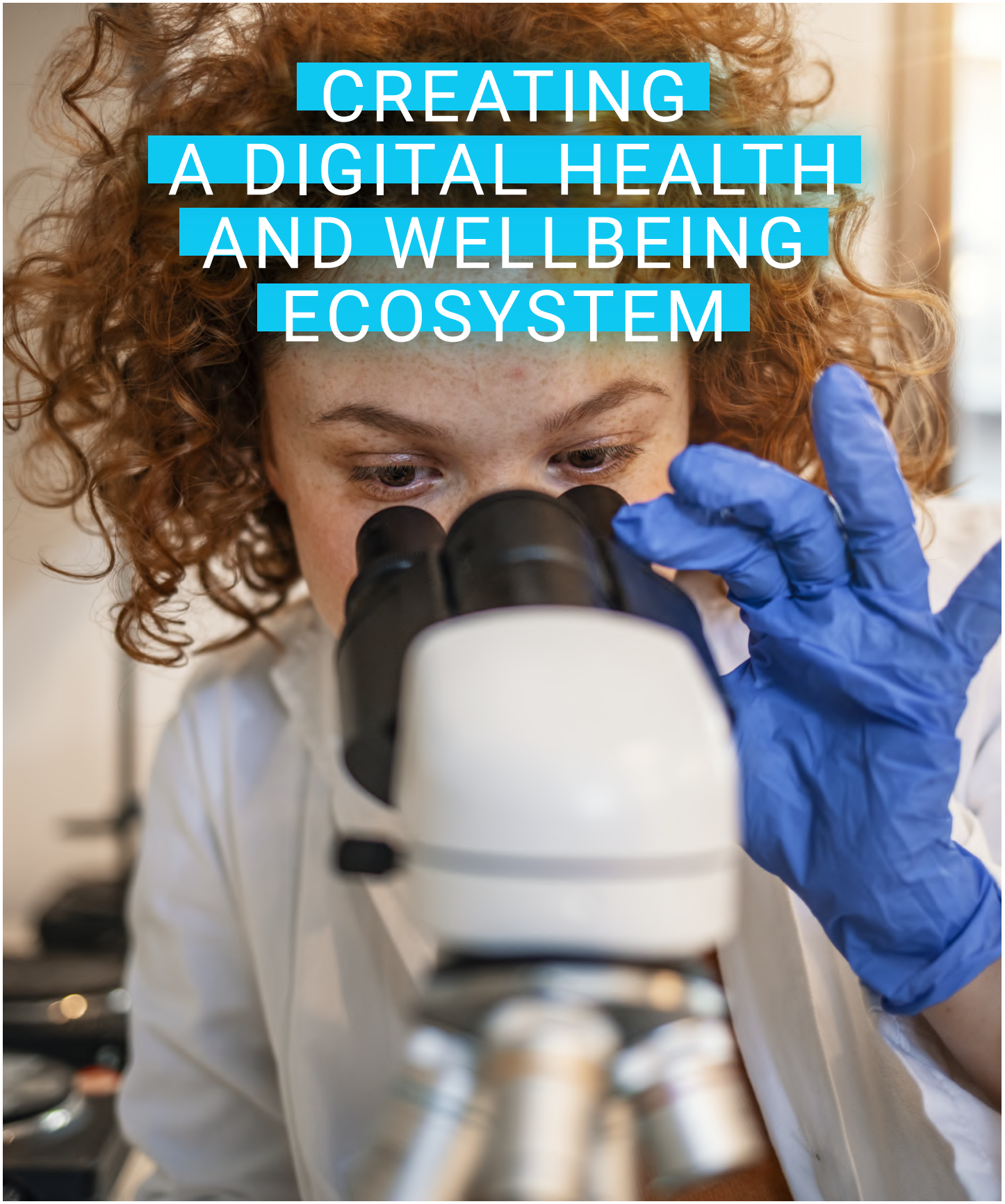

CREATING A DIGITAL HEALTH AND WELLBEING ECOSYSTEM

NTT

Digital transformation is key to a life of better health and wellbeing. Properly executed, it can support human-centric systems design, increase trust and trustworthiness, and enable more personalized care — other stages in this ongoing journey. While data-driven digital technologies have already begun to boost healthcare's reliability and patient focus, too many consumers still experience it as impersonal and disjointed.

The challenges extend beyond consumers. Across the spectrum, from clinicians to research scientists to application developers, stakeholders face difficulties when using and improving the data at their disposal. Instead of a supportive digital ecosystem, they often encounter systemic dysfunction. Yet opportunities are rising. Patient and consumer expectations, further impacted by the COVID pandemic, continue to grow. That shift in demand is affecting employers, insurance companies, regulators, and health care providers, providing openings for innovation. Integration tools, such as data fabrics, which bridge systems in other industries, can also drive better outcomes in health and wellbeing. The moment is ripe for change.

Costs of DIGITAL FRAGMENTATION

The costs of a fractured and inefficient healthcare data infrastructure may be hidden. But they nonetheless add up and are manifested in various ways, including:

- **The frustration of patients** being asked to manually re-enter basic information upon office or hospital visits and then log into multiple separate portals to see results, make payments, etc.

- **Reduced medication adherence** by patients not optimally engaged, leading to lower medical outcomes and potentially higher hospital readmissions.

- **Higher costs of drug development** incurred by pharmaceutical or life sciences companies unable to exploit digitally driven efficiencies.

- **Custom implementations** of 'meaningful use' health record applications, whose unique configurations make it difficult to communicate with other apps

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The landscape is populated with several dominant electronic health record (EHR) companies and has recently seen several giant cloud-based tech companies launch healthcare initiatives. The new players have yet to establish a beachhead. Companies such as Amazon and Apple are unaccustomed to limits on their use of data, and the incumbent EHR firms, which require heavy IT investments to deploy, have designed their self-contained systems more to block than share information.

The result is unrealized potential. "It isn't just about the patient not having information about them and that our current ecosystem is not patient-centric," said Lisa Esch, head of Industry Solutions for the Healthcare Provider business at NTT DATA Services. "They barely can get access to some of it. It's disjointed, it's disconnected, and it's only one of many sources of information about a patient."

INTEGRATION and DATA FABRICS

The status quo may appear largely static, but several factors point to a more dynamic future. The COVID pandemic, for instance, forced many changes upon the healthcare industry, including

greater openness to underwriting change outside the four walls of existing operations. Telehealth is a case in point. Another byproduct of the pandemic has been greater workplace disruption. The "Great Resignation" is associated with a voluntary mass exodus from the workforce, with some surveys pointing to as many as 40-50 percent of remaining employees considering a job change.

Consumption of non-COVID-related healthcare services fell during the pandemic, and employees who leave the workforce could also lead to service providers seeing further leakage or the loss of customary patients. The prospect of a lower lifetime value of patients tends to capture the attention of healthcare business leaders and make them more amenable to initiatives that improve patient experience, cuts costs and boost efficiency.

On the technology front, the deployment of artificial intelligence (AI) to automate workflows and extract value out of data is proceeding across many sectors of the economy. It is poised to deliver similar benefits to this industry. Another harbinger of change is the growing adoption of standards related to electronic health information, which creates an opportunity for a data fabric or middleware that lies within the healthcare data stack, between the systems at the lower tier and ones that have emerged on new presentation layers.

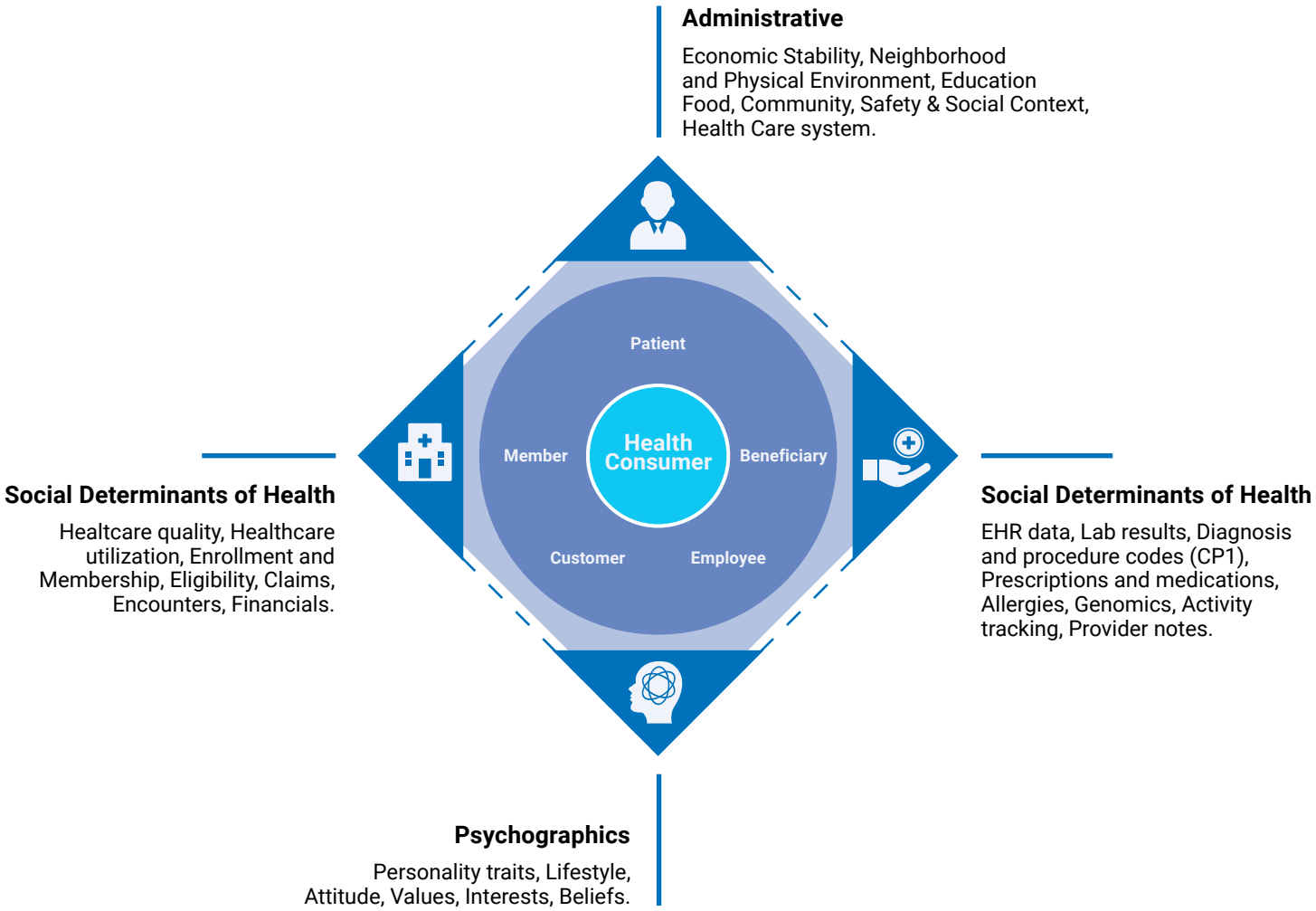
"It's that middle layer that allows you to have access to any systems on the lower tier, and it doesn't matter what they are, or whether they talk to each other," said Richard Swafford, Ph.D., Industry Consulting Director, NTT DATA Services. "That tier becomes the central point for all the activities that then provide the experience to the end-user, who would be a patient, clinician or administrator. This is the fabric in the center that allows ubiquitous connectivity."

Data fabrics can help stakeholders move away from silos and create increased continuity across care and everyday settings. They can drive enhanced security, mitigating risk. They make information valuable and usable. They are focused on both the clinical and patient experience side. They can enable accurate data sharing with life-sciences companies, hospitals, and EHRs open to exchanging data.

> *The nice thing about most of the folks working on the middle tier is that it is based on a more ubiquitous standard, FHIR (Fast Healthcare Interoperability Resources), part of the HL7 suite.*

The contribution from NTT to this emerging class of software is called Nucleus. A bridge between administrative and clinical data, it can interweave psychographic data and social determinants of health (SDoH) to create a 360-degree view of a health consumer. (See figure.) While NTT is not alone in this space, the prospect for another traffic jam (like that arising in the U.S. from the profusion of health record applications following the 2009 21st Century Cares Act) is unlikely. "The nice thing about most of the folks working on the middle tier is that it is based on a more ubiquitous standard, FHIR (Fast Healthcare Interoperability Resources), part of the HL7 suite," said Dr. Swafford.

Another noteworthy aspect of this emerging market is that. In contrast, large Internet companies are funding their work in this arena by taking or licensing and monetizing the data; NTT is simply aiming to manage the services and create interoperable and higher value functionality.



Source: HFS Research 2021, data attributes are sample and not exhaustive.

From SYSTEMS to ECOSYSTEMS

A digital fabric that securely integrates data from multiple sources while respecting its ownership can help healthcare systems interoperate. Other components playing a role in this transformation include natural language processing (NLP), robotic process automation (RPA), machine learning (ML), and AI. But the fabrics will serve as key interoperability hubs going forward that will drive more expansive and open HWB ecosystems.

A digital ecosystem offers value to customers through optimized data and workflows from various sources, partners, and stakeholders, including customers. Anyone who downloads software applications (some of which today qualify as 'medical devices') and makes online purchases will be familiar with this proven business model.

Complementary and adjacent digital systems that could add value to patients, practitioners, and hospitals already exist. Sales and weather data, for instance, have been used separately to predict outbreaks of the flu. Psychographic and SDoH data, as noted, can enhance administrative and clinical records. Wearable devices present another source of medical data, provided the data is relevant. "There's got to be a layer of intelligence around all the information that we gather on patients," Esch said. "Because you have lots of information now, and it's not all of value. It's just information."

A digital fabric embedded with AI and algorithms that have been screened for possible bias can meet and exceed that requirement. But there are still barriers surrounding many EHR providers that can keep valuable and medically relevant data at a distance. The good news – on the one hand, some insurance carriers are moving forward on their own, and on the other, not all EHR providers are the same.

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"The idea here is that for those that do accept this data, let's build this digital ecosystem that interacts seamlessly because, at the end of the day, no patient cares what's on the backend of their EHR," said Dr. Michael Petersen, Vice President Consulting and Chief Clinical Innovation Officer, NTT DATA Services. "What they care about is what's important to them, and so we need to make that seamless."

Two more promising signs include a surge of interest among healthcare executives for AI technology and new solutions that fill that gap. A report in 2021 by healthcare business consultancy Sage Growth Partners revealed that 90 percent of hospitals in the U.S. have an AI/automation strategy in place, up from 53 percent in 2019. While only 9 percent of hospitals have fully operationalized their strategies, compelling roadmaps are on hand. One firm, Olive, has an enterprise AI-as-a-service solution built specifically for healthcare that dovetails with NTT's digital intelligence fabric. Such combinations deployed with compatible EHR systems can help create a tipping point and catalyze this ongoing digital transformation.

Adjacent industries such as life sciences and pharmaceutical companies are especially motivated to collaborate. "Clinical trials are the most expensive long pole in the tent," said Steven Figman, Digital Business Transformation and Strategy Leader, Health & Life Science, NTT DATA Services. "And as we know for getting a drug approved, many people aren't even aware that they're eligible for a clinical trial." The idea is to become better at identifying candidates, keeping them engaged (drop-out rates can be very high) and streamlining communications. At-home medical operations that ramped up over the pandemic can play a supporting role in another significant paradigm shift, one fully supported by NTT. "Technology is decentralizing those trials," Figman added, "allowing people to do clinical trials remotely for the most part."

A more integrated digital ecosystem could also improve the accuracy and speed of the FDA-managed reporting of adverse effects. This ecosystem could bring the industry closer to grasping what should be low-hanging fruit but which remains persistently out of reach: higher medication adherence rates.

Health and Wellbeing of ECOSYSTEMS

A vibrant digital ecosystem is easy to identify. For instance, Amazon's online retail platform accommodates 6 million third-party sellers and 300 million active users. Moreover, its infrastructure has led it into numerous adjacent markets, including consumer electronics, film production, and cloud computing.

Likewise, the strength of a digital healthcare ecosystem is reflected in its scope. It is not the size of an individual company, the number of its applications and customers, but rather the range of complementary organizations and interoperable systems that share a common mission. Because health and wellbeing are universal aspirations, the scope is inherently broad. A digital ecosystem should be accessible to all consumers, extending outside traditional healthcare channels into communities and companies. New government-sponsored broadband initiatives are seeking to reach the unserved or underserved in part because of the growth of telehealth, and employers have stepped up in their domains, as well.

"Organizations have a duty of care around wellbeing and health," said Alex Bennett, Global Senior VP, Workplace and Employee Experience Division, NTT Ltd. "We're seeing with many reports that it's the number one priority and investment area for executives within their organizations."

The focus is driven not only by a "duty of care" but by a need to attract and retain talent within today's peculiar labor market, where a large percentage of those who have not left are thinking about it. Digital native companies have been quicker to adjust to these shifts, but the place of work is widely regarded as a key factor. Commercial real estate, for instance, has assumed its place in the digital health care spectrum. The new NTT Research facility in Sunnyvale, California, with special virus-attacking units within its HVAC system, is a case in point.

Ultimately, the health and wellbeing of this digital ecosystem is about results. How many sub-systems interoperate within it? How are employee and patient experiences trending?

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Have decentralized clinical trials led to reduced costs and accelerated drug development? Has better patient engagement improved adherence to medication plans? Stakeholders entering this ecosystem should define their targets. Still, successful collaboration should lead to positive outcomes in health and business, and even in areas that fall beyond the health system as traditionally understood, such as indoor air quality.

A different and better WAY FORWARD

A staggering array of new approaches and technologies promise to transform healthcare. From genomics to biomechanics to IoT sensors and beyond, providers and clinicians have within their grasp informatic and therapeutic capabilities once scarcely imaginable. As in the past, however, existing practices and operations can become impediments to progress. The path forward is often marked by obstacles, delays, and systemic inertia.

In reorienting toward a future of better health and wellbeing, NTT identifies four transformative phases: Human by Design, Trust and Trustworthiness, Health of Me, and Digital Ecosystem. These mutually reinforcing stages and the principles they embody can guide all industry stakeholders facing decisions at today's crossroads. The desire for a better life has been a persistent goal throughout history. Implementing a healthy digital ecosystem that is informed by both expert insights and best practices is a crucial next step in this journey.

LEADING THE WAY to a better life of HEALTH AND WELLBEING

NTT believes in resolving social issues through our business operations by applying technology for good. We help clients accelerate growth and innovate for current and new business models.

Our services include digital business consulting, technology and managed services for cybersecurity, applications, workplace, cloud, data center and networks – all supported by our deep industry expertise and innovation.

As a top 5 global technology and business solutions provider, our diverse teams operate in 80+ countries and regions and deliver services to over 190 of them. We serve over 80% of Fortune Global 100 companies and thousands of other clients and communities around the world.

https://www.global.ntt/healthandwellbeing/index.html