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Uncovering hidden data roadblocks of cloud and AI adoption in healthcare

Insights from health system executives on
top challenges to innovating in the cloud



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Insights from health system executives on top challenges to innovating in the cloud

Without the adoption of cloud technology in healthcare, it's becoming increasingly difficult for healthcare IT and strategy teams to innovate, streamline processes, and make patient and clinician experience improvements that rival those that are now commonplace in other industries. Getting clinical data into the cloud is a necessity in unlocking the advanced analytics, artificial intelligence, and machine learning tools that can truly change the game in healthcare. But there are significant barriers to achieving real-time data exchange from legacy healthcare systems to the cloud—barriers that are slowing or even halting progress.

In this whitepaper, we'll explore the historical context that leads us to today's cloud healthcare challenges. We'll then dive into how resource, budget, and infrastructure barriers can prevent teams from quickly scaling cloud adoption and innovation—many of these challenges unforeseen or underestimated until after significant time and resources have been expended.

The slow rise of cloud in healthcare

Cloud has been widely lauded — spanning industries from fintech to manufacturing — for its ability to catalyze innovation and accelerate digital transformation. Gone are the days of fragmented legacy IT systems. The future is harmonized data, on demand analytics, and advanced artificial intelligence (AI) and machine learning (ML) capabilities, easily accessible and actionable through the cloud.

But one industry is lagging behind.

The appetite for innovation in healthcare is vast — as demonstrated by regulatory shifts pushing for better interoperability, and over \$58 billion in digital health venture funding raised since 2020.¹ Despite a series of promising milestones, progress has been slow.

What is the root cause of healthcare's lagging, conservative adoption of disruptive cloud technology?

Historically, shaky confidence in cloud data security and a lack of financial incentives in a fee-for-service reimbursement model were major barriers. Many healthcare organizations have been hesitant to rock the proverbial on-premises boat as a result.

Through widespread adoption in other disciplines, security and compliance have become a table-stakes function amongst the major cloud players. Through interoperability-focused regulatory measures, shared-risk and value-based care

models are becoming increasingly more common and incentivized, requiring provider organizations to explore more holistic models of care and build longitudinal views of their patients to drive better outcomes.² And these outcomes can be delivered faster, more efficiently, and at greater scale through a secure cloud environment.

While other solutions exist, cloud provides an onramp to some of healthcare's most robust and innovative technology solutions. Cloud offers unprecedented access for organizations to securely centralize and scale the management of millions of patient records, eliminating silos of patient data that have previously been the standard in on-premises environments. More holistic, longitudinal views of a patient's healthcare journey not only lead to improved patient outcomes and experiences, but hopefully reduced costs and higher incentives for providers in a shared-risk and value-based care model.

As a result of these industry and regulatory shifts and a more positive sentiment toward cloud adoption, barriers have also shifted. While provider organizations are motivated by the outcomes enabled through cloud technology, their main reservations now stem from a lack of human and technical resources, as well as budget, needed to accelerate cloud-based initiatives.

Research on cloud investment drivers

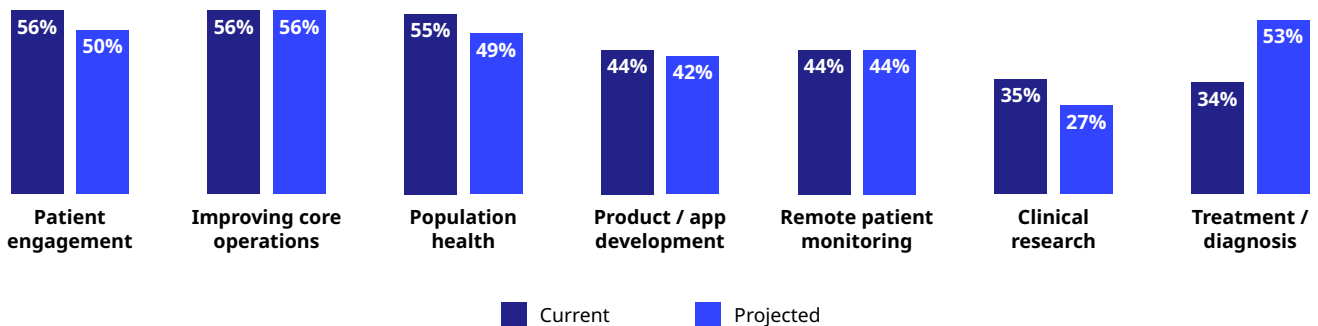
To better understand cloud data integration and interoperability challenges, Redox partnered with Sage Growth Partners to survey over 100 US provider organizations, including multi-hospital health systems and academic medical centers. The survey seeks to understand how the cloud is being utilized today, and explores areas of future investment to drive business outcomes. These initial findings informed a deep dive into challenges to ingesting clinical data into the cloud, drawing on the experiences of healthcare technology executives and how their desired use cases and business outcomes have impacted their movement to the cloud.

Through survey responses, a variety of use cases were identified as drivers for cloud investment. Top current provider use cases for cloud include:

- **Improving core operations**, including improved data storage capabilities, enhanced security and accessibility, and better cost efficiencies
- **Population health** initiatives to improve patient population outcomes
- **Patient engagement** initiatives to improve patient experience and retention

In the future, providers anticipate movement into more advanced treatment and diagnosis use cases.

Cloud technology use cases³



Realizing these use cases through the advent of cloud technology is an exciting opportunity to improve the experience of patients, providers, and clinical staff—but ultimately, cloud has the potential to directly affect the bottom line. Respondents shared substantial enthusiasm for the impact that advanced cloud capabilities will have as a result of enabling use cases, driving tangible business outcomes that improve profitability, security, and innovation.

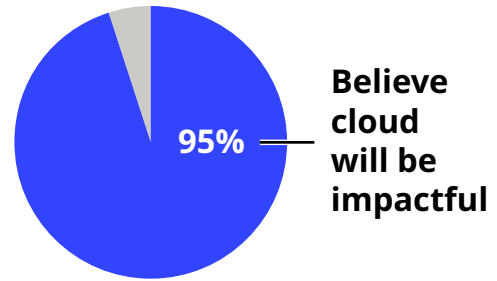
Provider organizations are deriving significant value from use cases enabled through cloud innovation, leading to enhanced business outcomes including:

- **improved data security**
- **reduced costs**
- **improved patient engagement and retention**

In the future, leaders expect to add the realization of enhanced product innovation and improved treatment and diagnosis.

These use cases and business outcomes represent a vast opportunity for healthcare organizations to both improve their table-stakes IT functions and core operations, as well as drive innovation and strategic investment.

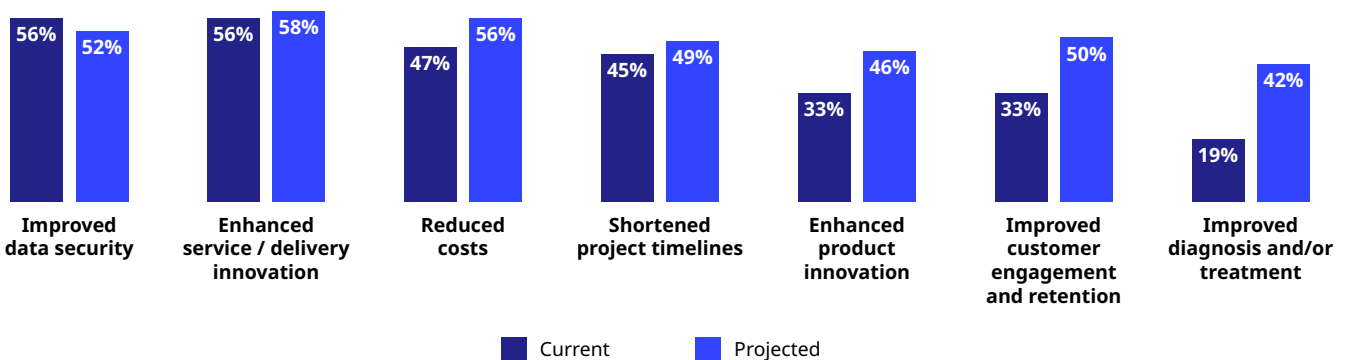
95% of surveyed healthcare executives revealed that cloud will be impactful to their business strategy over the next 24 months.



“Healthcare informatics is growing as a major component of the strategy of health systems across the country. Advanced AI and machine learning capabilities through cloud are the future. We want to be aligned with that strategy to stay competitive in an increasingly crowded landscape.”

– SVP, Health Informatics

Cloud technology business outcomes



Key challenges to cloud adoption in healthcare

Despite widespread excitement and high expectations for cloud-based innovation in healthcare, these opportunities don't come without obstacles, particularly around the ingestion of clinical data into the cloud at scale.

According to a report on healthcare analytics, 51% of healthcare executive respondents noted data integration and interoperability as the most significant barrier to achieving strategic priorities.⁴

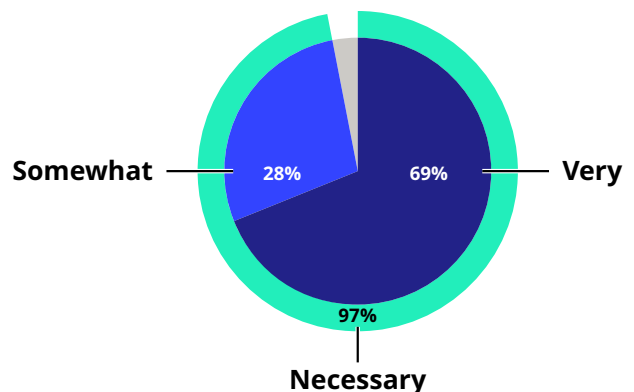
The remainder of this piece will explore the current landscape of cloud data ingestion and transformation, barriers to composing impactful healthcare experiences in the cloud, and how healthcare IT decision-makers are crafting their strategies in response.

A major barrier for health systems when attempting to ingest clinical data into the cloud is a lack of technical expertise. IT teams will require expertise with multiple EHR systems, as well as a deep proficiency in a number of data standards specific to different clinical and administrative use cases. These standards include DICOM® (Digital Imaging and Communications in Medicine), X12, CDA® (Clinical Document Architecture), and HL7v2® (Health Level Seven International Version 2) for applications from clinical encounter documentation to revenue cycle management. Surveyed organizations interface with most or all of these standards today, with DICOM leading the pack as the medical imaging standard of communication.

These standards offer a clunky, overly complex, and disjointed approach to interoperability. They require development teams to stay sharp in outdated approaches to data exchange, making the harmonization of data across systems to view patient data in a longitudinal way nearly impossible. Many of the above standards are now considered to be legacy in the presence of FHIR® (Fast Healthcare Interoperability Resources).

According to **97%** of surveyed provider organizations, ingesting real-time clinical data is very (**69%**) or somewhat (**28%**) necessary to enable cloud use cases. Only **3%** of respondents have not encountered significant challenges when attempting to ingest clinical data into the cloud.

The necessity of ingesting real-time clinical data



FHIR is the future – But how do we get there?

Introduced as a response to the evolution of modern REST based connectivity methods, FHIR created a landscape for healthcare interoperability driven by discrete and conceptual resources for clinical data exchange. It's built on standards widely used outside of the healthcare industry, making it more familiar and accessible, especially for resource-strapped IT teams. Both interoperability legislation, largely from CMS (Centers for Medicare & Medicaid Services) and ONC (Office of the National Coordinator for Health Information Technology), as well as private industry interoperability efforts have made FHIR the cornerstone of transforming the healthcare IT landscape.⁵

Nearly **100%** of surveyed provider organizations shared that FHIR is critical (**58%**) or somewhat (**42%**) critical as a mechanism for future cloud innovation.

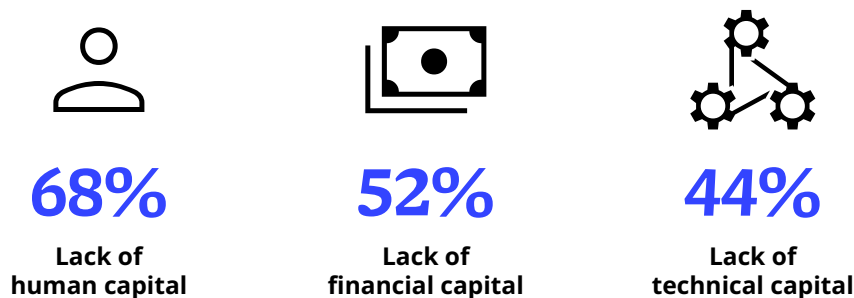
Large cloud hosting providers like Google Cloud, Microsoft Azure, and Amazon Web Services require data to be in the FHIR format for ingestion into clinical data repositories.

This means that if existing data is held in multiple legacy formats, data transformation needs to occur before organizations can ingest it into the cloud and fully take advantage of advanced cloud capabilities.

While this data transformation is resource intensive, it can be a game changer for healthcare, allowing organizations to access deeper patient and workflow insights through cloud-native AI and ML tools.

When attempting to transform legacy data into FHIR for cloud ingestion, provider organizations cite lack of human capital, lack of technical infrastructure and capital, and lack of financial capital as their top three challenges. Based on anecdotal survey responses and synthesis of the data, time to value was also identified as a major barrier to realizing outcomes in the cloud.

Data-ingestion challenges



Challenge #1 – Lack of human capital

Provider organizations stated that lack of in-house expertise and human resources to map legacy standards to FHIR and maintain integrations (68%) were their top challenges to accessing clinical data.

Cloud integrations require human resources with specific expertise to both implement and maintain. As health systems continue to deal with staffing shortages and hiring challenges, it's become increasingly difficult to find and retain in-house IT staff that possess the required breadth and depth of knowledge to execute on cloud ingestion projects. Seasoned developers are particularly difficult (and typically more costly) to recruit and retain.

First, a strong understanding of multiple EHR systems will be necessary to access and interface with this clinical data. As of 2021, more than 96% of hospitals and nearly 80% of office-based physicians utilize one or more EHR.⁶ While there are a handful of widely adopted market leaders like Epic, Cerner, and Allscripts, a single health system could use multiple instances and variations of the same EHR across different locations and sub-specialties, requiring deep knowledge and experience working across the EHR. Prior experience working with many EHRs is necessary to accelerate project speed and close knowledge gaps—in addition to advanced working knowledge of HIEs (Health Information Exchanges), payers, and other potential data sources.

Next, IT resources on the project will need to work with multiple legacy data standards, including the aforementioned standards DICOM, CDA, HL7v2, and X12, to prepare for FHIR transformation. Typically only the most seasoned healthcare IT professionals will have experience with multiple legacy standards, making the consolidation and transformation of these standards more challenging as the project evolves.

Additionally, as the mapping and transformation process is in progress, many IT teams discover that standards aren't nearly as "standardized" as they expected. Typically 80–90% of healthcare data in these legacy standards is indeed standardized—but the remaining 10–20% requires in-depth knowledge and experience across a variety of implementations for full transformation.⁷ This step of the process often creates a major roadblock, leading to unexpected project delays and cost overruns.

Lastly, once an initial data ingestion project is completed, it will require ongoing maintenance and troubleshooting. As more EHRs, legacy systems, and new data sources are introduced, resources will be needed to manage additional mapping and transformation.

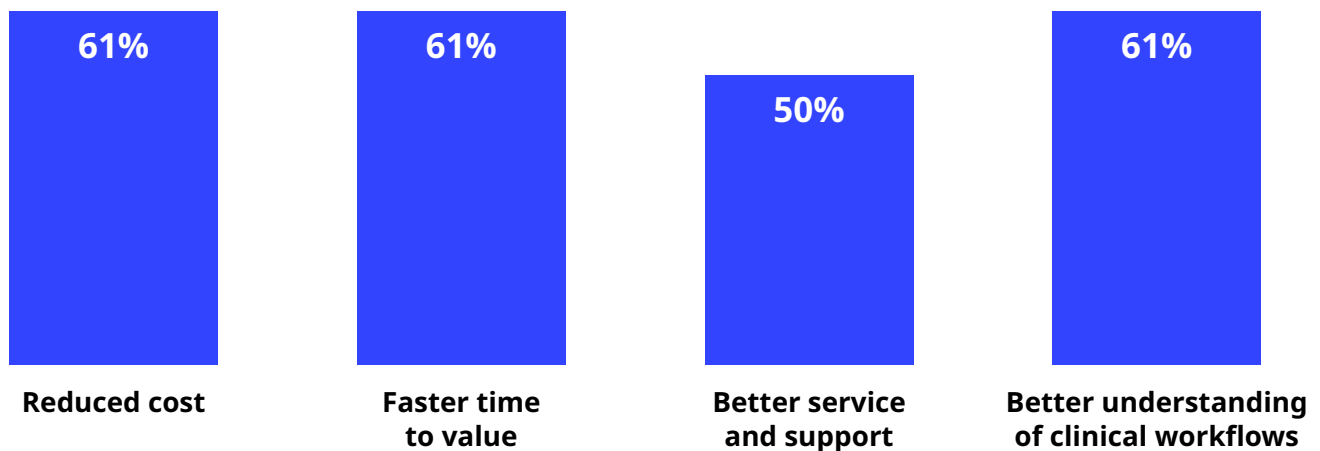
Faced with these human capital challenges, many health systems look to consultants and systems integrators to support their clinical data ingestion efforts. While consulting partners can bring deep rooted industry experience and much needed expertise in program and change management, they too often lack deep knowledge of legacy system workflows and healthcare data standards. These partners can assist with enabling a specific use case, but typically aren't the most effective long-term solution for reusable, scalable healthcare data integration infrastructure.

Many of the surveyed respondents cited a number of areas where they would like improvements from their consulting partners. The biggest requested improvements were reduced cost, faster time to value, and a better understanding of clinical workflows. It is not particularly surprising that there would be a request for faster, cheaper projects, but the need for deeper clinical workflow knowledge from partners stood out. With so much potential variation between legacy systems and their unique implementations at each organization consultants may need to learn as they do the work — further contributing to lagging implementation timelines and unexpected costs.

“It’s increasingly difficult to devote resources to projects that bring this type of value-add. Much of our efforts are spent on regulatory updates and the immediate needs. This has always been a struggle but is exasperated today by difficulty filling positions and keeping staffed at 100%.”

– Chief Information Officer

Improvements requested on consultant-led cloud integration projects



Challenge #2 – Lack of financial capital

Cloud integrations are expensive to initiate and maintain — more than 50% of survey respondents cited lack of budget to facilitate ingestion and translation as one of their main challenges.

Due to macroeconomic factors impacting rising equipment and staffing costs, razor-thin hospital profit margins continue as the norm. While cloud projects were consistently stated as critical endeavors by survey respondents, budgetary concerns will ultimately be paramount to prioritization.

Migrating to a cloud strategy presents an interesting challenge. Up-front costs can be prohibitive but longer-term cost savings should result. The aforementioned access to disruptive AI and ML tools also presents a path for improved business and healthcare outcomes. More than 60% of providers anticipate a lack of budget to facilitate ingestion and translation of clinical data into the cloud, despite a majority stating the importance of cloud to overall strategy.

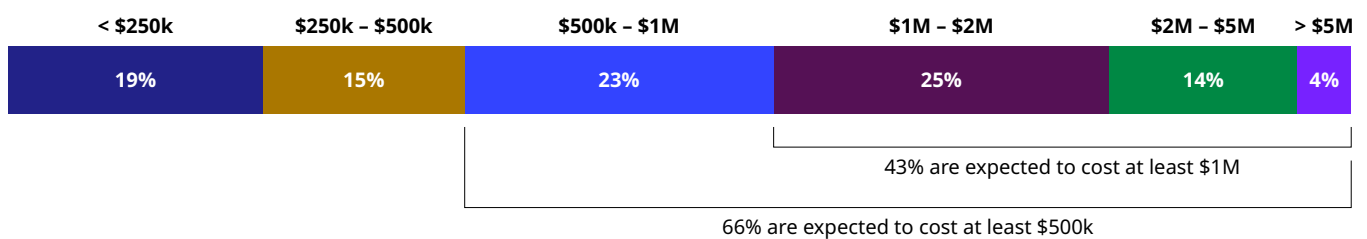
More than 65% of cloud ingestion projects are expected to cost over \$500k to implement, with

nearly 40% expected to cost at least \$1M. The visualization below represents initial costs associated with survey respondents' most recent cloud ingestion projects.

Reasonable ongoing maintenance costs spanned a broad range. Nearly 35% of respondents expected to pay less than \$250k per year ongoing, while almost 40% would pay anywhere from \$500k to \$5M depending on recurring scope.

Almost 60% of survey respondents shared that they partner with third party consultants and systems integrators on clinical data ingestion projects — however, only 63% of those projects were completed on budget. Over 60% of those provider organizations stated that they desired to reduce costs when working on these projects, leading to an opportunity for third party technology vendors to offer more cost-effective solutions.

Cloud ingestion initial project costs



Challenge #3 - Lack of technical capital

Lack of technical capital to facilitate ingestion and translation (44%) is one of the biggest challenges for provider organizations when accessing clinical data.

As organizations seek to enable real-time interoperability between legacy systems and the cloud, it is necessary to translate millions of messages and records from legacy standards to FHIR each day—a daunting task even for the most seasoned, well-staffed teams (see challenge #1).

The technical architecture required to facilitate truly real-time clinical data exchange can take years to build, optimize, and perfect. Infrastructure that is reusable across data sources, with reliable execution and fast messaging speeds are only possible once all the pieces have been built. These include:

- **Integration Design:** To achieve more advanced use cases cloud ingestion from multiple legacy systems is likely required (EHR, HIEs, payers, etc.). Your design will need to maintain some level of flexibility to support reusability, otherwise you will be building from scratch with each new data source.
- **Initiation:** Healthcare data can be made available on demand (query) or transferred automatically in response to some event (patient admitted, order placed, etc.). All organizations integrating clinical data into the cloud at scale will need to be capable of leveraging both exchange mechanisms.

- **Configuration and processing:** To ingest data to cloud clinical data repositories and make it available for advanced analytics or AI, organizations will need to parse, standardize, and normalize from legacy standards to FHIR and also build mechanisms to keep messages in correct order.
- **Monitoring and Error Handling:** Once established, each integration is a living thing. You must have tools to monitor, maintain, and address issues when they occur.
- **Security:** The technical infrastructure must safeguard the compliance and security of PHI.

“Lack of data standards is a challenge. Lack of consistent data formatting within the standards is a challenge. The amount and types of data are a challenge.”

– SVP of Health Informatics

Challenge #4 – Time to value

According to survey respondents, 85% of cloud integration projects take longer than 6 months to complete, with more than 45% taking at least 12 months to complete.

Due to factors like technical complexity and resource challenges, cloud integrations often exceed budgeted timelines, delaying the achievement of cloud project goals.

When working with third party vendors, while 50% of surveyed providers were quoted project completion in 6 months, only 32% of projects were actually executed in that time frame. Almost 40% of projects were either completed within 12 to 24 months instead, or are still in progress and not on track to meet deadlines.

Survey respondents expressed continued frustration on the direct negative impact that delayed project timelines have on budget, project sentiment, and business and clinical outcomes.

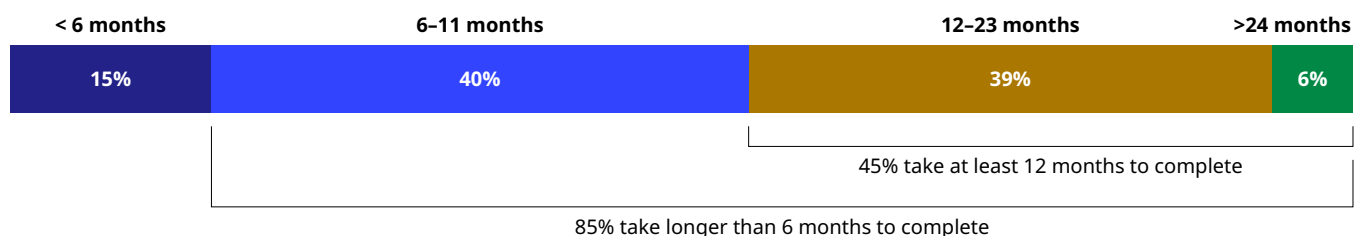
Working with an experienced integration partner can accelerate project timelines and avoid cost overruns due to delays, especially those due to a lack of appropriate technical expertise.

When working with third party partners on cloud data ingestion, **61%** of providers stated that they wanted to see faster time to value from their investment.

“We recently migrated our data to a cloud-based environment using a third party. The transition was challenging, and took longer than budgeted—we seem to consistently exceed budgeted project timelines by 200% to 300% of estimated implementation time.”

– Chief Information Officer

Cloud integration time to value



Avoiding the challenges

Cloud technology presents an enormous opportunity for healthcare organizations to optimize, innovate, and scale. To achieve better business, clinician, and patient outcomes through cloud, legacy healthcare data needs to be transformed into FHIR for cloud ingestion—but resource constraints and budget barriers make this a daunting task.

Providers are poised to make cloud-based innovation central to their strategies. How will they bridge the technical resource gap at an attractive price point?

Working with a seasoned integration partner that is fluent across legacy standards as well as FHIR not only provides the necessary expertise to execute projects on time and on budget, but enables a reusable and scalable data transformation infrastructure that can enable nearly any cloud use case imaginable, both now and in the future. As consultants and systems integrators define business strategy and change management, an integration partner should work seamlessly in tandem to deliver on the expedited mapping of healthcare data from legacy systems to FHIR for real-time ingestion into the cloud.

Explore how Redox Nova is transforming healthcare data to unlock innovation in the cloud at redoxengine.com/product/nova.

About

About the survey

In Q1 2023, Sage Growth Partners surveyed 117 provider organizations with at least 1,000 employees. The research was commissioned by Redox, a leader in healthcare interoperability and data integration. Respondents included executive leaders from standalone hospitals, multi-hospital health systems, and academic medical centers. Approximately 20% of respondents identified as Chief Information Officers, 13% as a technology executive at the director level or above, and 9% as Chief Medical Information Officer. The remainder of respondents held roles in health informatics and innovation.

About Redox

With extensive integration experience working with over 4,500 healthcare organizations and more than 400 digital health vendors, Redox has catalyzed cloud projects with multi-location health systems and national healthcare retailers to completion up to 80% faster than other solutions.

Redox partners with Google Cloud, Amazon Web Services, and Microsoft Azure to accelerate healthcare data interoperability and unlock data trapped in legacy formats for health plans, providers, and digital health organizations. Learn more about Redox cloud offerings at redoxengine.com/cloud.

About Sage Growth Partners

Sage Growth Partners is a healthcare advisory firm with deep expertise in market research, strategy, and communications. Founded in 2005, the company's extensive domain experience ensures that healthcare organizations thrive amid the complexities of a rapidly changing marketplace. Sage Growth Partners serves clients across the full healthcare spectrum. For more information, visit sage-growth.com

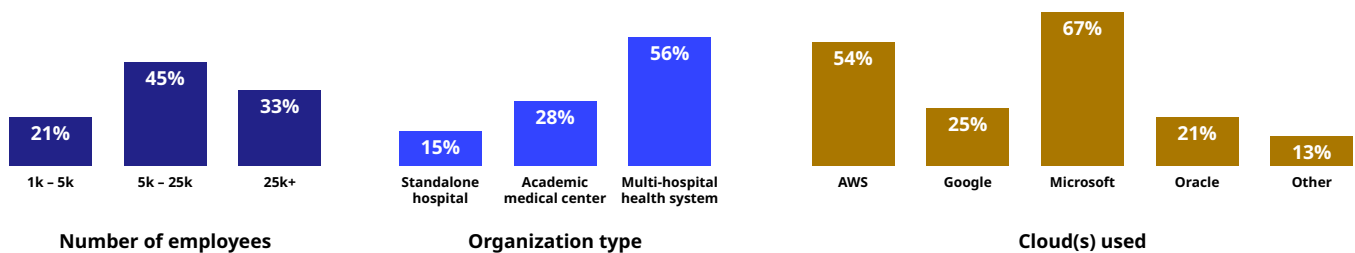
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Nichole creates content for Redox partners and customers, ranging from long-form thought leadership pieces to sales enablement. Her past experience includes work in customer success, professional services, and customer education. Nichole holds both a B.S. and M.S in Marketing from the University of Alabama.

117 responses from IT, innovation, and strategy executives from provider organizations with 1,000 or more employees in February 2023



Notes

1. "2022 year-end digital health funding." Rock Health, 2023.
2. "Investing in the new era of value-based care." McKinsey & Company, 2022.
3. "Uncovering hidden data roadblocks of cloud and AI adoption in healthcare." Redox + Sage Growth Partners, 2023.
4. "Bad Data, Bad Analytics, Bad Decisions." Sage Growth Partners, 2021.
5. "What is FHIR?" The Office of the National Coordinator for Health Information Technology.
6. National Trends in Hospital and Physician Adoption of Electronic Health Records. HealthIT.gov.
7. "Better Data for Better Health: FHIR Helps Fulfill Healthcare's Interoperability Promises." The FHIR Business Alliance. 2021.