

What if you had ...

- ... a smarter way to connect your EMR?
- ... a smarter way to put information at your fingertips?
- ... a smarter way to create the longitudinal patient record?
- ... a smarter way to prepare for healthcare analytics?
- ... a smarter way to improve the patient care journey?
- ... a smarter way to provide tomorrow's healthcare today?



## Carilion Clinic and Hitachi Data Systems Intelligently Connect the Healthcare Enterprise With a Fully Integrated Solution

Virginia-based Carilion Clinic desired to differentiate itself from competitors with better clinical data, maximum use of data capabilities, mobility and a way for healthcare professionals to view the entire patient care pathway from one source, anywhere, anytime. It chose Hitachi Clinical Repository (HCR), a fully integrated, end-to-end solution that unifies the provider's existing applications and offers intelligent data life-cycle management and analytics for optimal utilization of data.

The implementation of HCR has enabled both a patient-centric and a population health management (PHM)-oriented view of care delivery at Carilion and paved the way for PHM. At a later phase, HCR will help Carilion move into the future with clinical analytics and innovation in disease prevention and care to support PHM.

### About Carilion Clinic

Carilion Clinic is a 1026-bed, not-for-profit healthcare organization based in Roanoke, Virginia. Its network of hospitals, primary and specialty physician practices, and healthcare complementary services employs 11,700 individuals. Carilion has over 50,000 admissions, 877,000 primary care visits and 170,000 emergency visits per year. The organization's mission is to improve the health of the communities it serves, comprising nearly one million people. Carilion seeks to advance care

through medical education and research, help its community stay healthy, and inspire its region to grow stronger.

Carilion actively seeks the latest and most effective healthcare IT solutions to accomplish its mission of improving the health of the communities it serves. As a healthcare provider offering advanced medical technology, it emphasizes the importance of a "commitment to staying on the cutting edge of healthcare technology" as vital to delivering quality healthcare services. Carilion substantiates this approach to



**CARILION CLINIC**

### Carilion Clinic

**INDUSTRY**  
Healthcare

**SOLUTION**  
Hitachi Clinical Repository

**HARDWARE**  
Hitachi Content Platform (including server and storage)

**SOFTWARE**  
Hitachi Clinical Repository

### Benefits at a Glance

- System integration.
- Data mobility.
- High-performance image retrieval.

### Hitachi Clinical Repository: Intelligently Connecting the Enterprise

patient care with an investment of more than US\$200 million in information technology over the last 10 years.

These efforts have not gone without notice. The organization has earned a privileged spot as a pioneer of social innovation in the healthcare industry, winning Health Care's "Most Wired" designation from the American Hospital Association (AHA) and the College of Healthcare Information Management Executives (CHIME) multiple times.

#### The Challenge: Create a Connected Healthcare Enterprise

To make the leap to a fully connected health system, Carilion needed a solution to better manage the growing amount of patient-relevant data distributed throughout the enterprise. In any solution, change or update, the provider always seeks to improve patient outcomes. With this in mind, it focused on finding a platform that would support scalability, manage a wide range of data formats, including both DICOM (Digital Imaging and Communications in Medicine) and non-DICOM, and significantly reduce the need for remote storage.

#### Hitachi Clinical Repository Solution Delivers Wide- Ranging Features and Benefits

##### Unified Longitudinal View of Patient Care

Like many healthcare providers, Carilion relied on a series of proprietary applications to capture and store clinical data. This meant having to use multiple interfaces to obtain full information on patients as well as delay in transmission of information from separate applications.

In addition, there was always the "pain" of integration when it came to upgrading existing applications. Each application required time-consuming processes to ensure data sharing across the enterprise as well as keeping the application up to date with the latest version of a solution.

That scenario drastically changed after HCR was implemented. This is because HCR augments the electronic hospital or medical record (EHR/EMR) with unstructured data not captured by the EHR/EMR. It collects and integrates all digital medical images, electronic medical records and the associated metadata related to patient care. It unites picture archiving and communication systems (PACS), hospital information systems (HIS), radiology information systems (RIS) and healthcare data-generating systems. It then stores the data as standard-based objects not restricted by proprietary formats.

As a solution, HCR enables providers to securely unify disparate information silos, allowing stakeholders to see and interact with clinical data, regardless of origin, data format or location.

Carilion physicians and healthcare professionals have reached unmatched interoperability with a universal viewer that pulls up all priors and information to enrich the diagnosis at the point of care, in real time. As a result, physicians have faster access to records and information about the entire patient care journey during clinical decision-making.

##### No Need to "Rip and Replace"

On the back end, Carilion has consolidated data systems and retired inefficient technologies. HCR currently hosts over four million records. New data is directly written into HCR. Additionally, 95% of radiological data now resides in HCR. With the latter, Carilion has a significantly more efficient data management process that eliminates the need to pre-fetch prior studies.

HCR has simultaneously united existing applications for a universal view. Carilion did not have to "rip and replace" data systems within the enterprise. HCR "painlessly" slid into the current infrastructure, establishing a single, nonproprietary bridge between all of the applications, healthcare 'ologies and disparate data sources.

In partnership with DataFirst, HDS executed data migration as a background process that did not affect clinical workflow. This method allowed for extremely robust multithreaded migration tooling to be used to dramatically speed up the project. Sustained migration speeds attained at Carilion were at 225,000

records every 24 hours, or nearly 8TB per day. As a result of this smooth transition, Carilion desires to extend HCR to other departments such as pathology and add other non-DICOM data formats.

##### Data Life-Cycle Management

Record retention constitutes another important issue for healthcare providers. Government and industry guidelines require providers to manage each step in the record life cycle to ensure record availability.

HCR allowed Carilion to unify a range of data-generating systems throughout the enterprise. This eliminated the cost of maintaining other systems that were being solely utilized for record-retention purposes. HCR revolutionized the way Carilion thought about record-keeping by guaranteeing long-term storage and fast recall of information. With its ability to manage both structured and unstructured data, Carilion can include any data format into their storage protocol, from DICOM and non-DICOM images to PDFs, voice recordings, digital photographs and beyond.

##### Data Ingestion

Carilion provides healthcare services to over one million individuals. That is a lot of patient-relevant data coming from all areas of care. In addition, 60 to 70% of patient data outside of medical imaging is unstructured. With HCR, Carilion physicians and healthcare professionals have full access to all patient data, whether it is structured or unstructured.

One of the features Carilion's staff feels most excited about is HCR's ability to unify siloed, unstructured data without affecting the original object. The result? Physicians are diagnosing based on the actual object, regardless of its origin, whether an image in radiology, a video in the operating room or a pharmacy record. HCR does not alter the format at any stage in the data life cycle.

At Carilion, phase 1 of the HCR roll-out, which included radiology and cardiology, has gone smoothly. Mahesh C. Tailor, Director of Technical Services, comments: "We are consolidating all our data into a single repository so we don't have to maintain silos of storage, with the next evolution being big data and analytics."

It also translates into better patient care by reducing the number of times a patient is exposed to radiology. As Taylor points out: "We are looking to mine the metadata so we can take that data and correlate it to patient records. We can then make better decisions, such as knowing how often a patient has been exposed to radiological images and not overexposing because we can't access their full medical history."

Now that patient data is stored safely, easily accessible and future-proof, Carilion has moved on to the next level: clinical analytics that support population health management.

## Future Directions: Clinical Analytics and Beyond

### Clinical Analytics

Clinical analytics has become omnipresent in healthcare. Data management is not only about storing but also transforming information into insight. Analytics presents a win-win scenario. It is good for business, with an expected compound annual growth rate (CAGR) of 25.2% to reach approximately US\$21.3 billion by 2020.\* On the other hand, sophisticated data mining improves patient outcomes, especially when it comes to preventive care.

Carilion understands the positive impact of big data and how to use HCR to reach this next level. In order for data to be optimized, it has to be first captured and indexed. With the HCR platform, Carilion can ingest and index objects and their associated metadata. Administrators can customize metadata parameters through up to 1,024 additional fields to make sure information can be easily located and retrieved. This rich metadata repository can upload and index over 450 MIME types.

Mining and organizing patient-relevant data pave the way to predictive analytics to identify high-risk patients and implement evidence-based protocols.

Carilion stands as a pioneering provider using big data to improve patient care. With HCR, the organization ensures that data is always accessed in real time and remains clinically relevant.

### Population Health Management

For Carilion and other providers on the cutting edge of technology, population health

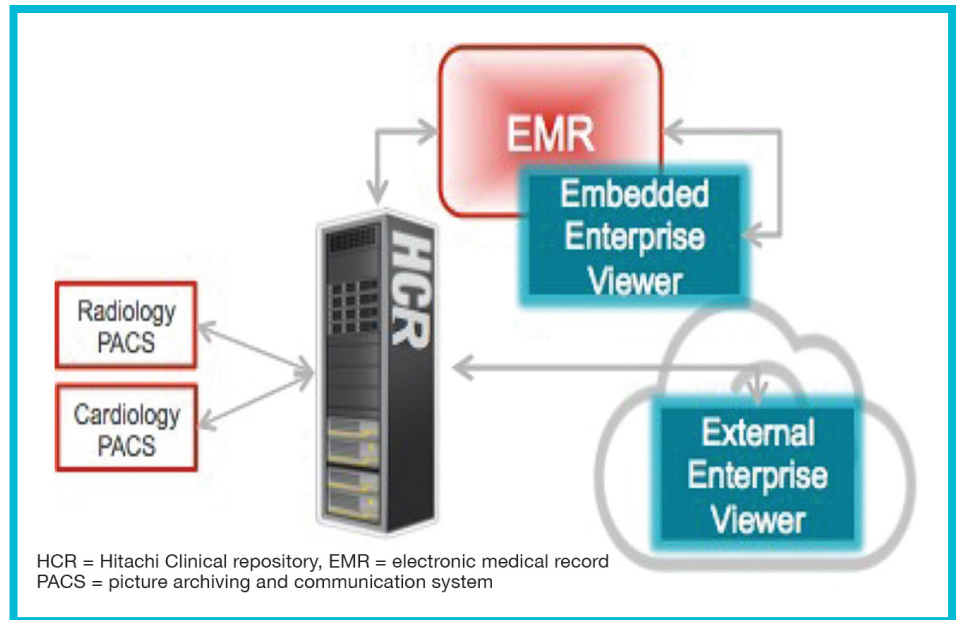


Figure 1. HCR at Carilion Clinic

management is the next frontier in healthcare. Clinical analytics provides access to data that can be used to study populations and identify major health issues and associated costs. With the power of an intelligent data management platform, Carilion is one of the few providers in the United States with the knowledge, data management capacity and resources required to capitalize on population health management. As a "Most Wired" hospital, Carilion leverages the latest technologies to optimize its data, use it to improve care and achieve outstanding patient outcomes.

Venturing into PHM will help Carilion to reduce readmissions and better target causes of disease by focusing on care options for high-risk patients with significant health costs. EHR/EMR end-to-end access allows providers to systematically address preventive and chronic care needs of every patient. HCR's scalable

**Connected Health With HDS**

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platform allows search modification that can be potentially used to study how health risks might change over time in a particular geographical area.

## Summary

Complete data integration is the healthcare industry's vision for the future. HCR gives providers the building blocks: interoperability, a connected enterprise and "intelligent" data management. As a next-generation player in healthcare, Carilion is redesigning its approach to data as an active factor in the everyday delivery of care. HCR at Carilion taps into clinical, administrative, and patient-generated data to create a more precise and wholesome road map to quality care improvement projects. The Carilion-HDS partnership advances the provider's vision of commitment to better patient care, better community health, and lower cost in its delivery.

“ [With HCR,] we are looking to mine the metadata so we can take that data and correlate it to patient records. We can then make better decisions, such as knowing how often a patient has been exposed to radiological images and not overexposing because we can't access their full medical history. ”

*Mahesh C. Taylor, Director of Technical Services  
Carilion Clinic*

\* MarketsandMarkets, "Healthcare Analytics Market worth \$21.3 billion by 2020." September 2014. Research and Markets. www.researchandmarkets.com

