Healthcare Data—Little and Big Use Cases

Healthcare stakeholders understand they are surrounded by masses of data from patients, professionals, and transactions. It is key to know how to drive value and meet KPIs (key performance indicators). The following are a selection of exciting healthcare data use cases.

Predicting Waiting Times

In Paris, France, four of the hospitals that comprise the Assistance Publique-Hôpitaux de Paris (AP-HP) teamed up with Intel and used data from internal and external sources, including 10 years of hospital admissions records, to determine day- and hour-based predictions of the number of patients expected to enter their facility.[22]

Time series analysis techniques were used to predict admission rates at different times. This data was made available to all surgeries and clinics and demonstrates an immediate way data could be used to improve efficiency and empower stakeholders.

Most, if not all, clinics across the world have access to similar data, which demonstrates just how healthcare is only beginning to scratch the service of data's application.

Reducing Readmissions

The same approach to waiting times can be used to help manage hospital costs. Using data analytics, at-risk patient groups can be identified based on medical history, demographics, and behavioral data. This can be used to provide the necessary care to reduce readmission rates. At UT Southwestern hospital in the United States, EHRs analytics led to a drop in the readmission rate of cardiac patients from 26.2% to 21.2% through successful identification of at-risk patients.[23]

Predictive Analytics

The preceding examples could very well use static data (i.e., non-real-time small data) and be fairly accurate in predicting waiting times and readmission intervals. The same concept of analyzing data can be used at scale for prediction of disease and the democratization of care.

In the United States, Optum Labs has collected the EHR for over 30 million patients, creating a database for predictive analytics tools to improve the delivery of care. The intention is to enable doctors to make data-driven, informed decisions with proximity and therefore improve patients' treatment.[24]

The robustness that 30 million health records provide allows models to be trained and validated to find people who fit predictive risk trends for certain diseases such as hypertension, type 2 diabetes, heart disease, and metabolic syndrome.

By analyzing patient data including age, social, economic demographics, fitness, and other health biomarkers, providers can improve care at both an individual and population level through not only predicting risk but through the delivery of treatments for optimal patient outcomes.

Electronic Health Records

EHRs haven't quite come to fruition as yet. The idea is theoretically simple: that every patient has a digital health record consisting of their details, demographics, medical history, allergies, clinical results, and so forth. Records can be shared, with patient consent, via secure computer systems and are available for healthcare providers from both public and private sectors. Each record comprises one modifiable file, which means that doctors can implement changes over time with no danger of data replication or inconsistencies.

EHRs make perfect sense; however, complete implementation across a nation is proving a task. In the United States, up to 94% of hospitals use EHRs according to HITECH research. Europe is further behind. A European Commission directive has set the task of creating a centralized European health record system by 2020.[25]

In the United States, Kaiser Permanente has implemented a system that shares data across all their facilities and made it easier to use EHRs. A McKinsey report highlighted how the data sharing system achieved an estimated $1 billion in savings as the result of reduced office visits and lab tests. The data sharing system improved outcomes in cardiovascular disease.[26]

The EHR is evolving into the blockchain, which seeks to decentralize and distribute access to data.

Value-Based Care/Engagement

No longer are patients considered passive recipients of care. Healthcare is now obliged to engage patients in their health, healthcare decision-making, care, and treatment. Engagement can be maintained through digital means. Note that patient engagement is not to be confused with patient experience, which is the pathway (journey) a patient may take.

Financial drivers have already seen healthcare practices becoming increasingly incentivized to best engage with each patient, to ensure services received are satisfactory and of quality.

One of the key drivers of data-driven solutions is the demand for patient engagement and the transition toward value-based care. Better patient engagement enhances trust between patients, treatment providers, and bill payers. Moreover, it leads to better health outcomes and cost savings (or some other benefit) to the provider.

Pioneering health insurance initiatives seek to engage patients with the goal of better health outcomes through entwining premiums to good health. Health innovators Diabetes Digital Media in Warwick, England,

are working with global insurance providers and health organizations to provide scalable digital health technologies for users to optimize their health and wellbeing.[27]

Blue Shield of California is improving patient outcomes by developing an integrated system that connects doctors, hospitals, and health coverage to the patient's broader health data to deliver evidence-based, personalized care.[28] The aim is to help improve performance in disease prevention and care coordination.

Healthcare IoT—Real-Time Notifications, Alerts, Automation

Millions of people use devices that datafy their lives toward the quantified self. Devices connected to the Internet currently include weighing scales; activity monitors (such as Fitbit, Apple Watch, Microsoft Band) that measure heart rate, movement, and sleep; and blood glucose meters: all of which send metrics in real time and track user behavior in up-to-the-second fashion. Early 2018 even saw the first fetal heartbeat wearable.[29] The data recorded could be used to detect the risk of disease, alert doctors, or request emergency services depending on the biometrics received. Many integrated devices are going beyond pulse and movement to measure sweat, oxidation levels, blood glucose, nicotine consumption, and more.

With sophisticated devices come sophisticated solutions to novel problems. For instance, now that heart rate monitoring is cheaper and more pervasive, conditions such as AFIB can be detected far easier and far earlier than ever before. Fluttering of one's heart rate above 300 bpm (rather than 60–80 bpm) could be a symptom of AFIB. Patients diagnosed

with the condition are 33% more likely to develop dementia; and more than 70% of patients will die from a stroke.[30] The treatment can often be simple: anticoagulants and blood thinners, which are up to 80% effective. Healthcare providers are moving slowly toward sophisticated toolkits to utilize the massive data stream created by patients and to react every time the results appear disturbing. This adoption is being driven by established digital organizations and startups in conjunction with health bill payers.

In another use case, an innovative program from the University of California, Irvine, gave patients with heart disease the opportunity to return home with a wireless weighing scale and weigh themselves at regular intervals. Predictive analytics algorithms determined unsafe weight gain thresholds and alerted physicians to see the patient proactively before an emergency readmittance was necessary.[31]

What is interesting to recognize is that these connected health devices do not necessarily motivate the audiences or populations most at risk of adverse health events. According to several randomized trials, Fitbit wearers do exercise more, but not enough to guarantee weight loss and improved fitness. In fact, some studies have determined they can be demotivating.[32] Then there is the question of accuracy. A Cleveland Clinic study in 2016 found that heart rate monitors from four brands on the market were reporting inaccurate readings 10 to 20% of the time, which demonstrates that there is some way to go in the precision of the technology.[33]

While these devices show potential, there is still the problem of an average abandonment rate of more than 30% after a period of engaged usage. The software application is now the channel for engagement, used as an intelligent layer on top of devices and IoT, where they can also introduce behavior change psychology for sustainable behavior change and usage.

Offering users of devices such as these tangible incentives like discounts on health or life insurance could become more mainstream,

and drive prevention of many chronic lifestyle-related diseases similar to incentivized car insurance with embedded black-box sensors.

Real-time alerting can also be used to notify patients of adverse effects of medications they are prescribed. Currently, patients wouldn't receive any notification unless they were registered with the treatment provider. Healthcare providers can use public feeds to notify their patients of potential adverse effects. E-mails or text messages would suffice as a form of engagement and could provide as much instruction as required, reducing time with the clinician.

EHRs can also trigger warnings, alerts, and reminders for when a patient should get a new lab test; or track prescriptions to see if a patient has been following treatment instructions.

Movement Toward Evidence-Based Medicine

Evidence-based medicine is a term denoting treatment given based on proven scientific methods in pursuit of the best possible outcomes. Clinical trials work on a small scale, testing new treatments in small groups with internal validity (i.e., no other conditions or concerns other than those specified), and looking at how well treatments work and establishing if there are any side effects. With growing datafication, there is also increasing "real-world evidence" or data, which can be analyzed at an individual level to create a patient data model and aggregated across populations to derive larger insights around disease prevalence, treatment, engagement, and outcomes. This approach improves quality of care, transparency, outcomes, value, and at its core, democratizes healthcare delivery.

Using data for similar groups of patients, we can understand the treatment plans patients with similar profiles have taken, allowing the best treatment plan to be recommended based on how others in the population responded to any given treatment. The recommended treatment pathway would be best for the patient and could be explained to both the patient

1. Disease Prediction & Early Diagnosis
    - AI predicts disease risk using patient data, genomics, and wearables.
    - Example: Pancreatic cancer risk detection.

2. Medical Imaging & Radiology
    - AI assists radiologists in MRI, CT, X-ray scans.
    - Example: Detecting micro-tumors invisible to human eye.

3. Personalized Treatment & Digital Therapeutics
    - Tailored therapy using lifestyle + genetics + history.
    - Example: Low Carb Program app → diabetes remission, reduced meds.

4. Drug Discovery & Development
    - AI screens drug compounds, predicts success in trials.
    - Example: AI with Next-Gen Sequencing accelerates R&D.

5. Virtual Health Assistants & Follow-Up Care
    - Digital coaches/chatbots remind meds, monitor patients.
    - Example: NextIT health coach for chronic disease care.

6. Surgery & Robotics
    - AI supports robotic-assisted surgeries for precision.
    - Example: Da Vinci robot → minimally invasive surgery.

7. Population Health & Outbreak Prediction
    - AI analyzes health + environment data for epidemic risk.
    - Example: Malaria prediction using rainfall & temperature.

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Mnemonics for Use Cases

Use Cases → “Do My Pretty Doctor Visit Safe Place” (D-M-P-D-V-S-P)
- D – Disease Prediction
- M – Medical Imaging
- P – Personalized Treatment
- D – Drug Discovery
- V – Virtual Assistants (Follow-up care)
- S – Surgery & Robotics
- P – Population Health

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Quick Keywords (for last-minute revision)
- Prediction → Risk detection (pancreatic cancer, malaria)
- Imaging → MRI, CT, micro-tumors
- Personalization → Low Carb app, diabetes
- Drug Discovery → Compound screening, sequencing
- Virtual Assistants → Digital coach, follow-up
- Surgery → Robotic precision, Da Vinci
- Population → Outbreaks, epidemic prevention

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