A Future in **Digital Health**

Transforming Healthcare for Patients and Providers
Dear Customers and Partners,

With 10 billion people – that’s the global population projected by 2050, and with many enjoying longer lives – the services required by healthcare systems will have to adapt and grow. No one can be certain how the industry will evolve, but with new challenges come exciting solutions. What we can be certain of is that future trends will be driven by unprecedented access to Big Data and a greater involvement by the patient or healthcare consumer in shaping those services to their greater benefit.

A new era of true digital connection is giving people greater access to health information and resources through the Internet, not only driving revolutionary advancements in medical research and technology, but fulfilling the promise of a new, individualized approach towards personalized medicine. Digital innovation is already helping the healthcare industry anticipate real-time demand and supply for services, streamline prevention and treatment, and give patients greater control over their health.

Such progress requires quick and ongoing adaptations by healthcare providers, insurers, and life sciences organizations. What is emerging is a healthcare ecosystem, moving beyond traditional hierarchies, in which all healthcare shareholders participate and benefit. Leaders will be inspired to reevaluate business models, business processes, and workforce structures to meet their strategic objectives, including:

- Enhancing the **patient experience** to meet the needs of today’s and tomorrow’s healthcare consumers
- Optimizing outcomes for each individual patient
- Empowering healthcare workers to perform at their best
- Increasing their organization’s operational efficiency to free resources for innovation and better care
- Applying data-driven innovations to help caregivers and researchers rely on real-world evidence

SAP’s expertise in digitalizing every aspect of our customer’s value chain aims to help healthcare stakeholders provide the best value to their customers at an affordable cost. We create the foundation and gateways to connect the digital healthcare network to core solutions for patient engagement, care delivery, care collaboration, clinical analytics, and personalized medicine.

This document explores the many opportunities in the healthcare industry that await us and how SAP will support the industry’s digital transformation. I look forward to our journey together.

**Message from Martin**

*Martin Kopp*
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# Table of Contents

4  **The Big Picture**

5  The Big Picture: Healthcare Goes Digital

6  The Big Picture: Being a Part of The Future Of Healthcare

7  **Reimagine Healthcare in a Digital World**

8  Reimagine Business Models

9  Reimagine Business Processes

10 Reimagine Work

11  **Digital Business Framework for Healthcare**


13 How Does It All Come Together?

14  **Let's Get Started**

15 Transforming from Your Current State to Digital Health

16 SAP is Committed to Healthcare Innovation

17  **Additional Resources**
The Big Picture
Embracing technology to shape the future of healthcare

Digitalization has reached every aspect of life today and is about to change how we as a society provide and consume healthcare services. Breakthrough technologies, such as the Internet of Things, artificial intelligence, blockchain, and cloud computing, have matured and are finding broader adoption in the healthcare world. Advancements in medical technology, such as genomics, health wearables, and sensors, show increasing success in medicine. And research around nanomedicine, robotics, and medical 3D printing is promising to deliver targeted, precise, and timely healthcare services.

What’s driving the switch to digital?
The convergence of three main drivers is the catalyst for many healthcare organizations to start their digital transformation, with the goal to create more value for patients along the continuum of care:

• **Cost pressures**, demographics, and the rise of chronic diseases
• A digital, empowered, “connected” patient, who shares valuable data with the wider community
• The emergence of digital technology and advanced medical devices, sensors, and wearables for extended monitoring and prevention and more fact-based care decisions

Formation of a digital healthcare network

To respond to those driving forces and capitalize on the opportunities that digitalization brings along, the traditional healthcare value chain is evolving towards a digital healthcare network. This network connects patients, professionals, and providers in real time for more responsive, patient-centric care. The digital healthcare network is the foundation for a new, consumer-centric healthcare system in which stakeholders respond more and more to mutual, shared challenges. Its open platform for communication and integration enables shared, connected, and fluid data among all network participants.

How can digital transformation improve healthcare?
The transition to digital healthcare offers many opportunities for both established organizations as well as new players. All future healthcare services will need to be designed in a way that promotes the following concepts:

• Value-based care: adapting structures focusing on optimal patient outcomes at the lowest possible cost
• Patient engagement: encouraging patients to take a more responsible role in disease management and prevention
• Personalized medicine: gaining groundbreaking insights into the human body at unprecedented, highly granular levels
• Participatory research and clinical trials: including more stakeholders and a higher number of participants
• Balanced demand and supply: optimizing service offerings and eliminating waste with real-time insight and predictive analysis
Digital Healthcare

The Big Picture: Being a Part of the Future of Healthcare

Strategic priorities for healthcare providers

Executives are aware that current healthcare models are not sustainable. They understand the impact digital transformation can have on creating more value in healthcare, but are unsure how to make it happen. In working with thousands of healthcare providers of all kinds and sizes across the globe, we observe investments and energy focused around five strategic priorities:

- **Improve the patient experience**: Every patient is a consumer, and consumer expectations are bleeding into healthcare. Digital technology is changing the traditional role of patients, enabling better-informed choices regarding health and well-being. Patients can more readily access health information and diagnose their own conditions or easily obtain test results and even receive better treatment. **How can we meet the expectations of the new healthcare consumers?**

- **Subscribe to patient outcomes**: Today’s patients need to see value from the insight into options they have for their specific health issues, based on key performance indicators and assessments of other patients facing similar circumstances. Pure statistics are not meaningful. The demonstrated outcomes must be specifically relevant to the individual patient and his or her particular context. **How do we provide healthcare services with optimized outcomes for each individual patient?**

- **Empower the workforce**: Complexity is the enemy of workforce empowerment. It can drive up costs and slow down progress. New digital tools enable the workforce to reevaluate how they work and get the most out of their professional training, freeing them from paperwork to focus on patient care. **How can we restructure and empower our workforces to allow them to perform at their best?**

- **Operate smart and efficiently**: Providers are under constant cost pressures and resource constraints. A next-generation digital core will be the foundation for a smarter business – leveraging Internet of Things (IoT) and machine learning for higher automation and offering cockpits with embedded analytics, prediction, and simulation to ensure a more agile nervous system for the entire organization. **How do we remove unnecessary cost and waste and free resources for innovation and better patient care?**

- **Apply data-driven clinical innovations**: The most dramatic change in the digital economy will be driven by hyperconnectivity and Big Data science. These will transform nearly every business model in healthcare. The ability to monitor patients, collect health data, and react early to, or even predict, medical conditions, independent from physical constraints, will massively change the healthcare value chain and the way healthcare professionals deliver care to their patients. **How can we move from a mainly experience-based healthcare model to delivering personalized medicine based on real-world evidence?**

Reimagining

The starting point of the digital journey is the ability to reimagine everything. To help you reimagine your organization, you can think along three core dimensions: business models, business processes, and work environment. We recommend evaluating those dimensions using the concept of value-based care, asking two basic questions:

- Are we improving patient outcomes?
- Are we reducing costs?
Reimagine Healthcare in a Digital World

Creating a digital network for a new, consumer-centric healthcare ecosystem
Digital Healthcare

Reimagine Business Models
Healthcare by and for the community

Healthcare is evolving from the optimization of single providers to building a community of specialists that collaborates in a wider ecosystem. By harnessing the flexibility of digital and, in particular, cloud-based solutions, the healthcare industry can find new ways to help professionals and consumers jointly create more comprehensive, patient-centric, and cost-effective healthcare.

Integrating the care continuum to elevate quality of care and health consumer interaction
Digital technology provides an opportunity to orchestrate one-dimensional, single-step care providers into communities of care. The goal is to ensure targeted and personalized responses across the spectrum of service providers.
- Help patients navigate the healthcare system with digital services
- Foster prevention and manage chronic diseases
- Empower patients to take an active role in monitoring and managing their health
- Use real-time analytics for insights into the population and trends
- Help clinicians and researchers make good decisions at the moment of necessity

Leading in patient outcomes through specialization
Healthcare providers can specialize rather than offering a wide selection of services. To adopt this business model, organizations need to know their key strengths (such as units leading in patient outcomes), and identify noncore services to shed. This could include:
- Investing in clinical research
- Attracting new patients seeking specialized, high-quality care
- Leveraging economies of scale through a higher volume
- Exchanging specialized knowledge within the ecosystem

Leveraging data-driven innovations as a new source of clinical insights
By harnessing digital technologies and electronic medical records from various sources, clinics can unveil new insights from large populations beyond traditional clinical trials.
- Inform patient care with lessons learned from previous cases
- Optimize and personalize clinical treatment
- Increase transparency of clinical outcomes

Creating a patient-centered experience by growing into new market segments
To address the needs of the new healthcare consumer, providers offer innovative healthcare services and leverage new channels.
- Corporate health – help companies keep the workforce healthy and productive
- Medical tourism – offer high-quality, specialized services at attractive prices to patients willing to get healthcare abroad
- Retail healthcare – offer standard services at convenient locations and office hours

Brokering resources within healthcare networks to balance demand and supply
By creating opportunities with real-time digital platforms that help eliminate inefficiencies in healthcare delivery, stakeholders connect beyond traditional channels to match supply and demand better using the digital age to close the gap.
- Second opinions
- Specialist appointments
- Medical equipment, transport

Sequencing genomes could cost less than $0.10 as early as 2020, promoting a shift from reactive to proactive medicine.6

The average cost of an outpatient physician visit is about $100–$150, whereas most e-visits are priced at about $40.7
Digital Healthcare

Reimagine Business Processes
Optimizing the lifecycle of health

With new business models opening the doors to increased collaboration across the digital healthcare network, processes are arising that provide solutions at every stage of healthcare – preventative, curative, and educational.

Engaging patients in disease prevention for better health outcomes
Create effective preventive healthcare by empowering and motivating patients to take responsibility for their health. Digital technologies, such as sensors and mobile devices, help the patient and the care team to monitor conditions and behavior in real time and react faster and more effectively.

Underpinning clinical decisions and diagnostics with real-world evidence
With digitalized solutions, healthcare professionals can gain new insights into our physiology, biology, and anatomy. By sharing health information over the digital health network and combining it with relevant clinical research, we can rely less on experienced-based medicine and find the root causes of diseases. This includes:
- Outsourcing of highly specialized diagnostics
- Identifying and accessing relevant clinical research
- Eliminating duplicate testing
- Making patients a trusted source of valuable health information

Virtualizing care venues to boost monitoring and reaction
Through delivery of telemedicine services with digital and interactive technologies, organizations can virtualize care venues, continuously track relevant biological signals, and facilitate early detection and prediction of health issues – extending their impact beyond traditional borders.

Meeting health consumer expectations for individualized care
Medication and treatment can be tailored to each patient, promising better health outcomes, for example, by matching doses and active ingredients to individual genetic profiles rather than the general population. Leveraging the digital healthcare network, patients and providers will jointly define actionable health plans, agree on individual health goals, and use technology to monitor progress and react to deviations in real time.

Managing resources smart, efficiently, and in real time
When live data from all critical resource categories becomes available in the digital healthcare network, physical assets, care teams, and the patient can be planned simultaneously, even across organizational borders. Data capture can be automated through machine-to-machine communication and connected medical devices in real time. Advanced resource planning combines actual status with simulations and what-if scenarios.

Empowering the workforce with real-time insights and communication
Organizations enjoy full transparency and real-time insights into all care activities and across all care team roles and care venues. New technology makes it possible to eliminate repetitive hand-over of tasks and error-prone manual transmission of information. Lightweight, enterprise-grade communication tools provide professionals the same level of convenience they experience in their private lives.

Remote patient monitoring is among the top 10 use cases that will drive IoT growth through 2020 across all industries.8

In-memory computing technology can transform clinical analytics, saving months or years of scientific work.9
Digital Healthcare

Reimagine Work
Greater value for patients and professionals

People working in healthcare do so because they feel it is their calling, even a dream job. Yet the burgeoning healthcare infrastructure prohibits them from giving hands-on, effective care. With digital technology, they find new opportunities to do their job better and grow in their profession. They are also able to actively contribute to the solutions of the future, creating the next cycle of proactive care.

Empowering physicians to facilitate overall care
In the new digital healthcare network, a physician’s responsibilities go beyond one-off diagnostics to include advising and coordinating along the continuum of care. Access to relevant clinical and research information combined with advanced clinical decision-support systems help empower physicians to evolve into a new role of trusted facilitator.

Improving the patient experience through hands-on attention
Supporting technology, such as sensors, speech recognition, and automated documentation, releases nurses from traditional, routine tasks, freeing them up for more time with patients. They can focus on value-adding activities, such as interaction, providing advice, and planning recovery, making for an improved patient experience.

Driving better outcomes with a new level of clinical decision support
Whether rule-based or through insights from smart data, the digital health network will provide a new level of clinical decision support to healthcare stakeholders to make the best decision for each patient based on real-world evidence.

Encouraging collaborative care teams
Employers create work environments that foster open communication across specialties. Mutual knowledge-sharing based on proven patient outcomes creates a new generation that questions hierarchies and assumes shared responsibility. Cross-functional teams then create clear and patient-centric key performance indicators.

Applying data-driven innovations to extend and accelerate clinical research
Researchers use real-time analysis of clinical and genomic data, ranging from large patient cohorts down to the individual, anonymized patient. This capability allows researchers to validate hypotheses instantly and ask the best follow-up research question based on the results. Breakthrough research results can be generated in hours rather than years.

Automating processes for smart and efficient operations
Redesigned applications enriched with machine learning and embedded analytics can not only automate back office processes, like patient billing. They can also relieve your workforce from related tedious routine tasks and help to overcome knowledge silos across departments.

Human interaction will continue to be key in healthcare. Digitalization intends to enrich this interaction for better patient outcomes and more efficient deployment of scarce medical resources.

| 40% faster checking of medical records during preparation and postprocessing of ward rounds with enterprise mobility.¹⁰ |
| 48% of hospital managers expect training related to digitization to be mandatory to their employees in the future.¹¹ |
Digital Business Framework for Healthcare

A simple and proven approach to creating more value in healthcare through digitalization
Leading healthcare providers investing in digital capabilities need an IT architecture that provides both stability and long-term reliability for the core business processes. At the same time, it must allow for flexibility in areas of frequent change.

This concept, which is often referred to as “bimodal IT,” is brought to life through the SAP® Digital Transformation Framework methodology – a methodology of five pillars that supports new business strategies and ensures agility while delivering value-added patient services.

With this framework, the entire value chain will be digitalized, including the core, which serves as the platform for innovation and business process optimization. The key lies not in any one of the five pillars, but rather in how they interconnect to achieve the best business outcomes.

- Introduce the digital core to establish the foundation for the core enterprise processes, which need to run consistently and uninterrupted. It provides real-time transactions and analytics, the capacity to work with Big Data, and connectivity to the outside pillars of the framework.
- Improve health consumer interactions to enable personalized medicine, value-added services, and outcome-based therapies.
- Build and maintain an agile workforce by empowering and engaging all employees as well as contingent staff.
- Set up and collaborate across healthcare networks to improve efficiency and provide seamless patient service.
- Manage assets and your supply chain efficiently and in real time to maximize patient value and optimize resource utilization.
How Does It All Come Together?
Get on a patient journey in the digital age

While the five digital business pillars deliver significant value as stand-alone capabilities, the ultimate goal is to design the next generation of healthcare solutions that will span all the digital pillars, leaving organizational boundaries and technology friction behind. Patients come first when healthcare organizations orchestrate all activities to provide personalized care – at the right time by the right partner. Let’s look at an example of a patient journey in the digital age.

Meet Alex. He’s 42 years old and seemingly healthy. When walking his dog, Alex is alerted about a deviation in his health condition by his wearable device and advised to see a doctor. He schedules an appointment with his family physician in one click using his smart phone.

The physician reviews Alex’s patient history, including the most recent information from his wearable device, performs an examination and advises Alex to see a cardiologist. Using a registry of ranking specialists, Alex receives recommendations based on his personal preference and schedules an appointment.

By giving the cardiologist access to Alex’s patient history, Alex enables her to review all relevant information prior to the appointment. After her examination, the specialist adds her diagnosis to Alex’s patient history. Comparing Alex’s patient profile against a large set of patients with the same disease and similar health profiles, she can predict that the standard surgery for this disease would be risky for Alex. The analysis shows that for Alex’s specific case, a certain drug can be expected to provide the best outcomes.

Because Alex has given his consent to mapping his profile against ongoing clinical studies, he is matched to a clinical trial that has shown positive results and fewer side effects than with current drugs on the market. Alex decides to enroll in the clinical trial to benefit from the new drug and to contribute his data to the research study.

As part of the trial, Alex downloads an app to track specific health parameters. He uses his monitoring device to manage his physical activity, and resumes life as before, knowing that he will be notified if anything urgent arises.

Meanwhile, the smart care team consisting of doctors and supporting professionals remotely monitor Alex’s progress in real time through the information provided by his wearable device. They use this information to advise him on his daily plan, if necessary, and motivate Alex to continue on his prescriptions and follow his health plan.

Alex has also given his consent for his data to be used by researchers in different organizations for the creation of new drugs and the adaption of drugs in order to help improve the lives of patients just like him.

With a scenario like this, you are able to:

• Improve patient outcomes by tailoring healthcare services to a patient’s individual needs
• Deliver a unique patient experience and streamline the continuum of care
• Empower clinicians and researchers to make decisions based on real-world evidence
Let’s Get Started

The journey to becoming a digital healthcare provider begins with planning a digital transformation road map.
Transforming from Your Current State to Digital Health
The keys to success

End-to-end digital transformation journey
In the digital age, simplification and innovation matter more than ever. SAP has a broad range of services to cover the end-to-end digital transformation journey. It ranges from planning a digital innovation road map and implementation plan with proven best practices to the ability to run all deployment options and ultimately optimize for continuous innovation with a focus on outcomes.

Flexibility and stability going hand in hand
SAP is uniquely positioned to enable your transformation by digitalizing all key aspects of your value chain. The digital platform from SAP provides the reliability and security that is vital to running your healthcare organization. At the same time, it allows you to acquire the new business capabilities you need to achieve your strategic goals.

Orchestrating the ecosystem to deliver faster value
No matter what size or place your organization has in the healthcare system, the comprehensive SAP ecosystem helps you adapt and thrive with the new opportunities created by digital disruption:

- Integration into a wide range of healthcare services and industries, such as life sciences, insurance, higher education, and defense and security
- Open architecture with a choice of hardware and software for Internet of Things use cases, medical devices, and wearables
- Complementary and innovative third-party solutions, for example, for healthcare analytics
- Accessibility to partners that can serve your business of any size, anywhere in the world

Learn more about SAP solutions today and discover planned innovations by accessing the SAP road map here:
www.sap.com/roadmaps -> healthcare:
Digital Healthcare

SAP Is Committed to Healthcare Innovation
Let’s bring the digital age to your healthcare business together

Cut antibiotic overprescribing
Seoul National University Bundang Hospital built a clinical data warehouse on the SAP HANA® platform. The organization can now track 320 clinical indicators with the help of only 6 nurses, leading to a reduction of antibiotic cycles for preoperative patients from six days to one day.7

Accelerate and simplify cancer screening
Heidelberg University Hospital has initiated a project to improve prevention and treatment of cervical cancer in Kenya, where the disease is the number one cause of death in women. Using SAP Cloud Platform for timely collection, exchange, and access of screening data, nurses are able to help save women’s lives, even in very remote areas.8

Unlock insights for cancer research and care
ASCO, one of the world’s largest organizations of professionals dedicated to the study and care of cancer patients, is leading the development of its Big Data solution, “CancerLinQ,” on the SAP HANA platform. CancerLinQ will allow clinicians and researchers to move beyond the 3% of patients represented in oncology clinical trials today and also learn from the 97% of cancer patient data previously locked away in unconnected files and servers.9

Assess
Your organization’s digital readiness and get recommendations to manage your digital transformation by completing this short survey.

Connect
With us so we can take the journey into the digital healthcare age together.

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Discover
Opportunities for digital transformation in design thinking workshops.

“There’s nothing that can make a difference in the world more than improving the outcomes of health in society. And, therefore, we are totally dedicated to it.”

Bill McDermott, CEO, SAP SE
Outlined below is additional external research that was used as supporting material for this white paper.


9. Quote from Prof. Dr. Christoph von Kalle during Hasso Plattner’s keynote address at the SAPPHERNOW conference in 2015. https://youtu.be/6vYg2u6wvOQ


Note:
All sources sited as “SAP” or “SAP benchmarking” are based on our research with customers through our benchmarking program and/or other direct interactions with customers.

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