

Research Institute Explores Better Ways of Clinical Data Collaboration Across the Enterprise



Reggio Emilia Hospital (A.O. Santa Maria Nuova IRCCS) is a 900-bed research institute and reference hub to five additional rural satellites, in total serving over 530,000 clients.

Reggio Emilia Hospital is on the leading edge of advanced IT management, and is an outstanding example of a highly organized clinical workflow environment. It's annual IT investment amounts to 3% of total hospital management budget and scores 5.7 on EMRAM ranking. The overall IT infrastructure connects 1,500 clients on LAN, and serves a province healthcare IT WAN comprising 1,800 additional clients.

In addition to the CARESTREAM Vue PACS installed in 2003, the hospital has implemented full electronic ADT and paperless Ancillaries, EMR Adoption, full electronic medication CPOE and a Structured and Document Clinical Repository (connected to regional EHR).

Despite the completeness of this IT infrastructure, the hospital was still searching for an optimal solution for an integrated clinical image repository and distribution system.

"The Hospital had already solved the issues of storing clinical reporting and administrative documents and had already perceived the significant advantages of centralizing information management. Images were the natural and obvious completion of this process, and probably the most challenging." -- Sergio Bronzoni, CIO

Clinical Needs Driving New Data Management Model

- An *integrated care path* for patients is a major trend in healthcare. The approach to complex pathologies is evolving from the traditional model, in which a reference clinician managed the entire diagnostic and therapeutic process by gathering information from many specialties independently. The new model is conceived around a virtual, yet coordinated, patient "journey" through different diagnostic and therapeutic steps, each one benefiting from the information gathered at previous steps. **Integrated care paths require access to all clinical data for all professionals involved.** Data has to be readable and relevant to any professional—and care paths may be geographically distributed. As a consequence, data repositories should be logically centralized through database federation or physical consolidation of individual storage.
- Interoperability of this central repository becomes a key aspect for integrating all information generated in the clinical pathway. Cross-availability of examinations between the central hospital and satellite facilities permits both the early referral of critically ill patients and the subsequent follow-up for patients on secondary/distributed structures—which allows the **hospital to focus more on critical care while monitoring data of stable patients followed in peripheral facilities.** The data should then be potentially accessible through universal clinical viewer software rather than the one that is used only with the individual department such as PACS. This prevents interruption of individual clinical departmental services, as each is able to preserve its own clinical workflow while allowing central archiving and distribution.

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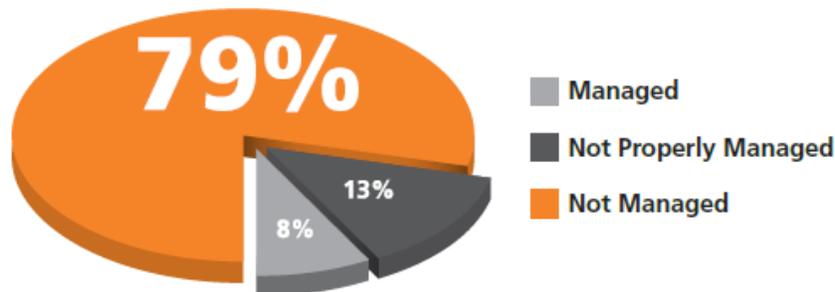
- Each physician should be able to access archived clinical data through **universal viewer software**—because the originating departmental viewer often requires a special download and does not accommodate viewing of multiple data types. A universal viewer can preserve each clinical department’s workflow while enhancing data sharing and access.
- National and European **regulations require the availability of all data** acquired upon patient request. Improper management of clinical data (images, videos or any other media) at a departmental level—or even by a single physician—poses the risk of total or partial data loss. Therefore, it is vital to centralize the management of all clinical data.
- As a research institute, the Reggio Emilia Hospital is constantly required to **provide evidence** for both retrospective data mining and prospective research trials. This makes fast, easy availability of diagnostic and clinical images an essential requirement.

The First Step to Success

Based on these requests, the IT department of Reggio Emilia Hospital began analyzing the status of their clinical images. A complete inventory was collected on all existing imaging equipment to determine types of data output, number of examinations, number of images, media types, status of storage, and the actual or potential clinical value of media not stored or improperly stored.

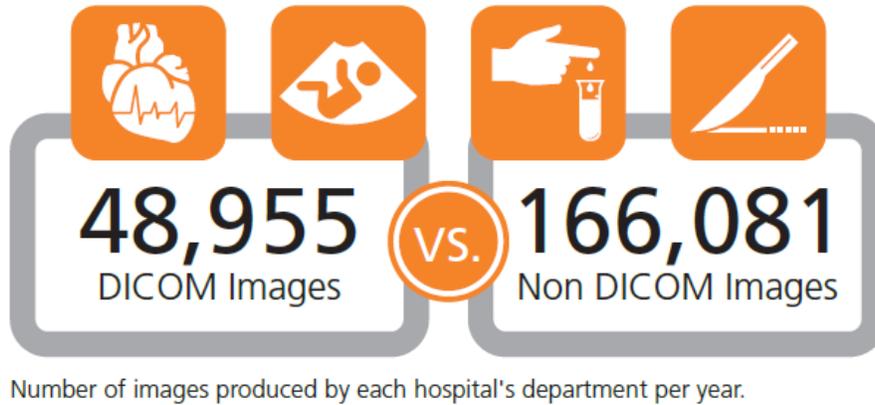
“What we realized at the end of the exercise was that up to 79% of our non-DICOM images were not properly or securely archived. This meant that they were not necessarily part of the full patient clinical portfolio,” says Marco Foracchia, PhD, IT Medical Systems Manager.

Figure 1: Management of Various Clinical Data



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Figure 2: Inventory of Various Images Generated (Exams per Year)



CARESTREAM Vue Archive was the selected solution for the integrated clinical data repository. It is scalable to archive multiple data inputs and, because it's vendor-neutral, it offers a smooth experience for end users. Carestream has been a long-term partner in the Radiology and Cardiology Imaging area, so it became the natural fit for the hospital's long-term vision to evolve and scale projects of data integration.

"Having a true vendor-neutral clinical image repository means my facility can ingest all data formats without interrupting the department workflow, regardless of their specialty or variance in their processes. This was the goal of our project," says Marco Foracchia, PhD, IT Medical Systems Manager.

Table 1: Image Volume Comparison between Radiology and Non-Radiology

Radiology (Data from 1 Hospital Department)		
Exams	Images	Images/Exams
174,648	15,027,544	86

Outside Radiology (Data from 21 Hospital Departments)		
Exams	Images	Images/Exams
223,035	833,100	4

Endoscopy has been selected as the first phase for the project for several reasons:

- The department has high clinical value for the oncology care path
- It produces significant volume, at 36,000 exams/year
- While it also produces non-DICOM images, all have a homogeneous type of output and capture modality
- Modalities are all concentrated in just a few departments

The **magnitude of data storage for endoscopy images is very high** when compared to radiology data, and the effects of its mismanagement are just as significant on the quality of care. The average size of a full endoscopy video examination is roughly 10 MB/minute, with an average video duration of 15 minutes and a total throughput of 3000 minutes/week.

The migration of endoscopy examinations stored in scattered departments was successfully completed in the Fall of 2013. The hospital believes that transferring data to a bioimaging vendor repository has proven to be a wise investment, because it allows for future scalability; and in fact, they have set a clear path forward in this direction.

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"For example, endoscopy exams, which are often tied to oncology follow-up, are a critical part of patient care, yet they're only stored on the equipment itself. Enterprise image access with report distribution is providing physicians the relevant clinical evidence they need for diagnosis," says Dr. Sassatelli, Director of Gastroenterology and the Digestive Endoscopy Unit.

Table 2: Profile of Various Endoscopy Procedures

Modality	Exam Type	Number of Exams/Year	Number of Images/Year	File Type	Storage*
Endoscopy - Bronchoscopy	Endoscopy	1500	10000	NON DICOM	DB
Endoscopy - Gastroenterology	Endoscopy	15000	40000	NON DICOM	DB
Endoscopy - Gastroenterology	Ultrasound Endoscopy	635	1905	NON DICOM	On device
Surgery	Endoscopy (Artoscopy, Isteroscopy)	18974	5692	NON DICOM	DB

*DB = binary files stored in the database managing the patient folder

Additional Considerations for Enterprise Data Management

Benefits of a centralized bioimaging archive are not evident exclusively to clinicians and IT departments. Reggio Emilia Hospital clearly sees that tangible advantages of this project can also be extended to direct patient care.

Two outpatient environments were examined as the next phase for consolidation of the clinical repository.

The Epilepsy Center at Reggio Emilia Hospital cares for approximately 800 patients, all of whom need ongoing follow-up—EEG is the recurrent examination and each exam is performed at the Reggio Emilia Hospital. Non-critical cases could be followed at the satellite centers in the surrounding territory, and EEG could be shared to/from the main center. These **VNA benefits would result in a reduced need for patient transport (they can be checked at centers close to their homes) and in a reduction of waiting list** at the main center (where only three EEC units are in operation). Even better, the immediate availability of exams all over the territory provided by the repository could improve the quality of care.

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Figure 3: Reasons for Not Accessing Patient Prior Data

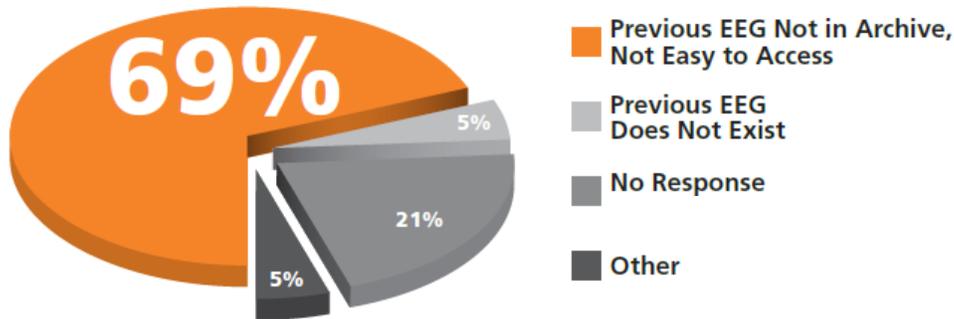
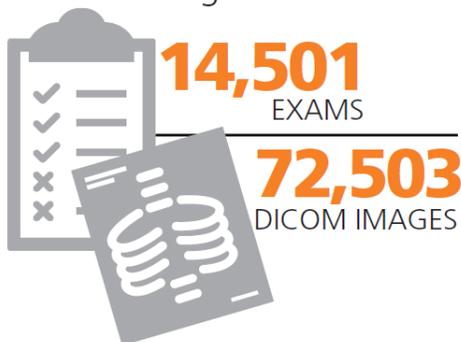


Table 3: Clinical Status of the Patient

Clinical Status of the Patient	#	%
Unstable cases, requiring follow-up at the Epilepsy Center	87	64%
Stable cases, with proper devices and acquisition, could have had a follow-up at decentralized sites	50	36%

The second case is OBG “at-risk” pregnancies, in which the number of current images accessed at Reggio Emilia Hospital is high, but the patients are followed for a short period of time (only during their pregnancy). In this case, ultrasound exams are repeated on the patients with high frequency and can be useful in the comparison with previous scans. Also, images can be shared with cardiologists and neurologists for evaluation of possible neonatal pathologies.

OB/GYN Images Produced/Year



Data migration for these two specialties is set for fall of 2014, when Carestream’s universal viewer Vue Motion will also be part of a wider image-distribution pattern throughout the hospital to display archived clinical data and reports for referring physicians. This zero-footprint viewer does not require any download, and is accessible from the web, including the use of mobile devices. Its intuitive interface means no dedicated application training is needed to facilitate a quick enterprise deployment.

The ultimate step of this Reggio Emilia project aims at allowing storage of lengthy **videos, typically from operating theatre and rehabilitation procedures**, which can be more than an hour long. This poses challenging new technical issues for streaming technologies, which are crucial in achieving a fluent fruition of the video data, and in some cases would allow online editing of the content. These technologies, very rarely applied in the medical field, are already available in other fields and are the core constituents of any possible future development of adopted enterprise data management.

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The Value of Enterprise Data Management

By leveraging the existing Radiology archive that is capable of managing a wide variety of clinical data, the foundation for enterprise data-management infrastructure is in place. With the positive experience in Endoscopy and the tests for all data format categories, Reggio Emilia is confident about its migrations of all clinical data in Epilepsy and Ob/Gyn.

The implementation of a clinical data repository is shaping the future of a clinical data collaboration platform, where its benefits far exceed system interoperability:

- Produces economies of scale by consolidation of otherwise individual archives, reducing costs of ongoing maintenance and management.
- Enables regional patient population follow-up for all clinicians that is part of the integrated care path.
- Provides enterprise distribution of all types of media without changing the individual departmental workflow.
- Can reduce the inefficiencies of access, providing convenience for patients.

“The first era of hospital information management has necessarily focused on the most significant sources of clinical information, mainly radiology and laboratory. These fields now have consolidated solutions, and the demand is shifting toward the extension to other types of media. The approach can be similar, but it has to address the intrinsic diversity of these new types of information. Both administrators and medical IT companies are therefore facing new challenges. Our experience suggests that the issue of being “open” to all kinds of media is critical, since any partial solution would not reach a sufficient ‘critical mass’ to justify the investment.”

-- Marco Foracchia, Medical IT Systems Manager

