Healthcare 3.0 Is Digital
Transforming to a Digital Enterprise
Healthcare and life sciences organizations aim to maintain equilibrium between providing high-quality and efficient healthcare, regardless of where the patient is located, and managing healthcare costs — all while facing constrained budgets and rising patient expectations.

The way forward is digital care transformation, which taps into advances in mobility, automation, intelligence, information sharing and more to improve healthcare outcomes. While organizations now have access to unprecedented amounts of healthcare information that can revolutionize treatment, turning the deluge of data into personalized, actionable insights remains a challenge. Modern healthcare needs to place itself at the intersection of patient treatment and population health analytics, using artificial intelligence (AI) and machine learning to inform personalized health and wellness pathways.

One solution is a cloud-based digital services platform that:

• Optimizes data acquisition and integration (data flow)
• Delivers actionable, contextual and regulatory-compliant insights into the workflow of health and care professionals (insight flow)
• Creates an outcome-driven process enhanced by point-of-care automation across the care ecosystem (care flow)
• Focuses on the holistic view of the patient to support value-based care and remuneration models (financial flow)

When built on the pillars of interoperability, analytic insights and security (which in healthcare is focused on patient privacy and consent), a digital health platform is the basis for a connected ecosystem of health provision. And it propels organizations into the next stage of care, Healthcare 3.0.
Digital healthcare is transforming medicine and revolutionizing global health systems. Integrated delivery networks, accurate patient data and increased access to information all work together to improve outcomes, speed processes and decrease costs. And, crucially, the next wave of AI and machine-learning techniques will drive personalized care pathways and population health initiatives that shift the focus from acute care to lifelong wellness.

Providers are shifting their focus to value, quality and prevention to keep patients from having to seek out more costly healthcare services down the line. These patient-centered care models are transformational and are already contributing to higher quality of care and a better patient experience.

Patients, meanwhile, are playing a more active role in the management of their health. Informed patients are more likely to follow a clinician’s medication and treatment plan, which contributes to more positive health outcomes. At the same time, these patients have higher expectations for the healthcare customer experience, and providers need to improve clinical customer relationship management (CCRM).

Life sciences organizations are looking toward more targeted and personalized treatments, as increased computer processing power begins to unlock the potential of human DNA analysis. Genomics enables personalized testing and treatment that could vastly improve patient outcomes. Genomics uses genetic data which can be secured on blockchain – an exciting new technology that has the potential to standardize secure data exchange in a less burdensome way than previous approaches.

Mobility, meanwhile, makes healthcare accessible, portable and personal. Mobility and cloud access have increased accessibility for patients and doctors alike. By 2018, it’s estimated that 65% of healthcare interactions will be mobile. Some 80% of doctors already use smartphones and medical apps, with 72% looking up information about medications on smartphones on a regular basis.1 Hospitals, insurance companies and doctor’s offices are now storing patient medical records in the cloud, with patient access to test results available online 24x7.

Eighty-five percent of U.S. health consumers say that email, text messages and voicemail are at least as helpful as in-person or phone conversations with healthcare providers.2 Web-based portals that enable regulatory-compliant video interactions between patients and clinicians are now supported by a wide array of web-integrated wireless monitoring devices.

Telemedicine offers patients and providers new freedom and accessibility. Even patients in remote areas can now receive the highest quality of care, provided they have an internet connection and smartphone. Mobile devices can perform

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The Security Challenge

Over the past few years, digital transformation and cybersecurity have drastically changed the digital landscape. Many industries have been forced to assess their ability to protect and secure sensitive data, evaluate newer forms of technology and implement security measures to enforce more secure IT environments.

The health sector faces a drastic shift with both physician offices and hospitals adopting electronic medical records (EMR) systems, augmented by enhanced connectivity, internet of (medical) things and mobile devices. In this environment, the opportunity to create a highly connected ecosystem that delivers improved clinical outcomes is within reach.

However, without active defense mechanisms that enable health systems to derive value from “openness” while protecting their assets, the risk exposure could have huge financial and reputational implications.

Active defense requires C-level executive engagement and a risk-based approach to cybersecurity management. Analytics should be used to detect events and threats and enable a far swifter response to incidents. Security is the new “cold war” and must be tackled as a continuing priority and not as a single project.

Health systems must make security the foundation of every application they launch and every infrastructure they procure.

The main cyberthreats in the healthcare industry are:

1. Data breaches involving medical records, leading to identity theft
2. Vulnerabilities in medical devices and supporting infrastructure services
3. Ransomware blocking access to systems, data and networks
4. Data leakage through poorly secured APIs in connected ecosystems

As cyberattacks in all of these areas continue to threaten the healthcare industry, new preventive security mechanisms and standards must be put in place to safeguard medical data and critical assets. Health systems are advised to develop mature standards and use proper risk management approaches to create transparency about the cyberrisks they face.
ECGs and do-it-yourself blood tests, or serve as a thermometer. Patients can be prompted to check their weight, pulse or oxygen levels, and enter results into mobile patient portals. Those details help predict risk of heart disease and other illnesses, ultimately saving lives. With the rise of the internet of (medical) things (IoMT), mobile and wearable devices are becoming increasingly connected, contributing to a comprehensive medical record that's accessible anywhere.

Technology keeps primary care providers up to date on their patients’ health, even if patients go elsewhere for treatment. Health information exchanges allow providers to securely track and share a patient’s complete medical history, which helps to coordinate patient care, reduce duplication and avoid costly mistakes.

AI is playing a wider role in healthcare as well. Machine-learning programs are now able to suggest diagnoses from scans and test results. Leading hospitals now stream and analyze live health data, delivering — via an app used by doctors and nurses — alerts of severe health risks.

Moving healthcare out of acute settings is already a major transformation trend, both to improve patient experience and to reduce cost. The coming together of technological maturity, consumer interest in new approaches, and physicians’ willingness to embrace mobility, data and emerging technologies all points to adoption of new models of care delivery and coordination to achieve this shift.

As more and more doctor-patient interactions become virtual, with care delivered to patients in their homes, more lives — and money — will be saved.

More speculatively, gamification — the use of consumer- or gaming-style approaches for personal healthcare apps — makes interactions with patients more effective and also helps provide tangible, engaging and motivating feedback. Gamified health tracking keeps the patient motivated to stay on the appropriate therapy path, and it is also used in some telehealth programs to educate patients, health workers and the general population.

By 2019, 60% of healthcare applications will collect real-time location data and clinical IoT device data and embed cognitive capabilities to discover patterns, thereby freeing up 30% of clinicians’ time.

Improving Lives Outside the Hospital Walls

Today’s most powerful opportunities for patient well-being often present themselves outside the hospital walls.

Progressive healthcare systems are expanding their influence beyond the physical campus and establishing partnerships with community organizations and government agencies. Stronger ties with communities improve wellness, expand services and increase access to quality care.

The right information, paired with intelligent machines, can help make community care easier and much more effective. With analytics, we can use environmental factors such as air quality, social media activity and economic activity to make real-time predictions about hospital emergency room admissions. This intelligence allows hospitals to anticipate health risks and even automate the creation of community-specific plans to reduce exposure.

We can also use public community data to anticipate health risks, develop optimal outreach plans and reduce impact.

Hospitals can then anticipate the risk of diseases such as diabetes and create plans for those who may not be receiving proper care.

Deploying industrial-scale machine learning into already complex healthcare systems may seem daunting, but there are best practices to drive steady, reliable progress. Start by mapping the priorities of the health system and the needs of the patients. Use those maps to select the “data stories” — insights driven by data — that make the biggest difference.

Deploy solutions using hybrid cloud technologies that combine the security of private cloud and the flexibility of public cloud. Keep in mind that the nature of advanced analytics is experimental. Avoid biting off an analytics transformation all at once. Instead, run small experiments, deliver valuable results quickly, learn and adapt as you go.

Machine learning is becoming an indispensable tool in our efforts to improve healthcare. Now is the time to establish and improve your overall Analytics IQ.

— Jerry Overton, Data Scientist, Senior Principal, DXC Technology
Outcome-based transformation powered by technology

These digital health trends require healthcare systems to rethink the way they operate, adopting new models that shift from acute to preventive care. Treatment variation needs to be addressed in a way that supports standardized pathways, while also embedding digital technology into the heart of these pathways. Digital technology powers this transformation by supporting connection and collaboration, and by providing both the patient and population information needed to make better decisions.

Matching these industry trends are several broad technology trends:

• **Bridging the gap between the old health economy and the new.** The old health economy measured success by patient volume; the new economy measures success by outcomes. APIs and modern application development allow federated workflow and data across legacy systems, off-the-shelf solutions and new applications. In turn, this “health cloud” provides a base of current data for innovative AI and machine learning.

• **A revolution in platforms.** It’s now possible to define ecosystems of healthcare technologies and design healthcare IT platforms to capture data from disparate sources (e.g., wearables, smartphones, glucometers). These new data sources and systems provide patients and caregivers with a richer, more holistic and real-time view of patients’ health.

• **Bringing it all together in the era of the intelligent enterprise.** The data explosion — accompanied by advances in processing power, industrial-scale machine learning, health analytics and cognitive technology — is fueling intelligence. Clinicians now have access to contemporaneous patient data at the point of diagnosis and treatment. Medical devices and wearables can now “think” with contextual and situational awareness — and they can respond accordingly. The intelligent healthcare enterprise means more efficient business operations, more personal care and, most importantly, better health and wellness outcomes.

Rather than building new centralized and proprietary systems, healthcare IT should focus on connecting, improving and exploiting the existing diverse healthcare IT ecosystem. This shift requires the friction-free flow of information and an ecosystem-

By 2020, care plan adjustments will be made in real time with cognitive/AI using data from wearable devices, resulting in 20% more patients being engaged in their health.

By 2020, 20% of payers will offer personalized benefits with options for a consumer to dynamically reduce premium and/or alter deductible/copay by disclosing personal health data.


wide workflow to support collaboration between clinicians, other health professionals, health administrators and patients. At the lowest level, healthcare systems need coordination, with effective resource scheduling, and patient data available at the point of care. On top of this, AI and industrial machine learning are needed to transform information into insights that can guide decisions at the patient, provider, organization and population levels.

In this intelligent health enterprise, sophisticated clinical pathways can be powered by evidence-based insights, and boosted by AI and advanced predictive and prescriptive analytics. Healthcare organizations can deliver the right therapy, tailored to the right patient, in the right place and at the right time — all dynamically orchestrated. But this environment can succeed only if it is built on three pillars: interoperability, analytic insights and security.

Developing a connected ecosystem of services

A connected healthcare ecosystem enhances patient engagement, improves operational efficiency and boosts flexibility across healthcare enterprises and communities, leading to better outcomes. Unfortunately, the IT status quo does not fit the bill.

What’s needed instead are flexible and interoperable computing resources and a connected ecosystem that brings together disparate data from multiple systems to deliver evidence-based insights about individuals and populations.

To achieve this, many providers must liberate the large amounts of data they hold in enterprise systems, such as electronic medical records (EMRs). Such patient data is of enormous value to individual patients and physicians, but the potential for the healthcare system as a whole is much greater — especially when overlapped with real-time data gathered by the patient.

The opportunities in this space seem endless. Consider, for example, home telehealth devices, which have become more sophisticated and less expensive in recent years. Telemonitoring data can be transmitted to care managers much more easily than in the past. And many individuals are routinely collecting personal information through smartphones and wearable devices. It’s not hard to imagine a future in which health insurers advocate a digital health approach in the same way car insurers have grasped the benefits of telematics.
Health Data and the 21st Century Human

One of the Leading Edge Forum’s (LEF’s) key areas of research is the topic of what it means to be a 21st century human. The program investigates the skills and awareness we need to possess when we are surrounded by technology.

As humans, we are not naturally biologically equipped to “see” the digital world, and the LEF posits that major risks arise when we ignore this situation. There is an overarching need for us to take responsibility to improve our understanding of our place in the world around us.

In this regard, individual digital skills are increasingly vital for managing our health and well-being, particularly by mastering data and our personal API. As individuals, we are generally sensor-laden, carrying multiple connected devices during most of the active day. The combination of these products generates a unique stream of information about us and our activities. Indeed, this data stream is also being used by startups such as UnifyID to generate biometric security, where you become your password.

We need to be aware of how sophisticated this data capture is; it’s not simply counting our steps. Sensors in our phones track our sleep, can tell when we are seated, when we’re traveling by plane or by car, when we’re stressed — even when we’ve had alcohol. Modern Bluetooth headphones are capable of tracking heart rate and activity. Accelerometers and radios are everywhere, and with internet of things (IoT) appliances, the very fabric of our home will sense data about us. The emergence of personalized DNA testing and augmented reality will give rise to new human computer interfaces; new ways of “seeing” and interacting with our data will appear all too soon.

The term “Quantified Self” is often used as a catch-all phrase, but it is probably poorly understood. The realization that our data has value to us as 21st century humans is key knowledge. Managing those metrics is another thing. We need to own our data, understand what is generated, and how it is being monetized, packaged and sold by the services we use. Both individuals and businesses need to be aware of the ongoing rise of consumerization. As devices get smarter and services are provided to us for “free,” Facebook, Google, Apple and others will continue to battle for access to our data. It is grist for the mill of the social graph, which illustrates interconnections among people, groups and organizations.

In the near future, we will also begin to see opposites appear. Alongside the epidemic of obesity and diabetes is the rise of biohacking and nootropics, where humans try to maximize well-being and longevity through new foodstuffs and eating regimens. Personal health is big business, and huge sums of investment capital are flowing into these research areas, as the digerati seek to solve health issues the way they fix problems with code. The question for each of us with regard to personal health is: Do I want to be part of the fix or part of the problem that is managed?
In 2017, patient engagement across the life science/healthcare ecosystem will jump from passive to active.

Digital transformation

The more data generated, the greater the need for smart tools that can derive meaningful insights from that information. The power of data comes from analytics, and new IT investments must focus on combining information sources to derive greater context.

For example, a lab result showing an elevated HbA1c level could indicate the onset of diabetes for the patient and should be cause for concern. However, when allied with predictive analytics algorithms to identify possible interventions, the problem could be addressed early with an appropriate care plan. Optimizing diabetes care reduces the need to treat potentially avoidable complications down the road, thereby improving patient outcomes and significantly reducing costs for the organization.

Missed opportunities are a major challenge in healthcare today. But by creating a network of connected information sources, healthcare organizations can act on information and use the most current data to support better care.

Mobilizing this information requires action across five dimensions:

- **Turning functionality into real utility.** Systems must be API-enabled or open data-enabled, with the ability to unlock data and make datasets completely ubiquitous across the enterprise.

- **Driving insights at every point in the ecosystem.** Data needs to be federated and freely available across the ecosystem to drive insights for everyone, whether it’s the patient, physician, paramedic or policy maker.

- **Transforming clinical network navigation.** Organizations should not only connect their ecosystem and enable point-of-care automation across every point, but they should also help patients navigate the systems.

- **Operationalizing the data.** All aspects of the health and care ecosystem should look to data and AI/machine learning for productivity improvements, including asset scheduling, staff rostering, record keeping and service management.

- **Using hybrid clouds for integration.** Organizations must connect what is in the cloud with what is on-premises. A hybrid platform brings elasticity, scalability and resilience cost-effectively. Costs shift from CAPEX to OPEX, which drives more value to investment. Hybrid platforms also minimize the time it takes to get up and running, providing advantages in operating models as well as operating costs.

As organizations embrace Healthcare 3.0 and the promise of population health management, the selection and implementation of healthcare IT becomes key. EMRs are only the first step toward adopting the range of digital technologies and processes required for a data-driven, automated, patient-engaged approach.
The journey to Digital Healthcare 3.0

The shift to digital health opens opportunities for healthcare providers, payers, policy makers and patients to move toward outcomes-driven, personalized healthcare by collecting and sharing new kinds of data. But personalized healthcare requires more than just the use of predictive analytics to generate tables and graphs. It requires advanced analytics capable of adding context to large varieties of data and distilling them down to actionable insights.

The end state is a digital service platform that allows disparate systems to connect seamlessly. This API-enabled platform allows “born-in-the-cloud” services to be delivered in concert with existing on-premises solutions. The platform lets enterprises easily onboard organizations and applications, even as the technology around it changes.

An open-cloud platform encapsulates the following levers:

- **Vendor-neutral data acquisition and integration**, with a data ingestion/accessibility pipeline that supports real-time, potentially transactional, batch and streaming interfaces

- **The capability to semantically and structurally transform incoming data** (and to persist where necessary while preserving provenance) so that downstream operations can operate on a more stable base of richly curated data

- **Built-in operational and clinical surveillance** supported by federated query capabilities that range from non-time-sensitive queries against read-consistent information, to highly transactional, sensitive, real-time continuous requests

- **An innovation enabler that orchestrates intelligent routing of contextual and pre-curated information** to upstream business processes and applications to exploit the integrated data for delivery of improved patient care
The digital future

Regulatory pressures, new technologies and patient expectations are pushing providers toward systems and models that provide improved care and an improved patient experience for less money. The next wave of productivity gains will not come from the delivery of information, but from the cross-linked aggregation of a more complete body of information. While the transition requires an investment in new technologies and ways of doing business, the tools are rapidly maturing and the costs are coming down.

APIs built to the Fast Healthcare Interoperability Resources (FHIR) standard can quickly link innovative systems of engagement with systems of record and connect with machine- and AI-driven insights. Following years of investment in advanced EMR applications and related technologies, healthcare organizations now have the potential to capitalize on these assets and accelerate key business and digital care transformations.

By applying relevant technology to every aspect of healthcare management, provider and payer organizations will be able to deliver high-quality care to patients in an efficient and sustainable manner. As a result, the transition from volume to value will be smoother, and organizations will have a much better chance of achieving the results they desire for their patients and their practices.

It is time for health economies to look at how they will integrate and connect their existing systems with new digital technologies and merge the data locked inside to generate meaningful, actionable insights both to inform personalized clinical care and to drive the development of new treatments. Organizations that embrace change will emerge as winners in a world that demands first-class clinical care, better patient experiences and reduced costs.

Seeking a passive way to measure patients’ vital signs and other biometrics, more than 40% of healthcare organizations across the world will use IoT-enabled biosensors by 2019.

How DXC Technology Can Help

For more than 50 years, DXC Technology has delivered healthcare and life sciences IT services to payer, provider, government and life sciences organizations across the world. The scope and scale of our healthcare and life sciences activities means we understand how to make outcome-based transformation work. Our solutions combine an outcome-driven approach to digital care transformation and proven capabilities with underpinning infrastructure services.

Particularly important to Healthcare 3.0 is DXC’s connected ecosystem approach, DXC Open Health Connect, which is a digital service platform that delivers industry-focused solutions to transform health and care services.

DXC Open Health Connect comprises:

**A data layer that unifies your IT enterprise:** A focus on standards-based interoperability (with FHIR API abstractions) allows reuse of existing investments, increases flexibility in platform extension, simplifies operations and maintenance, and empowers sharing and productivity. Whereas data scientists and developers often spend up to 70% of their time preparing data and 30% building the app or insights required, our open-data approach reverses that trend, allowing 70% of their efforts to be focused on more productive activities.

**Distributed queries that obliterate stovepipes:** By organizing application-specific indices through the ubiquitous data layer, applications can share, discover and provide context to data across the federated health and care ecosystem.

**FHIR API gateway that governs and controls access to patient data and enables new clinical models:** By insulating consumers from systems-of-record design issues, DXC Open Health Connect enables accelerated onboarding of innovative systems and makes it easier to integrate legacy information within proprietary EMRs.

**Security that is treated like a first-class citizen:** Object-level security is provisioned across SQL and NoSQL data stores.

DXC’s Open Health Connect platform supports the digital health paradigm, making data ubiquitous, secure and easy to use.

### Industry-focused solutions. Next-generation technology.

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