even negatively impact patient outcomes.[10]

An alliance between Roche Diagnostics and GE Healthcare aims to combine and analyze patients' in vitro diagnostic data—including genomics, tissue pathology, and biomarkers—with their in vivo medical imaging and monitoring data. When combined with the increasing availability of big data and advanced analytics, a patient can be placed quickly within the context of a broader evidence base.

Co-developed tools present a patient's in vivo and in vitro information alongside not only patient records but also medical best practices and the latest research outcomes, helping physicians make more informed, earlier, and faster diagnoses and helping them determine the most appropriate, individualized treatment for a specific patient.

Among the tools in development is cloud-based software that would fundamentally change the process of tumor board meetings that bring together clinicians from multiple disciplines to discuss the diagnosis and treatment plan for cancer patients.

Lack of effective data integration can also prevent clinicians from understanding the root cause of an illness and may hinder informed decision making when it is most crucial, including in acute situations, such as identifying the onset of sepsis. Without quick treatment, sepsis—a common but serious complication arising from an infection—can cause multiple organ failure. It is estimated to affect more than 30 million people worldwide each year, claiming the lives of 6 million patients.[11]

Roche and GE Healthcare are working to create an AI-enabled "virtual collaborator" to integrate data from electronic medical records with other hospital systems to provide insights into the status and trends of patients who are at-risk for sepsis-related deterioration. The virtual collaborator aims to highlight and integrate the detectable, but potentially undetected, data.

Giving providers the ability to access and analyze patient information across specialties through a single solution, in their existing workflow, empowers them to deliver the kind of care that is expected today—precise, data-driven, and evidence-based.

Using data to individualize precision therapies

Integrating valuable data can have transformative effects not only in a hospital or patient-facing setting but across the healthcare ecosystem. We have recently begun a partnership with Vanderbilt University Medical Center (VUMC), essentially drawing on data to enable safer, more-precise immunotherapies. Immunotherapies use the immune system to recognize and attack cancer cells and can be more effective than traditional treatments, but response rates are often low and side effects can be severe.

Together, we will retrospectively analyze and correlate the immunotherapy treatment response of thousands of VUMC cancer patients with their anonymized demographic, genomic, tumor, cellular, proteomic, and imaging data. We will then develop AI-powered apps that draw on this data to help physicians identify the most suitable treatment for each individual patient.

Not only will these techniques help predict the efficacy of an immunotherapy treatment but also its adverse effects for a specific patient, before the therapy is administered. This would allow physicians to better target immunotherapies to the right patients and avoid potentially damaging, ineffective, and costly courses of treatments.

Addressing capacity, safety, and quality

In the 1960s, airports started using air traffic control technology that allowed them to swiftly transition from scheduling a few hundred flights a day to managing thousands. Now, many airports handle millions of passengers every day. Despite the vast complexity of such a logistical challenge, the airline industry also became significantly safer and more efficient along the way.

This "air traffic control" concept soon spread to other industries. Online retailers use data and technology to predict when customers need their next batch of vitamins. Brick-and-mortar businesses and restaurants use it to track busy times and appropriately staff those periods.

Now the healthcare industry is implementing its own "air traffic control". A small but growing number of hospitals are implementing NASA-style Command Centers, designed to serve as a central mission control across a hospital's functions and services. The goal: address the capacity, safety, quality, and wait-time issues that have plagued healthcare.

A Command Center constantly pulls in streams of data from multiple systems at a hospital. Using simulation, algorithms, and AI, the system will generate predictive analytics that will help staff recognize patterns in real-time and predict what will happen in the next 24 to 48 hours. Advanced algorithms help staff anticipate and resolve bottlenecks in care-delivery before they occur, recommending actions to enable faster, more responsive patient care and better allocation of resources. The data is displayed not only on the Command Center screens but also on tablets and mobile devices. All of this allows the staff to prioritize and focus on delivering care rather than organizing it.

Johns Hopkins Hospital in Baltimore, Maryland was an early adopter of the Command Center, which helped them transfer patients to other hospitals 60% faster, reduce wait times in the Emergency Department by 25%, and decrease time spent waiting in the operating room for a post-surgical bed by 70%.

Industry experts say that this type of digitization is not only inevitable but is just the beginning. Deloitte's Center for Health Solutions report cites centralized digital centers to enable decision-making as one of the major changes the hospital of the future will need to implement to function in a world of evolving technologies, demographic shifts, and economic changes.[12]

According to the report, AI can continuously monitor the data to alert hospital operators and caregivers, enabling more efficient care and better outcomes. Through big-data analytics, machine learning, and AI, patient harm—or unintended consequences—can be predicted before it occurs and suggested interventions can be fed to caregivers. For example, using data on admissions, inter-facility transfers, and predictive analytics on possible days for discharge, command centers can help staff manage patient flow and improve care delivery, better manage lengths of stay, and enhance the discharge process.

Catalyzing the transformation of healthcare

Even though these techniques will change the interaction between doctors and patients and change how care is delivered, they should not be overtly noticed but rather they should seamlessly integrate the existing care continuum—embedded into workflows, processes, applications, and devices already in use today.

This won't happen overnight, but opportunities to deliver precision health already exist throughout the global healthcare ecosystem, from integrated digital diagnostics and AI-based clinical decision support to precision therapeutics like immunotherapies and 3D printing for treatment planning, telehealth, and remote patient monitoring. These are just the beginning.

These tools will quickly feel natural, making way for a more personal doctor-to-patient experience.

Conclusion

To deliver better quality healthcare at a lower cost to more people, healthcare needs to become more personalized, more digitally integrated, and more collaborative. Effective integration of useful data is the key to this transformation. Advanced analytics teams have made significant progress over the past few years, and we are already seeing the impact in pockets of healthcare. The potential is exciting, but there is a lot of work to be done.

Harnessed effectively, data and analytics can increase the efficiency of health systems, offer insights to support clinical decisions, better organize care, and even help to predict future health events. Ultimately this all means more effective, precise, and individualized healthcare with better outcomes for patients, providers, physicians, and healthcare staff.

Notes:

1 EMC MC with Research & Analysis by IDC, 2014.

2 World Health Organization, 2016.

3 Little et al., 2017.

4 GE Healthcare, 2018.

5 Bintcliffe et al., 2014.

6 Morjaria et al., 2014.

7 Rachh et al., 2017.

8 Bray et al., 2018.

9 Patkar et al., 2011.

10 Foster et al., 2016.

11 Fleischmann et al., 2016.

12 Deloitte Center for Health Solution, 2017.

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