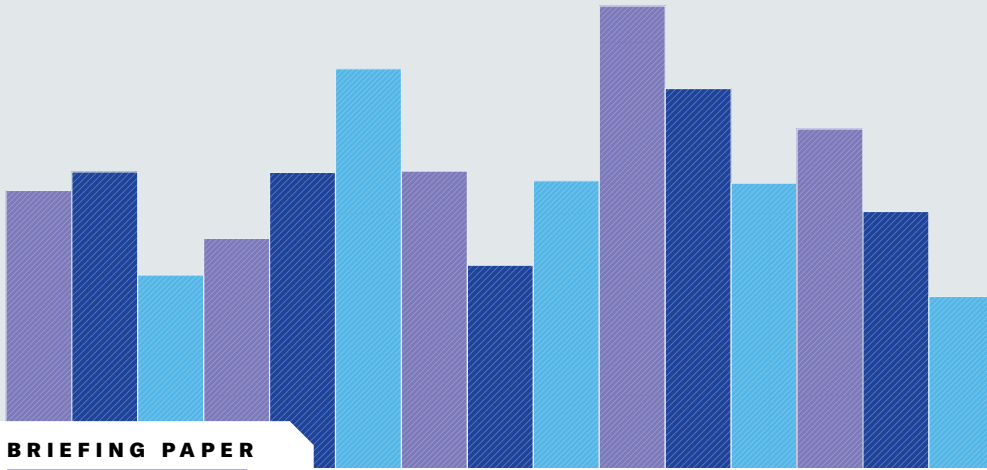




**Harvard  
Business  
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ANALYTIC SERVICES



**BRIEFING PAPER**

# The Business Case for a Fully Converged Medical Imaging Platform



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Human history catalogs continual improvement by innovative technologies that converge services, disrupting the status quo to bring benefits to private, professional, and economic lives. Your smartphone is a recent example, converging dozens of once stand-alone devices and applications, delivering significant convenience and cost savings.

Due to this century's rapid growth in imaging technologies across the more than 70 service lines that capture and consume medical imaging, many health care systems today are saddled with the cost of technology fragmentation. One by-product of these technical silos is the fragmentation of patient information. This presents significant risks in security, data accuracy, cost, and, in some cases, lost revenue.

The troves of images that specialists create during an episode of care provide a gold mine of visual intelligence to drive informed decision making and, ultimately, quality delivery of care. But they must be easily and securely accessible to be fully utilized. The complex demands of a health care system require ongoing reviews of their digital transformation initiatives to seek out new efficiencies to improve processes and patient-centric information flow.

In response to forward-thinking clients, Agfa HealthCare works hand in hand with health systems to help improve their financial stability, clinicians' diagnostic abilities and satisfaction, and, importantly, patient outcomes.

By using platform technology to converge imaging services, health systems are creating an Imaging Health Record™, empowering physicians with the ability to view a patient's longitudinal image history in the context of the electronic health record, securely accessible from anywhere along the continuum of care.

We've sponsored research by Harvard Business Review Analytic Services to examine how technology and clinical leaders create business value by transforming their imaging IT and processes. Through in-depth interviews, this paper shares these leaders' motivations and ongoing results as they endeavor to create tangible business, clinical, and operational impacts and help their systems grow and thrive.

I encourage readers to review this report and consider how technology might be a key to align the health care enterprise with pressing initiatives, such as increasing high-impact, data-driven care; moving away from the complexity of maintaining multiple and redundant systems; and creating secure, universal access to care documentation.



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# The Business Case for a Fully Converged Medical Imaging Platform

Physicians who can see diagnostic images and instantly connect them with other test results, notes, and patient reports are better informed to make decisions and diagnoses, which translates into more time available for patient care. So, the more than 6,000 hospitals as well as the over 120,000 health care practices owned by hospitals and corporate entities in the U.S. are at a distinct disadvantage if health care providers don't have every piece of patient information in the same place at the same time. In other words, merging multidisciplinary imaging systems including picture archiving and communication systems (PACS) and electronic health records (EHRs) into a single system interface will lead not only to better patient care, but quicker, more informed decision making.

In fact, in an April 2018 study, the Journal of Digital Imaging quantified “the impact of implementing picture archiving and communication system-electronic medical record (PACS-EMR) integration on the time required to access data in the EMR and the frequency with which data are accessed by radiologists.” The results showed that the time it took for radiologists to access data and images in the EMR after unifying the two decreased from 52 seconds to six seconds. Researchers also discovered that such integration was associated with a “significant increase in the proportion of studies for which radiologists obtain additional clinical data.”

## HIGHLIGHTS

Nearly every department in a health care setting has **its own medical imaging systems/picture archiving and communications systems** equipment and corresponding storage and retrieval technology.

Some forward-thinking executives are **starting to confront the inefficiencies** inherent in their traditionally siloed imaging systems.

Integration can help with a **hospital system's day-to-day operations** and help physicians do a better job across the board.



**“Health care executives recognize the importance of imaging integration but don’t have the background or experience to make it happen,” says Christopher Roth, vice chairman of radiology, information technology, and clinical informatics at Duke University and director of imaging IT strategy for Duke Health.**

Despite the benefits that such time efficiency helps produce—from improved care to lower costs for that care—there remains a deep gulf between wanting more data management in health care and achieving it. Ninety-five percent of the 742 health care leaders surveyed globally in April 2019 by Harvard Business Review Analytic Services said it is important to manage data across care settings, but only 19% reported being able to do so effectively.

To be sure, PACS and specialty imaging tools are mostly separated and siloed. Industry experts say complexity, lack of internal expertise, and a willingness to stick with the status quo are holding the consolidation process back. “Health care executives recognize the importance of imaging integration but don’t have the background or experience to make it happen,” says Christopher Roth, a neuroradiologist who is the vice chairman of radiology, information technology, and clinical informatics at Duke University and the director of imaging IT strategy for Duke Health in Durham, N.C. “In addition, imaging today is a big fee-for-service revenue driver that, in value-based care reimbursement models, may later become a cost leader because of expensive technology and expensive physicians.”

As a result, health care providers within the same organizations stockpile similar technologies, including software, servers, and storage. Consolidation efforts could prevent this. The cost for all the duplicate software licenses and hardware is absorbed by each department in hospitals and other health care facilities, boosting capital expenditures. Since the IT organization within each must support every piece of hardware and software, operational expenses swell, too. Worse still, this technology grab makes it nearly impossible for health care providers to share information

quickly and makes it much more difficult for that data to be accessed directly by consumers, as well.

“Health care is probably the most inefficient industry we have in the United States,” says Melissa Davis, assistant professor at the Emory School of Medicine in Atlanta and the medical director for Emory’s quality and radiology department. “As a patient, if you walk into the ER, you’re asked a set of questions. [Your answers] are put into a system that’s usually separate from the core EHR. But chances are someone else [from that hospital] is going to come in and ask the same set of questions because they don’t have access to the same systems, and it’s a problem throughout the hospital. The systems that we use in radiology are different than the systems that are used in emergency medicine, which are different than the systems that are used on the inpatient side, which can be different and not communicating to the systems that are used on the outpatient side.”

This paper gives an overview of the problems siloed PACS and specialty imaging systems and services create, and what an evolutionary change to such platforms looks like when converged with EHRs. The report explores how an integrated, consolidated system can help health care providers reduce personnel, hardware, software, and services costs. It also examines the potential clinical and patient benefits these efficiencies help produce, such as improved patient care, fewer medical mistakes, and improved continuity of care.

## Imaging Gets an Upgrade

PACS is an umbrella term that includes disparate medical imaging technology that provides economical storage, retrieval, management, distribution, and presentation of medical images captured by devices such as X-ray, MRI, and ultrasound machines, among others. Nearly every department in a health care setting has its own medical imaging systems/PACS equipment and corresponding storage and retrieval technology. Enterprise imaging, which includes PACS, encompasses the various types of multimedia created, captured, and used by clinical staff and includes diagnostic images, video, and photographs.

For health care executives who want to tackle integration, there are plenty of advocate organizations championing the wedding of PACS, enterprise imaging systems, and EHRs. For example, the Healthcare Information and Management Systems Society, a nonprofit organization that promotes the best use of IT and management systems in the health care industry, in 2016 introduced the Digital Imaging Adoption Model (DIAM) in conjunction with the European Society of Radiology. The model is designed to support health care organizations planning for and implementing imaging IT. The eight-stage DIAM provides goals and milestones, creating a maturity model for health care organizations.



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**FIGURE 1** The highest stage—External Image Exchange and Patient Engagement—advances the notion that the “majority of image-producing service areas are exchanging and/or sharing images and reports and/or clinical notes based on recognized standards with care organizations of all types, including local, regional, or national health information exchanges.” It also requires that the applications used in “image-producing service areas support multidisciplinary interactive collaboration.”

Some forward-thinking executives are starting to confront the inefficiencies inherent in their traditionally siloed imaging systems, *Imaging Technology News* reported in November 2020. Most see the need for enterprise-wide efficiencies while balancing clinical, business, and operational goals. They are also aware of the technological work that’s required to make it happen such as converging disparate imaging technologies into one technology platform and presenting that information in the commonly accepted graphic user interfaces of the EHR. The reason is simple: They know that when these processes are executed successfully, health system executives can reduce cost and complexity and improve productivity across disciplines for all departments.

Bill Phillips, a senior vice president and chief information officer of University Health, a county hospital system based in San Antonio, Texas, is seeing the benefits of convergence firsthand. The health care system in 2017 had multiple PACS, isolated by department. In some cases, PACS even within the same department lacked interoperability, he says.

The health care system hired a consultant, who was charged with identifying and cataloging every imaging repository across the hospital system’s properties, including at its Level 1 trauma center, ambulatory care network, and nonprofit provider group practice. The consultant also spent time one-on-one with health care providers, interviewing them about their imaging concerns. University Health executives were surprised at how much work needed to be done before the organization could achieve convergence. They had more systems than they expected, and health care staffers stored and saved data independently and, oftentimes, on local drives. The IT department, the consultant said, needed to handle technology changes and reconfigure the way that medical staff worked.

“They found disparate systems all over the place,” Phillips says. “They found systems we didn’t even know that existed

FIGURE 1

### Cultivating the Right Image

The eight-stage Digital Imaging Adoption Model targets operational and clinical improvements.

STAGE	MILESTONE EXAMPLES
8	Most image-producing areas are exchanging and sharing imaging and reports. Patients can access reports and images online and can upload and download images.
7	Systems capable of providing feedback about the appropriateness to perform an examination based on patient information and guidelines are in place.
6	Clinical, organizational, and financial parameters are tracked and benchmarked and can be presented in real time via dashboards. Internal and external data for making predictions about needed therapies and examinations is used.
5	The organization uses an enterprise-centralized repository for image content storage. Clinical image, multimedia, and metadata capture and storage processes are standardized.
4	An enterprise imaging strategy is in place, including appropriate governance and oversight.
3	Clinical image acquisition and communication workflows are formalized, implemented, and designed to support clinicians within their normal care processes.
2	Images and associated reports/clinical notes, created in at least three image-producing service areas or 80% of all medical images/videos produced in the organization, are accessed via multiple, unique links within the EMR or similar interface.
1	Medical imaging information systems, installed to manage image acquisition workflows, reports, and/or clinical notes are implemented in at least two departments/service areas.
0	There is little or no electronic management.

Note: Edited for length

Source: Healthcare Information and Management Systems Society, 2016

**The cost of a single  
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2021—a \$2 million  
increase over the  
previous year.**

**“The 2021 Cost of a Data Breach”  
from IBM Security and the Ponemon  
Institute, July 2021**



“When you have a bunch of disparate systems, it’s hard to secure each one, especially when each one has its own security restrictions and policies,” says Bill Phillips, senior vice president and chief information officer, University Health.

in departments. We had staffers saying, ‘Hey, I’m dumping pictures from this [system] and throwing them on my desktop.’ Physicians said they didn’t want to have to keep clicking and loading and asked us, ‘Can’t we do it easier? Can’t you make it faster for us to see studies? Can’t it be easier to exchange imaging?’ They wanted one platform.”

Armed with these facts, the organization launched a three-part, multi-year project to integrate all its PACS and imaging technologies within its EHR. It was good timing since the EHR was coincidentally scheduled for a \$170 million upgrade. The entire process—from getting buy-in from multiple stakeholders and medical professionals to creating a project plan to rolling out new software—took more than three years. It’s paid off, though. The organization reduced the number of disparate systems it has, improved patient care, and raised employee satisfaction and efficiencies.

## Taking It Step by Step

The University Health executive team started its work by setting performance metrics so that its members would know where the lowest-hanging fruit was when it came to getting started, as well as which benchmarks they should strive to attain. With such a long-term project plan, the organization wanted to start seeing benefits as early in the process as possible. One of the first tasks in the project was documenting the number of steps a physician had to go through in the hospital’s disparate systems before gaining access to an image. This included quantifying how long the original process took and, using data, setting realistic goals for how long access should actually take. Although the health care system is still working on the project, it is already seeing impressive benefits and results, Phillips says.

Today, University Health has achieved “significant” cost savings due to the phaseout of software licenses and maintenance contracts. The county system is also recouping time now that its IT support staff isn’t rushing around from department to department when something goes wrong, he says.

“Multiple systems, multiple systems’ support, maintenance contracts. Every disparate system you have around imaging, you’re paying a maintenance fee on it, and you’re providing

servers and you’re providing patching and cyber updates and system updates,” he explains. “When you really add them up, you’re spending a lot of money to support them. When you have all your imaging housed in one location, it’s more cost effective, it’s easier to handle, it’s normally faster, and it’s easier to integrate with [the] EHR. You’re only talking one integration path. There was the cost of having multiple systems: the maintenance of multiple systems, the support staff to maintain them, the lack of speed when physicians were trying to access images.”

Nothing is thus lost or misplaced, either. Plus, security is enhanced since health care providers aren’t storing images and files on personal devices or systems that lack direct network connectivity, and there are simply fewer systems to keep track of and fewer entry points into the systems, Phillips says. “When you have a bunch of disparate systems, it’s hard to secure each one, especially when each one has its own security restrictions and policies.” Limiting disparate systems is a compelling benefit considering the cost of a single health care breach was \$9.23 million in 2021—a \$2 million increase over the previous year, according to a July 2021 report, “The 2021 Cost of a Data Breach” from IBM Security and the Ponemon Institute.

Duke Health made a similar commitment to integrating its multispecialty imaging management systems, PACS, and EHR, says Roth, the director of imaging IT strategy. “When we started our journey in 2015, we realized that we had purchased more than 400 ultrasound devices and 100 models of ultrasound scanners across 21 different vendors. Some had the requisite connectivity, some didn’t,” he says. “The biggest cost drivers [for us] were needing fewer employees to support clinical use cases and needing fewer applications.” Such an integration also has clear clinical communication and documentation benefits, he adds.

The organization started its conversion and integration internally, creating a decision-making body comprised of Duke Health physicians, employees, and contractors, including residents, specialists, image creators, and providers who were exclusively consumers of images. “We wanted a spectrum of opinions on how to enhance and simplify clinical care, as well as optimize our risk management, credentialing, information security, revenue, and documentation,” he says.



“Having all that information when I’m reading the scan makes me a better radiologist because I have a lot more clinical context. It also makes me more efficient because I don’t have to dig through each platform to find that information that I need. It boosts speed and efficiency,” says Melissa Davis, assistant professor at the Emory School of Medicine.

### Looking at the Bigger Picture

Duke identified issues such as the need to decrease data stored on external storage devices such as CDs or thumb drives and the inability for one department to access imaging data that was captured in the same facility but in a different department. There was also a huge opportunity to better integrate imaging with the EHR and redesign an ideal compliant clinical workflow that captured rich metadata and documentation so it could be rolled out system-wide. With everyone in the organization using the same metadata or keywords around images, it became easier to search, store, and access enterprise imaging assets.

“The approach with enterprise imaging and integration is not just to scale a limited number of effective technologies across departments, but also to build culture across those departments to share resources and collaborate better than we have before,” says Duke Health’s Roth. “When you take an enterprise approach, you say, ‘Several groups have a similar set of problems. Let’s work together. Let’s stand up systems that work for everybody. You all can learn from each other.’ Now you’ve not only stood up effective technology, but you’ve actually got like-minded people working more closely together. It’s a culture win, too.”

Emory’s Davis says integration and consolidation can help with a hospital system’s day-to-day operations and help physicians do a better job across the board. With a fully integrated and consolidated system, it’s like having every health care provider who encountered the patient right there with you when you access an image, she says. “I understand when they got scanned, how long it took to get the scan, if there were any issues with it, how much contrast they got, if they got contrast or not,” Davis explains. “Having all that information when I’m reading the scan makes me a better radiologist because I have a lot more clinical context. It also makes me more efficient because I don’t have to dig through each platform to find that information that I need. It boosts speed and efficiency.”

Without a converged system, the physician is forced to ask nurses and other support staff to find answers to all these data points, she says.

### Tackling Patient Satisfaction


The benefits of a converged medical imaging system that’s integrated with PACS and the EHR don’t stop with recouped personnel and equipment costs—or the physicians who use them. There are tangible and intangible benefits for patients, too. The most useful for physicians is the ability to show patients their images, videos, and other multimedia at the point of care. An oncologist can show a patient a lab report showing a tumor’s genetic markers, a video of the patient’s biopsy, and MRI images of the tumor all at the same time.

“It always helps when the physician brings it up on a screen right in front of the patient and explains things. ‘Well, this is what I’m seeing. Let me show you your MRI and tell you about it,’” says University Health’s Phillips. “Not being able to do that from a patient-presenting standpoint—having to say, ‘Well, I don’t have access to that image,’ is huge.”

Converged medical imaging systems put power into the hands of patients, too, which is something that they are overwhelmingly asking for. A July 2019 study in the *Journal of Medical Internet Research* found that nearly nine out of 10 patients surveyed reported a desire for access to radiology images within their own online patient portals. “Most respondents (70.5%) said it would help them feel reassured that their doctor was doing the right thing,” according to the article in the journal accompanying the survey, “and 63.8% said it would increase their level of trust in their doctor.”

As patients become more mobile and are more willing to seek health care in a location-agnostic manner, this strategy of access to images via portals becomes increasingly important for timely and efficient care. It can also help physicians retain their patients. Roth says integrating images so they are accessible via patient portals boosts patient engagement and “stickiness.” Patients are taking advantage of this option, too, according to a June 2021 study in *Data Science and Radiological Practice*. “Nearly 7-fold more patients accessed their images online when offered a new pathway in the patient EHR portal compared with the long-standing option of separate direct login to a patient image portal. It becomes a competitive differentiator for us,” Roth asserts. “One of the ways we’ve deployed our enterprise imaging is through





**“One of the ways we’ve deployed our enterprise imaging is through the patient portal. You’re empowering patients to take more control over their health care.”**

**Christopher Roth, vice chairman of radiology, information technology, and clinical informatics at Duke University**



Doctors and other health care providers recoup time spent chasing down necessary information, images, and test results, and the IT department frees up its employees from time they would have spent on systems and software maintenance and upgrades.

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## Conclusion

Right now, hospital and health systems aren't clamoring to converge health care imaging systems, PACS, and EHRs because of the investments already made and the revenue being generated by those systems. Health care executives may also be hesitant to embark on such a journey because such widescale integration and consolidation takes a lot of time and effort, Roth says. Integration of medical specialty imaging workflows and archives, for example, can take years to complete and may require knowledge and capabilities that many health care organizations just don't have within staff ranks.

But for health care executives who have taken steps to integrate systems and achieve convergence, the benefits make such an effort powerful. Cost savings can be significant, especially when maintenance costs are removed from the bottom line and redundant storage repositories and systems are whittled down. There are also savings due to cutting

personnel costs and added personnel efficiencies. Doctors and other health care providers recoup time spent chasing down necessary information, images, and test results, and the IT department frees up its employees from time they would have spent on systems and software maintenance and upgrades. Finally, patients—who are at the heart of every health care imaging system and EHR integration—get better care and more control over their own health care information and images.

With all of these obvious and attainable benefits available for hospital and health care systems, it's clear that a fully converged imaging platform that's deeply integrated with the EHR is no longer optional. It should be seen as table stakes for health care executives looking to not only cut costs but also improve patient care and medical provider job satisfaction.

"Medical multimedia accessible from the EHR is requisite for optimal care," says Roth. "If you want directions to an unknown place and I give you an answer with text instead of maps, it's harder to get there. You're going to take longer and perhaps do a worse job getting to where you need to be." The same applies to health care and the decision making involved, he says, adding, "A picture says a thousand words."



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