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# Virtual Remote Imaging Services: CT and MRI Scanning

# Key Messages

Virtual remote imaging services have the potential to help alleviate some of Canada's capacity challenges in medical imaging. However, in some circumstances, this is contingent on expanding access to imaging services in rural, remote, and underserved locations.

These services are being piloted at a site in British Columbia for CT imaging, and there are also plans to implement virtual remote imaging services at a site in Manitoba for CT imaging and later expanding its use to mobile MRI.

Virtual remote imaging services can help increase workforce capacity by enabling medical radiation technologists (MRTs) to remotely assist with imaging examinations. This technology has the potential to improve access to specialized expertise, optimize staffing, and offer flexible coverage during peak demand or staff shortages.

Training and professional development opportunities can be broadened using virtual remote imaging services by enabling MRTs to learn from experienced professionals in different locations, thereby promoting skill growth and enhancing their expertise.

The successful deployment of virtual remote imaging services requires effective communications between onsite and remote staff, standardizing staffing policies, establishing standards and quality assurance protocols, navigating licensing complexities, ensuring data security, and integrating technology systems to enable high-quality image transmission.

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## Context

Innovative approaches are needed to tackle the growing demand for medical imaging in Canada. One emerging approach is to optimize workforce resources by exploring ways to reallocate expertise to areas where it can most effectively support imaging departments. Virtual remote imaging services enable a technologist located offsite to access a remote advanced imaging modality, either to support onsite staff while they conduct the exam[1] or perform the examination themselves.[2]

Virtual remote imaging services are intended to enhance accessibility and efficiency in diagnostic imaging, by leveraging technology to bridge gaps in health care delivery. This includes tackling lengthy backlogs for imaging examinations and expanding the availability of qualified MRTs in some locations.[2-4] Virtual remote imaging services have the potential to enhance equitable access to imaging services, particularly in rural and remote settings.[2-5] These services also support environmentally sustainable care by helping to reduce travel and cutting emissions by minimizing the need for in-person consultation.[6-8]

Although the technology promises many benefits, its potential may be constrained by implementation challenges that may be different within and between hospitals, regions, provinces, and countries. Understanding the experiences of those who have used the technology can provide valuable insights into the potential application of virtual remote imaging services in Canada and help identify effective strategies for its implementation. Anticipating challenges and learning from past experiences is essential for evaluating viability of virtual remote imaging services in Canada and providing effective solutions for its successful deployment.

## Objective

This report summarizes information on virtual remote imaging services. The key objectives are as follows:

- to describe the technology
- to report on the extent of its use in Canada
- to outline the main implementation considerations
- to identify the main benefits and challenges.

## Methods

An information specialist conducted a literature search on key resources, including MEDLINE and Embase, through Ovid, the Cochrane Database of Systematic Reviews, the International HTA Database, the websites of Canadian and major international health technology agencies, as well as a focused internet search. The search approach was customized to retrieve a limited set of results, balancing comprehensiveness with relevancy. The search strategy comprised both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords. Search concepts were developed based on the elements of the research questions and selection criteria. The main search concepts were diagnostic

imaging (CT and MRI) and remote software platforms and suites. The search was completed on April 11, 2024, and limited to English-language documents published since January 1, 2019.

In addition, we received some informal feedback from early users of this technology as well as feedback from others who are considering implementing it.

# Results

## The Technology

Virtual remote imaging services refer to the practice of imaging examinations being completed or supported by an MRT who is located at a different site (offsite) from the patient and imaging control room (onsite).[2,4,9] The offsite remote MRT can connect with the onsite MRT, as well as with radiologists, through live video, audio, and chat functions, and can be given complete control or read-only access.[1] The offsite remote MRT can view the patient through a camera in the control room, although MRI-safe in-room cameras have been noted as a potential improvement.[10]

The offsite MRT can remotely access an imaging modality using special software and by using workflows to help facilitate safe care coordination. This technology requires the availability of the scanners at the sites where the exams are conducted.

The software may enable an offsite remote MRT to virtually connect to a CT, MRI, PET-CT, SPECT-CT, or SPECT imaging unit in a different location to provide support in 2 main ways:[2,4,11-13]

- to perform examinations with assistance from onsite MRTs
- to support onsite MRTs by reviewing and adjusting optimal imaging techniques and ensuring patient care. Supportive assistance for onsite MRTs may include assistance in the following ways:
    - patient positioning
    - exam protocols
    - imaging acquisition parameters.

Informal feedback from users in Canada indicates that virtual remote imaging services could potentially assist with image postprocessing and reformatting, which may help to reduce turnaround times between exams, particularly for CT scans.

Virtual remote imaging services is a teleradiology tool that enables continuous access to imaging services by offering either full-time support or coverage during periods of limited staffing, such as evenings and weekends. Virtual remote imaging services can be performed by a remote operator at home, at an office, or at an imaging hub.[4,14] However, through informal feedback, the exam would likely need to be conducted from a radiology department to align with existing operational and credentialing requirements in some Canadian jurisdictions. Typically, offsite remote MRTs are highly experienced and can support less experienced onsite staff by sharing their expertise and providing on-the-job training.[2,4,11,13]

Although the software could potentially allow offsite staff to remotely monitor up to 3 scanners at a time,[2] informal feedback from 1 user suggests that, in practice, they would monitor no more than 2 scanners simultaneously and only those of the same imaging modality (i.e., offsite staff will not be able to provide MRI and CT support concurrently) to ensure safe operation. Concerns have been raised regarding patient safety when multiple patients are scanned at once because reduced focus on each patient could increase the risk of medical incidents and the need for follow-up care. Additionally, managing multiple scans simultaneously could introduce unforeseen challenges and complexities.[12]

## Use in Canada

The syngo Virtual Cockpit (Siemens Healthineers AG) was approved by Health Canada for advanced imaging in 2024. In the US, the FDA has provided 510(k) clearance for at least 2 systems, including the Digital Expert Access with Remote Scanning (GE Healthcare) in 2023[15] and the syngo Virtual Cockpit (Siemens Healthineers AG) in 2024.[16]

At least 1 site in Canada is piloting a virtual remote imaging service. The Royal Columbian Hospital in British Columbia has launched a pilot program using remote virtual software for CT exams, with plans to expand to MRI in the future.[1] Manitoba is preparing to implement virtual remote imaging technology, starting with CT in a hospital in Swan River and then implementing the system with a mobile MRI unit. Virtual remote imaging services is in the final steps of approval within Manitoba's provincial accrediting body, the Manitoba Quality Assurance Program (Dr. Stephen Ying, Provincial Lead, Imaging Services, Shared Health Manitoba, Winnipeg, MB: personal communication, Jan 27, 2025).

## Implementation Considerations

When considering the implementation of virtual remote imaging services, there are several factors decision-makers may wish to consider that can impact the successful adoption of the technology. These factors include both human elements and technology-related considerations, some of which are outlined here.

## Staff Acceptability

Although there were no Canadian studies available, research from other countries about staff acceptance of new technologies has been published. For instance, when employees feel assured that these tools are intended to assist them rather than replace them, there is increased willingness to embrace the technology.[12] At the same time, if a new technology raises concerns about job security or alters the scope of existing roles and responsibilities, staff may respond with skepticism or resistance. Similarly, the perceived usefulness of a technology also influences the successful adoption and implementation of new systems.[10]

- A 2022 study from the UK revealed that acceptance of virtual remote imaging services among radiology staff was variable and considered most valuable for remote supervision and training. While the perceived ease of use of the virtual remote imaging services was high, it had little impact on the staff's overall intention to use the technology. In contrast, perceived usefulness was lower but showed a stronger correlation with both attitudes toward and the intended use of virtual remote imaging services.[10]

- According to results of the American Society of Radiologic Technologists 2023 Professional Workforce Survey, which was conducted to gauge medical imaging professionals' knowledge and beliefs about remote imaging, 71% of technologists did not feel comfortable managing imaging examinations remotely.[17] This discomfort stemmed from uncertainty regarding their roles, as well as a lack of clarity around responsibilities and scope of practice within the context of remote imaging.[17]

## Communication

Clear and effective communication among onsite and offsite team members is imperative to the successful implementation of virtual remote imaging services because it can directly impact patient care. Similarly, good communication between health care providers and patients has the potential to improve the coordination of care and increase patient satisfaction.[2,4,5,9,18,19] Some suggested strategies to facilitate communication include:

- Provide secure and reliable communication channels between staff and ensure these meet privacy requirements.[5,9]
- Establish common terminology to use among the onsite and offsite teams to ensure that operations are carried out smoothly and to help to reduce the likelihood of misunderstandings.[18]
- Ensure that offsite MRTs do not feel disconnected from patients due to the lack of direct communication or in-person contact with them. It has been reported that onsite staff often need to facilitate communications by relaying messages between offsite MRTs and patients.[10,20]
- Limit multitasking. Communicating across 3 scanners simultaneously can introduce multitasking challenges. Multitasking can reduce efficiency and increase the likelihood of errors because focus is divided across several tasks.[20]

According to a study that reported on the implementation of these services, the successful deployment of this technology can be improved by effectively communicating changes to policies, notifying staff about new procedures, and clarifying the setting in which the policies should be applied (i.e., remote or onsite).[12]

## Licensing and Credentialing

In Canada, the regulatory landscape for MRTs can be complex.[9] All jurisdictions with their own regulatory bodies for MRTs have independent licensing, insurance, and practice requirements. This can create challenges for MRTs working remotely or across multiple jurisdictions.[9,21] Some key points to consider regarding the licensing and credentialing process for offsite MRTs include the following:

- There is a national certification process in place for MRTs in Canada, but licensure, scope, and standards of practice are set at the provincial level.[9]
- Offsite MRTs working in different provinces or remotely for multiple jurisdictions may need to obtain licensure, association membership, and/or certification in each jurisdiction where they practice.[5,9]
- In some instances, MRTs supporting multiple hospitals may require site-specific credentials.[5,9]
- The need for multiple licences and credentials across jurisdictions can act as a significant barrier to entry, limiting the ability of MRTs to engage in cross-jurisdictional remote scanning.[21]

The Canadian Association of Medical Radiation Technologists (CAMRT) is establishing a task force to develop a strategy to address remote scanning within the Canadian medical imaging context.[22]

## Coordination of Care

Seamless coordination between onsite and offsite MRTs is required to ensure optimal patient care. Revising or developing new policies for virtual remote imaging services may help to outline responsibilities, accountabilities, roles, and patient safety considerations.[12,20] Specific areas to consider may include:[12]

- equipment safety
- modality-specific handling instructions (e.g., MRI coils)
- patient screening
- patient preparation and positioning
- emergency protocols and actions
- emergency stop procedures at the console
- virtual technology access procedures
- patient privacy.

## Access to Services

Ensuring equitable access to medical imaging services is essential for addressing health care disparities. Currently, 20% of MRI units in Canada are located in rural and remote settings.[23] Further expansion of advanced imaging equipment to these settings would be required for the benefits of virtual remote imaging services to be more broadly realized.

For health care facilities in provinces and territories that rely on charitable funding for imaging equipment,[24] local communities would need to raise funds for new equipment procurement and installation, which may be challenging in the current environment of competing health care priorities, changing community needs, and a shrinking donor pool. Jurisdictional health authorities would also need to support the expansion of advanced imaging modalities to new locations. The decision to do so is typically guided by criteria that may include:[24]

- increased patient volume
- travel distance
- health human resources
- cost considerations
- infrastructure to support equipment
- changes in patient demographics
- government priorities.

Achieving broader access to these services would require a collaborative effort across multiple levels of government as well as community support.

## Service Quality

Quality assurance protocols, and adherence to them, may vary from province to province, facility to facility, and in some instances from department to department. Virtual remote imaging services would require compliance to standardized protocols among all participating hospitals. Implementing protocols and ensuring compliance may be time consuming and complex.[5] According to informal feedback from 1 user that tested virtual remote imaging services, not all sites implemented a continuous quality assurance program.

The delivery quality of virtual remote imaging services also relies on effective collaboration between onsite and offsite MRTs, as well as the performance of the MRT conducting the examination. The relationship between the onsite and offsite MRTs may vary across sites. To maintain consistency, regular mandatory training and blind audits are 1 strategy to consider to standardize performance.[4]

## Technological and System Integration Factors

Virtual remote imaging services is dependent on a variety of system integration and telecommunication networks (e.g., satellite, internet, mobile phones) to transmit images and data from 1 location to another. There are numerous technological factors that should be considered for the successful implementation of virtual remote imaging services. These may include the following:

- **IT capabilities:** Robust network infrastructures with bandwidth that supports high-resolution imaging data transfers. Large imaging files must be transmitted without degradation of image quality. This involves considerations of VPN protocols, storage capacity, and ensuring sufficient data transfer speeds.[5,9,19] In rural and remote settings, internet services are not always available to everyone, and these services may be unstable.[25]
- **Privacy and security:** Safeguarding patient data will require strong security measures at every stage of the data transmission process, from image capture to storage. Access controls will also need to be implemented to ensure that only authorized staff have access to sensitive patient information to maintain confidentiality and compliance with privacy regulations.[2,4,5,9,18,19]
- **Interoperability of systems:** Different imaging sites may use a variety of technologies, systems, and software. This can create challenges in ensuring that remote staff can access patient information and medical images seamlessly. Systems must be compatible to allow for smooth integration and data exchange across platforms.[5]
- **Network emergency protocols:** Imaging sites must have clear emergency protocols in place to address potential network disruptions. This is particularly critical in the event of internet service failures or network issues during live scans because this could compromise the quality of care or delay critical diagnoses.[9,19]
- **Image management:**
  - Reliable image handling: Secure and effective image management systems are essential for remote scanning. These systems must meet industry standards, such as Digital Imaging and Communications in Medicine (DICOM), to ensure proper handling, storage, transmission, and printing of medical images and metadata.[5,9]

- Maintaining image quality: Transmitting high-quality medical images over long distances requires reliable systems that can preserve image integrity during transmission, minimizing the risk of distortion or loss of diagnostic value.[5,9]

## Compensation

Consideration would need to be given to how virtual remote imaging services operate across multiple employment locations and employers, each with varying policies, compensation packages, liability coverages, and union agreements.

Equitable compensation may also be a consideration for MRTs who monitor multiple scans at a time.[12] At 1 site in the US, a US$20 per hour bonus was provided to MRTs reviewing up to 3 examinations simultaneously. The bonus was reported to help increase enthusiasm for adopting the virtual remote imaging services and contribute to increased job satisfaction.[12]

# Benefits and Challenges of Virtual Remote Imaging Services

The effective implementation of virtual remote imaging services may yield numerous benefits, helping to address gaps in health care delivery that contribute to wait times and staffing challenges. However, these benefits are contingent on the presence of imaging equipment onsite; facilities without CT or MRI units cannot leverage the technology.[26] Some commonly cited potential benefits and challenges of virtual remote imaging services are outlined in Table 1.

### Table 1: Potential Benefits and Challenges of Virtual Remote Imaging Services

| Potential benefits | Potential challenges |
|---|---|
| **Patient care** | |
| Improves diagnostic accuracy by enabling specialist MRTs to guide or conduct exams, leading to better treatment outcomes for patients.[10]<br>Expands advanced imaging skills for specialties such as cardiac, breast, and prostate exams in remote areas, according to informal feedback from 1 user.<br>Enhances patient experience by allowing onsite MRTs to engage with patients while the offsite MRT conducts the procedure.[12] | Remote imaging may limit direct interaction between technologists and patients, potentially affecting the patient experience and reducing opportunities for immediate reassurance or adjustments during scans.[19]<br>Without direct, onsite supervision, inconsistencies in image acquisition may arise, particularly if local staff require guidance on complex scans.[27] |
| **Staffing** | |
| There is a shortage of skilled MRTs, especially for complex exams such as cardiac scans, which often require patient transfers to specialized facilities[12,14] of which there are only a limited number.[12]<br>Recruiting and retaining trained MRTs is difficult, particularly in remote areas with limited resources, and virtual remote imaging services can help overcome this limitation.[12]<br>According to informal feedback provided by 1 user, virtual | Staffing challenges are more pronounced in rural and remote imaging departments, where it is harder to fill MRT positions.[28,29] Without adequate staffing in these areas, the benefits of virtual remote imaging services may be limited.<br>Effective remote oversight requires strong trust between offsite and onsite staff, which can be difficult to establish when there is limited interaction.[10]<br>Some imaging departments with weekend and evening services |

| Potential benefits | Potential challenges |
|---|---|
| remote imaging services could allow skilled offsite MRTs to support remote operations during off-peak hours, such as evenings and weekends. This would reduce onsite staffing needs, which would allow them to focus on more complex exams during the day, enhancing both staff well-being and service efficiency. | face staffing shortages, leading to burnout and recruitment challenges.[30,31] This is particularly relevant for virtual remote imaging services because requiring after-hours shifts may make it harder to recruit skilled offsite MRTs for these times. |
| **Training opportunities** | |
| Offers staff the chance to learn from highly qualified MRTs, expanding their exposure to different practices and expertise.[11,32]<br>Supports junior MRTs by allowing them to gain experience with complex exams under the guidance of skilled professionals, boosting their confidence and capabilities.[4] | Real-world interaction may be important for skill development, and an absence of it may limit the learning experience.<br>If expert MRTs are unavailable (e.g., due to workload), real-time training and troubleshooting may be delayed, reducing the effectiveness of virtual learning.[11,33] |
| **Mitigation of service disruptions** | |
| Sustains essential imaging services during public health emergencies. Virtual remote imaging services helped minimize disruptions to MRI and CT services during the COVID-19 pandemic by reducing the need for onsite staff and minimizing the risk of virus transmission.[11,32]<br>Ensures service continuity during periods of staff illness or self-isolation, allowing imaging services to continue even when staffing is low.[10] While onsite staff are needed to provide services, virtual remote imaging services may help to minimize disruption.<br>Addresses postpandemic backlogs and delays by expanding access to services.[6] | Patient safety during system failures or connectivity loss will need to be secured.[34]<br>Dependence on stable internet connections means that network failures or cybersecurity threats could disrupt imaging services.[34]<br>Without clear protocols and contingency plans in place, interruptions to remote imaging could result in diagnostic delays.[34]<br>If complications arise during an exam, onsite MRTs must manage the situation without direct support from remote specialists.[34] |
| **Supporting equitable access to services** | |
| Mitigates service disparities, especially in rural and remote areas with limited access to health resources.[5,9,18,19]<br>Reduces the need for patient travel or transfer to larger sites, particularly for patients with high priority, such as people who have had a stroke.[5,9,18,19]<br>Expands access to specialized imaging and expertise, allowing smaller or underserved facilities to offer more services.[4]<br>Supports standardization of imaging practices, improving system efficiency and consistency in patient care.[35] | Rural and remote communities often face limited access to high-speed internet and reliable connectivity, which are essential for the delivery of virtual remote imaging services. Inadequate internet infrastructure can hinder the effective delivery of remote imaging services, which may cause delays, service disruption, or result in poor image quality.[36] |

## Conclusion

The increasing demand for medical imaging in Canada emphasizes the need for innovative solutions. Evidence suggests that, when leveraged effectively, virtual remote imaging services has the potential to optimize resource use, broaden access to diagnostic imaging, and enhance patient outcomes, particularly in rural and underserved regions. Fundamentally, the successful integration of virtual remote imaging services

depends on the availability of imaging equipment in underserved areas because facilities without adequate CT or MRI units or sufficient staffing will be unable to fully utilize the technology.

Concerns also remain regarding issues such as MRTs multitasking across multiple scanners, as well as communication challenges between onsite and offsite MRTs, both of which could reduce efficiency and increase the risk of errors. Additionally, navigating licensing and credentialing across jurisdictions, along with ensuring secure, uninterrupted high-quality image transmissions, presents further obstacles. While virtual remote imaging services could help bridge gaps in areas with limited specialized expertise, its advantages must be weighed against the challenges involved in implementation.

Although virtual remote imaging services have yet to experience widespread adoption in Canada, pilot programs — such as the program at Royal Columbian Hospital in British Columbia — could provide valuable insights into how this technology could improve the sustainability and efficiency of medical imaging services in specific settings.

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