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Health Care

Al and Digital Tools for Better Health

Good health is more precious than gold: for millennia, humans have sought ways to cure ailments, treat injuries, and prevent sickness. New tools and technologies have always been a vital part of health care, from the ancient Egyptians writing medical histories on papyrus, to the invention of the surgical scalpel in 1914.

As artificial intelligence (AI), machine learning (ML), and cloud computing become mainstream, health professionals worldwide are finding these new tools equally invaluable. Digital tools can streamline treatment, develop new drugs, improve patient outcomes and—most importantly—encourage healthy lifestyles that prevent the need for intervention altogether.

This is a timely innovation. The World Health Organization projects a global shortfall¹ of 10 million physicians, nurses, and midwives by 2030, which will be particularly bad for low- and middle-income countries. Health care staff everywhere are already feeling burned out after the COVID-19 pandemic. Al and cloud technologies can help them in multiple ways, from taking care of routine, administrative tasks (which can take up to 70 percent of a health care practitioner's time), to training the next generation of professionals remotely through augmented reality (AR).

This report explores a range of areas where Al and software-enabled digital transformation is improving health care, with a focus on three areas: the patient journey, innovations in treatment, and public health/macro-level research. All three show the importance of getting digital solutions in place today to face the challenges of tomorrow.

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At the same time, demographic shifts make the digital transformation even more urgent. By 2050, one in four people in Europe and North America will be over the age of 65. Managing older patients will require systems to shift from an episodic care-based philosophy to one that is much more proactive and focused on long-term care management. Al could play an invaluable role in this, according to a report by McKinsey and EIT Health.²

Health care currently lags other industries in Al adoption, according to a National Bureau of Economic Research paper,³ which estimates that wider adoption of Al could lead to savings of 5–10 percent in US health care spending—roughly \$200–\$360 billion annually in 2019 dollars. Combined with tangible improvement to people's lives through better health, this opportunity cannot be missed.

It is also a huge opportunity to improve sustainability. Health care's climate footprint is equivalent to 4.4 percent of global net emissions, according to the NGO Health Care Without Harm⁴—or put another way, if the health industry were a country, it would be the fifth-largest emitter on the planet.⁵ Going digital enables the sector to become more efficient, reduce waste, and better use the planet's resources.

Investment is there: venture capital (VC) funding for the top 50 firms in health care-related AI has reached \$8.5 billion, according to McKinsey/EIT Health. Regulators are creating rules where it is possible to harness the benefits of digital tools while keeping patient confidentiality sacrosanct. And BSA members are developing innovative solutions for every stage of the process, from assisting conception to palliative care.

Part One: Patient Journey

Improving Communication

In the Hippocratic corpus, ancient Greeks set out guidelines for how doctors ought to interact with patients, and good communication is an essential part of effective treatment. Digital tools can play a huge role in improving communication, from an AI that listens to emergency calls and flags potential cardiac arrests,⁶ to private virtual meeting rooms for doctors to consult with specialists. Developments in digital security mean patient confidentiality is designed in.

Something as simple as automated appointment reminders saves health care providers from wasting time and money.⁷ Using AI trained on existing health care datasets can be a smart way to triage people and provide direct and immediate access to care where there may be delays otherwise, such as health care systems with long waiting times, rural areas with a shortage of primary care resources, or in some emerging markets. In the wake of the pandemic, patients have come to expect the convenience of virtual services, so digital connectivity will continue to be a critical part of medical care.

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cisco

Slashing Treatment Times for Cancer

Cisco works with 17,000 health care organizations to provide immersive, secure health care experiences. Their videoconferencing product, Webex, is reimagining the future of care as health care organizations are increasingly deploying new care delivery models that combine physical and virtual spaces.

One area where this is particularly useful is Tumor Boards, which review the situation of cancer patients before deciding on the best treatment. Not every health care facility has the relevant expertise, and traditional video calls are not flexible enough for experts to review longitudinal care records and high-resolution scans in one place.

In partnership with Oslo University Hospital in Norway, Cisco developed an on-premise Multi-Content Solution (MCS) on the Cisco Meeting Server to allow multi-disciplinary teams to coordinate on decisions, improve care performance, and optimize patient outcomes. "The use of video conferencing helps reduce the time from diagnosis to cancer treatment start for a patient from seven weeks to one," said Petter Brandal, Head Physician at Norwegian Radium Hospital.

Monitoring Patients

"I'll just take a few observations" is the way most routine medical appointments begin, but the Internet of Things (IoT) offers unprecedented ways to monitor health indicators, wherever the patient finds themselves. From using a chatbot to check in on a COVID patient's symptoms, to wearable devices such as watches and step counters, digital tools have transformed the management of a range of conditions. There are preventative benefits as well: Studies show that consistently using a fitness tracker can increase your steps per day by more than a mile,⁸ especially if users establish a daily goal to improve their cardiac health.

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sales*f*orce

Safe, Speedy Triage Through a COVID Hotline

Georgia's largest health care provider, Piedmont, was inundated with calls from concerned community members as the pandemic unfolded. Supported by **Salesforce** partner Slalom, Piedmont Healthcare transformed its call center to stabilize and then grow its capacity to engage with customers.

Piedmont developed new COVID-related call scripting and flows⁹ for Health Cloud and scaled it throughout the organization in just three days. The call scripting enabled nurses and call center agents to ask callers standardized questions about risk, exposure, and active symptoms, and then quickly guide them to the right level of care. Within five hours of Piedmont Healthcare deploying the new technology, its team members had logged and triaged more than 150 calls. The solution was quickly scaled up, with 80 nurses and 70 agents onboarded within weeks.

Microsoft

Staying Out of the Hospital for a Healthier Heart

In Portugal, like most developed countries, chronic heart failure is the most frequent cause of hospital admissions in people over the age of 65. "It's increased by more than a third in the last decade," explains Dr. Luís Oliveira from Cova da Beira Hospital, a co-founder of Hope Care. "Like many countries, our population is ageing and we are treating this disease on almost a daily basis."

Hope Care¹⁰ helps keep older patients with cardiac issues out of the hospital by remotely monitoring their temperature, weight, and blood pressure daily. The system runs on **Microsoft** Azure, with data submitted to Hope Care's centralized system and stored securely in the cloud.

Once the data is submitted, the hospital is alerted if a patient's condition is outside set limits. This has led to an 85 percent reduction in visits to the emergency department and cut hospital admissions. "Patients with chronic conditions getting the treatment they need without making multiple trips to the hospital. That's the reality of our monitoring system," says José Paulo Carvalho of Hope Care.

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Identifying Patients

Patient ID is an absolute priority for health care professionals worldwide. In the most extreme cases, treatment that could cure one patient can be fatal to another. According to a 2020 survey, 38 percent of US health care providers have incurred an adverse event in the last two years as the result of a patient matching issue.¹¹

But even in less headline-grabbing cases, it is paramount: patient confidentiality is at the heart of an effective relationship with physicians, and enshrined in law through HIPAA in the US and GDPR in Europe. Worldwide, health care billing systems vary hugely between countries and regions—but they all require that the right person is identified. Digital solutions can play a huge role in safely delivering coordinated, patient-centric care.

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okta

Integrated ID for Innovative Institutions

Modern identity and access management (IAM) provides a single control panel through which health care organizations can manage risk-based access to resources for all their employees, partners, contractors, and beyond. BSA member Okta has created a neutral, powerful, and extensible platform that puts identity at the heart of everything companies do.¹²

Dignity Health turned to Okta and Cerner to power its patient portal. Through this patient portal, Dignity Health provides seamless access to apps, information, and services through a single unified **Okta** identity. The result is a highly secure, highly scalable authentication process that provides patients easy access to more personalized service.

Channeling the Data Explosions

Health care systems can contain 30 or even 60 petabytes¹³ (PB) of patient data, a quantity so vast it is incompatible with traditional storage methods. At best, they slow down services, and at worst, represent serious cybersecurity vulnerabilities. Embracing the cloud can help health care companies store, sort, and process these unprecedented amounts of data.

Patient safety is paramount, and health care providers also have to think about the professional accountability of their clinicians and minimizing risks. Health care lawyers interviewed in the EIT/ McKinsey report were clear that accountability ultimately rests with the clinician under current laws. Innovators are also proactively addressing related risks. Many are putting new processes in place and ensuring a "compliance by design" approach is at the core of product development.

→ kyndryl

Secure Systems, Safer Data

In this anonymized case study, a rapidly growing health care insurance provider with more than 1,500 applications, 19 lines of business (LOBs), and 60PB of siloed and unreliably documented data needed to address security vulnerabilities. These vulnerabilities could have put them at financial and compliance risk¹⁴ in the event of a disaster or cyber incident.

To help the insurance company, BSA member **Kyndryl** took two steps. First, they implemented a tool-based Application Interdependency Mapping to create an end-to-end view of the customer's data. Next, they developed an orchestrated resilience plan to design, enhance, and validate their disaster recovery procedures. Kyndryl helped the provider develop a five-year Recovery Management Plan to integrate all critical workloads to the cloud. Through consolidation of disparate and siloed LOBs and improved test planning, gateway application recovery was reduced by 60 percent across distributed and mainframe environments.

Get Appy: Consumers Take Control of Their Own Wellness

"Digital natives" have been a part of the discussion since the turn of the century, and the generation that grew up online are now using digital tools to navigate the health challenges of middle age. A recent Salesforce survey of 12,000 global health consumers revealed the importance and implications of improved consumer trust. Consumers are taking matters into their own hands, managing their own health, and relying on a wider variety of channels to do so. In fact, 41 percent of consumers rely on search engines for public health information.

From apps that gamify daily stretches to flu jab reminders and fertility trackers, users are happy to upload personal information about their physical and mental state because they understand the benefits it can bring. According to the Salesforce survey, 92 percent of consumers who completely trust pharmaceutical organizations are amenable to disclosing non-medical details in exchange for benefits like personalized service or savings. On the opposite end of the trust spectrum, 47 percent of consumers who do not trust pharmaceutical companies refuse to share non-medical information regardless of the incentive.

Prevention is better than cure: the fitness tracker generation is aware that digital tools are even more effective than an apple a day in keeping the doctor away.

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ORACLE

An OS for Digital Health Care

Deloitte Health—**Oracle** Accelerated¹⁵ is designed to help health care organizations navigate this patient-driven shift from reactive care to proactive wellness. The health care universe is shifting from being driven by hospitals, providers, or insurance companies to being driven by patients who use a broad ecosystem of platforms and tools, many of them virtual.

As the industry transforms, the medical field needs to meet patients where they are through mobile access and data portability, and supporting providers looking to overcome thin margins and workforce challenges. In the current environment, the health care delivery system can benefit from Deloitte's industry know-how and BSA member Oracle's extensive portfolio of technology, which is uniquely positioned to become the operating system for health care.

Part Two: Treatment

Scanning the Horizon: A Second Pair of Al Eyes

Tumor Boards, as mentioned above, are an example of how multiple physicians review scans to decide on a course of treatment. Health care professionals have access to an unprecedented range of diagnostic tools, including X-rays, ultrasound, CT and MRI scans, and endoscopic procedures. Our ability to visualize the inside of the human body is changing medicine, but analyzing these pictures takes time, skill, and experience.

Identifying anomalies can be vital in the early detection and treatment of illnesses, cancer in particular. However, success rates depend on the practitioners' experience and skill at spotting them during the investigation, as well as the physical appearance and stage of development of the abnormality. Al can draw on existing datasets of millions of images of affected cells, tissues, and organs and act as a second pair of eyes during investigations.

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Medtronic

Faster, More Accurate Detection of Cancer Risks

Colonoscopy can reduce a patient's risk of colorectal cancer by detecting and removing polyps in their bowel. **Medtronic**'s GI Genius¹⁶ is an AI assistant that has "seen" no fewer than 13 million white-light endoscopy videos. GI Genius acts as a vigilant second observer, assisting in the fast, automatic detection of colorectal polyps regardless of shape and size. It is 82 percent faster than the average endoscopist at detecting polyps.

The system plugs into existing endoscopy towers, including video processors and monitors. This means it neither requires special equipment or adaptation to be used nor does it change a physician's procedural technique or workflow. And these new scans are added to the dataset, so the system continues to learn, enabling health care providers to better reduce patients' risk of colorectal cancer.

Drug Development

Developing new drugs is traditionally a time-consuming, expensive, and uncertain process. Al, the cloud, and digital technologies can remove friction at every stage from invention, to manufacturing, to injection. Boosted by AI, wasted years of trial-and-error experimentation can be avoided.

Al can sift through results from decades of previous experiments and suggest molecules with the potential to fight diseases. Digital twins can facilitate testing, avoiding the use of more invasive methods at earlier stages. The process of proving new medicines to be safe and effective with the FDA and Europe's equivalent, the EMA, can be streamlined by getting virtual assistance with the paperwork.

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Using AI to Find Hidden Gems

Keystonemab¹⁷ is a startup that uses AI to find hidden links among millions of scientific papers that can potentially be used to develop new treatments, especially for uncommon diseases. Scientists working on drug discovery can take decades to review scientific literature, but Keystonemab can quickly unearth insights with **IBM** Watson's Natural Language Processing (NLP) capabilities.

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Using AI to Find Hidden Gems (continued)

Founder Tushar Satav and his team developed software that makes connections between different drugs that are not typically considered to work together. By sifting through vast swathes of information about drugs, diseases, target proteins, biomarkers, and signaling pathways, they hope to discover multiple matching needles in a very large haystack.

Pharma clients demand a high level of security for their data due to the highly regulated nature of the industry. "We work with pharmaceutical clients, and data security is very important for us," Satav says. He chose IBM's Watson because he's not an AI expert by training. "I am not an artificial intelligence expert, I am more of a wet-lab scientist," he says. "So for me this user friendliness was important."

Clinical Trials

Clinical trials have a reputation for being slow and extremely expensive. They involve an extensive clinical data management process, where inefficiencies can cause serious delays—which hold up getting potentially life-saving medicines to patients. Even before the pandemic, virtual integration of clinical trials was already ongoing, with thousands worldwide incorporating connected digital products to facilitate remote data collection.

When COVID-19 struck, the FDA and international counterparts developed guidance to protect both research participants and trials by advocating for remote data collection supplemented by telemedicine. Stephen Hahn, then FDA commissioner, supported retaining aspects of virtual trials¹⁸ and regulatory agencies worldwide are looking at how best to integrate virtual aspects of testing alongside traditional ones.

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Capturing Data, Accelerating Trials

Biorasi is a full-service contract research organization that carries out clinical trials for smalland mid-sized pharmaceutical and device companies. They wanted a data science partner that could potentially shorten the clinical development life cycle—and do so at a reasonable cost.

According to Biorasi, the standard for an electronic data capture build for a clinical trial is 73 days. With **IBM** Clinical Development solution,¹⁹ they could build an electronic data capture in less than 40 days. "The speed with which you can deploy in IBM Clinical Development is crucial and has proven vital to clinical trials," says Roberto Silberwasser, Vice President of Data Sciences and Biometrics at Biorasi. "And having technology that you can trust has been very, very important."

Manufacturing Success

Once a treatment has been invented and approved, pharmaceutical companies need to manufacture it. Digital can make a difference at every stage; AI, cloud and big data are already powering the next evolution of industry. Intelligent machines are already in place in smart factories, enabling manufacturing companies to be safer, more efficient, more productive, and more profitable.

Building a digital twin first can enable troubleshooting in factories before they are built, collect data for predictive maintenance, and optimize energy use for sustainability. Employees can use virtual reality (VR) and AR technologies such as Microsoft HoloLens²⁰ to improve processes and provide training by remotely sharing what they see with colleagues.

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Boosting Bioreactors

Led by an international team with extensive experience in biologics manufacturing, Cheerland Biotechnology offers the first 15-kiloliter bioreactor in Asia. They wanted to streamline compliance with WHO good manufacturing practices (cGMP) quality standards, and meet EU data privacy regulations. To achieve these aims, the company needed to modernize its operations on a digital foundation, unify data and processes across the four businesses, and enable data-driven decision-making.

They invested in RISE with **SAP** S/4HANA Cloud, private edition. It provides Cheerland Biotechnology with a highly reliable and future-ready business backbone to support digitalized operations. The company successfully unified data from the business units of its four main businesses and streamlined front-end and back-end processes, gaining enterprise-wide visibility.

With tightly integrated business and finance processes, the company has seen a 30 percent increase in supply chain efficiency and shaved three days off month-end closing activities. By adopting standardized business processes and embedded functionality, Cheerland Biotechnology is now managing the drug manufacturing business in line with global best practices.

Part Three: Digital Shifts for a Healthier World

Training Doctors

The WHO predicts a global shortfall of 10 million health workers by 2030 due to challenges in the education, employment, deployment, retention, and performance of professionals in the sector. In addition to this, the increasing international migration of health workers may exacerbate health workforce shortfalls, particularly in low- and lower-middle income countries.

Moreover, many experienced doctors are leaving the profession, with a recent WHO report²¹ highlighting the ageing nature of the workforce and the high proportion of doctors approaching retirement age. In the UK, the number of doctors taking early retirement from the National Health Service (NHS) has more than trebled from 2008 to 2021, official figures show.²²

Digital transformation can play a huge role in remedying this. Al systems can learn from the knowledge of retiring professionals. AR and VR solutions can hone the skills of the new generation. And remote learning can build bridges across generations and geographies to train the people and systems that will care for earth's growing population.

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Unity[®]

Learning Through Play: Surgery Edition

BSA member **Unity** is a leading platform for creating and operating interactive, real-time 3D content, and their tools are used by numerous companies in the health care space.²³ It's also the technology behind Level Ex, the world's leading medical video game studio.²⁴ Level Ex has brought together experts in health care and interactive entertainment to use the neuroscience of play to support new skills and treatments in medicine.

With hyper-realistic visualization, players can remove foreign objects from bodies, perform life-saving heart surgery, and cauterize wounds. Clinicians can refine their technique through ultra-realistic virtual surgery on any mobile device, headset, or web browser. More than one million medical professionals have played Level Ex games—and enhanced their skills.

📚 ptc

AR for Knowledge Transfer

AR is a natural knowledge transfer technology where companies can seamlessly scale expertise to less-experienced personnel. Since 1985, BSA member **PTC** has been providing solutions for health care providers, including AR platforms. Senior physicians can connect with geographically dispersed medical personnel through real-time collaboration to work on a case: they can use annotation patterns on a patient to identify symptoms and work together on a diagnosis. AR can also capture information on a procedure, such as running an MRI, from experienced technicians and scale it to junior-level personnel.²⁵

Running Facilities, Healing Patients

"The world is changing, and so are hospitals," writes McKinsey in their report²⁶ about shifting trends in health care delivery. From the IoT-facilitated revolution in home care outlined above, to shifting patient expectations, hospitals are transforming. Through these innovations, hospitals can better position themselves to survive—and even excel—in tougher conditions.

BSA members are supporting them in this shift by providing state-of-the-art tools to manage their business. Hospitals, especially large regional hubs are seeking to increase volumes in specialized services to deliver high-quality care affordably. With multiple departments, specialist staff, and complicated supply chains, a hassle-free management system is just what the doctor ordered.

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workday.

Keeping It Simple in San Diego

Robotic cardiac surgery. Gene therapy. Radiation suites. In San Diego, Sharp HealthCare is synonymous with pioneering medical treatment. Many tens of thousands of Sharp Health Plan members perennially rank it among California's best. To keep things in prime condition, Sharp HealthCare's supply chain team wanted to simplify its diverse sourcing and contracting systems and processes.

"With so many facilities, our team indirectly touches about \$1 billion a year in spending, while directly managing \$400 million," says Ryan Koos, Chief Supply Chain Officer. "But this spending extended across more than 10 departments with their own contracting responsibilities. We had too many systems and manual touch points."

They chose **Workday** Strategic Sourcing to smooth things out,²⁷ with greater stakeholder engagement, cleaner data, and real-time reporting from a single source, resulting in \$4.2 million in savings in first six months following the switch.

Innovation in Insurance

The US health care system is unique. According to recent data from the Kaiser Family Foundation,²⁸ about 156 million Americans receive employer-sponsored health insurance, with the other half of the population covered by Medicare, Medicaid, cover for veterans, or private insurance through health insurance marketplaces.

A senior faculty editor for Harvard Health Publishing recently described the system²⁹ as "expensive, complicated, dysfunctional, [and] broken," but the good news is, digital solutions can help individuals, employers, and providers make their way through the maze more easily.

With vast swathes of options available, choices can be overwhelming for smaller companies in particular. Digital solutions can match people and companies with insurance solutions and create innovative ways to offer people these services. Platforms and marketplaces can facilitate access to health insurance systems for health care providers, insurers, employers, and patients alike.

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trinet

Connecting HR and Health Care

With recent disruptions to America's economy, many people have had to change the way they access health care. BSA member **TriNet** provides small- and medium-size businesses (SMBs) with human resources solutions, and embraced the power of the cloud to offer an HR solution connecting SMBs with health care providers.³⁰

With millions of workers at risk of losing their health coverage, additional options are needed. Workers who lose health coverage may continue their coverage through COBRA, but it is still unaffordable for many. TriNet is responding to the looming health insurance coverage gap by facilitating access to alternative health plan options in addition to COBRA, at a range of price points: it is currently helping 18,000 SMB customers navigate transitional health care coverage options for their employees.

Understanding Data, Improving Outcomes

With widespread global vaccination programs, provision of clean water, and an understanding of the importance of hygiene, many diseases that have plagued humans for millennia are declining globally. In high-income countries, the leading causes of death³¹ now include heart disease, stroke, dementia, cancer, and diabetes—all diseases where lifestyle can be a factor. The more we understand about how people live and public health trends, the healthier societies can become.

Long-term, longitudinal studies of how we live will enable policymakers, insurers, and individuals to make better health care decisions in the future. Recent advancements in ML and Al have fueled computational technologies that can aggregate inputs from multiple data sources, with the potential to derive rich insights that can expand our knowledge base and drive faster innovation.



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Five Million People, One Giant Leap

Our Future Health³² is the UK's largest ever health research program. A ground-breaking collaboration between the private, charity, and public sectors—including the NHS—it has recruited five million volunteers. They will track health-related information about themselves with the aim of developing new ways to prevent, detect, and treat diseases such as dementia, cancer, diabetes, heart disease, arthritis, and stroke.

Because privacy is paramount for health matters, it will use **Microsoft** Cloud to securely store the data collected in a Trusted Research Environment (TRE) provided by DNAnexus, which will sit in a UK Azure region. Cloud services "will be an integral part of Our Future Health, underpinning so many important systems that are essential to the running of the program and ultimately helping to create one of the most detailed pictures we've ever had of people's health," says Andrew Roddam, Chief Executive of Our Future Health.

Al and Digital Tools for Better Health

Digital transformation means new tools at the service of doctors, carers, and patients worldwide. From remote monitoring of health conditions to keep people out of the hospital, to checking in with an app every day, they help prevent illness and improve health outcomes.

Al, ML, and NLP are helping researchers discover new treatments for rare diseases, as well as bringing new understanding to the way humanity tackles the most common ones.

And new insights gained from health data thanks to the unprecedented power of cloud computing and big data mean the digital transformation promises a healthier tomorrow for us all.

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