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Joint project of the international network of agencies for health technology assessment—Part 1: Survey results on diffusion, assessment, and clinical use of positron emission tomography

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Objectives: The International Network of Agencies for Health Technology Assessment (INAHTA) has been tracking activities associated with the clinical use of positron emission tomography (PET) in its members' healthcare systems since 1997 and published its first Joint Project report on PET in 1999. Part 1 of this Joint Project report presents survey results on diffusion, assessment activities, and policy for clinical use related to PET among INAHTA members since 1999.
Methods: INAHTA members were surveyed in 2003–2004.
Results: Twenty-seven INAHTA agencies (69 percent response rate) from nineteen countries responded to the survey. Dedicated PET systems are the most universally installed systems to date. Mobile scanners and modified gamma cameras are used occasionally as lower cost alternatives, and interest in PET–computed tomography hybrid models is rising despite limited assessment of impact on service planning. PET was used and assessed most commonly for managing patients with cancer. All respondents reported having some form of public funding for clinical PET frequently linked to data collection for the purpose of gathering evidence to refine clinical use and guide resource allocation toward indications that maximize clinical and cost-effectiveness.
Conclusions: The use of HTA within a continuous quality improvement framework can help optimize scarce resources for evaluation and use of high cost diagnostic technologies such as PET, particularly where potential clinical or cost-effectiveness is considerable but conclusive evidence is lacking.

Keywords: Positron emission tomography, Tomography emission computed, Technology assessment, Health policy, Diffusion of innovation

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Positron emission tomography (PET) is an example of a costly, popular, and potentially beneficial diagnostic imaging test that has been introduced rapidly into health care often without definitive evidence of clinical or cost-effectiveness. As healthcare systems struggle to manage the introduction and use of diagnostic imaging modalities in clinical care, many use health technology assessment (HTA) to help define the clinical benefits of these technologies and direct policy for clinical use and research within the context of improved health outcomes, limited healthcare resources, and patient focus.

Several HTA agencies within the International Network of Agencies for Health Technology Assessment (INAHTA) have assessed the scientific evidence of PET's clinical utility for the purpose of informing purchasing and reimbursement decisions, research policy, and clinical utilization within an evidence-based framework. INAHTA established a Joint Project on PET scanning in 1997 to synthesize information on the diffusion, evaluation, and policy implementation of PET in healthcare systems represented by its members. INAHTA Joint Projects are collaborations among member agencies to evaluate medical technologies of mutual interest. The first Joint Project report on PET was produced in 1999 (1).

Since then, both INAHTA's membership and interest in PET have continued to expand along with the need to carefully manage the technology's diffusion into clinical care with increasingly scarce healthcare resources. As a result, INAHTA sought to update its first Joint Project report by again surveying membership on diffusion, assessment, and policy for clinical use of PET. To supplement the survey results, INAHTA sponsored a pre-conference workshop at the first scientific meeting of Health Technology Assessment International in Krakow, Poland, in June 2004 entitled: *Strategies for Managing the Diffusion of High Cost Diagnostic Technology—the Case of PET Scanning* (2). The objectives of the workshop were to expand discussion on the role of HTA in and present a range of policy implementation strategies for managing the diffusion of PET.

Part 1 of the INAHTA Joint Project on PET presents the survey results. Part 2 presents and summarizes the proceedings of the workshop, emphasizing the use of HTA to guide policy strategies for managing the diffusion of PET in clinical care within local contexts (unpublished data, 2005).

METHODS

In June 2002, the INAHTA Executive Board, represented by Elizabeth Adams of the Veterans Health Administration Technology Assessment Program (VATAP) in the United States (US), sought expressions of interest from member agencies in updating its 1999 INAHTA Joint Project on PET (1). Officers from the Australian Department of Health and Ageing (DHA) volunteered to coordinate a new survey looking at PET utilization and HTA within INAHTA member countries.

DHA's involvement in a new survey was seen as a useful adjunct to its existing PET program. Since 1999, DHA has been actively engaged in developing public funding policy for PET, informed by PET HTA conducted by Australia's Medical Services Advisory Committee (MSAC), the body that advises the Federal Minister for Health and Ageing on evidence relating to new medical technologies and procedures.

DHA Officers, Ms. Adams, and representatives of the Centers for Medicare and Medicaid Services (CMS) in the United States and the Canadian Coordinating Office for Heath Technology Assessment (CCOHTA) jointly developed the survey instrument. All INAHTA agencies were surveyed in January 2003 using INAHTA's electronic listserv. Follow-up requests were made in April 2003, September 2003, and March 2004 to nonrespondents.

RESULTS

Twenty-seven INAHTA agencies in nineteen countries responded to the survey, representing a 69 percent response rate, including four agencies who replied with no involvement in PET scanning ("nil") (Table 1). The National Association of Statutory Health Insurance Physicians Department of HTA (NASHIP) provided data for Germany on behalf of the German INAHTA agency DAHTA@DIMDI. Responses from the Swedish HTA agencies (SBU and CMT) were addressed by the PET Centre at Uppsala University Hospital, the Karolinska Hospital Departments of Radiology and Nuclear Medicine, and University Hospital Department of Oncology in Lund. Responses for Canada were provided by CCOHTA and AHFMR.

The wide timeframe over which responses were received, along with the lack of detail in some responses, made it difficult to construct a definitive "snapshot" of the situation at a single point in time. The survey information, therefore, provides a general overview of PET diffusion and evaluation of the period from early 2003 to early 2004 based on a range of anecdotal responses. Tables 2 through 4 summarize the key survey results.

Diffusion of PET

Members reported the number and type of PET scanners in clinical use in their country, region, or local health system; the survey considered dedicated PET scanners, PET–computerized tomography (PET-CT) hybrid scanners, and gamma cameras modified for coincidence detection (Table 2). The majority of models in use were dedicated scanners, and most were situated in the public sector. Use of mobile scanners and modified gamma cameras as a lower cost alternative to traditional PET scanning was reported anecdotally.

INAHTA members reported an average of 16.4 dedicated PET scanners (range, 2–80 scanners; median, 9.5 scanners) per country, region, or health system and 0.65 scanners per

Table 1. INAHTA PET Survey 2003/2004: List of Respondents (as of June 2004)

Country	International Network of Agencies for Health Technology Assessment (INAHTA) member
Australia	Medical Services Advisory Committee (MSAC)
Austria	Health Technology Assessment Unit of the Institute of Technology Assessment, Austrian Academy of Sciences (ITA)
Belgium	Belgian Knowledge Centre for Health Care (KCE)
Canada	Canadian Coordinating Office for Health Technology Assessment (CCOHTA)
	Alberta Heritage Foundation for Medical Research (AHFMR)
Denmark	Danish Centre for Evaluation and Health Technology Assessment (DACEHTA)
Finland	Finnish Office for Health Care Technology Assessment (FinOHTA/STAKES)
France	Comité d'Évaluation et de Diffusion des Innovations Technologiques (CEDIT)
Germany	DAHTA@DIMDI represented by National Association of Statutory Health Insurance Physicians (NASHIP), Department of HTA
Israel	Israel Center for Technology Assessment in Health Care (ICTAHC)
New Zealand	New Zealand Health Technology Assessment (NZHTA)
Norway	Norwegian Centre for Health Technology Assessment (SMM)
Spain	Agency for Health Technology Assessment, Madrid (AETS)
	Andalusian Agency for Health Technology Assessment, Seville (AETSA)
	Catalan Agency for Health Technology Assessment and Research, Barcelona (CAHTA)
	Coordinación de la Unidad de Evaluación de Tecnologías Sanitarias, Madrid (UETS)
Sweden	SBU and CMT represented by PET Centre at Uppsala University Hospital; Karolinska Hospital Depts. of Radiology and Nuclear Medicine; University Hospital, Lund, Dept. of Oncology (Lund)
The Netherlands	College voor zorg Verzekering (CVZ)
	Netherlands Organisation for Health Research and Development (ZonMw)
United Kingdom	NHS Quality Improvement Scotland (NHS QIS)
	National Coordinating Centre for Health Technology Assessment (NCCHTA)
USA	Veterans Administration Technology Assessment Program (VATAP)
Nil responses:	
Chile	Health Technology Assessment Unit, Chilean Ministry of Health (ETESA)
France	French National Agency for Accreditation and Evaluation in Healthcare (ANAES)
Scotland	Institute of Applied Health Sciences (IAHS)
Switzerland	Medical Technology Unit / Federal Social Insurance Office Switzerland (MTU/FSIOS)

1 million people (equals 1.5 million people per scanner). Respondents conveyed a shifting interest toward PET-CT hybrid systems. Five countries or regions reported planned expansion of PET services, including installation of PET-CT hybrids:

- Ontario, Canada: At least three hospitals plan to install PET or PET-CT hybrid in the near future.
- Denmark: A third PET scanner/cyclotron facility is planned for Odense in 2005.
- France: Total dedicated PET scanners are expected to increase from approximately fifty scanners to approximately sixty-five in the future.
- Israel: Ten scanners are to be installed in the near future to meet their regulatory requirement of one scanner per 600,000 population.
- The Netherlands: Eight scanners are to become operational in the near future (including at least one PET-CT hybrid scanner).

Table 2. Distribution of PET Scanners Reported by INAHTA Members

Country/region	Total no. of PET scanners (dedicated/PET-CT)	PET scanners per 1 million population
Belgium	13 (9/4)	1.26
Denmark	6 (3/3)	1.2
Austria	9 (9/0)	1.13
Germany	80 (80/0)	1.0
France	50 (NR/NR)	0.83
United States (VHA)	6 (6/0)	0.83
Australia	13 (9/4)	0.65
Sweden	5 (5/0)	0.57
Israel	3 (1/2)	0.46
Canada	10 (10/0)	0.39
Finland	2 (2/0)	0.38
Spain	13 (13/0)	0.33
United Kingdom	16 (NR/NR)	0.28
The Netherlands	4 (NR/NR)	0.25

PET, positron emission tomography; CT, computed tomography; INAHTA, International Network of Agencies for Health Technology Assessment; VHA, Veterans Health Administration; NR, breakdown not reported.

Responders provided data on clinical throughput; however, incomplete reporting and variability with respect to time period of data collection, definition of utilization, types of scanners represented, and the number of PET sites reported by each respective country or region hindered interpretation of the data. Countries with the highest annual throughputs

Table 3. PET Indications Assessed since 1999 INAHTA Survey[a]

Indication	No. of agencies	Agencies
Oncology		
Head and neck cancer	12	AETMIS, AETS, AETSA, CAHTA, CEDIT, DACEHTA, ICTAHC, Lund, MSAC, SMM, VHA, ZonMw
Lung cancer	11	AETMIS, AETS, AETSA, CAHTA, CEDIT, DACEHTA, ICTAHC, MSAC, NHS, VATAP, ZonMw
Colorectal cancer	10	AETMIS, AETS, AETSA, CAHTA, CEDIT, DACEHTA, ICTAHC, MSAC, VATAP, ZonMw
Lymphoma	9	AETMIS, AETS, AETSA, CAHTA, CEDIT, ICTAHC, MSAC, NHS, ZonMw
Melanoma	8	AETMIS, AETS, AETSA, CAHTA, CEDIT, DACEHTA, ICTAHC, MSAC
Solitary pulmonary nodule	7	AETS, AETSA, CAHTA, DACEHTA, MSAC, SMM, VATAP
Breast cancer	4	AETMIS, DACEHTA, VATAP, ZonMw
Brain tumor	3	AETMIS, MSAC, SMM
Thyroid cancer	3	AETS, AETSA, CAHTA
Glioma	2	AETMIS, MSAC
Esophageal cancer	2	MSAC, ZonMw
Tumors of the central nervous system	2	AETS, AETSA
Cervical cancer	1	MSAC
Gastric cancer	1	MSAC
Ovarian cancer	1	MSAC
Prostate cancer	1	AETMIS
Sarcoma	1	MSAC
Neurology		
Epilepsy	6	AETMIS, AHFMR, CEDIT, DACEHTA, MSAC, SMM
Dementia/Alzheimer's disease	4	AETMIS, DACEHTA, SMM, VATAP
Cardiology		
Myocardial viability/perfusion	5	AETMIS, AHFMR, DACEHTA, MSAC, SMM

[a] For agency abbreviations, see Table 1.
AETMIS, Agence d'évaluation des technologies et des modes d'intervention en santé (Quebec, Canada).

included Belgium (10,273 scans in 2002), Australia (8,146 scans in 2003), Canada (4,700 scans in 2002), and the United States (VHA) (3,721 scans in Fiscal Year 2001). The most popular indications for PET use were in oncology. Lung cancer, colorectal cancer, lymphoma, and melanoma were among the most common indications for which scan were performed, whereas some of the less common indications included myeloma, testicular cancer, chronic skeletal infection, and tumors of the liver, pancreas, and spleen.

Assessment of PET

The number of agencies involved in assessing PET and the list of indications assessed since the 1999 INAHTA survey are expanding, particularly in oncology (Table 3). HTA approaches included new systematic reviews of primary studies, syntheses of existing systematic reviews, and primary data collection. Reasons for assessment centered on determining PET's clinical and cost-effectiveness for the purposes of improving quality of care and maximizing public resources with respect to the appropriate number of PET centers and their use within a local context.

The clinical applications most often assessed by INAHTA agencies were the following cancer forms: head and neck, lung, colorectal, lymphoma, and melanoma. Assessments were restricted to studies using dedicated PET models, but some respondents expressed a need for evaluating the clinical utility of alternatives to dedicated PET systems and their impact on service provision.

Seven agencies reported planned assessments of PET typically as part of a research protocol (Table 4). All but one agency (Coordinación de la Unidad de Evaluación de Tecnologías Sanitarias, Madrid, UETS) are evaluating multiple indications for use. MSAC in Australia is assessing a range of indications as part of a multicenter single-arm study of PET's impact on patient management.

Policy Implementation of PET

All respondents commented on having some form of public funding for clinical PET scans, usually in the form of a prescribed list of indications, on a "case-by-case" basis, or within a research protocol. Clinical use and funding for PET were determined initially by external or in-house review of the clinical evidence, at times supplemented with expert input. Strategies for implementing clinical policy of PET usually included linking funding to continuous data gathering for the purposes of refining clinical use and optimizing resource allocation toward indications that maximize patient outcomes. Such strategies included monitoring utilization, monitoring published evidence to define PET's diagnostic

Table 4. Planned Reviews and Prospective Multicenter Research of PET[a]

Indication	Agency	Details
Colorectal cancer	MSAC	Prospective protocol study (multicenter single-arm) into PET's impact on patient management.
Epilepsy	MSAC	A second systematic review is being undertaken to consider new evidence to emerge since the original MSAC review in 2000.
	ICTAHC	NR
Glioma	MSAC	Prospective protocol study (multicenter single-arm) into PET's impact on patient management.
Head and neck cancer	MSAC	Prospective protocol study (multicenter single-arm) into PET's impact on patient management.
	Lund	Diagnosis of residual or recurrent disease; unknown primary tumors; prediction of therapy outcome.
Lymphoma	MSAC	Prospective protocol study (multicenter single-arm) into PET's impact on patient management.
	AETSA	NR
	Lund	Prediction of therapy outcome.
Melanoma	MSAC	Prospective protocol study (multicenter single-arm) into PET's impact on patient management.
Esophagogastric cancer	MSAC	Prospective protocol study (multicenter single-arm) into PET's impact on patient management.
	ICTAHC	NR
Ovarian cancer	MSAC	Prospective protocol study (multicenter single-arm) into PET's impact on patient management.
	ICTAHC	NR
Sarcoma	MSAC	Prospective protocol study (multicenter single-arm) into PET's impact on patient management.
	ICTAHC	NR
Non-small cell lung cancer	DACEHTA	Randomized study of mediastinal staging +/− PET; planned total of 430 patients; accrual until December 2004; publication in 2006 after follow-up.
Thyroid cancer	ICTAHC	NR
Breast cancer	ICTAHC, UETS	NR
Dementia	ICTAHC	NR
Cardiology	AETS	NR
	ICTAHC	Ischemic heart disease
Pancreatic carcinoma	AETS	NR
Tumors of unknown origin	AETSA	NR

[a] For agency abbreviations, see Table 1.
PET, positron emission tomography; NR, breakdown not reported.

performance in selected indications, and examining PET's impact on patient management and health outcomes within a local context.

CONCLUSIONS

Experiences of INAHTA members show an increasing use of HTA to direct appropriate use of PET services in clinical care, taking into account clinical and cost-effectiveness, patient needs, and local resources. INAHTA members have reported integrating continuous quality improvement (CQI) approaches into clinical policy for PET, in which initial use is defined through systematic review, modeling, and expert opinion, and subsequent use is refined through continuous literature review, research protocol, and monitoring of utilization and outcomes. A CQI framework can assist policy makers in optimizing scarce resources for both evaluation and clinical use of high cost and potential beneficial diagnostic technologies such as PET, particularly in areas where potential clinical or cost-effectiveness is considerable but conclusive evidence is lacking.

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