

Chronic illness consumes an inordinate amount of health spend worldwide. Advanced remote patient monitoring enables more focused and timely interventions, reducing preventable, expensive health incidents by gathering massive amounts of raw data streamed from connected devices, identifying the critical signals, and feeding them into powerful analytics engines that produce actionable insights in near real time. Cloud computing platforms are making such solutions feasible and cost-effective at scale, enabling providers, payors, and pharmaceuticals to optimize care pathways, substantially reduce costs, and produce better outcomes, not only for individual patients, but also for populations as a whole.

From the person, to the cloud, and back

How remote patient monitoring and intelligent feedback loops are driving the personalization of care

The term “remote patient monitoring” may evoke images of an elderly person confined at home, connected to Internet of Things (IoT) devices that stream vital signs to a local hospital where clinicians interpret them and decide when to send an ambulance.

Yet such a limited scenario doesn’t begin to tell the story of what remote patient monitoring can do when cloud computing becomes part of the equation.

Processing data collected from patients in cloud-based algorithms is providing new treatment insights for chronically ill patients that boost the ability of providers, payors, and pharma to optimize care, not only as separate entities, but also as a collaborative ecosystem.

Over time, as patient data starts to reflect improvements to treatment pathways, health organizations can make further refinements that improve outcomes for patients and providers, lower costs for payors, and increase opportunities for pharma.

Earlier detection for better outcomes: diagnosing diabetic retinopathy

Consider the case of diabetic retinopathy, the leading cause of blindness in adults worldwide. More than 30 million diabetics in the United States alone are at risk. Not only is blindness a personal catastrophe for individuals and their families, but with a lifetime medical cost that averages close to USD1 million, it drains the global economy of billions of dollars a year. If caught early, blindness can be prevented in better than 95 percent of cases with treatments that cost as little as USD50. Although the key to early detection is screening, which providers and payors recommend to all diabetic patients, 60 percent of people in the United States who should get screening don’t.



To make screening for diabetic retinopathy more readily accessible to more people, Intelligent Retinal Imaging Systems (IRIS), LLC of Pensacola, Florida devised a simpler [testing solution](#) that a clinical care assistant can administer in five minutes anywhere there’s an internet connection, whether in a big city or a small rural town. An automated camera takes images of each retina and sends them to an IRIS-developed algorithm resident in Microsoft Azure, which returns a preliminary report within minutes and a detailed final report within 24 hours. Because processing happens in a cloud datacenter, the solution doesn’t require high-end screening equipment, expensive in-house IT infrastructure, or an on-site specialist. The equipment and software necessary to capture data can be lightweight, making it more affordable and accessible.

IRIS customers are seeing striking results. In mere months, [CoxHealth](#) reported an increase in screening rates from 32 percent to almost 70 percent. Providers like CoxHealth can now monitor more at-risk patients and provide feedback to make sure they’re adhering to their treatment protocols. They can report higher screening rates to payors, who can provide measurable incentives to help keep patients on programs to improve their overall health. Pharmaceutical companies benefit from increased sales of medicines that treat diabetic retinopathy in its early stages. The benefit to patients is obvious—they keep their sight.

Reducing the worldwide burden of chronic illness

Although diabetes alone costs the world USD827 billion a year, it's only one chronic disease that threatens to overwhelm healthcare systems worldwide. The World Health Organization projects that by 2020, the three leading causes of death—cardiovascular diseases, cancers, and respiratory diseases—will consume half of the healthcare spend worldwide, about USD4 trillion.* As cloud-powered remote patient monitoring creates more intelligent feedback loops to improve diagnosis and treatment, it promises to alleviate the growing burden of chronic illness.

- [Poole Hospital NHS Foundation Trust](#) is developing a system to monitor epileptics in the United Kingdom, with the goal of using machine learning to identify patterns that can predict seizures.
- [Children's Mercy Hospital](#) of Kansas City, Missouri, developed CHAMP® (Cardiac High Acuity Monitoring Program) to monitor babies at home recovering from surgery to treat single ventricle heart disease, drastically reducing hospital readmissions and death rates.

*World Health Organization. (2017, January). [The top 10 causes of death](#). Retrieved from World Health Organization media centre.

- [Optolexia](#), based in Stockholm, Sweden, analyzes eye-tracking data to identify students at risk for dyslexia so they can receive appropriate therapy and develop coping mechanisms at an earlier age.
- [Kinect HoloLens Assisted Rehabilitation Experience \(KHARE\)](#) uses 3D tele-rehabilitation and cloud-based intelligence to help doctors, physical therapists, and neuroscience researchers predict rehab trends in exercising patients as they recover from injuries or strokes.
- [Julho Hospital](#) in São Paulo, Brazil, uses video analytics, images of beds in a large database, and artificial intelligence to detect movements that put patients at risk of falling out of bed in the hospital.



- A cloud-based solution from [InterKnowlogy](#) uses the vision capabilities in Microsoft Cognitive Services to scan ultrasounds for posterior urethral valves (PUV), an often fatal condition, in prenatal boys.
- After clinicians draw blood using a connected device from [Becton Dickinson](#) to make quick flu diagnoses, the data gets aggregated and analyzed in the Azure Cloud to inform population health decisions, for example, if the data reveals a potential flu epidemic.

More data, more intelligence

Intelligent feedback loops require lots of data, which healthcare is supplying by the exabytes from collections of EMRs, high-resolution images, connected IoT devices, and genomics data. Self-contained data silos are now converging in vast cloud storage repositories, where powerful machine learning and artificial intelligence algorithms have easy access to identify patterns and generate insights in near real time versus days, weeks, or months.

Indeed, the amount of data required to train algorithms, and the computing power necessary to drive them, require a level of resources that only the cloud can provide.

The advent of ever more intelligent algorithms that consume data to produce insights opens up immense opportunities for providers, payors, and pharma.

Fewer emergencies and better patient outcomes.

Remote patient monitoring solutions backed by cloud resources can serve as a "virtual assistants" that identify the most useful information for clinicians making diagnoses or optimizing care pathways for individual patients. Through regularly scheduled assessments—daily, hourly, or minute-by-minute—they can measure disease progression, assess patient risk, and initiate timely interventions.

Informed incentives. Screening for early detection of preventable chronic diseases, monitoring patient compliance with medicine regimens, and tracking efficacy of patient treatments can help payors tailor individualized care plans, design incentives, and measure impact of wellness programs.

Proof of treatment value. Under increasing pressure from patients, providers, and payors to demonstrate the value of their medications, pharmaceutical companies can use remote patient monitoring to reduce the cost and increase the success of clinical trials, identify patients who need medications based on symptoms and test results, and gather data on which medications work best for which types of individuals.



Proactive, predictive, and prescriptive solutions

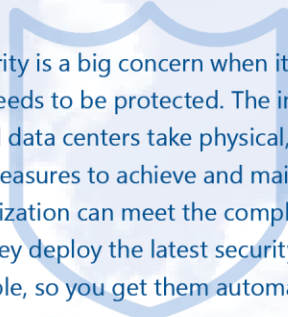
As a leading provider of cloud-based data storage and analytics platforms, which include Azure Storage, Azure IoT, and Cortana Intelligence Suite, Microsoft is working with partners to offer premade, compliant remote patient monitoring solution architectures that contain the necessary platform components, the functionality that dictates how they interact, and the mechanisms for deployment. Using these templates, building solutions that take advantage of medical data stored in the cloud becomes as simple as determining the data sources and the algorithms that will run on them. The Intel® Health Application Platform, for example, helps collect data from smart, connected devices and deliver it to services in the cloud to enable advanced remote care solutions and drive efficiency.

With an aging population and increasing rates of chronic illness, pressures on global healthcare resources will continue to intensify, making proactive measures essential. Remote patient monitoring can help the health ecosystem combine the power of data and AI with acquired knowledge or clinical interpretation to derive insight, personalize care, realize precision medicine, and ultimately improve outcomes for everyone.

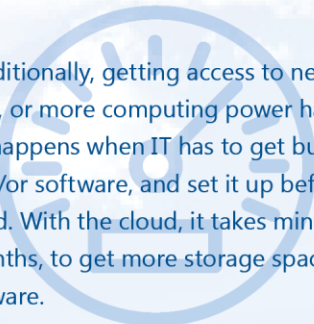
Moreover, monitoring and analyzing data on individual health can not only illuminate, but also predict, trends in the larger population. The health industry can then work together to create an increasingly intelligent, virtuous feedback loop that identifies effective prescriptive measures to promote wellness and reduce the incidence and impact of chronic illness.

To explore more stories about innovation in health, please visit [Microsoft's health industry website](#).

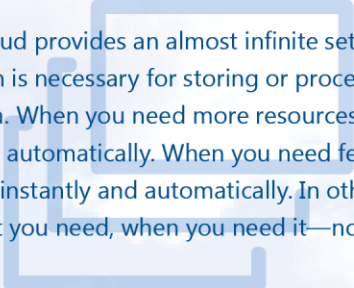
Benefits of cloud computing



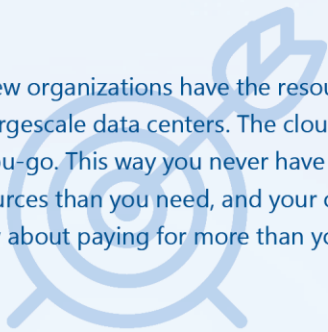
Trust. Security is a big concern when it comes to cloud adoption. Health data needs to be protected. The industry experts who manage cloud data centers take physical, technical, and operational measures to achieve and maintain security and privacy so your organization can meet the compliance requirements of regulators. They deploy the latest security patches as soon as they're available, so you get them automatically.



Speed. Traditionally, getting access to new or better tools, more storage space, or more computing power has involved a lot of waiting. This happens when IT has to get budget, purchase hardware and/or software, and set it up before they can give you what you need. With the cloud, it takes minutes instead of days, weeks, or months, to get more storage space, compute cycles, or updated software.



Scale. The cloud provides an almost infinite set of computing resources, which is necessary for storing or processing massive amounts of data. When you need more resources, you can scale up instantly and automatically. When you need fewer resources, you scale down instantly and automatically. In other words, you get exactly what you need, when you need it—no more, no less.



Economics. Few organizations have the resources to set up or manage very-largescale data centers. The cloud model, like a utility, is pay-as-you-go. This way you never have to worry about having fewer resources than you need, and your organization never has to worry about paying for more than you're using.

Choosing a cloud offering

Health organizations need cloud services that are not only powerful, but also secure and compliant. Here is a short checklist to consider when evaluating cloud offerings:

- Is it Enterprise-ready? Do the services it offers scale to large organizations with many users or customers?
- Does it offer more than infrastructure, such as platforms that support core functions for productivity, communications, relationship management, and analytics, so you can easily tailor solutions to meet your needs?
- Does it work with on-premises environments and with technologies from multiple cloud providers and device manufacturers?
- Does it have certifications to show it complies with health security and privacy regulations in the countries where you do business, and can it support the regulatory requirements of your industry?



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