A Decision-Making Framework for the Prioritization of Health Technologies

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Abstract

During the last two decades most provinces and territories in Canada have created regional or district health authorities with the goal to improve health care provision in a process that has come to be referred to as "regionalization". The district or regional health authorities (RHAs) created through this process were intended to streamline the delivery of health care to make it less fragmented and more integrated across regions and provinces, whilst maintaining local accountability and transparency to health care providers, patients and the public.

Regardless of the reasons why regionalization has occurred, it has brought into focus a number of important issues related to decision-making frameworks for Health Technology Assessments (HTAs) and Health Technologies (HTs). Many new health technologies are proposed each year while old technologies require upgrading or replacement. Decision makers face pressures to obtain the safest and most effective HTs within a limited budget. There ought to be objective and transparent guidelines for prioritizing HT expenses. In the past two decades in Canada, the responsibility for these decisions has been devolved from provincial/territorial ministries to district and regional health authorities (RHAs). While regionalization is intended to improve health services according to specific regional needs, the diversity of health authorities has created inconsistent methods for prioritizing HTs.

We proposed and tested a method for prioritizing HTs based on a standard set of 11 criteria. We developed consensus on these criteria through key informant interviews and a focus group. Participants from 35 RHAs provided Criteria Surveys, from which relative weights could be calculated based on relative importance of each criterion. The criteria weightings were validated by using experts' ratings of selected HTs at a pilot site.

Ratings of HTs on each criteria were consistent with the overall priority assignments provided by the experienced managers, both with and without the importance weights. The importance weights provide an objective standard for discussing the key criteria (and priorities) in health technology assessment.

Introduction

During the last two decades most provinces and territories in Canada have created regional or district health authorities with the goal to improve health care provision in a process that has come to be referred to as "regionalization".[1] The district or regional health authorities (RHAs) created through this process were intended to streamline the delivery of health care to make it less fragmented and more integrated across regions and provinces, whilst maintaining local accountability and transparency to health care providers, patients and the public.[1]

Although this process of regionalization has taken different forms in the provinces and territories, in most cases there are provincially or locally appointed regional boards responsible for the delivery of health care services and programs. Generally however, responsibility for policy development, funding, coordination of services, goals, standards and evaluations for the RHAs remains at the provincial or territorial level.[2] RHAs show great diversity in size, structure, mandate and numbers per province. The regionalization process is in different stages across the country, having started 25 years ago in Quebec and being implemented only now in Ontario (in 2005).

Regardless of the reasons why regionalization has occurred, it has brought into focus a number of important issues related to decision-making frameworks for Health Technology Assessments (HTAs) and Health Technologies (HTs). In this work, the following definitions for HTs and HTAs are used based on the literature.[3,4]

> *HTs are broadly defined as technologies used in the promotion of health and disease, illness, and injury. These include new and old diagnostic tests and machines, various testing procedures, screening techniques, surgical techniques, pharmaceuticals, information technologies, information management, human resources, and innovative methods for combating chronic and acute diseases, illnesses, and injuries.*
>
> *HTAs are defined as the systematic evaluation of the properties and effects of health care technology with regards to effectiveness, appropriateness and cost of the technology.*

In turn, decision-making frameworks for HTAs have become a major concern in the industrialized world. The National Institute for Clinical Excellence (NICE) in the United Kingdom (UK) published a series of guidelines during 2004, with the aim of increasing the transparency of processes and providing a structure for the assessment of HTs.[5] Global co-operation through the International Network of Agencies for HTA links the many organizations involved in this field of development.

Since the late 1960s, European health care programs have been changing rapidly due to rising costs. As such, HTA strategies have become common. Prioritization of such technologies in Europe is meant to reflect the likely costs and benefits of the assessments being considered. The assessments are measured against explicit criteria to determine the

value gained for expenditures made. Though systematic in nature, uneven results were common due to different priorities within different Euro nation-states. In 1993, the EUR-ASSESS project[6] was initiated to bring uniformity to HTA within the European Union. Its main objectives encompass international HTA co-ordination, improvement of priority setting methods, broadening the use of technology in HTA decision making, and the dissemination of findings, both internally and internationally.

Of equal concern is the decision-making framework of RHAs. RHAs typically focus on determining community needs, adapting HTAs to local needs, economic evaluations and integration of new HTs into budgeting, organizational mandates, and the development of implementation and evaluation plans.[4,7] The Alberta Heritage Foundation for Medical Research[4,7] and Alberta Health and Wellness[8] are examples of organizations that have published guidelines to aid decision makers in the complex process of prioritization. The decision-making framework of RHAs encompass guidelines for HTs and HTAs, taking into account stakeholders such as health care providers, clinicians, patient groups, industry and the public.[4,7] A vital component of this framework is the prioritization of HTs. HTs are put forward by request proposals which seek to meet the demands identified within RHAs.

Faced with continuous streams of new HT proposals put forth by stakeholders to consider under budget constraints, decision makers at the RHA level are faced with tremendous external and internal challenges. External pressure from patients, public and media, drive the requirement for more transparency. Internally the prioritization process of HTs must consider demands from multiple areas of health care provision within the RHA and involves decision making through a multidisciplinary approach, with a number of stakeholders, including physicians, care providers and various players in hospital management. A wide range of sources of information (e.g. media, the internet, manufacturers, randomized controlled clinical trials and meta-analysis) adds to the complexity of the prioritization process with respect to addressing the needs of patient populations. Furthermore, prioritization decisions are often made in an environment where information about the HTs is lacking or conflicting. This raises the need for the development of decision-making tools that can make the prioritization process standardized and transparent.

The aim of this research is to provide a new decision-making framework for prioritising health technology assessments and to pilot test it in the context of regional and health authorities in Canada. The method proposed here is derived from the d ecision-theoretic evaluation field. There are four main steps in the process, which are based on decision theory: (1) deciding upon a set of criteria—some of which might be very important and some of which might be much less important—upon which health technology assessments will be judged (examples include expected effectiveness, sustainability, acceptance, feasibility, etc.); (2) assigning “importance” weights to the different criteria to reflect the subjective judgment of decision-makers regarding how much influence these criteria ought to have in the decision making process; (3) rating each health technology on how well it meets each criterion (for example, how sustainable is it?); and

(4) combining weights and ratings into overall scores and ranking (i.e., prioritising) the health technologies based on these scores.

Decision-Theoretic Methodology Background

A select number of priority setting tools for HTs can be found in the literature to guide decision makers in the prioritization process: nominal group method, Delphi method, rating method, and ranking method.

For the nominal group method, small group discussions are conducted by a skilled facilitator who poses thought-provoking questions.[9,10] Decision makers write down answers and present them to the group. All answers are discussed and ranked. Disadvantages of this method include lack of precision and a lack of formal assortment of ideas.[9] This method has been used for priority setting for HTA in Spain.[11]

The Delphi method is another systematic method for eliciting expert opinion on a particular topic. A facilitator solicits informed opinions from a panel of experts. The facilitator then provides feedback on all responses so that experts can review and possibly change their answers. This process is repeated in an iterative manner and comes to an end when experts no longer make alterations to their answers. Then, experts are asked to provide a final ranking of priority areas based on their responses to the information-eliciting questions. These rankings are agglomerated, and a final, overall ranking is determined. The Delphi process has been used to prioritize HTs in Spain [11] and to prioritize Positron emission tomography technologies in the UK. [12]

The rating method requires that decision makers rank candidate HTs based on pre-selected criteria.[13] The first step is to decide on a set of criteria. Next, each decision maker is asked to assign each health technology a score on each of the pre-selected criteria. A total score for each health technology is computed by adding the scores for each of the several criteria. Finally, HTs are divided into priority groups (e.g. "high," "medium," and "low" priority) based on the total scores assigned to them through the rating procedure. The rating method has been used in Israel, for example.[14]

The main difference between the rating and ranking methods is that the ranking process explicitly requests rankings from decision makers. Thus, for the ranking method, decision makers are asked to rank (rather than rate) candidate HTs on each of pre-selected criteria. The HTs are then scored in the same manner as in the rating method, except that technologies with lowest scores receive the highest priority. One advantage of this method, relative to the rating method, is that it forces decision makers to compare HTs, and therefore makes the prioritization process more explicit. However, the number of possible comparisons can quickly grow quite large if more than a dozen or so HTs are under consideration; this method is therefore most appropriate when the number of options is relatively small. The ranking method has been used to prioritize HTs in Spain.[15]

The general idea of the ranking method—that each decision-maker is to rate each health technology on multiple criteria—can be extended to take into account the subjective importance of each of the criteria by the method proposed here based on multi-attribute decision theory. In this scheme, criteria that the decision maker believes are important are given greater weight than those felt to be less important. This method is proposed here for the first time in the context of HTA. It is derived from the decision-theoretic evaluation field,[16] and it has been applied in decision analysis: in the context of deciding where to build the Mexico city airport,[17] to aid local decision makers in developing countries,[18] for obtaining patient values on periondontal health,[19] in the decision of nursing students in Taiwan to be vaccinated against hepatitis B infection,[20] in identifying areas of family life most affected by childhood atopic dermatitis,[21] for assessing patient perceptions on the impact of menorrhagia on their health,[22] and in an Alzheimer's framework.[23] The effectiveness of the multi-attribute utility decision framework has been assessed in a study addressing groups for personnel selection problems differing in complexity[24] and among Alzheimer patients.[23]

Methods

The method proposed here is derived from the decision-theoretic evaluation field[7]. There are four main steps in the process, which are based on multi-attribute utility theory: (i) deciding upon a set of criteria; (ii) assigning "importance" weights; (iii) rating each health technology; (iv) combining weights and ratings into overall scores.

Deciding Upon a Set of Criteria

Identifying decision makers for key informant interviews and a focus group

An initial background search focused on publicly available materials on the Internet, providing general information about HTAs in Canadian provinces and territories, as well as contact details of senior level decision makers at RHAs. The aim was to identify one small and one large RHA from each province/territory and particular individuals to interview in order to obtain information regarding the various prioritization processes across Canada. Two provinces and one territory were excluded from the study (one province is currently in the process of being regionalized; a second province has an additional language requirement; and one territory is newly defined).

For the initial key informant interviews, a select number of RHAs were contacted through one-on-one telephone interviews using a script. It was found from 15 initial key informant interviews that the Chief Executive Officer (CEO), or a Vice President (VP) appointed by the CEO, were the most appropriate individuals with whom to make contact regarding the prioritization of HTs. One-on-one interviews were conducted using a second script, and information was gathered on the various prioritization processes of the provinces/territories, and the levels (regional or provincial) at which prioritization decisions are made.

The 15 participants of these initial interviews were found to have a substantial amount of experience in the health sector and were generally involved in some stage of the HT prioritization process. All participants were male with 15 to 30 years experience in health care. An offer to participate in the focus group went to all interviewed. Agreement to participate was based on the interest in the project, willingness to provide demographic data, time to allocate for a conference call, and experience with at least one prioritization cycle for HTs.

Three executives from three provinces/territories agreed to take part in the focus group conducted through a telephone conference call (approximately 1.5 hours). As a starting point, a discussion guide (based on collected documentation from the participants) was circulated prior to the telephone conference call. A fourth executive (who was not present but had been scheduled to participate in the focus group) was interviewed separately using the same discussion guide as the one used for the focus group. Participants received a small honorarium for the participation in the telephone conference calls.

In addition to participating in the focus groups, participants were asked to provide the following documented information: terms of reference, including criteria used for HT prioritization, their working definition of HTs and formal methods, and strategies used for the prioritization of HTs.

Identifying key criteria for the prioritization of HTs

Key informant interviews and a focus group aided in determining 16 important criteria in the prioritization of HTs: accessibility, compatibility, costs, efficiency, ethical issues, evidence (theoretical or empirical), feasibility, impact, incidence, knowledge, need, novelty, politics, proof (of beneficial uses), safety, and timeliness.

An electronic questionnaire was developed to elicit the relative importance of the identified criteria. This questionnaire was in-house tested for tone and clarity by three individuals not directly involved in the project. These individuals had diverse backgrounds ranging from health care policy, HT assessment, biostatistics/economics, and pharmaceutical formularies. Two new individuals directly involved in health care prioritization tested a further refined version of the questionnaire. As a result, several changes were made to the survey to improve its clarity and ease of use.

The list of criteria was shortened from an initial number of 16 to 11 (Table 1) to reduce the overlap between criteria and their definitions. The original criteria “Ethics” and “Politics” were combined into one criterion, “Compatibility.” The criteria “Knowledge,” “Novelty,” and “Timeliness” were removed.

Table 1: Identified Key Criteria for the Prioritization of HTs.

Criterion	Definition
Accessibility	Extent to which the HT facilitates accessibility to services, or address barriers to service (e.g. hours of operation, geographic distances).
Compatibility	Extent to which the HT fits in with the funding priorities, mission, values (i.e. ethical concerns), and strategies (i.e. political issues) of your agency.
Costs	Cost of the HT in terms of overall budget impact.
Efficiency	Extent to which the HT is cost effective (i.e. makes best use of available resources when compared to other competing programs /technologies and/or results in back end savings).
Evidence	The HT is grounded on a sound theoretical basis or empirical testing.
Feasibility	The HT is sustainable, practical, and workable given infrastructure and human resource availability.
Impact	Extent to which the HT is expected to have an effect on eligible individuals.
Incidence	The proportion of the population that can expect to be effected by the technology.
Need	The perceived level of need in the community/region.
Proof	Evidence that the technology has been implemented usefully elsewhere.
Safety	The safety/risk level of the HT.

Assigning "Importance" Weights*: *Identifying Key Criteria for the Prioritization of HTs

Administration of the Criteria Survey

We contacted 81 RHAs throughout the country by telephone call asking for the participation in the criterion survey. In most cases either the CEO, or VP appointed by the CEO, agreed to participate (and in some cases pass on the survey to prioritization committee members as well), or volunteered to provide an alternative contact name. The survey was administered by e-mail with implicit consent given upon its completion.

The survey took approximately 15 to 20 minutes to complete—it included six sections:

Section A	Demographic information and HT prioritization involvement
Section B	Paired-comparisons of criteria*
Section C	Statements about satisfactory and unsatisfactory aspects of their current HT prioritization protocol (7-point scale from "strongly agree" to "strongly disagree")
Section D	Statements about usefulness of information available to decision makers (7-point scale from "extremely useful" to "extremely harmful")
Sections E & F	Solicited general comments on participants' prioritization processes

* Section B, the paired-comparisons of criteria, required participants to explicitly compare two criteria at a time.[25] For the 11 criteria (Table 3), participants chose the more important criterion in each of the 55 possible pairs. The paired-comparison approach requires participants to explicitly compare two criteria at a time and decide which one was most important. The total number of times a criterion is selected serves as an indicator of the criterion's relative importance. To proceed with further analyses, the importance measurements must be represented on an interval-level scale. Therefore, we standardize the raw scores by arranging totals from lowest to highest, then finding the each criterion's relative ranking on the table of the standard normal distribution. This standardization method yields the relative importance of each criterion as a *z*-score (higher *z*-scores indicate higher importance). The advantages of paired-comparison techniques for generating the relative importance of items relative to direct estimation methods are the following: a) it avoids potential ceiling effects (a real concern here given the potential for all criteria to be viewed as important); b) it explicitly deals with probabilistic relationships among preferences; and c) it results in interval-level scaling from which the relative importance of each criterion can be determined.

Rating each Health Technology

Selection of pilot sites and study participants

Four pilot sites participated in the study: one of eight regional health hospitals in New Brunswick, South Shore in Nova Scotia, and two sites in Alberta. The four sites will be referred to as sites A, B, C, and D (with no relation to the previous order) to preserve confidentiality.

Participants were selected according to the following criteria: their interest in the project, their participation in at least one HT prioritization cycle, and being part of a formalized committee for HT prioritization (or an ad hoc group). All participants at all pilot sites used the forms independently of each other (i.e. did not fill in the forms as part of a committee meeting), and all HT proposals rated were new and replacement HTs from previous acquisition cycles. Participation in the project took approximately 2.5 to 3 hours per participant (including background reading of HT proposals from earlier

prioritization cycles), for which they were paid honoraria. All participants filled out a consent form.

Participants at Pilot Site A completed the Criterion Survey (which was designed to determine the relative importance of each of the 11 criteria) and the Rater's Form. Therefore, the current paper focuses on lessons learned from our study at Pilot Site A. The participants were members of a subspecialty committee that was newly formed and met six times per year. This committee had a goal to establish a transparent process for the prioritization of HTs that would be subsequently submitted to the provincial government for funding. The committee (which varied between 15 and 20 people) had representation from the following areas in the health care field: HTA units, pediatricians, preventive health care units, rural health, and public health. Ten of the committee members participated in study.

The committee had previously rated six HTs. First, participants had received literature review materials for each proposal prior to the meeting. Next, a presentation was given by a subject matter expert for each HT proposal at the meeting. Finally, a discussion took place in which the HTs were prioritized taking into consideration the following factors: potential impact on the health of populations and on incremental health system costs; effectiveness, cost and utilization, public policy and systems integration; and finally technological, socio-economic and fiscal aspects of the HT.

Participants at Pilot Site A completed the Rater's Form for each of six selected HTs, which we will refer to as A, B, C, D, E, and F. These HTs were selected because they had undergone previous rating as stated above and they were to be considered for prioritization followed by future funding possibilities by the province. The form asks for an assessment of how likely each HT is to meet each of the 11 criteria. A twelfth question asked, "What is the likelihood that you would fund this health technology on a scale of 1-100?"

Administration of the Rater's Form

The Rater's Form included 11 statements, each addressing one of the 11 identified criteria previously identified. Pilot site participants were asked to answer how well each statement addressed the prioritization of a specific HT, using a ten point Likert scale from 0 to 9 (with 0 being Not Likely and 9 being Extremely Likely).

The Evaluation Form – Evaluating the Rater's Form

Pilot site participants were also asked to complete an Evaluation Form eliciting their thoughts on the Rater's Form. The Evaluation Form asked participants to (i) express an overall "feeling" with regards to the use of a form in a prioritization process; (ii) critique the key criteria chosen for the process; (iii) critique the use of a grading system and the questionnaire's format; and (iv) outline the benefits and deficiencies of using a questionnaire in the process of prioritization. The Evaluation Form also asked participants about aspects they liked and disliked regarding the current process for

prioritizing HTs in their organization. It was estimated that the Evaluation Form took about 20-30 minutes to complete.

Combining Weights and Ratings into Overall Scores

The pilot site's ratings are to be combined with the pre-determined importance weights (in particular, in order to capture local preferences) to derive an overall score for each HT. Symbolically, the score assigned to a particular health technology by decision-maker j is

$$U_j = \Sigma_k w_k * r_{jk}$$

where the sum is taken over k different criteria; w_k represents the importance weight assigned to criterion k by respondents from the health authorities across the country; and r_{jk} denotes the rating on criterion k that health technology i received from decision-maker j. The total score for each health technology is the sum of the scores it received from the individual decision-makers. Thus, each health technology is assigned a score that reflects its priority ranking: the highest priority health technology is the one with the largest score, the second highest priority goes to the technology with the second greatest score, and so on.

Results

Highlights from Key Informant Interviews and Focus Group Discussions

Highlights from key informant interviews and focus group discussions denoted large variations in the way that RHAs make prioritization decisions. The annual prioritization cycle of many RHAs runs from yearly second through fourth quarters, with the first quarter of the year dedicated either to allocating funds from an internal budget or to seeking funding by a provincial/territorial authority. Meetings for prioritizing HTs take place eight to ten times yearly, or sometimes monthly, and involve prioritization of both new and replacement HTs. Some authorities also have emergency funds for ongoing replacement of HTs.

Prioritization processes at RHAs vary from having no formal procedures in place at all to having strict guidelines on detailed aspects. A number of RHAs merely base their prioritization decisions on HT proposals alone and/or wish lists from physicians. Others utilize elaborate processes with binding rules and guidelines both with respect to the committee's mandate and regarding HT proposals. In some instances proposals have to comply with several criteria prior to being considered by a prioritization committee. Certain RHAs have developed and have follow specific criteria and detailed requirements needed for HT proposal formats, especially when addressing replacement or new HTs. Subcommittees are occasionally formed in order to investigate the myriad aspects and evidence pertaining to different HTs. The number of HTs prioritized per year depends on the size and type of investment, ranging between five HTs per year, for large investments, to hundreds, when small investments are needed. Several committees mention prioritizing an average of ten HTs per committee meeting, which yields an annual total of 80 prioritized HTs. HTs are generally prioritized by consensus and

ranking techniques: some organizations compile rankings into “must have” lists versus “nice to have” lists.

Finally, many years of research and debate may lay behind a decision that eventually leads to a proposal reaching a funding decision. Subcommittees assessing HTAs of the HTs proposed and considering these in the context of the local population needs, exis ting infrastructure, and personnel resources, may spend a year preparing a proposal for HT investment. Once the proposal reaches a prioritization committee the HT may enter a cycle of being on a “wish list” only to be taken off, reassessed, and restored to the list.

Analysis of Paired-Comparisons of Criteria

Responses to the Criterion Survey were collected from 54 participants from 35 RHAs throughout the country. Section B (paired-comparisons of criteria) responses were used to measure the relative imp ortance of each criterion.

The generation of *z*-scores from the paired-comparisons of criteria important for the prioritization of HTs revealed the following ranking of the criteria in order of importance (Table 2), with 1 being most important and 11 bein g considered to be the least important criteria in the prioritization of HTs (*z*-scores are noted within parentheses). Missing values accounted for 0.03% of the total number of answers.

Table 2: Evaluation criteria ordered from highest to lowest relative importance (*z*-score in parentheses).

1. Safety	(0.57)
2. Effectiveness	(0.38)
3. Compatibility	(0.16)
4. Feasibility	(0.13)
5. Accessibility	(0.01)
6. Efficiency	(-0.02)
7. Impact	(-0.06)
8. Incidence	(-0.20)
9. Need	(-0.21)
10. Proof	(-0.25)
11. Costs	(-0.51)

It should be noted that negative *z*-scores indicate that the criteria are less important relative to other criteria. Negative *z*-scores do not indicate that the criterion was viewed as unimportant—all of the criteria in cluded in the survey are valuable to some extent, as indicated by our focus group interviews.

Data collected were also analysed using only one survey per RHA, yielding $n = 35$, to ensure that results were not biased by multiple survey responses. Where there were multiple responses from one RHA, the survey of the participant holding the most senior

position in the organization was chosen to represent the RHA. The discrepancy between the full data set (n = 54) and the subset was minimal: the correlation between the resulting weights was 0.97.

Usefulness of Information

When asked about their opinion regarding what resources are most useful when prioritizing HTs (e.g., professional reports/journal articles, community organizations) using a seven point Likert scale ranging from "extremely useful" to "extremely harmful", participants (n = 54) responded with the rank order shown in Table 3.

Table 3: Evaluation criteria ordered from highest to lowest relative importance (z-score in parentheses).

Rank	Statement	Mean (Range=1 to 7)
1.	Experience from other jurisdictions	1.8
2.	HTA reports	2.0
3.	Review articles	2.2
3.	Primary research published in peer reviewed journals	2.2
4.	Presentations by experts	2.3
5.	Meta-analyses of published studies	2.4
6.	Government reports	2.6
6.	Regulatory submissions	2.6
7.	Reference books written by experts	2.7
8.	Conference proceedings (abstracts, posters)	2.9
9.	Internet	3.1
10.	Manufacturer's information packages	3.2
11.	Printed media (e.g. magazines, newspapers)	3.7
12.	Electronic media (e.g. television, radio)	4.0

Most participants were mildly satisfied with usefulness of information available for the prioritization of HTs (n = 54) (missing answers accounted for 4.4%). In answer to the question regarding pro viding any additional information considered to be important in the prioritization process, one participant mentioned that organization specific analyses (e.g., cost, impact) are very important, and another participant indicated a dearth in HTA literature.

Other Comments

The section addressing general comments on participants' prioritization processes produced the following type of answers.

- New versus replacement, additional units compared to current, expanded capacity, wait lists and turn around times are very important.
- The area of prioritization is hugely deficient in the health care system, and yet RHAs are expected to make decisions often without evidence. If the HT is

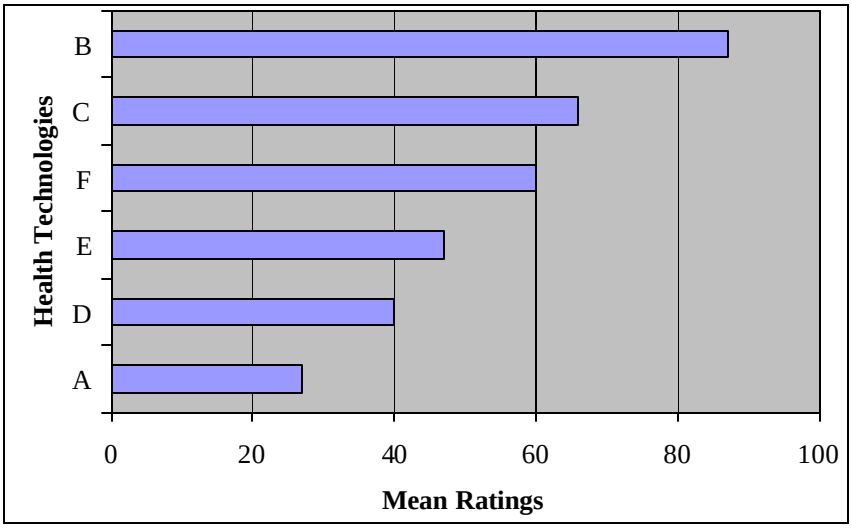
funded it is usually a “take it or leave it” proposition which comes from the government.

- Prioritization has to be within the context of the individual organization with respect to priorities and strategies: “not one size fits all”.
- It is important to be aware of future directions in a particular field and in HT in general, particularly those that are supported by government as they are our primary source of funds.
- The most effective manner in our experience to effectively prioritize is by having as much involvement from the stakeholders as possible. The greater the involvement and participation, the more effective the process tends to be. It usually results in more satisfied users, resulting in better service to the patient and less surprise equipment requests after the process has been completed.
- Opportunity costs do not get enough consideration. We start by funding expensive technologies demanded by the public or clinicians, and useful, lower cost preventive technologies do not get funded.
- It would be very beneficial to have product standardization throughout the province. It would also be very beneficial to have reports on best practices and best products, kind of like a medical consumer report magazine on all medical equipment and medication products.
- Knowing what other jurisdictions have done and the associated impacts is very useful information.

Results of the Pilot Study

Ten individuals participated from a subspecialty committee. Answers from one participant were omitted as this committee member did not meet one of the criteria for participation. The average age of participation was close to 55 years. Six females and three males participated, (one female’s answers were excluded as she did not meet criteria for participation), with an average of approximately three years experience in prioritizing HTs. For the Criteria Survey, the results of the pilot site’s paired comparisons were added to the data from the larger initial survey. Rating of HTs Rating of the HT proposals using the Rater’s Form gave the rank order illustrated by Figure 1 (with mean values).

Figure 1: Priority ranking of HTs prioritized at pilot site A.



The inter-rater reliability of the judgments in the ratings (average correlation between raters' responses) was equal to 0.79 (which is considered to be high), and internal consistency (average correlation between questions) was equal to 0.33 (which is considered to be low). Hence, there was little agreement between questions. For example, an HT with a high score for the criterion "Impact" does not necessarily correlate positively with having a high score for "Cost". The ranking from the Rater's Form identified the top three HTs. These matched the outcome of the previous prioritization process completed by the pilot site.

Note that the aim of the study is to determine how important certain criteria are for the prioritization of HTs, and to pair such importance weights with ratings for HTs at pilot sites. This creates an HT Prioritization Tool that can explicitly reflect a rank order of HTs as a result of a combination of scores assigned to the importance of the different criteria and ratings assigned to the HTs. An overall score was calculated for each HT by compiling the ratings for each criterion (Table 4). This score was compared to the overall mark that the participants had given the HT in question 12. It was found that the correlation was $r = 0.56$.

Table 4: Ratings of HTs without weights.

	Health Technologies					
Criteria	A	B	C	D	E	F
Accessibility	5	7	6	4	2	5
Compatibility	4	9	8	8	7	8
Cost	1	5	5	3	4	4
Efficiency	4	8	6	5	4	6
Effectiveness	6	7	7	5	6	6
Feasibility	7	5	6	7	7	7
Impact	7	8	8	6	7	8
Incidence	4	6	3	6	5	5
Need	6	8	7	5	6	6
Proof	6	8	8	6	7	7
Safety	5	1	1	4	3	2
Overall	27	87	66	40	47	60

The overall score was then calculated with the weight of each criterion included (Table 5). When this was done the overall score was again compared to the overall mark of question 12. It was found that the correlation was r = 0.53. Hence, this indicated that adding weights to the criteria in rating process had no effect. Indeed the correlation between criteria with weights and criteria without weig hts was found to be r = 0.99 (i.e. no difference).

Table 5: Ratings of HTs with weights.

	Health Technologies					
Criteria	A	B	C	D	E	F
Accessibility	14	20	17	11	7	15
Compatibility	13	26	23	23	22	25
Cost	3	16	14	10	11	11
Efficiency	11	23	19	14	13	17
Effectiveness	17	21	22	16	19	19
Feasibility	21	14	19	20	21	22
Impact	21	24	24	18	20	23
Incidence	11	18	9	17	14	15
Need	19	23	20	14	17	19
Proof	19	24	23	18	20	22
Safety	15	3	4	11	8	5

The fact that weighting yielded no improvement in predictive capacity could suggest that raters implicitly weighted each item when assigning their overall judgment. To test this possibility, the correlation between each individual item and the overall score was calculated. The correlation between the absolute value of these correlations and the *z*-scores elicited from the paired comparison exercise is moderately high ($r = 0.56$). Converting each variable to rank orders yielded an even higher correlation ($r = 0.70$), both results being supportive of the hypothesis that people are using the 11 questions in a manner consistent with the larger group's judgment regarding how they should be used. One ought to bear in mind however that the analysis was done for a small group and that the use of a larger group may yield different outcomes. Further, note that the HTs rated were all previously prioritized in an earlier cycle, where consensus had been reached.

The Evaluation of the Rater's Form

Most participants reported liking the Rater's Form. When asked to what extent the participants liked the Rater's Form, the average response ranged from "to some extent" to "quite a lot". Furthermore, most participants felt that the Rater's Form could provide "quite a lot" of useful input into the prioritization process. Participants noted the following when asked if the criteria were adequate in prioritizing HTs: a limited number of criteria was useful in terms of initiating discussions; list of criteria used in the study was inclusive, relevant, adequate and addressed key points in the prioritization process; there was perceived overlap between affordability and cost-effectiveness; and the criterion "need" which currently includes perceived external pressure was not viewed as an objective measure and therefore ought to be eliminated from the list of criteria to be considered for prioritization. One participant mentioned that criteria could benefit from being more specific than at present. Participants also found it important that all the criteria be known and agreed upon by all participants prior to the rating process.

Some participants found it somewhat difficult to contextualize criteria against their prioritization frameworks in their respective jurisdictions and how politics would play a great part in this. They also felt it was important to take into account clinical and fiscal perspectives when rating HTs. Participants also suggested that "Ethics" should be included as a separate twelfth criterion, rather than being incorporated into one of the existing 11 criteria. Generally, participants viewed the process of rating criteria as part of the prioritization process as a positive experience, leading to the standardization of the prioritization process, thereby maintaining objectivity. The methodology was also viewed as easily reproducible, and a recommendation was made to include a box or space after each criterion to allow participants to qualify responses.

Respondents felt that the use of a scale was adequate in prioritizing HTs and liked the use of a finely rated scale. A suggestion was given to use a five point Likert scale instead of a ten point scale. Finally, the scale was viewed as helping the decision-making process, but limiting to the rater. When asked to comment about the format of the Rater's Form, respondents felt positive about the formats and liked the drop down menus of the electronic version. They found that the form had useful prompts, that it was easy to use, and that the forms in hard copy formats can be very useful if they are to be used during a

meeting. Finally, when asked to describe negative and positive aspects about their current process of prioritization of HTs in their organization, participants mentioned that it is indeed challenging to prioritize among HTs across a broad spectrum of health needs in a multitude of program areas. Even after the prioritization process is completed a HT may not be implemented as it may rely provincial level funding.

Discussion

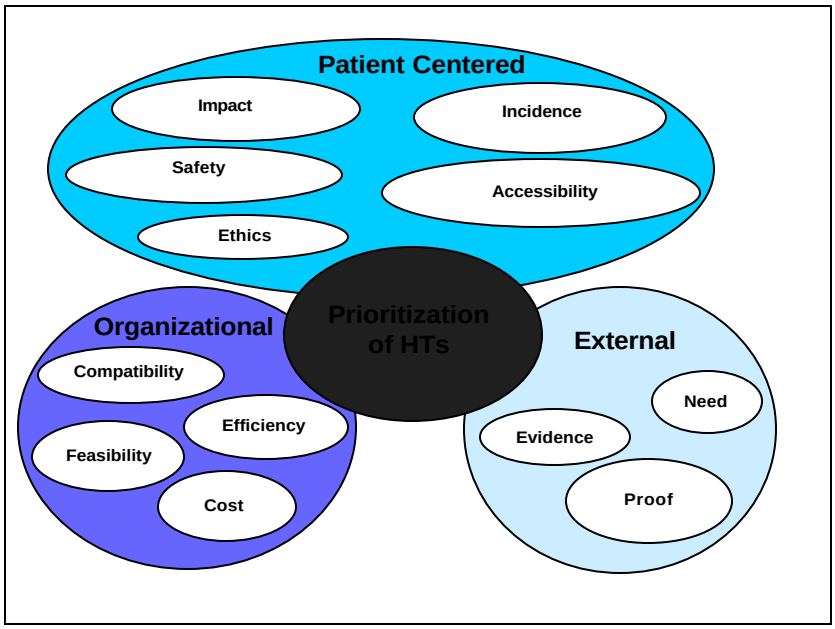
One aim of the study was to determine how important certain criteria are for the prioritization of HTs, and to pair such importance weights with ratings for HTs at pilot sites. This creates an HT Prioritization Tool that can explicitly reflect a rank order of HTs as a result of a combination of scores assigned to the importance of the different criteria and ratings assigned to the HTs. Responses to the Rater's Form at Pilot Site A were used to validate the relative importance weights established by the Criteria Survey completed at 35 RHAs throughout the country. The fact that weighting yielded no improvement in predictive capacity could suggest that raters implicitly weighted each item when assigning their overall judgment. To test this possibility, the correlation between each individual item and the overall score was calculated. The correlation between the absolute value of these correlations and the *z*-scores elicited from the paired comparison exercise is moderately high ($r = 0.56$). Converting each variable to rank orders yielded an even higher correlation ($r = 0.70$), Both results support the hypothesis that people are using the 11 questions in a manner consistent with the larger group's judgment regarding how they should be used.

There was high correlation between the weighted and unweighted ratings, which means that weights yielded no improvement in predictive capacity. This could indicate that participants were already weighting the criteria when rating the HTs, or that the previous prioritization process undergone at the RHA may have skewed these results. Nevertheless, one could infer that an HT prioritization tool could be used without weighted criteria as is supported by the literature.[26] Feedback from the pilot site participants, however, indicated that weights could be useful—documentation from RHAs also suggests that weights are indeed being used for criteria in the prioritization processes in use. Perhaps weights could be seen as useful when evaluating different types of HTs in an effort to allow for adaptation of the tool to a wide range of HTs. Using the tool for the rating of investments in IT and training could include weights to convey diminished emphasis on certain criteria, such as "Impact" and "Incidence" (since the extent of impact of these criteria on patients would only be indirect). For example, the prioritization process involving pharmaceuticals could benefit from a weighting scheme that would allow for less weight on certain types of criteria, such as operations.

The outcome of this study suggests that it would be beneficial to use a prioritization tool based on the format of the Rater's Form. Overall, participants at the four pilot sites felt that rating HTs based on a set of criteria can be useful in the prioritization process. There was resounding feedback with respect to adding an additional criterion to the list, namely "Ethics" (which was previously included in the list of 16 criteria primarily identified

through the focus group and key informant interviews). The 12 criteria can be grouped loosely into three categories: patient centred, organizational and external (Figure 2).

Figure 2: Basis of criteria for the prioritization of HTs.



Conclusions

The study aimed to identify criteria important for prioritizing HTs and to devise a tool that could be used by decision makers in this process. It is clear that large variations exist at regional and district health authorities with regards to the processes for the prioritization of HTs, and that there is a lack of tools that are structured, comprehensive, replicable and transparent. The study identified twelve criteria that are of importance for the prioritization of HTs. Pilot site participants felt that using these criteria to rate HTs as part of the prioritization process was useful.

The HT prioritization tool presented in this study cannot replace any existing processes of prioritization but can supplement any existing procedures with the aim to help local, provincial and federal decision makers make informed decisions. By using the tool stakeholders can organize thought processes with regards to using explicit criteria to evaluate HTs and can consider all important factors in a systematic and comprehensive fashion. Finally, the scores of individual HTs can provide concise summaries of the "value" of HTs which in turn, can be used to guide the decision-making process.

Although the identification of comparable studies and published guidelines to aid with the prioritization of HTs is not within the scope of this study, there appears to be an enormous void of information in this area. Continued research into frameworks surrounding HT prioritization ought to focus on the development of guidelines for HT proposals, linking this to prioritization tools such as the one proposed by this study. It would also be beneficial to devise tools for managing the accountability and transparency of the process, as well as short and long term implementation evaluations.

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