

Review Article

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Roadmap of Portable MRI Implementation in a Northern Canadian Setting - Lessons Learned from the Moose Factory Experience

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Objectives

1. Review the potential benefits of portable MRI use in a Northern Canadian setting.
2. Describe the challenges of portable MRI implementation in a resource-limited Canadian healthcare environment.
3. Provide guidance to portable MRI implementation at other Canadian and international sites.

Discussion

Portable MRI has been recently shown to be feasible in a remote Canadian setting. Portable MRI can be successfully implemented in remote communities as it requires limited resources to meet the local capacity for imaging under the developed workflows, can be housed and operated in a low-cost environment, can capture MR images of patients that are of sufficient quality, and has the ability to transfer images to radiologists who typically may be offsite [1].

A recent publication has shown Portable MRI to be economically viable in a remote Canadian setting. In fact, the financial savings to the healthcare system are substantial over a 5-year time period, largely due to patient transportation costs averted. The cost analysis of portable MRI implementation in Moose Factory Ontario, a remote Canadian community, showed savings of \$7,835,162 over 5 years for the implementation of the portable MRI [1].

There are a multitude steps to successful implementation of Portable MRI in a northern Canadian setting. These can be divided in 4 phases: i) Planning phase, ii) Approvals and Communication phase, iii) Launch phase, and iv) Operations phase.

Challenges were encountered during each of the aforementioned phases of Portable MRI in Moose Factory. We discuss the solutions to these challenges, leading to a successful implementation.

Weeneebayko Area Health Authority (WAHA) provides health services to approximately 12,000 predominantly Indigenous people, along the James Bay and Hudson Bay coastal regions, one of the most remote areas within Ontario, with none of the communities having road access. Weeneebayko General Hospital (WGH) has access to CT and ultrasound imaging onsite, however there is no MR imaging available. Currently, patients requiring MRI are transported via daily charter flights bringing patients 841

km (522 miles) from WGH to Kingston Health Sciences Centre (KHSC) in Kingston, Ontario (Figure 1).



Transportation of patients from a remote setting is complex and is associated with a substantial increase in risk [2, 3]. The ability to perform cerebral imaging locally would reduce such risks.

Up until recently, the technology for portable MRI has not existed. Health Canada has recently provided licensing for a portable, POC low field (0.064T) MRI that is capable of producing images for a number of neurological indications [4]. The portable MRI has been used in academic centers throughout the United States as of 2019 and in COVID intensive care units for cerebral imaging [5, 6]. In 2021, portable MRI has also been successfully deployed to a low resource setting in Malawi [7].

We can divide a successful Portable MRI project implementation into several distinct phases, which include a) Planning Phase, b)

Approvals and Communication Phase, c) Launch Phase, and d) Operation Phase.

In the Planning phase, the first step required was to obtain an Agreement in Principle to conduct the project. It is important to devote sufficient time to build the team, which in our case included Queen's University Department of Diagnostic Neuroradiology, Neuroradiology, Faculty of Health Sciences Decanals office, WAHA leadership, Hyperfine, and Information Technology (Kingston Health Sciences Centre).

Discussions on financing are relevant with consideration of funding options to include in-kind donation by the industry partner, study grants, research award(s) etc.

Development of a Statement of Works is crucial to outline the individual and shared responsibilities of all parties.

Finally, discussion on transportation planning is relevant, given the installation in remote communities across Canada, all of which have unique challenges.

The Approvals and Communication phase requires ethics approval, including description of Indigenous specific ethics requirements. It is vital to develop a close relationship early on with the local community, Indigenous elders, and local decision makers. Guidance from this group of stakeholders is essential in a successful implementation and to allay any concerns from the local constituents. Identification from amongst this group of a project champion would also be valuable. Local referring physician & technologist buy-in is required to ensure a successful launch, and importantly quality and sustainability.

The Launch phase involves training of the operators, interpreting physicians (neuroradiologists), and other users. A clear understanding of the usage volumes is key. This will be important for the local institution to develop a human resource staffing budget for operation of the portable MRI. Ideally, a single storage location for the portable MRI unit should also be identified, on order to maintain consistency and security.

During the Operation phase, a results communication pathway would need to be implemented that is efficient and rapid. Operational expenses would need to be calculated and built into the local institution annual budget. Consideration would be required for ensuring timely software and hardware upgrades as necessary, and as suggested by the manufacturer. All patient information data generated from the operation of the portable MRI unit would have to be stored securely, in line with all provincial and national regulations for health information storage.

Conclusion

Lessons learned from the Moose Factory experience outline a roadmap of portable MRI implementation in northern Canadian Settings. Recent studies have shown the benefits of portable MRI use in a Northern Canadian setting. This review describes the challenges of portable MRI implementation in a resource-limited Canadian healthcare environment and provides guidance to successful portable MRI implementation through the stepwise approach of four distinct phases at other Canadian and international sites.

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