

Is digital twin
technology the key
to more personalized,
equitable and efficient
health care?

How smart, analytics-driven insights can
mean better outcomes for all



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HOW SMART, ANALYTICS-DRIVEN INSIGHTS CAN MEAN BETTER OUTCOMES FOR ALL

Introduction

Imagine two people in different neighborhoods. Shawn has access to good primary care and is not stressed about money, but is overweight and has a father who died of heart disease. Marisa is sleep deprived because of working two jobs and frequently frustrated she can't find healthy fresh food in her neighborhood.

They have different nutrition, fitness levels, DNA, family history, homes, salaries, education, stressors and access to technology. But too often health care experiences do not take into account these important factors about people's lives that can help enable highly personalized and preventive care.

Digital patient twin technology that fuses together a wide range of data sources beyond the traditional medical record – from wearable sensors to air pollution levels – can forecast the future health of both individuals and help enable health systems to provide better care for each. Using predictive analytics, health systems can identify the points in an individual's life where they might be at higher risk for developing new conditions or seeing existing disease progress and intervene in powerful ways to change the course of a person's health.

The resulting individualized care path can achieve not only a better patient experience and engagement, but can bring quantifiable value for governments and payers, reducing the burden on the health care system overall. Digital twin technology holds the potential to make health care more personal, more effective, more efficient and more equitable.

Personalized care pathways offer a better health care experience

With the insights possible from digital twin technology, health systems can tailor each interaction with the patient – from the first outreach through treatment and post-recovery. For consumers who are accustomed to personalization in most of their shopping experiences, they do not want to be treated along standardized care pathway protocols that treat all patients the same; they want health care that meets their specific needs, preferences and personal circumstances.

As in retail, consumer preference data can signal to the health provider whether they would be most successful contacting an individual by phone, video chat, text or email. Predictive analytics applied to demographic, community, socioeconomic and environmental data sets can help health systems recognize key obstacles to care for certain individuals and communities.

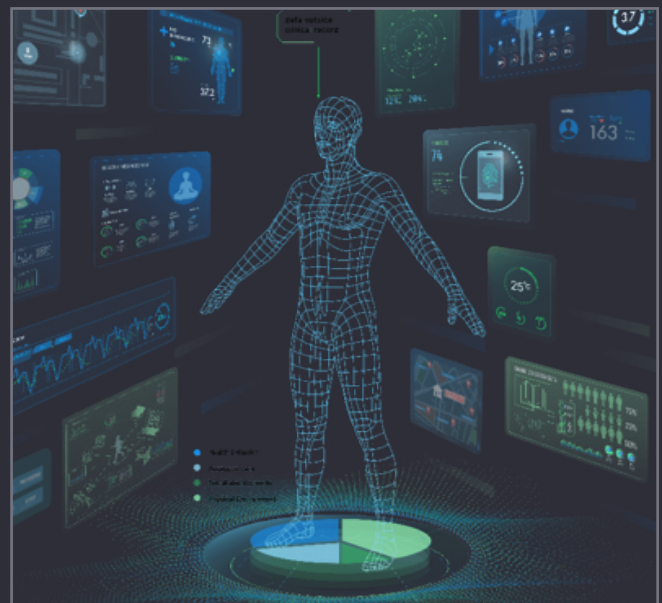
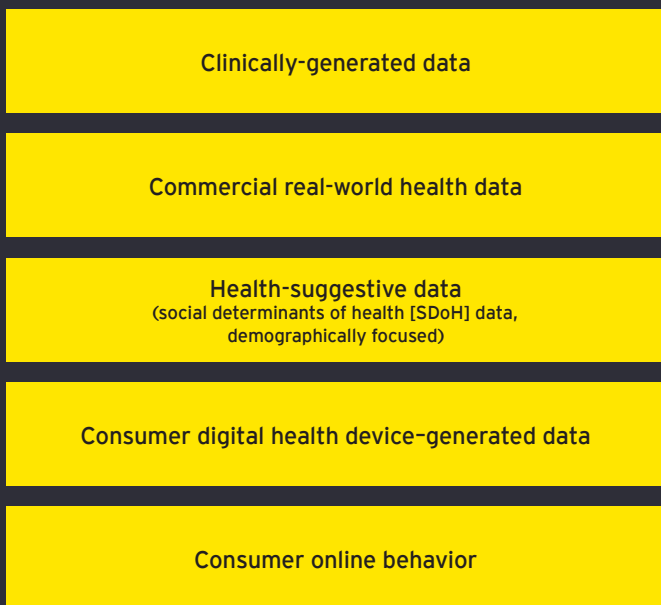
Other industries already employ similar technology to forecast journeys for consumers, using public data sets to align to different personas and make educated choices about how interactions should be designed to each individual. In health care, these insights can empower better decision-making for providers, payers and patients as well.

“Having a digital twin representing somebody allows you to decide which patients need to be seen in what order,” said Rachel Dunscombe, CEO of the NHS Digital Academy and Strategic Digital Advisor to the Northern Care Alliance NHS Group. “You can really create interventions based on personas and stratify risk. You put in the right effort in the right place, and not too much, not too little.”

Health systems can create relevant persona pathways by inviting patient group representatives to user-centered design workshops to make sure they reflect the realities of living with the condition. For example, at one hospital Dunscombe worked with, the team determined that patients with kidney failure often face challenges going to school or keeping a job because of dialysis and other treatments. By equipping them with home testing kits, telehealth options and access to more convenient dialysis centers with flexible schedules, some of those barriers to work and family life were removed. “For us, that was super impactful. We considered the whole human impact,” Dunscombe said.

How a digital twin is created

Instead of relying on traditional data collections that are too old, narrow and static, the health ecosystem can create a holistic data picture of a patient to help enable personalized, real-time and predictive human-centered care.



Digital twin technology also can accelerate recoveries if care teams can identify the points in time when, for example, a person recovering from a hip fracture should be up and walking to best avoid negative outcomes that can snowball to crisis. “That’s what really excites me about digital twins: it’s about not wasting time, it’s about precision recovery,” Dunscombe said.

Wearable sensors can be integrated with the digital twins to produce live data streams that alert clinical teams, caregivers and the patient when action needs to be taken both inside the hospital and at home, enabling more exception-based care management. US-based BioIntelliSense has introduced the BioButton®, a medical-grade wearable sensor that captures patient vital signs and feeds the data streams to their care team, enabling clinicians to identify when new symptoms are developing or if the patient needs an intervention.¹

While digital twins give clinical staff a more holistic vision of the patient’s potential future health, they also can provide a vision to the patient. Digital twins present an avenue to

educate the patient and their caregivers about the potential medications, procedures and quality of life they face, and involve them in the commitment to change that journey. The increasing attention toward the metaverse could mean virtual reality could be used to show individuals their virtual future and options to choose a healthier path. Often, behavior change can be the biggest obstacle in improving health. Some new entrants have emerged to try to address this need, with tools that use AI to help patients recognize their patterns and earn rewards for managing chronic disease.²

Of course, all of this hinges on health systems’ abilities to navigate challenges of properly securing patient data not only to meet regulatory requirements but also to earn the trust of patients to use their data, especially in regions where consumers fiercely guard their personal health information. Platforms that can unite data will have to have strong cybersecurity programs to keep the data from being improperly accessed or used.



Personalized care pathways can make health systems more effective and efficient

Digital twin technology not only allows for better patient experience but presents opportunities for significant cost savings for health systems, and for payers, who are looking for providers to show value for the US\$8.8 trillion that is spent globally each year on health care.³ In the US alone, the pressure is building, as the percentage of GDP devoted to health is expected to rise from 17.7% in 2018 to 19.7% by 2028.⁴

Routing patients to the right care is crucial for the move to value-based care to make sure the correct resources are applied to each patient. A recent analysis of 27 million emergency room visits in the US showed that two-thirds were avoidable, as the conditions could be treated in primary care settings, signaling huge opportunity to reduce costs.⁵ Beyond the health care system itself, wider savings to communities at large can be quantified in terms of additional quality years to remain mobile, independent and with family.

Albert Marinez, Chief Analytics Officer for US-based Intermountain Healthcare, said that to achieve value and better outcomes, health systems have to surface the right information to clinicians in ways that do not add burden, but rather empower them. "We should be proactive at identifying and closing gaps in care with support from analytics. This should be made as seamless to the provider as possible. So many solutions designed to close gaps and make care better actually end up creating noise and frustration for our provider. But shouldn't analytics be 'smart' enough to filter the noise and surface the minimum necessary for the maximum results?" Marinez said. "If we do this right with data and analytics, we can reduce the noise and enhance the human connection that our providers do best."

Teams at Intermountain Healthcare created a personalized, data-driven program to help identify chronic kidney disease patients earlier in the progression of their disease, stratify their risk and connect them with care navigators.⁶ In the US, an

The other 80% of data that determines patient health is outside the medical record

Enhanced ability to access and integrate real-world data from digital devices:

- ▶ Digital health app data
- ▶ Fitness trackers
- ▶ Wearable data

Trusted research environments and other licensing deals to access health system data:

- ▶ Clinical data
- ▶ EHR information
- ▶ Pathology, histology, radiology and other procedural notes
- ▶ Case history notes
- ▶ Medical claims data
- ▶ Medication orders, co-prescriptions and refills

Closer access to and relationships with patients, where regulatory systems allow:

- ▶ Patient-reported outcomes
- ▶ Adverse event reporting
- ▶ Quality-of-life measures
- ▶ Diet and lifestyle diaries
- ▶ Family history

Greater integration of diagnostic data:

- ▶ Biomarker panels
- ▶ Genomics and other omics data
- ▶ Consumer genetics and other consumer diagnostics

Better social listening:

- ▶ Online patient communities data

We must look beyond the EHR data to drive true insights.



estimated 90% of those who have chronic kidney disease do not know they have it as many may be symptom free until later stages and a blood or urine test is needed to detect it.⁷ Through the earlier interventions, Intermountain found in the first year of the program that those first identified in stage 3 of the disease did not progress to dialysis and only 14% of patients in the program had an unplanned admission.⁸

Understanding patient needs, lifestyle and preferences through digital twins can help health systems guide consumers to the appropriate care. For example, individuals with diabetes who do not manage their diabetes often end up developing complications, such as ulcers, heart attacks and acute kidney failure. The average cost for a patient visit to the ER for kidney disease is US\$1,722, and if that patient needs to be admitted, the average cost for an inpatient stay for those with kidney disease is US\$17,483.⁹ In 2021, 10.5% of adults across the globe had diabetes.¹⁰

But if providers can get to the root cause of the patient not being able to manage the disease, they can help remove obstacles and keep that patient from progressing to an expensive and painful crisis. Often the answer to what is preventing the person from controlling their disease may be found outside the electronic health record (EHR), in nonmedical data sets that present a picture of the challenges the person faces in leading a healthy lifestyle.

Health systems and payers could use predictive analytics to determine the segments of consumers that turn up most frequently in the ER for care that could be provided elsewhere. They can use that insight to predict the likelihood of individual patients being high utilizers.

Dr. Ulf Sigurdson, a surgeon and Manager of e-health for the largest health region in Norway, South-Eastern Norway Regional Health Authority, sees tremendous potential in achieving this type of savings with the most frequent consumers of hospital care. "Tens of millions of dollars could be saved annually if we can approach it like this," by changing treatment paths and how and where the system engages

patients with complex chronic conditions, he said. One example he cited was for health systems to empower younger patients with chronic conditions who are enthusiastic about digital options with those tools so they can be more in charge of their own health.

Another area where digital twins and predictive analytics can help health systems identify potential savings is in patient safety. Using predictive analytics to find the points in a journey where a patient is at higher risk for developing sepsis or pneumonia, the hospital can create responses at those exact points in time to avert the condition. A case of sepsis can cost as much as US\$51,000.¹¹ Keeping patients from being elevated to intensive care can save costs and improve quality and safety ratings, as well as readmission rates. The US-based company Decisio Health offers a medical device that provides data visualizations for care teams with continuous information about the patient in real time. The device is designed to detect risk early and to decrease the time it takes for clinicians to intervene. Teams also have dashboards where they monitor the hospital from a population level.¹²

While these changes in care can also help the patients save out-of-pocket expenses, they also contribute to a better patient experience if individuals are directed to the right care from the beginning instead of being lost in the system and if they are able to avoid the trauma of a health crisis.

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Insights from digital twin technology can help address health inequities

As the pandemic brought to the forefront the racial and social inequities that persist in health care, health systems have an opportunity to use digital twin technology and predictive analytics on a population level to identify barriers to care and help balance outcomes.

By stratifying the risk for different segments of the population, providers as well as payers can create digital community twins that help enable them to identify vulnerable populations and develop different tracts of outreach that reflect the community needs. Where and how the patients live contributes tremendously to health, as shown by asthma patients who have flare-ups during wildfires or heavy smog, or by individuals with COPD who repeatedly turn up in urgent care because their home is cold and wet.

“This is the future of health and well-being,” said Ray Messom, CEO of WentWest, Western Sydney’s Primary Health Network. “People should never be labeled as their ailment or illness. They’re individuals operating within family systems, in the context of their local community. We need to utilize data across health, social, education and other systems of care to anticipate what people need and how and when they need to receive support. We need to provide care proactively, before people know they need it.”

Vulnerable families in disadvantaged communities can easily get lost in complicated health systems. Recognizing that, WentWest has started a program – part of a larger movement – targeting families with children under 5 who have endured adverse childhood experience (trauma, incarceration, alcohol and other drug incidents, mental health challenges, etc.) and tailoring support in hopes of preventing those families from ending up where predictive models, which use integrated data sets, indicate they will end up without support. By understanding what their future digital twin looks like, health systems can intervene today to change that picture.

Navigators from across the health, social and education systems coordinate care and services. “We work with families through their crisis and then focus on preventative measures. This data-driven approach not only improves the experiences of providers and families in providing and receiving care but is more sustainable and has the best shot at breaking the cycle of disadvantage for these families,” Messom said.

Context is also important for developing predictive tools that rely on data that is reflective of the population. “We need to be proactive in terms of how we actually evaluate these algorithms to ensure that underlying data sets are not creating more disparities than what we have already,” said Marinez of Intermountain Healthcare. Intermountain established a Data Science and Artificial Intelligence Center of Excellence that (among other things) is charged with making sure algorithms are evaluated and deployed with equity in mind.¹³

In India, Apollo Hospitals recognized that existing tools to predict a patient’s risk of developing cardiovascular disease were dependent on Western data sets. To make sure the system’s response was more in tune to the Indian population, they analyzed external and internal data and developed an AI tool to predict the risk for cardiovascular disease in their country.¹⁴

While digital patient twins may seem futuristic to an industry that may still have paper-based records or siloed data collections, the reality is that if health systems are to address the building pressure of unsustainable health care budgets, personalizing care so patients are directed to the right care at the right time and avoiding waste can be a key component. Individualized care paths can help patients avert expensive and stressful medical procedures, payers find the value they seek, and providers achieve their goal of bringing more wellness to the communities they serve.

Providers as well as payers can create digital community twins that help enable them to identify vulnerable populations and develop different tracts of outreach that reflect the community needs.



FIVE QUESTIONS TO DRIVE TOWARD BETTER INSIGHTS AND BETTER HEALTH CARE FOR EVERYONE



1. Do we have the right data in the right format?

Health care data today is too often a collection of static bits of information that do not provide real insights. Expanding data sources to those that exist outside the health system, to demographic, consumer, wearable and environmental data can broaden the health system's understanding of individuals and of communities at large. Data should be available in standard formats so it can be shared in open, connected technology ecosystems.

2. Can we identify segments of consumers where we can quickly achieve value?

Health systems can find savings by personalizing care pathways for certain cohorts of patients who may have high utilization of the ER or poorly managed chronic conditions. Analyzing those segments may highlight paths to meet patients with the appropriate level of care where they are, providing exception-based care for those who do not need as much monitoring or who could benefit from deviating from standard pathways.

3. Can we define clear interventions that would move from insight to action?

Once health systems and payers have identified situations where individuals are at high risk for worsening health, they will need to determine the right responses and actions that will prevent the progression of disease. Which responses can be automated? And which will truly activate patients to change behaviors? It's important to take a comprehensive approach to update pathways, not just layer onto existing infrastructures in ineffective ways.

4. Can we put digital twin insights in the hands of clinicians in useful ways that don't contribute to burden?

Health care providers do not need another layer of "to-dos" when they are already experiencing high levels of burnout. Any plans for employing predictive analytics should think through the workflow of the care team and determine how the insights can actually be used in the physician's office, the ER and virtual care sessions. Automated alerts could flag worsening vital signs in a person's electronic medical record for the care team, making sure insights go to the right people so they are digestible for clinical action.

5. Can we quantify the value our personalized care provides for patients, payers and the community?

Health systems and payers should look for ways to transparently communicate the additional wellness they are providing, the areas where they are bringing savings in terms of less suffering in the community, and the lower burden to the health system as a whole. Beyond cost savings, more personalized health care that drives better outcomes can mean more productive and quality years of life, and when applied on a population level, can have a broad multiplier effect on the entire economy.



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Endnotes

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