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POSITRON EMISSION TOMOGRAPHY IN QUÉBEC

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English summary of the original French report submitted to the

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Agence d'évaluation des technologies et des modes d'intervention en santé

MISSION

To support the *Ministre de la Recherche, de la Science et de la Technologie* and Québec's public health system decision-makers, namely the *Ministère de la Santé et des Services Sociaux,* through the assessment of technology and methods of intervention in health issues, notably the assessment of their effectiveness, safety, cost and cost-effectiveness, as well as ethical, social and economic implications.

To support the *Ministre de la Recherche, de la Science et de la Technologie* in the development and implementation of scientific policy.

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POSITRON EMISSION TOMOGRAPHY IN QUÉBEC

Positron Emission Tomography (PET) is a non-invasive medical imaging technology. Unlike most other medical imaging technologies, which provide mainly anatomical information, PET makes it possible to track metabolic activity in the tissues and to locate lesions.

Originally a research tool, PET is increasingly used in clinical settings, and most public and private health insurers are looking into reimbursing patients who receive PET scans.

With this in mind, the Fédération des médecins spécialistes du Québec (FMSQ) and the Conseil québécois de lutte contre le cancer (CQLC) asked the *Agence d'évaluation des technologies et des modes d'intervention en santé* (AÉTMIS, the Québec government agency responsible for health services and technology assessment), to assess the value of introducing PET for clinical use in the province, which already has two PET facilities, mainly devoted to research.

AÉTMIS discovered that, while the list of clinical applications of PET continues to grow, formal assessments of the technology's efficacy and cost-effectiveness have been somewhat curtailed by a lack of persuasive data. In spite of these limitations, PET has a number of recognized clinical applications in oncology, neurology and cardiology, with several other potential or unrecognized uses (due to incomplete or non-existent data) in these fields as well.

The data nevertheless appear sufficient to recommend the introduction of PET in Québec for certain clinical applications. A ministerial master plan should be developed to supervise deployment of the technology, taking into account the clinical needs of the public and the specialized human and material resources required. Furthermore, deployment should be accompanied by research, training and testing activities, and should be carried out in close collaboration with universities and university hospital centres.

With this assessment, the Agency wishes to provide the best possible information to the policymakers concerned with this problem at various levels of the Quebec health services network.

Renaldo N. Battista
President and CEO

SUMMARY

Report context and objectives

This report was undertaken at the joint request of the Fédération des médecins spécialistes du Québec (FMSQ) and the Conseil québécois de lutte contre le cancer (CQLC) to assess the clinical efficacy of a medical imaging technology known as Positron Emission Tomography, or PET. Over the past decade, use of PET technology to diagnose, treat and follow up on certain medical conditions has increased significantly. The *Agence d'évaluation des technologies et des modes d'intervention en santé* (AÉTMIS, the Québec government agency responsible for health services and technology assessment) agreed to: a) gather appropriate data on current clinical use of PET technology in the fields of oncology, neurology and cardiology, and b) draw up recommendations on the deployment of PET in Québec. In fulfilling this mandate, AÉTMIS was supported by an advisory committee made up of representatives of the FMSQ, the CQLC and the Ministère de la Santé et des Services sociaux (MSSS), as well as other health technology assessment experts. It is important to note that this report assessed clinical uses of PET only, not its research applications.

Positron Emission Tomography (PET)

Introduced in research in the mid-'70s, PET differs from other medical imaging technologies in that it allows metabolic activity in tissues and blood flow to be observed. To conduct a PET scan, a radiopharmaceutical carrying a positron-emitting isotope is administered to the patient. For instance, FDG (fluorodeoxyglucose), the substance most commonly used in PET scans, contains a radioactive isotope called Fluorine-18. These isotopes are produced by particle accelerators, or cyclotrons. Data obtained from the detection of photons generated by the release of positrons into the body tissue are fed into a computer and, through a complex imaging process, are used to reconstruct three-dimensional images.

Most of the isotopes used in PET have a short half-life (for example, from two minutes for Oxygen-15 to 110 minutes for Fluorine-18). Facilities offering PET scans must therefore be equipped with a cyclotron, or must be located sufficiently close to one, to allow the products to be transported in a reasonably short period of time.

Québec already has two PET centres, each with a cyclotron, at the Montreal Neurological Institute (MNI) and at the Centre hospitalier universitaire de Sherbrooke (CHUS). These facilities are primarily used for research purposes. Compared with other industrialized nations, Québec has an average number of PET facilities per capita. The only other provinces with PET facilities are Ontario and British Columbia.

Methodology

To complete this study, AÉTMIS gathered and synthesized relevant data on the clinical efficacy of PET technology. The assessment was based on data from reports published by assessment agencies, reports from organizations issuing recommendations on PET scan reimbursements, and publications following these reports, selected according to criteria adapted from proven protocols.

As was the case for several other medical imaging technologies, clinical applications of PET were

started before the efficacy and efficiency of the technology in such contexts had been properly demonstrated. Areas of possible application for PET continue to grow as the research advances. Furthermore, the rapid pace at which the technology is being improved makes it difficult to gather appropriate data for assessment purposes. The list of potentially effective clinical applications is growing constantly. The use of PET technology is developing alongside a panoply of other medical imaging technologies that are also evolving very rapidly, although these were not the subject of this assessment report.

Clinical utility of PET

The study conducted by AÉTMIS confirms the clinical utility of PET in several areas of oncology, neurology and cardiology. In oncology, PET has proven useful for a number of specific applications in cases of lung cancer, colorectal cancer, melanomas, head and neck cancers and lymphomas. Depending on the type of cancer involved, PET can help diagnose, find metastases and follow up on treatment. In neurology, PET has proven to be particularly valuable in cases of epilepsy and brain tumours. In cardiology, the technology may be used to study myocardial viability and perfusion. PET also has a rich potential for other uses in all three clinical areas.

There are very little data on the efficiency of PET technology; for example, partial data for cases of non-small-cell lung cancer. That is why modelling was done for applications linked to that type of cancer, as well as those aiming to assess myocardial viability. This modelling suggests that PET would be cost-effective in such cases.

Potential areas for the use of PET in Québec

As the list of recognized or potential uses for PET is continually growing, it is difficult to accurately assess the number of patients who stand to benefit from the technology in Québec. Following discussions within the advisory committee, a preliminary estimate of the number of scans required per year has been set at around 15,000 or more. According to this estimate, the clinical needs appear sufficient to justify deploying PET for specific applications in oncology, cardiology and neurology.

These estimated needs could only be met in a gradual manner. In current operating conditions, deployment of PET technology would require from 10 to 12 scanners, fed by three or four cyclotrons (including the two that are already up and running). According to the implementation scenarios analyzed, the overall costs of deploying additional PET resources would range from tens of millions of dollars to over a $100 million.

Gradual deployment is also imperative, since specialized human and material resources are required to operate a PET centre. Currently in Québec, there are not sufficient human resources trained in PET technology to support the intended deployment strategy. Personnel training should therefore be a top priority.

A ministerial master plan should regulate the deployment of PET technology, taking into account the clinical needs it serves, as well as the specialized human and material resources (both existing and future) that it requires.

Recommendations

Deployment

- Since PET has recognized efficacy in several areas of oncology, cardiology and neurology, it would be appropriate to promote and support its deployment for clinical purposes in Québec's public health care system.
- PET scans should be offered primarily in areas where they have recognized clinical efficacy. These applications should be periodically reviewed, as new evidence become available.

Modes of deployment

- A master plan for PET deployment should be prepared by the MSSS.
- This plan should quantify the needs of the population in terms of PET scans. These needs should also be assessed in relation to optimizing other existing technologies, and in light of the human and material resources required to deploy PET technology. The plan should therefore be prepared in collaboration with existing PET centres and different stakeholders in tertiary care settings.
- The plan should account for the fact that deployment of PET for clinical purposes should include research into promising applications, the efficacy and cost-effectiveness of which have yet to be demonstrated.
- Since this plan should include a component to assess the efficiency of PET while it is being deployed for clinical purposes, deployment should be carried out in close collaboration with universities and teaching hospitals.