Metadata: Creating Meaningful Access to Clinical Images and Data for Any User

Where do your clinical images and related data go after you acquire them? And how easy are they to get to?

Effective diagnosis and treatment depends on timely access to patient images and clinical data collected from any department or location. But if your departments and sites function like most, you are storing the data locally, filing it ineffectively, providing it only to local physicians and only during the current episode of care – then deleting data over time to make room for new content.

But what if clinical images and data could live a much longer life, continuing to provide insight into a patient's entire continuum of care? What if they could be made readily available to other healthcare stakeholders beyond the physician? For example, what if the appropriate clinical data could be securely delivered to:

- Multidisciplinary care teams, diagnostic service providers, and referring physicians – helping them collaborate for more effective healthcare delivery
- Administrators – giving them greater insight into the quality of care for more effective planning
- Researchers – supporting medical progress through access to comprehensive, high-quality longitudinal data
- Patients – providing awareness and insight to take a more active role in promoting their own well-being
- Payers – helping them process payments more quickly

The key benefit of CARESTREAM Vue for Clinical Collaboration Platform is that it provides the right clinical data, in the right format, to the right people, at the right time. And that should be the essential IT goal for any healthcare system, no matter which specific platform you choose. Reaching this goal becomes even more crucial as consolidation of the healthcare marketplace demands increasing collaboration among disparate providers.

To support frictionless collaboration around patient-centered clinical data, healthcare organizations need sufficient storage to allow for long-term archiving. The storage needs to be centralized so that all departments and users can access the images and data they need. And, most important, all information needs to be tagged with appropriate metadata to make it securely, rapidly and easily available, searchable, and meaningful to the right people in the right context.

Understanding Metadata – The Key to Effective Data Storage and Access

Metadata are informational attributes that are added or "tagged" onto clinical images and data to categorize them for fast and effective searches. One familiar example is a filename on a personal computer. The extension tells you the type of file (pdf, jpeg, mp4, etc.), and a meaningful name tells you what's in the file and helps you search for it when you need it. Other metadata, such as date and file size, are generated automatically and provide further search assistance.

The same basic principles apply to metadata added to clinical images and data. File-level metadata may be generated automatically by the departmental device – a radiology scanner, endoscopy processor, dermatology camera, and so on. Depending on how well automated the departmental system is, it may be necessary to manually modify filenames to enable easier search and retrieval.

Metadata can be used to associate images with procedures.

Other levels of metadata exist beyond the filename, and the file folder is one example. By sorting files into folders representing individual patients, the user is essentially "tagging" each file as belonging to a particular patient. This makes it easy to find all the clinical images and information available for each patient as needed.

In the same way, an effective long-term storage and retrieval system depends on metadata to allow for easy searching and meaningful presentation of clinical information for its intended use. We have identified three levels of metadata needed for an efficient clinical-data storage system that supports access and collaboration by all key healthcare stakeholders.

Patient-Level Metadata

The first and most essential level is metadata identifying the patient associated with each clinical data file – because unless you know who the patient is, clinical images and documents are meaningless, and there would be no point in storing them beyond the current episode of care. Sorting files into individual patient folders is the most basic way to associate clinical data with patients, but an enterprise-wide storage and retrieval system can and should do more.

Having full patient demographic information associated with each clinical record makes that record much more meaningful to users across the continuum of care – from payers to researchers, clinicians to administrators. While this information should be available in all departmental systems, organizations that have implemented an electronic medical record (EMR) can simplify the process of capturing demographic information and ensure its consistency by integrating the EMR with a centralized clinical data archive.

Exam-Level Metadata

The next level of metadata captures information related to each unique patient encounter. Metadata acquired at order entry, combined with patient metadata, can be used to define and manage departmental workflows. In addition, each patient exam may contain multiple data objects, such as images, videos, and documents, which are acquired using different methods and devices. Exam-level metadata associates all these objects together for ease of management and access, while avoiding the mistakes and inconsistencies of entering information separately for each device.

Exam-level metadata can consist of general information such as patient name, medical record number, referring physician, department, and procedure – as well as additional technical data such the study type, accession number, modality and location, exam description, and more. Any detail that may be useful in searching for and understanding clinical data as it relates to a particular exam can be codified in the metadata.

While radiology and other diagnostic-imaging departments typically do collect varying amounts of exam-level metadata, it's worth reassessing the types of metadata that may be required when moving to an enterprise-wide archive and retrieval system. When exam records are archived permanently for future use by a variety of stakeholders, healthcare organizations need to determine what metadata will be required to support efficient searching, access, and analysis.

Object-Level Metadata

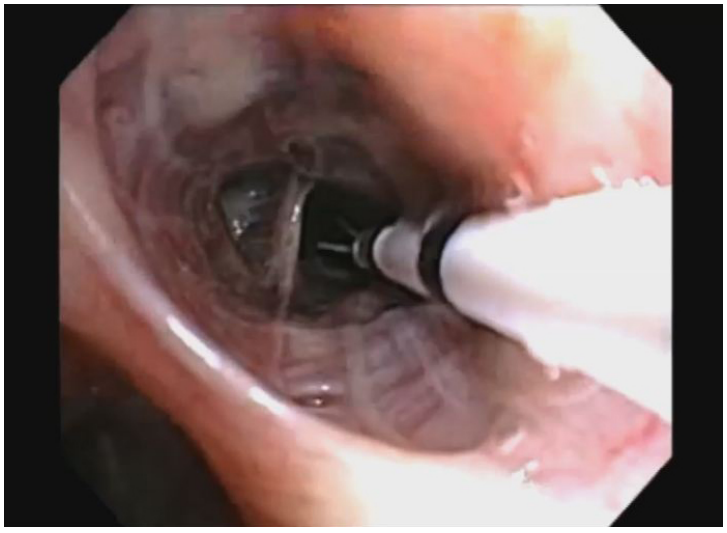
The third level of metadata identifies and characterizes the specific objects that are created during the patient encounter.

Most clinical images and data are associated, at the very least, with a minimal amount of patient- and exam-level metadata. Some departments may even choose to collect comprehensive metadata at these levels. However, fewer departments are currently tagging data files with object-level metadata, and specific standards and practices for tagging object-level metadata can vary widely across the healthcare system.

A particular exam may produce multiple objects, including images, videos, documents, and more. While all of these objects will be associated with a single patient and a single procedure, each object also has unique characteristics that can be identified through object-level metadata to make that object easier to search, visualize, and analyze.

For example, object-level metadata can include information such as the device used to capture an image, device settings, camera positioning, lighting, and so on. It may also include information such as the body part being imaged, left or right side, viewing angle, and other useful information that may not be obvious just by looking at the image. This kind of metadata can be very valuable, for example, when examining a mole or lesion that has been photographed in extreme close-up, making the specific location impossible to determine from the image alone.

Object-level metadata can also be used to add clinical comments that describe detailed aspects of the procedure and image. A dermatology department, for example, might capture metadata such as mole size, shape, border type, color, and surface appearance. Bronchoscopy images might be tagged with metadata such as insertion route, assessment site, procedure done, comments, and so on.



Metadata can capture information not obvious from the image, such as the location of a lesion.

Similarly, colonoscopy images and videos, CT scans, MRIs, mammograms, and other types of clinical data all have unique characteristics that can be tagged with metadata to make the images easier to search and interpret.

Metadata Types and Formats

Every item of clinical data has specific characteristics that can be tagged with metadata to make information more accessible and useful beyond the time and place of a particular exam. By identifying the types of information that are relevant to each patient, procedure, and object – and which types of information are relevant to users across the continuum of care – healthcare organizations can maximize the utility of each item without imposing unnecessary data-entry requirements.

This requires determining what metadata fields should be mandatory or optional, and what format each should take: free text, list, checkbox, radio button, true/false, and so on. For example, mole shape might be an optional, free-text field, while mole color might be an optional field limited to a menu of valid choices. For an ophthalmology image, however, a required field specifying either the left or right eye could help ensure patient safety when a surgical procedure is to be performed based on the image.

The Digital Imaging and Communications in Medicine (DICOM) protocol has gained wide acceptance for formatting and exchanging clinical images and metadata, particularly patient- and exam-level metadata. DICOM can also accommodate object-level metadata – and because a lot of knowledge and experience has been invested in the standard, it makes sense for many departments to build their metadata around it.

Still, some departments may prefer to base their workflows and access on non-DICOM data, and healthcare organizations should plan to accommodate this along with DICOM data in a unified system supporting collaboration across all departments.

Advantages of a Complete Metadata Ecosystem

Adding metadata makes clinical images and documents accessible and meaningful. This is intuitively obvious at the patient level. Even a physical radiology film needs to be placed in a physical folder labeled with the patient's name if it is to have any purpose or meaning.

In a digital world, metadata offers the opportunity to extend data meaning and usefulness far beyond the original context, to support every authorized participant in every facet of the healthcare delivery process. To give just a few examples, a complete ecosystem of patient-, exam-, and object-level metadata can help support:

- Standards-based automation and integration across information systems, including electronic medical records, for more efficient clinical workflows
- More effective diagnosis, planning and progress-monitoring through easier access to clinical information, including historical information, with the goal of improving longitudinal care
- Meaningful presentation of clinical data, filtered and displayed based on departmental standards and the specific needs of each user
- The ability to centrally store, index, and retrieve all clinical information for improved coordination of care across specialties
- Improved telemedicine and remote access, with complete information available anywhere, including details that may not be obvious when viewing an image out of context

- Access to comparable images from multiple patients to support education and research
- Enhanced reporting to administrators, payers, and compliance officers
- Patient access to clinical images via a specially designed portal that encourages patients to participate more effectively in their own healthcare
- The development of an electronic health record containing meaningful clinical information spanning the entire healthcare history of each patient

All these benefits and more begin with the ability to store clinical data centrally, to access it by searching for highly specific terms, and to understand what it means – without informational gaps or ambiguities.

Metadata: The Foundation of the Vue for Clinical Collaboration Platform

To enable these benefits, the Vue for Clinical Collaboration Platform provides a scalable, modular architecture built on a foundation of metadata, enabling integration of clinical data across:

- Capture and ingestion from any device
- Acquisition management
- The enterprise vendor-neutral archive (VNA)
- Distribution and access tailored to any need and any device

See our complete series of white papers to learn more about our Clinical Collaboration Platform. These white papers and other resources, along with our contact information to answer any question you may have, may be found at:

carestream.com/collaboration

Carestream