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Digital Health

Power of Tele-Radiology
Connecting Central Radiology Units to Peripheral Hospitals
Author's View on the Role of Tele-Radiology in Modern Healthcare Systems

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Introduction

The author takes the reader through a brief history of the emergence of Tele-radiology and then expands on the role of this service in modernizing Healthcare services.

The author uses his experience with Telehealth Software and Hardware and shares his thoughts on various designs of Tele-radiology services.

The article also includes the use case scenarios of Tele-radiology in both emergency and elective services.

The article is valuable for experienced clinicians relying upon radiology-based diagnosis ranging from X-ray taking, Ultrasound, CT or Ultrasound scanning in various clinical settings such as Cardiology, Vascular Services, Orthopaedics, Obstetrics and more.

Tele-Radiology – an Introduction

Tele-radiology is a medical speciality involving technology to transmit images and medical reports between different physical locations.

Teleradiology involves using telecommunications technology to send radiological images, such as X-rays, CT scans, and MRIs, from one location to another. Typically, teleradiology is used to send images from a hospital or clinic to a radiologist located at a different location, often in another city or state.

Conventional Radiology

Digital and Tele-radiology

Tele-Radiology – Usefulness in Modern Healthcare

Teleradiology has become increasingly popular recently as the technology has made transmitting

images quickly and securely easier. As a result, it is now possible for patients to receive high-quality diagnostic care even if they are located far from a major medical centre. Such bridging will allow for a quick turnaround time for diagnostic results, which can be critical for patients waiting for a diagnosis. In addition, teleradiology can be used to send images to specialists for consultation or to provide second opinions.

In many cases, teleradiology can provide timely access to care that would otherwise not be possible. In addition, teleradiology can help improve the quality of care by allowing specialists to collaborate on cases. While teleradiology has many benefits, some challenges need to be considered. For example, Teleradiology services must comply with local regulatory stipulations to protect patient privacy.

In addition, there can be delays in receiving results if the transmission system based on internet bandwidth is not working correctly. Despite these challenges, teleradiology is a valuable tool that can help to improve access to care and the quality of care for patients.

Teleradiology is used in remote diagnostic and therapeutic radiology services, including consultations with specialists and imaging equipment to diagnose and treat patients.

Teleradiology can be used for emergency and non-emergency cases and can be an essential tool for providing care in rural or underserved areas. In many cases, teleradiology can offer faster and more accurate diagnoses than traditional in-person care. It can also help reduce appointment wait times and improve patient outcomes.

Tele-Radiology – A Brief History of Emergency

Tele-radiology emerged as the reliance on X-rays films, and later CT/MRI images increased for accurate Diagnostic and Therapeutic decisions.

A summary of the historical evolution of Tele-radiology is presented below:

- It all started with successfully transmitting radiographic images through telephone lines in 1947.
- Dr Kenneth Bird from Boston's Massachusetts General Hospital installed an interactive television system to connect Logan Airport with the hospital to view the X-rays films across a distance.
- The first ACR (American College of Radiology) Standard for Teleradiology was issued in 1994, setting quality control for Diagnostic Accuracy as the remote viewing of radiological films and scans started becoming popular.

Tele-Radiology – Types

Tele-radiology can be sub-divided in two sections as below:

Clinical Services Types

- Elective Outpatient Clinic Tele-radiology Services
- Emergency Room or Operation Theatre Tele-radiology Services

Transmission Based Types

- Store and Forward or Asynchronous Tele-radiology
- Live or Synchronous Tele-radiology

Store and Forward or Asynchronous Tele-radiology

Store and forward Tele-radiology is a type of remote radiology where images are stored and then forwarded to a radiologist for interpretation. This form of Tele-radiology is often used for after-hours coverage or when a patient is located in a remote area.

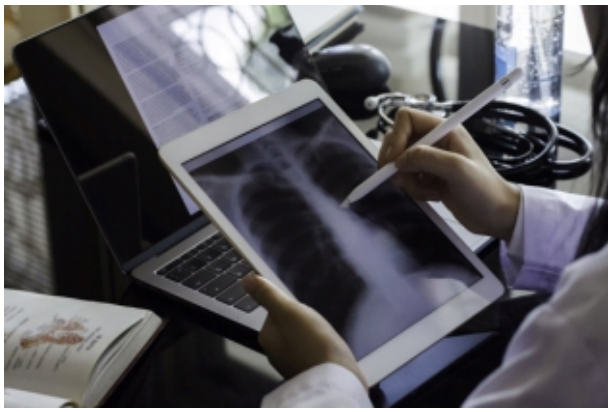
Store and Forward Teleradiology is the transmission of diagnosable images from one location to another for interpretation and consultation by a radiologist. The transmitted images are stored in a server or database until the Radiologist retrieves them. Once the images are retrieved, the Radiologist will interpret them and provide a report with their findings and recommendations.

This type of teleradiology is often used when a patient cannot travel to a radiologist or when there is a need for rapid interpretation of images. It can also be used to provide second opinions or to consult with specialists in other locations. Store and Forward Teleradiology is a convenient way to get the expert interpretation of diagnostic imaging studies,

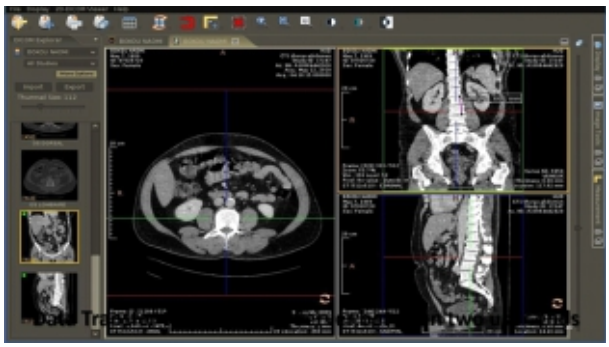
regardless of location.

One advantage of Store/Forward Tele-radiology is that it does not require instant, real-time communication between the Radiologist and the tech. Additionally, Store and Forward Tele-radiology can be used to connect radiologists with different subspecialties, allowing for a more comprehensive interpretation of images.

While Store and Forward Tele-radiology has many advantages, one potential downside is that image quality can be degraded if the original image is not high-quality. Additionally, delays in sending or receiving images can impact the timely care delivery. Nonetheless, store and forward Tele-radiology is a valuable tool that can improve access to radiology services.



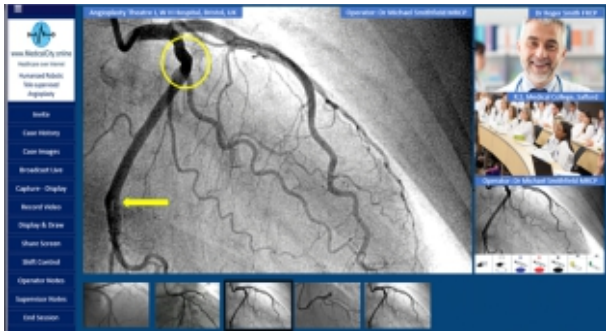
Screenshot of a Store/Forward Tele-radiology Software at the Radiologist's end



Live, Real-Time or Synchronous Tele-radiology

Real-time teleradiology allows for the live transmission of images between two locations. This type of service is often used for emergency cases or when patients need to consult with a radiologist in real-time.

Screenshot of the author's Tele-radiology Software for Tele-coronary Angioplasties



Comparing Store/Forward with Real-Time Tele-radiology

Store and Forward type is more common though Real Time Tele-radiology is catching up due to the rapid pace of relevant hardware and internet speed improvements.

Technical Priority – Storage space vs Data Transmission Speed

For Store/Forward type, the Storage Space is the overriding consideration, whereas for Live or Real Time transmission of images between Imaging Point (MRI or CT room) and the Delivery point (Clinic or Operation Theatre). Both factors are essential in each type, however, the overriding emphasis shifts to one or another classification.

Equipment Logistics – Central Processing Unit vs Graphics Capture

For Store/Forward type, the CPU speed of the machine transmitting the images matters more than the Graphics Processing Unit and vice versa for Live or Real Time transmission of the big data packets of high definition radiology images.

Clinicians' Need – Non-acute Reporting vs Urgent Intervention

Elective settings do not necessarily demand Live Tele-radiology services as much as Urgent Services such as the Trauma Centre, where an urgent interpretation of "Arteriogram" helps drive the management decisions.

Impact on Healthcare – Screening Tool vs Life Saving Service

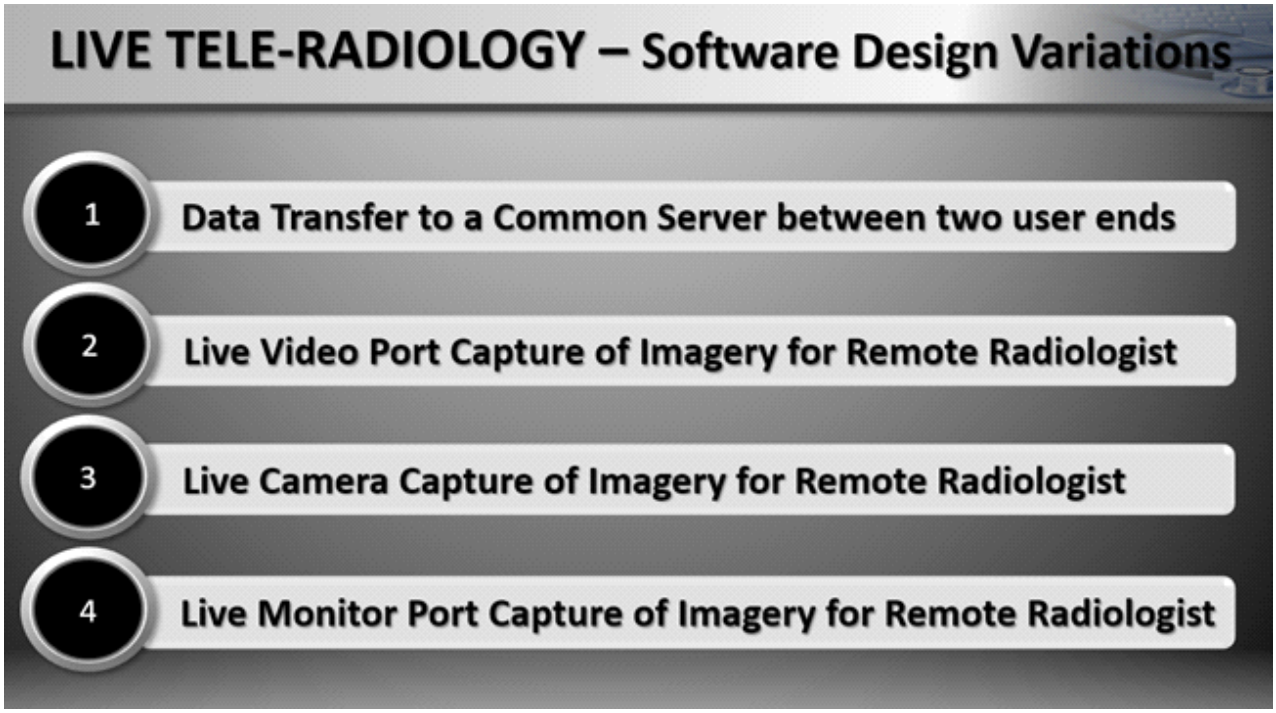
Store/Forward Tele-radiology serves well to the statutes of a Disease Surveillance such as Community Mammography as compared to Real-Time Tele-radiology setup where lives can be saved in Operation Theatre, whether the setting is a Poly-trauma case with life-threatening limb injuries or Angioplasty theatre with damage to a coronary artery during catheterization.

Use Case Scenarios for Live Tele-Radiology

- Urgent medical intervention & lifesaving clinical decisions
- Real Time & interactive remote radiology training
- Virtual Medical Knowledge testing & certification for Radiologists
- Live Community Disease Surveillance

Author's design of the "Live Tele-radiology Software" for Clinical Services

Technical Models of Live Tele-radiology Setup, proposed by the Author



Tele-radiology for Training, Examining and Certification of Radiologists from Distance

Along with Clinical Services, the training, examination and certification of Radiologists can benefit from Tele-radiology's distance bridging feature.

Author's summary of value offered by Tele-radiology in Medical Education