The role of surgeons in identifying emerging technologies for health technology assessment

Tania Stafinski, BSc, MSc*
Leigh-Ann Topfer, BA, MLS*
Ken Zakariasen, DDS, MS(ODA), PhD†
Devidas Menon, PhD, MHSA*

From the *Health Technology and Policy Unit, Department of Public Health Sciences, and the †School of Public Health, University of Alberta, Edmonton, Alta.

Accepted for publication
Nov. 14, 2008

Correspondence to:
Ms. Leigh-Ann Topfer
3021 Research Transition Facility
University of Alberta
8308-114 St.
Edmonton AB T6G 2V2
fax 780 248-1546
Leigh-Ann.Topfer@ualberta.ca

Background: Health technology assessment (HTA) is a tool intended to help policymakers decide which technologies to fund. However, given the proliferation of new technologies, it is not possible to undertake an HTA of each one before it becomes funded. Consequently, "horizon-scanning" processes have been developed to identify emerging technologies that are likely to have a substantial impact on clinical practice. Although the importance of physicians in the adoption of new technologies is well recognized, their role in horizon scanning in Canada has been limited. The purpose of this project was to pilot an approach to engage physicians, specifically surgeons, in provincial horizon-scanning activities.

Methods: We invited 18 surgeons from Alberta's 2 medical schools to a horizon-scanning workshop to solicit their views on emerging technologies expected to impact surgical practice within the next 5 years and/or the importance of different attributes or characteristics of new technologies.

Results: Surgeons, regardless of specialty, identified developments designed to enhance existing minimally invasive surgical techniques, such as endoscopic, robotic and image-guided surgery. Several nonsurgical areas, including molecular genetics and nanotechnology, were also identified. Of the 13 technology attributes discussed, safety or risk, effectiveness and feasibility were rated as most important. Lastly, participating surgeons expressed an interest in becoming further involved in local HTA initiatives.

Conclusion: Surgeons, as adopters and users of health technologies, represent an important and accessible information source for identifying emerging technologies for HTA. A more formal, ongoing relationship between the government, HTA and surgeons may help to optimize the use of HTA resources.

Contexte : L'évaluation des technologies de la santé (ETS) est un outil qui doit aider les responsables des politiques à choisir les technologies à financer. Toutefois, étant donné la prolifération de technologies nouvelles, il est impossible de soumettre chacune d'entre elles à une ETS avant qu'elle soit financée. C'est pourquoi on a établi des processus d'« analyse prospective » pour déterminer les technologies émergentes susceptibles d'avoir un effet important sur la pratique clinique. Même si l'importance des médecins dans l'adoption de technologies nouvelles est bien reconnue, leur rôle dans l'analyse prospective au Canada a été limité. Ce projet visait à faire l'essai d'une stratégie de mobilisation des médecins, et en particulier des chirurgiens, dans des activités provinciales d'analyse prospective.

Méthodes : Nous avons invité 18 chirurgiens des 2 facultés de médecine de l'Alberta à un atelier d'analyse prospective afin de savoir ce qu'ils pensent des technologies émergentes qui devraient avoir une incidence sur la pratique de la chirurgie au cours des 5 prochaines années et sur l'importance de diverses qualités ou caractéristiques des nouvelles technologies.

Résultats : Sans égard à leur spécialité, les chirurgiens ont retenu les progrès conçus pour améliorer les techniques chirurgicales à effraction minimale actuelles comme la chirurgie endoscopique, robotique et guidée par imagerie. On a aussi dégagé plusieurs domaines non chirurgicaux, y compris la génétique moléculaire et la nanotechnologie. Parmi les 13 caractéristiques des technologies abordées, la sécurité et le risque, l'efficacité et la faisabilité ont été jugées les plus importantes. Enfin, les chirurgiens participants se sont dits intéressés à participer davantage aux initiatives locales d'ETS.

Conclusion : En tant que promoteurs et utilisateurs de technologies de la santé, les chirurgiens représentent une source d'information importante et accessible qui permet de définir des technologies émergentes à soumettre à une ETS. Une relation continue plus structurée entre le gouvernement, le secteur des ETS et les chirurgiens pourrait aider à optimiser l'utilisation des ressources consacrées aux ETS.

New health technologies present both opportunities and threats for health care systems worldwide.[1] They offer the promise of improved patient outcomes, while creating pressure on health care budgets because their rate of development far exceeds the capacity of public systems to incorporate them efficiently. Therefore, deciding which technologies to fund and finding fair and acceptable ways to accomplish this are key challenges for health care policy-makers.

Since its inception over 30 years ago, health technology assessment (HTA) has been used to support such decisions. By adapting methods from epidemiology, evidence-based medicine and health economics, HTA assesses the potential clinical, economic, social and ethical effects of technologies on patients, health care providers, health care organizations and government.

Health technology assessment in Canada

Over the past 2 decades, Canada has made considerable investments in HTA. A national HTA agency, the Canadian Agency for Drugs and Technologies in Health (CADTH), formerly the Canadian Coordinating Office for Health Technology Assessment, was created by the federal, provincial and territorial deputy ministers of health in 1989, a year after the first provincial HTA agency was established in Quebec. Since then, several provinces, regional health authorities and hospitals have created their own HTA bodies to meet local demand.[2] In 2004, a national health technology strategy highlighted the need to broaden existing applications of HTA to include the evaluation of health technologies throughout their life cycle (i.e., from innovation to obsolescence).[3] Specifically, this strategy recognized the importance of planned, proactive approaches to the assessment of emerging drugs, devices, diagnostics and procedures that are anticipated to have a substantial impact on health care in the near future. Such approaches, collectively referred to as "horizon scanning," aim to ensure that the system is able to maximize the value of these technologies when the time comes to consider them for inclusion among publicly funded services.

Horizon scanning

Horizon scanning typically involves regular searches of medical news, clinical literature and industry sources, as well as contact with biomedical researchers, industry and clinical experts. It is guided by criteria designed to filter out technologies that are of lesser consequence, while retaining those used to treat diseases for which there are currently no existing treatments or for which treatments are life-saving but expensive, new low-cost technologies that may have a substantial impact on health care budgets because of a high volume of use, and those that raise ethical or social issues.

Technologies identified are then prioritized for early assessment, or, if the evidence needed to conduct an HTA is not available or the timing is not appropriate, they may be monitored for assessment in the future.

Canada's national HTA agency, CADTH, has been engaged in horizon scanning since its inception. Currently, its program comprises a series of peer-reviewed bulletins on specific technologies (*Issues in Emerging Health Technologies*) and a regular newsletter (*Health Technology Update*), both of which may be accessed through the agency's website. Despite the availability of these series for several years, efforts to evaluate their effect on decision-making have been limited. This may be explained, in part, by the fact that Canada's health care system is a decentralized one (i.e., decisions around which technologies to provide are made at the provincial and territorial level), and no formal mechanisms exist for systematically incorporating information produced by the national HTA agency into provincial and territorial decision-making processes.

Most HTA agencies around the world perform some type of horizon scanning. The most well-established programs include the Australian Safety and Efficacy Register of New Interventional Procedures–Surgical (ASERNIP-S) established by the Royal Australasian College of Surgeons in Adelaide, Australia, and the National Horizon Scanning Centre (NHSC) based at the University of Birmingham, United Kingdom. In both cases, information collected through horizon scanning is directly funneled into the priority-setting mechanisms of their national HTA organizations, where topics are considered for full assessment or continued monitoring. Specifically, new technologies identified by NHSC are reviewed by the National Institute for Health and Clinical Excellence (NICE) to determine whether appraisal or guidance for clinical practice is needed.[4] Technologies arising from horizon scanning by ASERNIP-S become part of their New and Emerging Techniques–Surgical (NET-S) database of new and emerging surgical technologies. They are then considered for review, along with topics identified by other Australasian horizon-scanning centres, by a national review committee, the Medical Services Advisory Committee.

The role of physicians

Physicians, especially those engaged in technology-intensive specialties such as surgery, play a critical role in the adoption and diffusion of new health technologies.[5,6] Physicians serve as innovators, developing and applying new technologies; they also serve as practitioners and patient advocates, seeking access to beneficial new treatments. They balance these responsibilities with those of a steward of the public health care system, ensuring that scarce resources are used appropriately. As noted by Riskin and colleagues,[7] "... surgical innovation is fundamental to surgical progress and has significant health policy

implication." Further, surgeons have a penchant for adopting new technologies (second only to radiologists).[8] Thus, they represent important "sentinels" for those involved in horizon scanning.

The importance of physicians to horizon scanning was first highlighted through an international Delphi survey of HTA horizon-scanning sources conducted in 1998.[9] Whereas the findings indicated that clinical experts were particularly useful for filling gaps in the information available from published sources, the role of physicians in horizon scanning has remained relatively limited. Both the UK National Horizon Scanning Centre and ASERNIP-S periodically survey clinicians to identify innovative technologies for review. In Canada, apart from a handful of hospital-based HTA agencies (e.g., McGill University Health Centre, Technology Assessment Unit), the HTA community has not formally engaged physicians in horizon scanning.[10]

Although not a horizon-scanning program, the Interventional Procedures Programme at NICE relies on clinicians (primarily surgeons) to identify, assess and make recommendations about "whether particular procedures used for diagnosing an illness or treating a patient are safe enough and work well enough for wider use in the National Health Service."[11] Thus, its focus is technologies that have already entered the system but are not yet part of routine practice.

Purpose

We undertook this project to determine the feasibility of engaging surgeons in provincial horizon-scanning activities. Specifically, we aimed to increase the awareness of HTA and its role in making technology funding decisions among surgeons in Alberta; to compile a list of emerging technologies likely to be introduced into local clinical practice within the next 5 years; to examine the importance of various attributes of new technologies, from a surgical perspective, which could inform the development of a set of horizon-scanning criteria for Alberta; and to determine the interest of surgeons in contributing to provincial HTA initiatives.

METHODS

Participants

In February 2008, 18 surgeons from several technology-intensive clinical specialties (including cardiac surgery, neurosurgery and orthopedic surgery) were invited to a 1-day workshop in Banff, Alberta.

Potential participants, who were identified through university directories and personal contact with senior faculty and administrators in Alberta's 2 medical schools, were selected because they reflect factors considered to influence the uptake of new medical technologies. Using stratified random sampling, we categorized the surgeons into groups according to their educational background, training and experience, from which 3 were randomly chosen to comprise the sample.

Data collection

Through presentations followed by a series of large and small group sessions, participants engaged in discussions about the role of HTA in making local technology funding decisions that optimize patient access to innovative technologies while using Alberta's public health care resources effectively. Particular emphasis was placed on the way in which technologies are currently identified for assessment by the provincial ministry of health and the importance of incorporating physicians' views into the process.

Participants were grouped according to surgical specialty and asked to generate a list of technologies that they thought would be introduced into clinical practice in the next 5 years, along with the rationale for their choices. The groups then reconvened and compared lists, noting similarities and differences across surgical specialties. In an attempt to validate these results and inform the development of a draft set of criteria for future horizon-scanning initiatives, a digi-voting exercise (electronic voting with immediate tallying of results), in which participants rated the importance of 13 attributes or characteristics (Box 1) of new technologies using a series of 5-point Likert-type questions (1 = not important, 2 = of little importance, 3 = neutral, 4 = important, 5 = very important). These attributes originated from both relevant published literature and the ongoing work of an international, multidisciplinary group of senior members of the HTA community (including researchers, clinicians and decision-makers), whose goal is to develop a comprehensive set of outcomes against which the value of new and innovative technologies can be more fairly assessed.[12] The workshop concluded with a discussion of the present and future role of physicians in HTA.

Data analysis

Four experienced recorders took detailed notes on the small and large group discussions. Two of the workshop's organizers (T.S. and D.M.) independently compiled and analyzed the notes using standard qualitative techniques (i.e., content analysis). This involved identifying, breaking down and coding sections of the notes into manageable categories that reflected key themes and concepts and then analyzing the order or sequence in which they appeared (i.e., relational analysis) to make inferences about the discussion.[13]

Technologies identified were categorized according to the number of times they appeared on lists obtained from the 3 surgical specialty groups. Reasons for selecting a particular technology were classified based on implication type

(e.g., clinical, economic, social, ethical). To assess surgeons' views about the relative importance of the 13 technology attributes, quantitative techniques were used. Specifically, weighted scores were calculated for individual attributes and then used to rank them from highest to lowest (i.e., most to least important). This ranked list of attributes was compared with the results of the analysis of reasons for selecting certain technologies to determine the extent to which there was consistency in findings from the 2 exercises (i.e., triangulation of results).

To confirm that the analyses of workshop discussions accurately reflected surgeons' views, all participants were given the opportunity to review and comment on interpretations and conclusions (member-checking).

Results

In total, 15 of the 18 surgeons recruited participated in the workshop. Of the remaining 3, 2 expressed interest but were not able to attend because of previous clinical commitments, and 1 declined the invitation because of a lack of interest.

Box 1. Description of technology attributes

Risk/safety

The technology has been proven safe by a government regulatory body

Efficacy/effectiveness

How well the technology has been proven to work in the relevant patient population

Feasibility

How easily the technology can be used in current clinical settings (e.g., is any special training required?)

Cost

How much it costs to use the technology in clinical practice

Certainty of benefit

How sure we are that the technology does what it is supposed to do

Budget impact

How much the technology will affect the budget of the organization (i.e., what the organization might need to take away from other services to provide this technology)

Return to daily activities quickly

Patients are able to return to work or their normal routines more quickly with this technology than with current standard care

Seriousness of the condition or disease

The condition for which the technology is used affects either a large number of patients or a small number of patients in an extreme way

Convenience

The technology is more convenient to use than is the current standard of practice for patients and health care providers

Newness

Nothing like this technology is currently available in the marketplace

Feel-good factor

The care and attention a patient receives as a result of using the technology makes him or her feel better

Price

How much it costs to purchase the technology

Immediacy

The benefits of the technology can be realized quickly

Surgeons' awareness of HTA and its role in provincial technology funding decisions

Questions and comments received after the opening session primarily focused on the term "HTA" and its place in the provincial ministry of health. In general, participants appeared to be unclear about its definition and what sets it apart from clinical trials or traditional systematic reviews of clinical evidence. In addition, few were familiar with existing HTA initiatives in Alberta, particularly the Alberta Health Technologies Decision Process (AHTDP), established by the provincial government 4 years ago.[14] Briefly, AHTDP is a multistage, collaborative process that involves identifying and prioritizing technologies of potential interest to government (i.e., horizon scanning), conducting assessments, consulting relevant stakeholders and making recommendations for funding to the minister of health. The assessments are prepared using the STEP model, which includes reports on social and system demographics (S), technological (i.e., clinical) effects (T), economic evaluation (E) and policy analysis (P).

To date, AHTDP has reviewed several surgical technologies, including laparoscopic adjustable gastric banding (LAGB) for treatment of morbid obesity and photoselective vapourization of the prostate (PVP) for treatment of benign prostatic hyperplasia. Based on these reviews, the government supported the provision of LAGB in regions through existing budgets and the controlled introduction of PVP through a field evaluation. Representatives from the ministry of health, who attended the workshop as observers, explained that formal mechanisms for communicating information about AHTDP to the broader clinical community in Alberta have not yet been established.

Identification of technologies likely to be introduced into clinical practice within 5 years

Before participants were asked to "forecast" technologies likely to impact clinical practice in the next 5 years, a brief introduction to horizon scanning and the current provincial process was presented. The view of the ministry of health about the importance of seeking such input from surgeons was also reiterated.

Based on the findings from a comparison of lists of technologies identified by each surgical subspecialty, there was agreement on the importance of several innovations, most of which represented "hotspots" of continuing technological activity or development, rather than individual technologies. At the top of all 3 lists was the broad category of minimally invasive surgical techniques (MIS) using laparoscopic devices and endoscopic visualization to perform procedures through smaller incisions. Laparoscopic

surgical procedures have been around for over 100 years, but the development of "enabling technologies" (such as light sources and device miniaturization) finally allowed the advance of these techniques in several surgical areas in the 1980s, after the first laparoscopic cholecystectomy was performed.[15] Workshop participants highlighted several new developments in this field, including natural orifice transluminal endoscopic surgery, in which access to the abdominal cavity is made through the mouth, anus, urethra or vagina.[16] Other examples mentioned were sutureless surgery, which uses alternatives to traditional suturing to close incisions, flexible endoscopes, which allow access further into the body, and robotic surgical devices, which allow for greater control and precision of surgical instrument manipulation.

All 3 groups also cited image-guided surgery. These technologies offer real-time imaging and provide a precise, controllable view that allows surgeons to more accurately pinpoint surgical targets. Specific examples mentioned included intraoperative magnetic resonance imaging and computed tomography (CT).

Surgeons in the cardiology and neurosurgery groups listed molecular genetics as an important development, mentioning that advances in this area have resulted in technologies such as biological tumour markers, which indicate a patient's risk of having a particular disease or condition based on their genetic make-up. This information can then be used to tailor diagnostic tests and therapies to the individual patient, reducing morbidity and health care costs associated with unnecessary tests and procedures. The orthopedics and neurosurgery groups cited clinical simulation (the use of simulation technology for clinical training), motion-sparing implants for spinal surgery, and nanotechnology (to aid in diagnosis, drug delivery and tissue repair) as other key developments.

Technologies identified by only one of the groups included blood-conservation technologies to reduce blood loss during surgery and decrease the need for blood transfusion, bone induction agents that stimulate bone growth and repair, cardiac restraint devices that support the heart and improve the clinical and functional status of patients with congestive heart failure, cardiac assist devices that can be used as destination therapy (rather than as a temporary bridge to heart transplantation) for patients who cannot undergo heart transplantation, fetal interventions to treat the fetus in utero, focused radiation or stereotactic radiosurgery, human papillomavirus testing to determine the risk for head and neck cancers, neuromodulation for the treatment of pain, movement and psychiatric disorders; and, contrast-enhanced positron emission tomography or CT scans for monitoring tumour recurrence. Notably, surgeons did not limit their selection to technologies strictly within their surgical subspecialty, nor did they identify only those related to surgical procedures.

Rationales reported were primarily related to clinical implications (e.g., reduced patient morbidity, quicker, less painful recovery, fewer complications, less unnecessary overtreatment, improved patient safety, less risk of infection). However, participants also raised economic implications, both positive (e.g., shorter hospital stays, can be performed as an out-patient procedure) and negative (e.g., increased infrastructure and equipment costs, longer operating times).

The importance of various attributes of new technologies

Results of the digi-voting exercise are presented in Table 1. Safety, effectiveness and feasibility (i.e., how easily the technology can be used in current clinical settings) received the highest scores and appeared to be most important to surgeons. These were followed by cost (i.e., the financial resources required to use the technology in clinical practice), indicating that surgeons also considered economic-related attributes of new technologies to be

Table 1. Distribution of votes and weighted scores for 13 technology attributes

Technology attribute	Not important	Of little importance	Neutral	Important	Very important	Total*
Risk/safety	—	—	—	3	8	52
Efficacy/effectiveness	—	—	1	5	5	48
Feasibility	—	—	2	8	2	48
Cost	—	2	1	6	3	46
Certainty of benefit	—	—	4	7	1	45
Budget impact	—	1	2	4	4	41
Return to daily activities quickly	—	—	1	9	2	40
Seriousness of the condition or disease	—	3	5	4	—	37
Convenience	—	4	3	5	—	37
Newness	2	6	2	2	—	28
Feel-good factor	3	4	3	2	—	28
Price	—	2	3	2	—	21
Immediacy	5	3	—	—	—	11

*Votes were not received from all participants for all questions. The votes were weighted as follows: Not important = 1, Of little importance = 2, Neutral = 3, Important = 4, Very important = 5.

important. Immediacy (i.e., the benefits of the technology can be seen right away) and price (i.e., cost to purchase the technology) received the lowest scores and were generally viewed as "not important."

These findings were consistent with the rationales surgeons provided for selecting technologies included on their forecasting lists. As mentioned above, they focused on both clinical implications associated with safety and effectiveness and economic implications related to cost.

Interest of surgeons in contributing to provincial HTA initiatives

During the closing session, surgeons had the opportunity to discuss their views on HTA and the introduction of new health technologies with representatives from the provincial ministry of health. Several issues were raised.

Funding

Many of the surgeons mentioned the need for increased funding to undertake field evaluations of promising technologies for which evidence is lacking. Field evaluations involve the collection of primary data on a new technology within a real-world treatment setting (opposed to that of a strictly controlled clinical trial). Thus, it facilitates access to such technologies while helping to minimize the risk of widespread, inappropriate adoption. Although some of the surgeons had been able to access funds for field evaluations through research and innovation units within larger regional health authorities, it was felt that the existing resources were inadequate.

Transparency of government decision-making processes

Surgeons viewed current government decision-making on health technologies as a "black box." They were unsure of how technologies were chosen for assessment, what processes were used to arrive at decisions and why some technologies were introduced from the "top down" whereas others seemingly "slipped in through the back door." They expressed the need for a more "transparent" process to eliminate communication barriers or gaps between health care practitioners and government decision makers.

Access to data

There was frustration over difficulties accessing government data, much of which they viewed as public information that should be made publicly available (following the removal of any unique identifiers). At the same time, they felt that the data currently collected do not always provide the evidence needed to evaluate treatments. As one participant noted, "We are counting a lot of things now, but we're not counting the right things. We're collecting information for a system based on funding requirements, rather than on what should be the key measure — patient outcomes."

Role of surgeons in HTA initiatives

Lastly, surgeons were asked about their future role in provincial HTA initiatives. They all appeared eager to continue participating in horizon-scanning activities and suggested that the same group meet regularly to discuss technologies for potential assessment. Moreover, they were keen to become involved in the assessments. It was proposed that clear avenues through which they could contribute be established within AHTDP.

Discussion

This pilot workshop represented the first attempt to formally involve physicians in horizon scanning for new and emerging health technologies in Alberta. Surgeons put forward several developments that had not been previously identified through existing provincial processes. In addition, they approached the task from a broad health care perspective, recognizing the value of and selecting nonsurgical advances as well as surgical ones. Their views on the importance of various attributes of new technologies were similar to the findings from an international, multistakeholder survey based on the same set, where "safety" and "effectiveness" appeared at the top of the list.[11] Other studies examining factors that influence the adoption of technologies by surgeons have also highlighted "feasibility" as a key consideration, specifically, whether their patient caseload would justify the learning time involved.[17]

Conclusion

The findings from this workshop offer a foundation for the development of a set of criteria for identifying new technologies to be assessed as part of the provincial ministry of health's technology decision process. Further, given the enthusiasm of surgeons and the approaching "avalanche of new technologies" to which they referred, initiatives designed to engage physicians in sifting through this avalanche will undoubtedly increase HTA's capacity to inform technology funding decisions that ultimately improve health outcomes.

Acknowledgement: This workshop was supported by a grant from Alberta Health and Wellness through the Alberta Health Technologies Decision Process.

Competing interests: None declared.

Contributors: Ms. Stafinski, Dr. Zakariasen and Dr. Menon designed the study. Ms. Stafinski, Ms. Topfer and Dr. Zakariasen acquired the data, which Ms. Stafinski and Dr. Menon analyzed. Ms. Stafinski, Ms. Topfer and Dr. Menon wrote the article, which Drs. Zakariasen and Menon reviewed. All authors approved the final version submitted for publication.

References

1. Hoare J. *Tidal wave: new technology, medicine and the NHS*. London: King's Fund Centre; 1992.

2. Menon D, Stafinski T. Health technology assessment in Canada: 20 years strong? *Value Health* 2009;12(Suppl 2):S14-9.

3. Health Technology Assessment Task Group; Federal/Provincial /Territorial Advisory Committee on Information and Emerging Technologies. *Health technology strategy 1.0: final report*. Ottawa (ON): Health Canada; 2004. Available: www.hc-sc.gc.ca/hcs-sss/alt_formats /pacrb-dgapcr/pdf/pubs/ehealth-esante/2004-tech-strateg/2004-tech-strateg-eng.pdf (accessed 2009 Sept. 23).

4. National Institute for Health and Clinical Excellence. *Guide to the topic selection process. Interim process manual*. London: the Institute; 2006. Available: www.nice.org.uk/niceMedia/pdf/boardmeeting/brd-nov06item4.pdf (accessed 2009 Sept. 23).

5. Fendrick AM, Schwartz JS. Physicians' decisions regarding the acquisition of technology. In: Gelijns AC, Dawkins HV, editors. *Adopting new medical technology*. Vol. 1 in *Medical innovation at the crossroads* series. Washington (DC): National Academy Press; 1994. p. 71-82.

6. Waddell JP. The introduction of new technology. *Can J Surg* 2004; 47:246-8.

7. Riskin DJ, Longaker MT, Gertner M, et al. Innovation in surgery: a historical perspective. *Ann Surg* 2006;244:686-93.

8. Freiman MP. The rate of adoption of new procedures among physicians. The impact of specialty and practice characteristics. *Med Care* 1985;23:939-45.

9. Robert G, Gabbay J, Stevens A. Which are the best information sources for identifying emerging health care technologies? An international Delphi survey. *Int J Technol Assess Health Care* 1998;14:636-43.

10. Sabo RR. The challenge of emerging surgical technology: the College can help. *Bull Am Coll Surg* 2002;87:8-14.

11. National Institute for Health and Clinical Excellence. *Contributing to NICE interventional procedure guidance — a guide for patients and carers*. London: the Institute; 2006. Available: www.nice.org.uk/niceMedia/pdf /ip/ContributingToNICEIPguidance0706.pdf (accessed 2009 Sept. 23).

12. Menon D, Stafinski T, Cicchetti A, et al. Determining the value of new health technologies — ongoing development of a survey questionnaire [poster presentation]. HTA in Context: 5th Annual Meeting HTAi 2008; 2008 July 6–9; Montreal.

13. Holsti OR. *Content analysis for the social sciences and humanities*. Reading (MA): Addison-Wesley Pub. Co.; 1969.

14. Borowski HZ, Brehaut J, Hailey D. Linking evidence from health technology assessments to policy and decision making: the Alberta model. *Int J Technol Assess Health Care* 2007;23:155-61.

15. Gelijns AC, Fendrick TG. The dynamics of innovation in minimally invasive therapy. *Health Policy* 1993;23:153-66.

16. Flora ED, Wilson TG, Martin IJ, et al. A review of natural orifice translumenal endoscopic surgery (NOTES) for intra-abdominal surgery: experimental models, techniques, and applicability to the clinical setting. *Ann Surg* 2008;247:583-602.

17. Wilson CB. Adoption of new surgical technology. *BMJ* 2006; 332:112-4.