Google Cloud

The new era of tech-driven healthcare
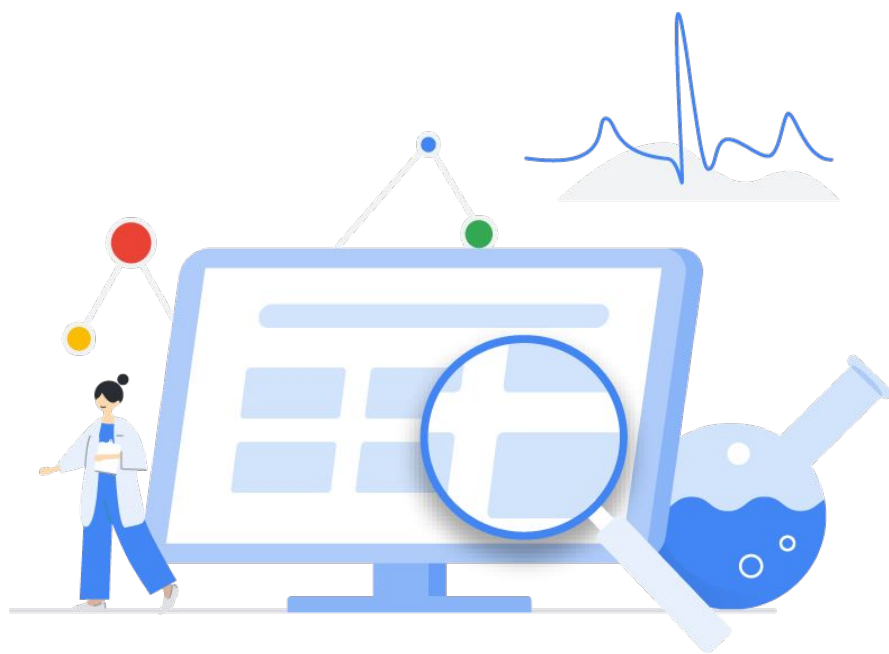
Google Cloud

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Introduction

The world is facing unprecedented challenges. In this eBook you'll hear from a number of leading healthcare organizations about how they are using Google Cloud to reimagine care post COVID-19.

Reimagining Healthcare: Aashima Gupta, Google Cloud HCLS solutions strategy lead sat down with Dr. John Halamka of Mayo Clinic to discuss how healthcare organizations are embracing new technology solutions to build a more resilient and digitally connected healthcare system.

Driving Business Transformation: Healthcare often requires custom technology solutions built for the industry. Dr. Thomas Tsai from the Harvard Global Health Institute walks through the institute's COVID-19 forecasting model powered by Google Cloud AI.   Joe Corkery, Director of Google Cloud HCLS product, explores how to drive business transformation in healthcare using Google Cloud and HCLS-specific artificial intelligence (AI) and machine learning (ML) products.

Security, Privacy and Compliance: With any digital solution, security is of utmost importance, especially with the number of cybersecurity attacks incresing during COVID-19.[1] Rohit Talreja, Google Cloud HCLS product manager, addresses the unique security and regulatory compliance challenges that our healthcare customers face. He focuses on key considerations like HIPAA and GxP in the United States and highlights several international compliance frameworks.

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1.   "Number of cybersecurity attacks increases during COVID-19 crisis", Healthcare finance, Jun 2020.

Reimagining healthcare

Turbocharging technology-driven healthcare

COVID-19 has accelerated adoption of cloud-based solutions that improve the speed and safety of care.

Before the COVID-19 pandemic, hospitals provided virtual visits to only a few thousand patients per month; now, they serve hundreds of thousands. The explosive growth in the use of telemedicine nationwide—a more than 700 percent increase [1]—has created a tipping point in healthcare, and the growth shows no signs of slowing.

Telemedicine inched forward slowly for decades, like a cautious new driver, until COVID-19 forced the world to floor the gas pedal. Virtual alternatives to in-person contact became essential for slowing the spread of the virus. Faced with this imperative, providers upgraded Internet connectivity to improve the video experience for caregivers and patients, caregivers learned new technology, and the U.S. government introduced temporary measures that allow Medicare and Medicaid to reimburse virtual visits at the same rates as in-person visits.

It's now clear that this change in care delivery is not crisis-driven and templory, but fundamental and here to stay. The virtual experience has improved enough that patients see it is a viable—even desirable—alternative. After their initial visit, patients are 92 percent more likely to use telemedicine than they were before [2]. John Halamka, M.D., president of Mayo Clinic Platform, envisions a "digital-first healthcare delivery system" catalyzed by COVID-19. "I think that healthcare will be 20 percent or more virtual across all modalities of delivery in this immediate new normal," he suggests.
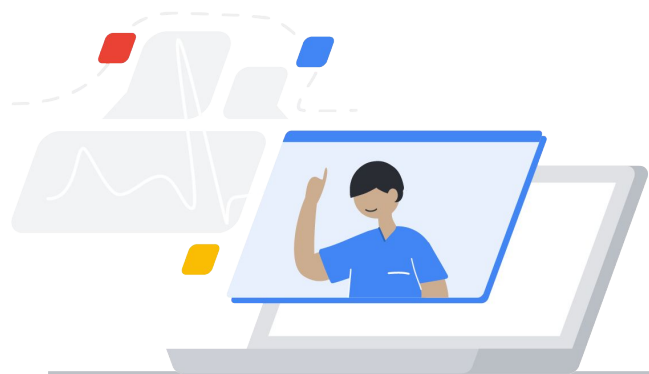
1. Grandview Research, April 2020
2. Google/LRW Access Point Research

Acceleration driven by necessity: A decade of telemedicine advancement in a matter of weeks

The Google Cloud Healthcare and Life Sciences Team has witnessed first hand the extraordinary transformation taking place in this extraordinary era. "Here at Cloud, healthcare innovation has become part of the new normal," says Aashima Gupta, global healthcare and life sciences strategy and solutions lead at Google Cloud. "What might have been done in 10 years has been done in 10 weeks."

Telemedicine has passed its driver's test with flying colors, and is now buckled in and safely transporting patients to their healthcare appointments. Tools like Chrome Enterprise, Nest, and Google Meet bring patients together with their loved ones, so that ICU patients and newborns alike can connect privately with faraway family members as they never could before. Google Meet for telemedicine, a secure and compliant solution developed in a few short weeks in response to the pandemic, allows providers like Cambridge Health Alliance to accommodate the suddenly soaring demand for virtual visits. Other forms of virtual care are helping to reduce risk and to preserve resources. Mt. Sinai Hospital uses Google Nest to livestream from patient rooms, which allows doctors and nurses to enter less often and thus preserve their personal protective equipment.

Picking up the pace everywhere: Information access, treatment options, data accessibility, and privacy

Google teams are supporting the accelerated transition to technology-driven healthcare with multiple COVID-19 related initiatives. The first involves helping people to access accurate information about the virus. Verily, an Alphabet company, provides COVID-19 testing in many states, while Google Search and YouTube direct users toward health authorities and Community Mobility Reports deliver crucial health insights from aggregated and anonymized data.

Aashima Gupta,
global healthcare and life sciences strategy and solutions lead, Google Cloud

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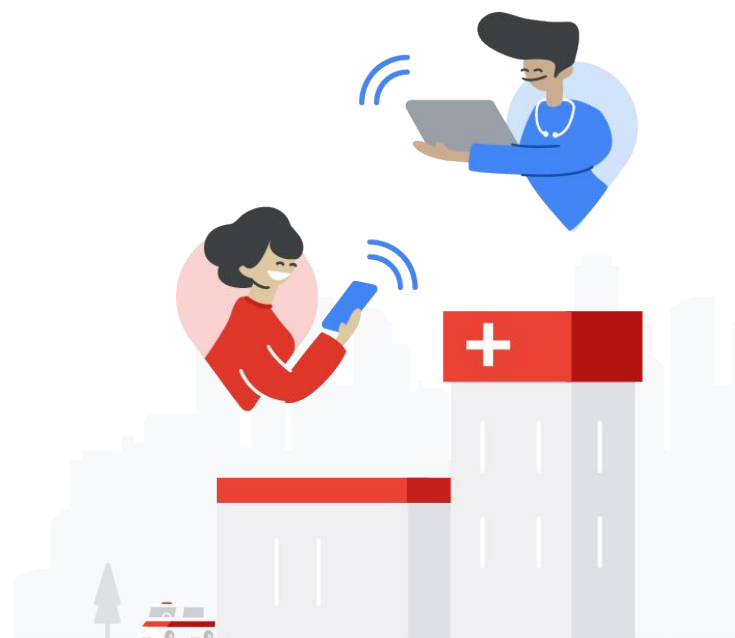
Google is also assisting hospitals and researchers by making COVID-related data sets available for research purposes, working with the Harvard Global Health Institute to distribute over $20 million in Google Cloud Platform credits for COVID research, and donating 16 million hours of compute time to fuel rapid drug discovery.

Third, and perhaps most critical, Google is helping customers to ensure that data remains both accessible and private. The recently launched Cloud Healthcare API "allows organizations to ingest and manage key data from a range of inputs and systems, and then better understand that data through the application of analytics and machine learning in real time and at scale," explains Gupta. The API enables real-time medical insights with a commensurate level of built-in security: all data is triply de-identified and then encrypted.

Through the pandemic and beyond: Technology in the service of human connection

In an endless sea of information, the ability to focus on the data that matters most makes a huge difference.

As Dr. Halamka explains, "The challenge in 2020 is we have too much data and not enough wisdom. We're getting a huge velocity of signals—our phones, our wearables, the medical record—and we need to be able to organize that and analyze that and deliver to our clinicians, to our patients, to all of our stakeholders what they need to know that is actionable." The partnership between Mayo Clinic and Google Cloud provides the opportunity, he says, "to take so much noise and find the signal."

Dr. John Halamka,
M.D., President, Mayo Clinic Platform

"The challenge in 2020 is we have too much data and not enough wisdom. Partnership between Mayo and Google gives us that opportunity to take so much noise and find the signal."

Beyond COVID-19, technology must serve human connection, Gupta asserts. It must improve the experience of each patient and each provider while guaranteeing privacy at every juncture. For this reason, Google Cloud is now focusing on four healthcare-specific areas: telehealth, data interoperability, hospital impact forecasting, and biomedical computing.

The pandemic has already accelerated medical progress and ingenuity: millions of patients can now see their doctors without risking infection; access to large medical datasets is speeding progress toward treatments; and virtual visits and digitization not only save time, but also help the environment by reducing carbon-emitting travel and paper files. Even in this bleak time, there is much cause for optimism; after all, if the healthcare industry has advanced 10 years in the past 10 weeks, what crisis-driven innovations will break through in the next 10 weeks—and the 10 weeks after that?

"Now is the time for all of us—the IT workers, the computer scientists, the researchers, the engineers, and many others—to step up to meet the new set of demands that have emerged due to COVID-19," Gupta says. "Here on the healthcare and life sciences team at Google Cloud, we feel very fortunate to play a small role in helping the healthcare community tackle the pandemic."

To learn more, watch the "Reimagining healthcare"

[webinar](#)

Driving business transformations

Fighting COVID-19 with artificial intelligence, machine learning, and Google Cloud

Google Cloud is helping U.S. public health officials and healthcare organizations construct an accurate picture of the COVID-19 pandemic so they can better plan ahead.

About the Harvard School of Public Health

The Harvard School of Public Health provides actionable data to health policy makers to improve health both in the United States and globally.

About Schrödinger

Schrödinger strives to improve human health and quality of life by transforming the way therapeutics and materials are discovered.

COVID-19 has been more than a health menace. In every part of the world, it has disrupted commerce, education, culture—and lives. National and local governments have struggled to balance the desire to let people live as normally as possible against the needs to understand the virus, to muster defenses against it, to promote safe behaviors, and ultimately to defeat it.

Nowhere has the battle been more intense than in the healthcare industry, where first responders, frontline caregivers, and research scientists—with support from their IT departments—have worked around the clock to treat patients and to hunt for effective therapies.

"If hospitals, policy makers, and public health officials could predict with more reliability future COVID-19 outbreaks, then they could be better prepared," says Dr. Thomas Tsai, who is a surgeon at Brigham and Women's Hospital, an assistant professor in health policy and management at the Harvard School of Public Health, and a faculty member at the Harvard Global Health Institute.

The Harvard Global Health Institute has worked with the Edmond J. Safra Center for Ethics at Harvard, as well as multiple academic groups, think tanks, foundations, and policy groups, to define metrics that communicate an accurate picture of the pandemic. As Dr. Tsai explains, the goal is not to "just show the underlying risk, but more importantly, to tie the community level risk to a corresponding set of public health actions around testing and nonpharmacologic interventions such as social distancing and even shutdowns."

Using artificial intelligence and machine learning to get the jump on COVID-19

One result of the Harvard collaboration is globalepidemics.org, which provides online dashboards to measure COVID-19 risk levels throughout the United States, along with progress against testing targets. To make the dashboards more actionable, the coalition joined forces with Google Cloud to augment them using artificial intelligence (AI) and machine learning (ML), healthcare-specific products from Google Cloud, and solutions from Google Cloud Partners. "The AI machine learning approach enables an opportunity to learn from the data in real time as we're progressing through this pandemic," Dr. Tsai explains.

Google Cloud researchers combined AI with a robust epidemiological foundation to predict key COVID-19 metrics—like the numbers of cases, hospitalizations, and deaths—over the next 14-day period for each U.S. state and county. This new model, trained on public data, also predicts demand for ICUs and ventilators to help frontline responders in healthcare and other sectors prepare for what lies ahead.

Google Cloud is also working closely with partners SADA Systems and HCA Healthcare to make COVID-19 forecasts available to the national response portal, so that as many people as possible have access to the information. "Many organizations have found value from these types of data," explains Dr. Corkery, Google Cloud HCLS director of product management. "Our hope is that other organizations will also be able to take this data and use it to plan accordingly to address COVID-19 needs at the hospital level."

Dr. Thomas Tsai, surgeon at Brigham and Women's Hospital

"If hospitals, policy makers, and public health officials could predict with more reliability future COVID-19 outbreaks, then they could be better prepared."

Gaining real-time insights into the pandemic

As the pandemic gained momentum in the United States, it threatened to overwhelm the nation's healthcare resources. "When COVID hit, it exposed a real problem in many provider systems," says Corkery. "The disease was moving faster than the data that they were using to make their decisions."Analytics solutions that relied on day-old or siloed data couldn't provide relevant information fast enough, but many providers didn't have the right IT resources to design and roll out new solutions.

"The data plumbing required in healthcare to build machine learning models is challenging and time consuming," says Corkery. "The Google Cloud Healthcare API is designed to make the data plumbing easier, cheaper, and faster, to accelerate healthcare data interoperability, and to enable you to unlock the power of your data to create and/or consume AI models, to run large-scale cross-modality analytics, and to build and deploy novel healthcare applications."

One large Midwest provider system developed a solution that feeds real-time HL7v2 messages directly into the Google Cloud Healthcare API, which transforms the messages into Fast Healthcare Interoperability Resources (FHIR) format before transmitting the data to BigQuery for analysis.

Data feeds from regional hospitals and clinics form a single aggregated data set for an entire provider system. Prebuilt Looker dashboards then combine provider data with local and national data to give healthcare leaders more accurate insights into the pandemic's trajectory.

"Traditionally, standing up this kind of a solution within the healthcare system would take months," says Corkery, "but we needed to act at the speed of COVID." Using technology like the Healthcare API and the Google Cloud Data Protection Toolkit, which automates the deployment of cloud projects and resources following HIPAA best practices, the team delivered the solution—from start to finish—in just three weeks.
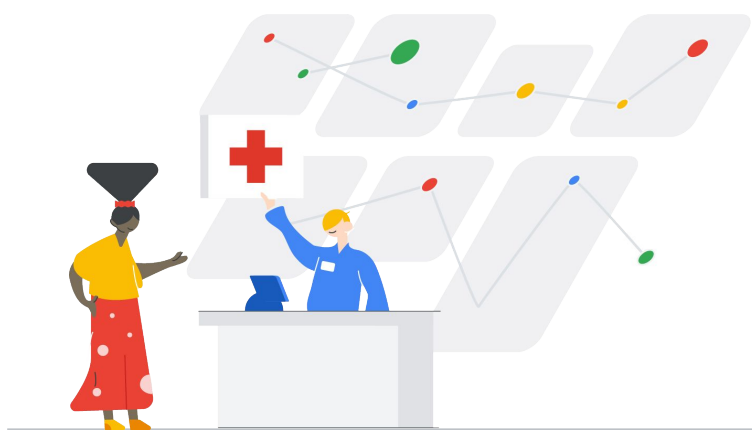
Enhanced tools for battling the virus

Other technologies that were already under development before the pandemic will soon join the fight against the virus by helping healthcare and life sciences organizations tap into their vast stores of unstructured data. For example, the Google Cloud Healthcare Natural Language API will make it possible to extract and organize clinically relevant data from text in electronic health records (EHRs), while the Google Cloud AutoML Entity Extraction for Healthcare will allow even non-coders to train models with custom rules to extract data from a variety of sources, such as call centers, chat bots, telemedicine visits, and in-person visits.

Google Cloud is also contributing resources to help life sciences organizations expedite the process of finding treatment candidates. Through their Research Credits Program, they gave Schrödinger, a drug and material discovery company, 16 million computation hours—more than 1,800 years' worth—on Google Cloud Platform. With these credits, Schrödinger can evaluate billions of molecules before deciding which candidates to pursue in the lab.

"To accelerate this drug discovery process, Schrödinger has teamed up with Takeda, Novartis, Gilead Sciences, and WuXi AppTec on a philanthropic initiative to share ideas, resources, and data with the goal of developing novel and viral therapeutics for COVID-19," Corkery reports.

Dr. Joe Corkery, director of product management, Google Cloud Healthcare and Life Sciences (HCLS)

"When COVID hit, it exposed a real problem in many provider systems. The disease was moving faster than the data that they were using to make their decisions."

AI and ML are giving healthcare organizations valuable weapons against COVID-19 by helping them understand and take action on a wide range of data. The solutions they're building on Google Cloud Platform will not only ease the burden on those managing the pandemic frontlines, but also transform the way healthcare organizations deliver services far into the future.

Watch the "Driving business transformations" webinar
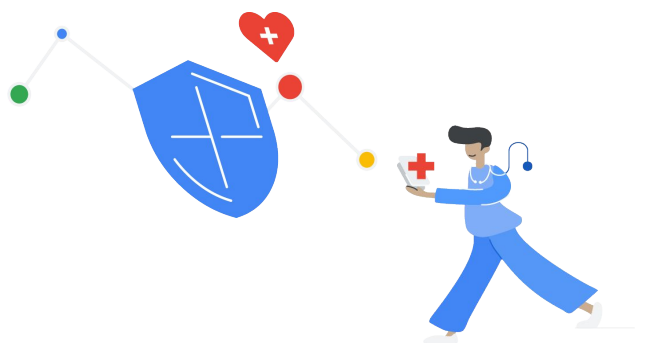
Healthcare security in the cloud

Google Cloud

Defending healthcare with security, privacy, and compliance solutions from Google Cloud

With a unified, cloud-based IT infrastructure for managing data, healthcare organizations can adopt new technologies and workloads while reducing the financial and operational burden of maintaining compliance.

About Google Cloud Healthcare and Life Sciences

Google Cloud Healthcare and Life Sciences applies deep industry knowledge to help you meet your toughest challenges while protecting confidential healthcare data.

Bad actors hungering to steal and exploit personal information find healthcare data particularly appetizing. Hoping to feast on the proceeds of crimes such as identity theft and insurance fraud, they attack healthcare organizations with unrelenting determination. To shield citizens, governments around the world have issued regulations on the protection of healthcare data.

Although they share commonalities, these regulations are varied and often deliberately broad. Examples include data privacy regulations, like HIPAA in the United States and GDPR in the European Union, which describe how organizations must secure protected health information.

Frameworks like FedRAMP in the U.S., which outlines requirements for contracting with government agencies, tend to be very specific with "hundreds or thousands of specific controls that an organization has to implement, test, and document," says Rohit Talreja, a product manager for Google Cloud Healthcare and Life Sciences.

Good practice, or GXP, regulations combine government rules, industry standards, tribal knowledge, and organization-specific controls. For healthcare and life sciences, these include "good clinical practice, good laboratory practice, and good manufacturing practice," Talreja says.

Organizations that fail to properly interpret, implement, and comply with government mandates can face expensive penalties. For example, Talreja explains, "breach of government frameworks can jeopardize contracts with government agencies, or it can result in lawsuits to recoup any damages."

Unfortunately, many organizations find it burdensome to guard data using practices that keep pace with regulatory requirements. These efforts divert valuable time and funds from the delivery of healthcare services. It makes sense, then, for healthcare organizations to find partners who specialize in products that support compliance and store data securely, efficiently, and cost-effectively.

Sharing responsibility for meeting regulatory requirements

Healthcare and life sciences organizations around the world are joining forces with Google Cloud to deliver a higher level of care via game-changing solutions that protect patient information. "In contrast to traditional IT, where the owner is responsible for maintaining the infrastructure stack top to bottom, with the cloud model, the responsibility is shared between the cloud provider and the in-house IT team of the organization," Talreja explains.

Google Cloud adheres to government regulations, frameworks, and industry standards relevant to healthcare and life sciences. This may assist organizations storing and processing data on Google Cloud with the highly involved task of maintaining compliance with evolving regulatory, security, and privacy frameworks. World-class security and privacy teams at Google Cloud can take on increasing levels of responsibility for securing an organization's environments, depending on their needs.

With infrastructure as a service (IaaS) technology—for example, with Google Compute Engine—the organization's IT team retains a fair amount of responsibility, while Google Cloud manages the proprietary hardware stack underlying the service. "At the infrastructure level—the physical machines, the virtual machines, the software running on the virtual machines—it's important that all of these various pieces are appropriately hardened to protect against vulnerabilities," Talreja emphasizes.

With a more managed service like BigQuery, a platform as a service (PaaS) offering from Google Cloud, the cloud provider takes on additional responsibility for scaling, security, and compliance. In this model, Talreja explains, "Google is responsible for maintaining the operations of the service, scaling automatically for the amount of data put in the platform."

Rohit Talreja, product manager, Google Cloud Healthcare and Life Sciences

"In contrast to traditional IT, where the owner is responsible for maintaining the infrastructure stack top to bottom, with the cloud model, the responsibility is shared between the cloud provider and the in-house IT team of the organization."

The cloud provider takes on most of the responsibility for deploying and maintaining software as a service (SaaS) offerings like Google Drive—although, Talreja points out, "customers will always retain some level of responsibility for choosing what content they put into the service, and who's able to access it within the customer's organization."
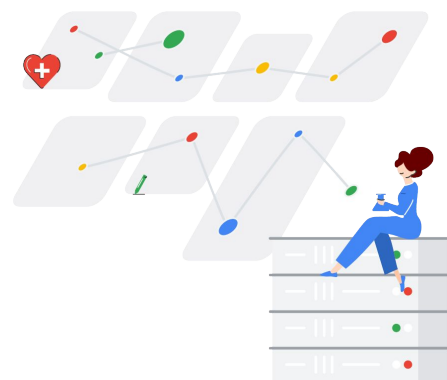
Google Cloud

Streamlining deployment and management of compliant IT environments

Organizations planning to set up and manage healthcare workloads on Google Cloud can take advantage of the Healthcare Data Protection Suite, an integrated tool for deploying, monitoring, and auditing Google Cloud environments and workloads running on Google Cloud. It offers predefined templates and best practices for common healthcare workloads. The product conveniently automates deployment and validation of HIPAA-compliant environments, for example. It then continuously monitors resources against a set of defined policies.

"You can have deployment modules across development, test, and production for specific services like BigQuery, Google Cloud Storage, and Compute Engine that tell the application how these services should be configured, where they should be set up, what the identity access management policy should look like, and what the monitoring rules should look like," explains Talreja. "These are all stored in the form of a declarative template."

For example, the tool can help map a data-retention policy for a BigQuery dataset to a specific privacy or compliance requirement. "It sets a data viewer group, as well as a project owner group that has access to all of the resources within a project. And essentially, once this template is deployed, it will result in a BigQuery data set with the appropriate settings and controls on it," Talreja says. A dashboard provides the necessary insight for monitoring, auditing, and reporting.

Another essential service Google Cloud provides is the Cloud Healthcare API, which can ingest data in standard healthcare formats like FHIR and DICOM. "This service has an integrated de-identification tool that can be used for de-identifying data sets, then joining and exporting them to machine learning models or analytics and BI tools," Talreja explains.

Rohit Talreja, product manager, Google Cloud Healthcare and Life Sciences

"The Google Healthcare API has an integrated de-identification tool that can be used for de-identifying data sets, then joining and exporting them to machine learning models or analytics and BI tools."

"There's also the ability to process individual records through the de-identification workflow, useful for real-time applications such as viewers or patient data applications, where patients and providers are interacting in real time with each other." The de-identification service is particularly useful for preparing research and development datasets.

Healthcare and life sciences organizations must always be vigilant in protecting patient data from unauthorized access and misuse. By working with Google Cloud and its large partner ecosystem, organizations can preserve valuable resources. Instead of carrying the full burden of deploying, maintaining, monitoring, and securing the latest and greatest technologies in compliance with regulations, they can focus on their core mission of helping patients.

Watch the "Healthcare security in the cloud" [webinar](#)

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Thank you

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