



# **IN PURSUIT OF A VALID INFORMATION ASSESSMENT METHOD**

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# ABSTRACT

**Context and objective:** The *Information Assessment Method* (IAM) is a unique tool for continuing education and knowledge translation research. IAM allows health professionals to report search objectives, cognitive impact, use and patient health benefit associated with objects of clinical information retrieved from electronic knowledge resources. While IAM has been previously validated in the information delivery context (PUSH), this thesis examines the content validity, relevance and representativeness, of IAM items in the context of information retrieval (PULL).

**Methods:** The study was conducted in three steps. In step 1, the relevance and representativeness of IAM items were assessed. In this step, data from a mixed methods triangulation study combining a prospective observational study with a qualitative multiple case study involving 40 family physicians were analyzed. Step 2 consisted of analysis and modification of every IAM item based on a set of guiding principles. Step 3 consisted of a multi-disciplinary expert panel discussion on all modified items and the development of a new version of IAM.

**Results:** The content validity of 16 IAM items was supported, and these items were not changed. Nine other items were modified. Three new items were added; two were extensions based on one existing item, and one was obtained from data analysis and literature review.

**Conclusion:** The final result of this thesis is a content validated version of IAM in the PULL context (IAM 2011).

# Résumé

**Contexte et objectif:** La *Méthode d'Évaluation des Informations* (MEI) est un outil unique pour les domaines de la formation continue et de l'application des connaissances. La MEI permet aux professionnels de la santé d'évaluer les objectifs des recherches d'information, les impacts cognitifs, les utilisations et les bienfaits sur la santé des patients associés à des objets d'information clinique, trouvées dans des ressources électroniques. Alors que la MEI a été validée pour évaluer plusieurs types d'informations envoyées par courriel (PUSH), ce mémoire examine la validité de contenu, la pertinence et la représentativité de chaque élément de la MEI pour évaluer les informations trouvées dans des ressources électroniques (PULL).

**Méthodes:** L'étude a été menée en trois étapes. Durant la première, la pertinence et la représentativité des éléments de la MEI ont été évaluées. Au cours de cette étape, les données d'une recherche mixte ont été analysées. Cette étude combinait une étude quantitative prospective longitudinale et une étude qualitative de cas multiple, et elle a été menée auprès de 40 médecins de famille. La deuxième étape consistait à analyser et modifier chaque élément de la MEI, en se basant sur un ensemble de principes directeurs. Enfin, la troisième étape consistait à discuter tous les éléments modifiés avec un panel d'experts provenant de plusieurs disciplines, puis à élaborer une nouvelle version de la MEI.

**Résultats:** La validité de contenu de 16 éléments de la MEI a été soutenue, et ces éléments n'ont pas été changés. Neuf autres éléments ont été modifiés. Trois nouveaux éléments ont été ajoutés : deux ont été construits à partir d'un élément existant, et le troisième a été suggéré à la fois par la revue de la littérature et l'analyse des données.

**Conclusion:** Le résultat final de ce mémoire est une nouvelle version de la MEI pour évaluer les informations trouvées dans des ressources électroniques 'PULL' (MEI 2011).

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# 1 Introduction

Keeping abreast of medical advances is a challenge for physicians (Amsterdam, 2003). The information mountain is constantly growing which does not make this challenge any easier for them (Petticrew & Roberts, 2006). Evidence Based Medicine (EBM) or Evidence Based Health Care further adds to this challenge. EBM is the process of applying research evidence to clinical practice (Pope, 2003). Family physicians like other health care providers strive to combine their clinical expertise and patients' concerns and conditions with the best available evidence (Nelson et al., 2005). Access to Electronic Knowledge Resources (EKR) can provide physicians with the best available evidence. EKRs form a part of Clinical Information Retrieval Technology or CIRT. CIRT refers to search engines that assist health professionals to find relevant references or research information in everyday clinical practice (Pluye, Grad, Dawes, & Bartlett, 2007). Information resources in CIRT can include updated clinical guidelines, systematic reviews, and synopses. For example, EKRs such as Essential Evidence Plus © contain 12 databases e.g., DailyPOEMS (Patient-Oriented Evidence that Matters), which are synopses of new clinical research filtered for relevance to primary care. In 2010, thousands of critically appraised topics (one-page summaries of evidence relevant to common clinical questions), can be quickly accessed at the point of care through EKRs. Furthermore EKRs offer potential advantages, such as, meeting information needs, dealing with clinical questions, solving clinical problems, supporting decision-making and overcoming limits of memory (Pluye, Grad, Dunikowski, & Stephenson, 2005). Thus, information technology can be used to disseminate and access information in a timely way, helping to bridge the gap between health care research and clinical practice. Information technology enables access to clinical information in two ways: (1) When it is delivered via email to health professionals: 'PUSH' context; and (2) When information is actively retrieved: 'PULL' context (Pluye, et al., 2005).



Rapid advances of health care technology warrant an evaluation of the value of information that is accessed from EKR's (Hersh, 2009). The value of information can be conceptualized as, the acquisition of information, associated cognitive impact, its use or application and, information related patient health benefit (Saracevic & Kantor, 1997). The presence of a feedback system can enable researchers to understand the reasons why physicians access information, the related cognitive impacts, and any types of information use or patient health benefits. A feedback system can be in the form of a comprehensive and systematic tool, such as a questionnaire.

There are many questionnaires that evaluate users' satisfaction with EKR's. However there is a unique questionnaire called the Information Assessment Method (IAM) that concomitantly examines search objectives, cognitive impact and use of information derived from EKR's (Pluye, Grad, & Repchinsky, 2009). IAM systematically and comprehensively assesses information from the perspective of the health professional.

Assessment tools need to be validated. Validity evaluates if the tool does what it is supposed to do (Carmines & Zeller, 1979). Carmines and Zellers also noted that assessment tools need to be validated in context of their purpose. Previously, IAM has been validated in the PUSH context (information delivery) (Pluye et al., 2010). IAM remains to be validated in the PULL context (information retrieval). Once validated, this tool can be confidently employed in routine clinical practice. The purpose of this MSc thesis is to examine the IAM questionnaire (IAM 2008) and develop a refined and content validated version, which we will call IAM 2011.

# 2 Background

## 2.1 The Information Assessment Method

Information is defined as codified knowledge (Amin & Cohendet, 2004). Information retrieval is “a conscious effort to acquire information in response to a need or gap in knowledge” (Case, 2007). The purpose of the Information Assessment Method (IAM) is to evaluate the value of information retrieved from EKR.s.

IAM is a unique questionnaire tool that can concurrently assess reasons for information search, cognitive impacts, use of information, and patient health benefits. Researchers at the Department of Family Medicine at McGill University built IAM over 10 years. It is considered as a systematic and comprehensive method to assess information from the perspective of health professionals (Pluye, Grad, et al., 2009). In its current form, in the context of information retrieval, the IAM questionnaire contains 26 items (or questions) and uses a dichotomous (Yes-No) response format. IAM assesses four components: (1) Search objectives, (2) Cognitive impacts, (3) Use of information for a specific patient, and (4) Information related patient health benefits.

In psychometrics a construct refers to the concepts, attributes or variables that are targets of assessment (Haynes, Richard, & Kubany, 1995). Thus, each component that IAM assesses is a construct. Constructs are composed of facets which aid in assessing the construct. The term factor is sometimes synonymously used with the term facets. We chose not to use the term factor, because it tends to connote a category of data analytic techniques concerned with statistical procedures (Smith, Fischer, & Fister, 2003). The items on a questionnaire reflect the facets of each target construct. The target constructs of IAM and the items that represent corresponding facets are presented below.

### 2.1.1 Target construct: Search objectives.

- (1) Address a clinical question/problem/decision-making about a specific patient
- (2) Fulfill an educational or research objective

- (3) Search in general or for curiosity
- (4) Look up something I had forgotten
- (5) Share information with a patient/ caregiver
- (6) Exchange information with other health professionals
- (7) Plan, manage, coordinate, delegate or monitor tasks with other health professionals

### **2.1.2 Target construct: Cognitive impact.**

- (1) My practice was (will be) changed and improved
- (2) I learned something new
- (3) This information confirmed I did (I am doing) the right thing.
- (4) I was reassured
- (5) I recalled something
- (6) I was dissatisfied as this information had no impact on my practice
- (7) I was dissatisfied as there was a problem with this information
- (8) I disagree with this information
- (9) I think this information is potentially harmful

### **2.1.3 Target construct: Use of information for a specific patient.**

- (1) To modify the management of this patient
- (2) To justify or maintain the management of this patient
- (3) To better understand a particular issue related to this patient
- (4) To persuade other health professionals or patients to make changes

### **2.1.4 Target construct: Patient health benefit.**

- (1) Increasing patient knowledge about health or healthcare
- (2) Avoiding unnecessary or inappropriate treatment, diagnostic procedure or preventative intervention
- (3) Increasing patient acceptability of treatment, diagnostic procedure or preventative intervention
- (4) Preventing disease or health deterioration (including acute episodes of chronic diseases)

(5) Improving patient health or functioning or resilience (i.e., how well the patient faces difficulties)

**Figure 2.1.** A screen shot of the IAM questionnaire



The screenshot shows a mobile application window titled "IAM (v74-204)". The main question is "What was the impact of this 'item of information' on you or your practice?". Below the question, the specific item is "ACE inhibitors effective in CAD without CHF". The instruction is "Check all that apply:". The response options are "Yes" and "No". The items and their responses are as follows:

Item	Yes	No
My practice was (will be) changed and improved	<input checked="" type="checkbox"/>	<input type="checkbox"/>
I learned something new	<input checked="" type="checkbox"/>	<input type="checkbox"/>
This information confirmed I did (will do) the right thing	<input type="checkbox"/>	<input checked="" type="checkbox"/>
I was reassured	<input type="checkbox"/>	<input checked="" type="checkbox"/>
I recalled something	<input type="checkbox"/>	<input checked="" type="checkbox"/>
I was dissatisfied, as this information had no impact on my practice	<input type="checkbox"/>	<input checked="" type="checkbox"/>
I was dissatisfied, as there was a problem with this information	<input type="checkbox"/>	<input checked="" type="checkbox"/>
I disagree with this information	<input type="checkbox"/>	<input type="checkbox"/>

*Figure 2.1* An example of a screenshot of the IAM questionnaire showing items of cognitive impact with a dichotomous (YES-NO) response format.

## 2.2 Development of Facets for each Construct

For each construct, the development of facets was based on literature reviews and empirical studies. Here, we provide some background on this development.

### **2.2.1 Search objectives or reasons to search for information.**

The seven reasons to search for information were identified by a comprehensive literature review and a qualitative case study involving family physicians (Pluye, et al., 2007). This literature review identified six reasons why physicians search for information from EKR, while the case study provided the seventh reason. Three reasons from the literature review were identified as individual objectives: (1) to address a clinical question/problem/decision-making about a specific patient, (2) to fulfill an educational or research objective and, (3) to search in general or for curiosity. These are associated mainly with an individual's needs for information. The other three reasons to search for information reflect organizational or collective stimuli arising from interaction with other health professionals and patients. These are: To share information with a patient/ caregiver, to exchange information with other health professionals and, to plan/manage/coordinate/delegate or monitor tasks with other health professionals. The case study of six family physicians identified a seventh reason for searching namely, to look up something forgotten. This reason was identified using the critical incident technique through interviews of participants.

### **2.2.2 Cognitive impact.**

Nine cognitive impacts were identified as part of a literature review aimed to assess the impacts of CIRT (Pluye, et al., 2005). This review classified impacts as high level impact, moderate level, no impact and negative impact. Currently the IAM items that assess cognitive impact can be broadly grouped into items of positive and negative cognitive impacts. Positive cognitive items are: (1) my practice was (will be) changed and improved, (2) I learned something new, (3) this information confirmed I did (I am doing) the right thing, (4) I was reassured and, (5) I recalled something. Negative cognitive impacts are (1) I was dissatisfied as this information had no impact on my practice, (2) I was dissatisfied as there was a problem with this information, (3) I disagree with this information, (4) I think this information is potentially harmful, and (5) This information had no impact on me or my practice.

### **2.2.3 Use of information for a specific patient.**

There are four types of use of information currently assessed by the IAM (Pluye, Grad, et al., 2009). The four types of use were based on the findings of an empirical study that examined how health-care providers across Canada use technology in health care and the limitations they encounter when using scientific knowledge (Hivon, Lehoux, Denis, & Tailliez, 2005). In general, the information could be used to: (1) directly modify a management plan (instrumental use), (2) increase awareness, thinking, or understanding of specific issues regarding a patient (conceptual), (3) persuade others to change an action (symbolic) (Knorr, 1976), and (4) justify or maintain an action plan for a patient (legitimizing).

### **2.2.4 Patient health benefits.**

There are various frameworks and models of patient health outcome indicators, of which none are specific to information related outcomes. The 'Results-based logic model for primary health care' provides a theoretical basis to outline effects of knowledge related patient health (Broemeling, Watson, Black, & Reid, 2006). With this model as a basis, the use of information for clinical decision-making may lead to five types of patient health benefits (Pluye, et al., 2010) which are currently elaborated as items on IAM: (1) increase patient knowledge about health or healthcare, (2) avoid unnecessary or inappropriate treatment, diagnostic procedure or preventive measure, (3) increase acceptability of treatment, diagnostic procedure or preventive measure, (4) prevent disease or health deterioration, including acute episode of chronic disease, and (5) improve patient health or functioning or resilience (the way the patient faces difficulties).

## **2.3 Theoretical basis for IAM**

IAM is based on a theoretical framework adapted from the Acquisition-Cognition-Application model proposed by Saracevic and Kantor (1997) to study the value of information. This model integrates the intention to search for information, related cognitive impacts, and corresponding use of information. In

addition to these three components, IAM incorporates patient health benefit as a fourth component (Pluye, Grad, et al., 2009).

Thus, IAM's theoretical framework can be conceptualized as ACAO (acquisition-cognition-application-outcome):

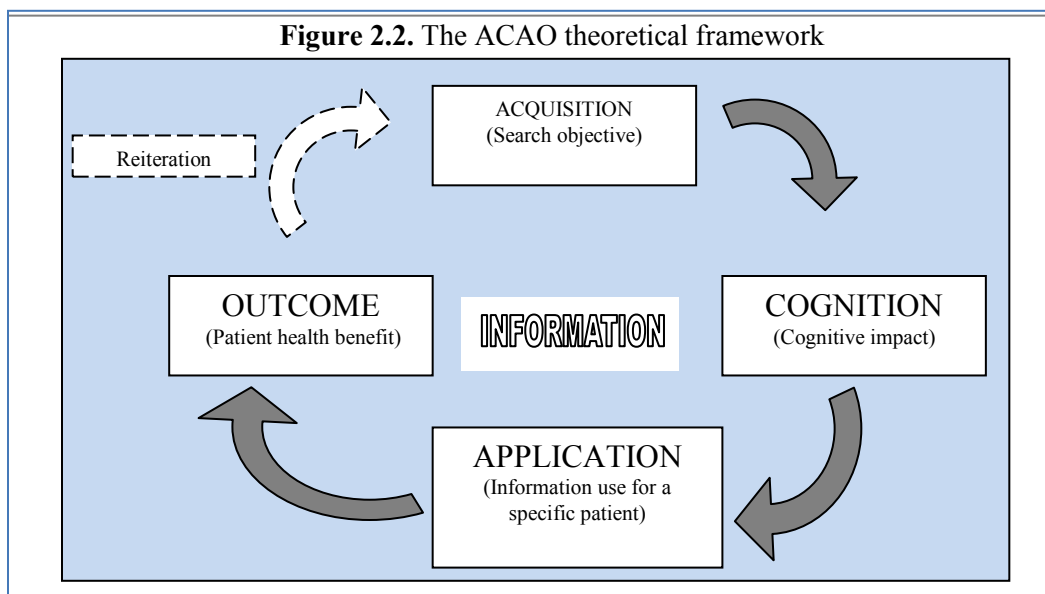
Acquisition: The process of getting information or objects potentially conveying information, as related to some intentions. For example, a physician retrieves information relevant to a clinical question, by searching an electronic resource ([http://iam2009.pbworks.com/f/Pluye\\_NAPCRG\\_poster\\_2010\\_presented.pdf](http://iam2009.pbworks.com/f/Pluye_NAPCRG_poster_2010_presented.pdf)).

Cognition: The process of absorbing, understanding, integrating the information. For example, cognitive processes (learning something new or recalling something) that takes place during reading and continues for some time afterward

Application: The process of (potential) use of this newly understood and cognitively processed information. For example, based on the information acquired and cognitively processed, the physician changes the management of a specific patient.

Outcome: The specific end result from applying information. For example, parameters such as improved patient health, lowered morbidity or mortality, and improved abnormal states.

The four constructs of IAM (search objective, cognitive impact, use of information for a specific patient and patient health benefit) operationalize the ACAO model as shown in Figure 2.2



## **2.4 Content Validation of Assessment Tools**

### **2.4.1 What is content validity?**

Content validity is defined as “the degree to which elements of an assessment instrument are relevant to and representative of the targeted construct for a particular assessment purpose” (Haynes, et al., 1995).

The components of this definition are explained as follows:

- An assessment instrument or tool refers to a particular method of acquiring data such as the IAM.
- Elements refer to individual items, response formats and instructions
- Construct refers to the concepts, attributes or variables that are the targets of assessments. For example, the constructs of the IAM are: 1) search objectives, 2) cognitive impact, 3) use of information for a specific patient and, 4) patient health benefit.
- Particular assessment purpose– the purpose to assess the above mentioned constructs.
- Relevance–the appropriateness of the elements of an instrument for assessing target constructs. Relevant elements reflect relevant facets to assess target constructs.
- Representativeness–refers to the extent to which the elements represent the facets to be assessed.

### **2.4.2 Why do assessment instruments need content validation?**

Content validation provides information about the data obtained from an assessment instrument and the inferences that can be drawn from those data (Guion, 1977). Using content invalid assessment instruments might over represent, under represent or omit facets of the target constructs. Thus, the data collected from such instruments might not accurately represent the assessment of the target constructs (Haynes, et al., 1995).

We identified two characteristics of content validity that provides the rationale for our research objective, i.e. content validation of the IAM.



(1) Conditional characteristic of content validity: The elements of an assessment instrument that are the most relevant and representative will vary with its intended use. This implies that an assessment instrument which is valid for one purpose may not be valid for another purpose (Vogt, King, & King, 2004). For instance, content valid elements of IAM in the context of information delivery or PUSH may not be content valid in the context of information retrieval or PULL.

(2) Dynamic characteristic of content validity: Definitions and facets of constructs have been known to evolve over time. As a result, the relevance and representativeness of the elements of an assessment instrument for the target constructs are unstable. Content validity can degrade over time as new theories evolve about the targeted constructs and due to this assessment instruments should be periodically re-examined. For instance, a comprehensive literature review can tell us about the current state of facets for the four constructs of the IAM (Haynes, et al., 1995).

Content validation of an assessment instrument sometimes involves refinement. The decision to refine elements or items of an instrument or develop new ones depends on knowing which items are performing poorly. Items might be considered for deletion or modification only if the facets of the targeted construct are not compromised (Haynes & Lench, 2003). Thus, instrument refinement might lead to construct underrepresentation (when essential facets of a construct are not assessed) or construct-irrelevance variance (when facets are too broad and not specific to the target construct) (Messick, 1995).

In addition to content validity, reliability is another property of assessment tools. It concerns the extent to which an assessment tool or measuring procedure yields the same results on repeated trials. However, reliability of the IAM cannot be assessed, because the constructs (e.g., cognitive impact) being assessed are subject to rapid, radical and momentary changes in routine clinical practice (Carmines & Zeller, 1979).

### **2.4.3 How do we validate assessment instruments?**

#### **2.4.3.1 Approaches to content validity.**

Content validation is a multi-method, quantitative and qualitative process that is applicable to all elements of an assessment instrument (Haynes, et al., 1995). Mixed method or multi method approaches to research are used when quantitative and qualitative approaches in combination yields a better understanding of the research problem than either approach alone (Creswell & Clark, 2007)

Some researchers consider that consulting members of the target population is vital to assess the content validity of an assessment instrument (Messick, 1995; Vogt, et al., 2004). Members of the population would be able to provide insight on item clarity based on their ease of understanding. Although consultation of members of the target population is considered the *sine qua non* of content validity only 1 in 4 researchers consult members of the population for the purpose of construct identification. Researchers commonly use structured interviews and focus groups to consult members of the target population (Vogt, et al., 2004).

#### **2.4.3.2 Content Validation Guidelines**

Numerous content validation guidelines have been put forth by experts in the field of psychometrics. These guidelines are recommended for content validity of new assessment instruments as well as for existing instruments. We followed a summary of guidelines proposed by Haynes et al. (1995) as well as Carmines and Zeller (1979). The summarized guidelines can be found in Box 1.

#### **BOX 1. Summarized Content Validity Guidelines**

- (1) Careful definition of target constructs and their facets
- (2) Use of a multi element approach to content validation(question stems and response formats)
- (3) Use of population and expert sampling in initial development of the instrument
- (4) Evaluating relevance and representativeness of items with respect to the target constructs
- (5) Detailed reporting of the results of content validation

After having described the background of the target constructs and facets, we now proceed to a literature review. To guide us in refining IAM during the process of content validation, it is necessary to understand how the four constructs and their facets are currently understood in the literature.

# 3 LITERATURE REVIEW

We carried out a comprehensive literature review to understand the current state of knowledge concerning the four constructs of IAM.

## 3.1 Importance of the Review

One of the aims of content validation of an instrument is to ensure comprehensiveness in assessing its target constructs (Haynes, et al., 1995). Comprehensiveness can be achieved if the instrument assesses all the essential facets of a particular construct. As mentioned previously, the nature of a construct is not constant as it evolves over time. The changes to a construct can happen due to discovery of new facets or modifications in the definition of the construct in the literature. Thus, it is important to understand the nature of the target constructs of an instrument from a review of the literature.

## 3.2 Goal of this Literature Review

We carried out this literature review to (1) identify how facets of the four target constructs of the IAM are currently assessed in literature and (2) to identify the existence of any facets that the IAM currently does not include.

## 3.3 Review Question

What does prior work tell us about the characteristics of the four constructs: (1) search objectives, (2) cognitive impact of clinical information, (3) information use for a specific patient, and (4) patient health benefits), in the context of physicians retrieving information?

## 3.4 Strategy of Literature Search

### 3.4.1 Overview.

To operationalize our literature search for this mixed studies review we started with the three review papers that have been associated with the development of the facets for IAM's target constructs (Pluye et al., 2007; Pluye et al., 2005; Pluye et al., 2010). We called these three review papers our *index*

papers. Mixed studies reviews are literature reviews that include original qualitative, quantitative, and mixed methods studies. For example, it refers to the combination of quantitative studies on outcomes with qualitative studies on processes (Grant & Booth, 2009). Mixed studies reviews are becoming popular in health sciences, and systematic reviews may use the *Mixed Methods Appraisal Tool* for critical appraisal of included studies (Pluye, Gagnon, Griffiths, & Johnson-Lafleur, 2009). For our search, we adopted the citation tracking strategy. Citation tracking consists of retrieving references that are cited in a potentially relevant article (tracking references backward in time), as well as retrieving references that cite the potentially relevant article (tracking citations forward in time) (Boell & Cecez-Kecmanovic, 2010). This strategy enabled us to track and retrieve who *cited them* and *who they cited*.

We adopted a citation tracking search strategy because it is complimentary with usual searches in database (Boell & Cecez-Kecmanovic, 2010). In fact, usual database searches were done for the index papers that include two systematic literature reviews. The combination of citation tracking with usual database searches makes our literature search better than a traditional search strategy alone (Boell & Cecez-Kecmanovic, 2010). In addition, citation tracking of known articles provides a greater focus to the search and avoids the inconsistencies that one may encounter in database searching (Bakkalbasi, Bauer, Glover, & Wang, 2006). Thus, we were able to cast an efficient yet wide net to retrieve potentially relevant articles for our mixed studies review.

### **3.4.2 Identification and selection of potentially relevant documents.**

We began by identifying the 64 potential references from the three index papers. The inclusion-exclusion criteria to identify and select potentially relevant reference based on titles/abstracts as well as full text papers are listed in Tables 3.1 and 3.2 below:

**Table 3.1***Inclusion-Exclusion Criteria for Titles / Abstracts of Retrieved References*

<b>Inclusion criteria</b>	<b>Exclusion criteria</b>
Empirical studies	Not empirical studies
Involving physicians- staff or resident	Involving only medical students or pharmacists or nurses or other allied health professionals
Information retrieval – direct or indirect	Information delivery
2003 or later	Before 2003
	Microbiology/Naval info management
	Not English or French

**Table 3.2***Inclusion-Exclusion Criteria for Full Text of Retrieved References*

<b>Inclusion criteria</b>	<b>Exclusion criteria</b>
Empirical studies	Not empirical studies
Involving physicians- staff or resident	Involving only medical students or pharmacists or nurses or other allied health professionals
Information retrieval – direct or indirect	Information delivery
A-C-A-O of the clinical information	No A-C-A-O of information
	Studies on database access frequencies
	Microbiology/Naval info management
	A-C-A-O related to hand held devices

We used the SCOPUS database for the citation tracking process. When references were not found on SCOPUS we used ISI Web of Knowledge or resources at the McGill University Library. We conducted our search in two phases or loops. In literature reviews the process of searching and selecting are often interwoven (Boell & Cecez-Kecmanovic, 2010). Thus, each loop was an iterative process of retrieving, identifying and selecting. Figure 3.1 depicts the two loops of the search strategy.

Loop 1:

We tracked citations for the 64 potential references as well as references to the three index articles. We limited our search results to 2003 or later because the oldest of the three index papers was published in 2005. Hence, in order to be able to retrieve potentially relevant studies that this paper might have missed, we decided to lower our limit to 2003 or later.

In loop 1 we retrieved 972 references. Based on title and abstract we were able to exclude 899 references and retain 72 references for full text reading. Based on inclusion-exclusion criteria for full text papers, we excluded 63 references, which lead to selecting nine potentially relevant references at the end of loop 1.

Loop 2:

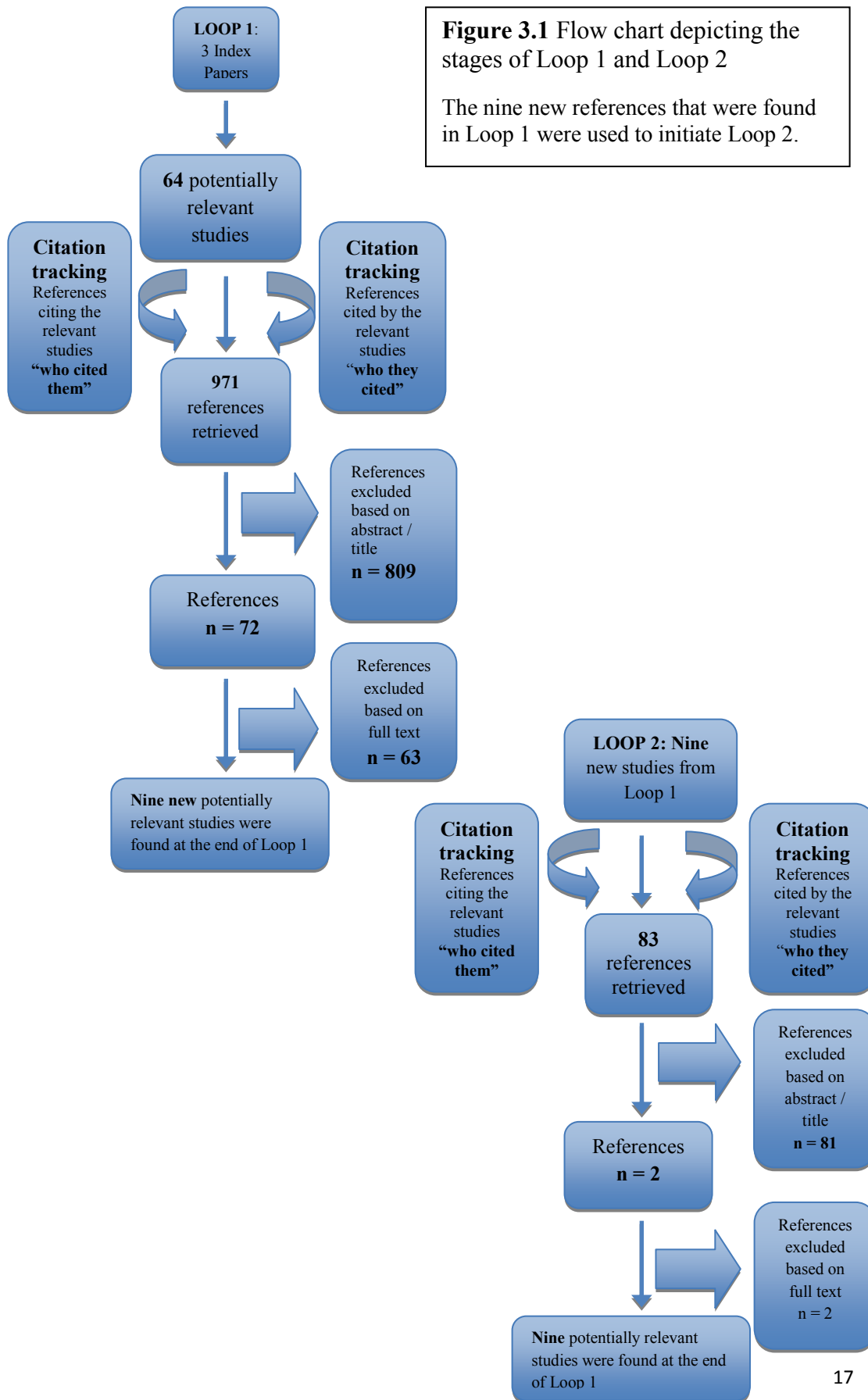
Nine potentially relevant references from loop 1 were subjected to citation and reference tracking. This led us to retrieve a total of 83 references. Based on titles and abstracts we excluded 81 references, which lead to retain two references for full text reading. On applying inclusion-exclusion criteria for full text papers we excluded both references, thus closing the loop. We thus considered 73 relevant references (nine relevant references from loop 2 and the 64 relevant references that we had initially identified) for synthesis.

### **3.4.3 Appraisal of the quality of selected studies.**

We did not use a formal tool to appraise the quality of the 73 relevant references. We believe that we accomplished a comprehensive review of the literature. Appraisal of selected studies is a necessity for systematic literature reviews. The thesis preparation guidelines of the Graduate and Postdoctoral Studies at McGill University (<http://www.mcgill.ca/gps/students/thesis/>) consider that a systematic review is not within the scope of a Masters' thesis.

### **3.4.4 Synthesis of retained studies.**

We used thematic analysis for data extraction. Thematic analysis is a method of data analysis to detect emergence of patterns or common themes. It can be used as a method of data extraction in literature reviews by considering the retained studies as pieces of data. We used an inductive-deductive thematic analysis (Fereday & Muir-Cochrane, 2008). The deductive component was



**Figure 3.1** Flow chart depicting the stages of Loop 1 and Loop 2

The nine new references that were found in Loop 1 were used to initiate Loop 2.

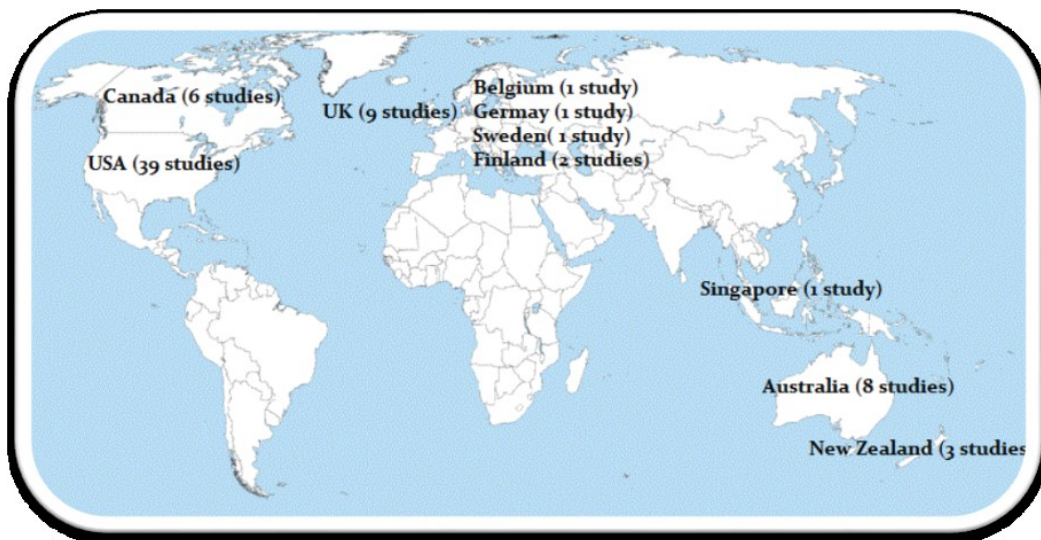


prominent because we used IAM item/facets as initial themes. Deductive thematic analysis was done to map or code facets of the four target constructs in the literature with the IAM items. The purpose of the deductive component of the thematic analysis was to assess if each IAM item/facet corresponded to existing facets in the literature. The inductive component was employed to identify the existence of new facets for any of the four target constructs that IAM did not assess. We used Microsoft Excel for the synthesis of the retained studies. We could not extract data from two studies (Freeth, Weist, & Roberts, 2001; Wallingford, Humphreys, Selinger, & Siegel, 1990) because of missing sections which could not be retrieved from SCOPUS, ISI Web of Knowledge or the McGill University library. Thus, 71 studies were subjected to data extraction.

### 3.4.5 Findings of the review.

Appendix 1 (Tables 1 to 7) summarizes the characteristics and findings from the retained studies. Figure 3 shows the geographic location of the retained studies. The country is based on the university affiliation of the first author at the time of publication. Of the 71 studies, 60 studies were quantitative studies, nine were qualitative studies and two were mixed methods studies.

**Figure 3.2 Geographic distributions of 71 potentially relevant studies.**



Since each of the 71 studies could address one or more constructs, the total number of studies addressing the four constructs are: Reasons to search for information (N= 51), cognitive impacts (N=23), use of information for a specific patient (N=31 studies), and patient health benefits (N=15).

Findings from the inductive-deductive thematic analysis can be found in Tables A1 to A5 (See Appendix A). We found that all IAM items are facets that are supported in the literature at least once. In addition, we found new themes or facets which IAM currently does not assess. The first is a facet under the construct of use of information for a specific patient. It is the use of information to promote discussion with a specific patient or exchange information with colleagues about a specific patient. Eight studies reveal this new facet (Axelson, Wårdh, Strender, & Nilsson, 2007; Barley, Murray, & Churchill, 2009; Cullen, 2002; Del Mar et al., 2001; Ranson, Boothby, Mazmanian, & Alvanzo, 2007; Scott, Heyworth, & Fairweather, 2000; Swinglehurst, Pierce, & Fuller, 2001; Westbrook, Coiera, Sophie Gosling, & Braithwaite, 2007). The second facet is under the construct of patient health benefit. It is a ‘no outcome’ facet. It reflects that the information did not lead to an improvement in patient health abnormality. This facet was revealed in a study by (Lindberg, Siegel, Rapp, Wallingford, & Wilson, 1993). We also found other information related types of use and outcomes such as ‘decreased hospital stay’ and ‘increased longevity of the patient’. ‘Decreased hospital stay’ was interpreted to be subsumed under the existing IAM facet ‘avoiding unnecessary or inappropriate treatment, diagnostic procedure or preventative intervention’ and hence we did not consider it as a new facet. Similarly, ‘increased longevity of the patient’ was interpreted to be corresponding to the existing IAM facet ‘improved patient health or functioning or resilience’. Many studies also reported general, nonspecific or vague reasons to search for information, vague cognitive impacts, types of use of information, and patient health outcomes.

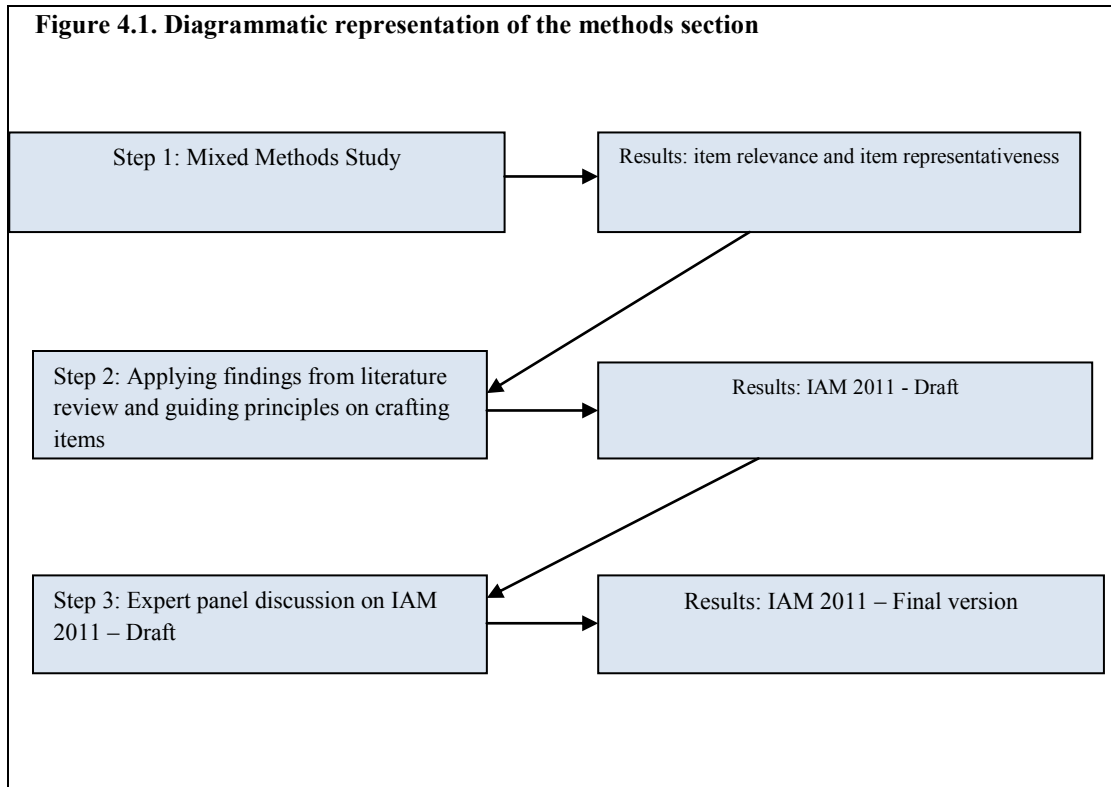
### **3.5 Summary of the Findings**

Our literature review substantiates the facets of IAM in assessing its target constructs. This review specifically aides in understanding how the target

constructs are currently being assessed in literature. In addition, this review will help with IAM item modification (as described in methods section 4.2). Furthermore, by incorporating new facets identified in our literature review, we can conclude that the new version of IAM is comprehensive and contemporary.

# 4 METHODS

Method steps 1, 2, and 3 are described in the methods section and the corresponding results are presented in the results section of this thesis. We summarize the steps of our methods section in Figure 4.1 below:



## 4.1 STEP 1

### 4.1.1 Overview.

To fulfill our purpose of content validation of the Information Assessment Method, we used mixed methods research. Mixed methods research is defined as a combination of quantitative and qualitative methods conducted by a researcher or research team, for the broad purpose of gaining breadth and depth of understanding or corroboration, within a single study or closely related studies (Creswell & Clark, 2007). As described previously, content validity can be considered to be composed of two arms: (1) relevance and (2) representativeness. Relevance is a measure of the appropriateness of the items of an instrument to

assess target constructs. Hence, relevant items indicate the essential facets in assessing the target constructs. Representativeness refers to the extent to which the elements represent the facet to be assessed.

Since relevance is considered a *measure*, quantitative methods were used to evaluate relevance of the IAM items. Representativeness reflected the extent to which an item clearly represented the facet that was being assessed, hence qualitative methods were used to assess representativeness of the IAM items. The central premise of using mixed methods research was that quantitative and qualitative approaches in combination enable comprehensive evaluation of the content validity of an assessment instrument (both relevance and representativeness).

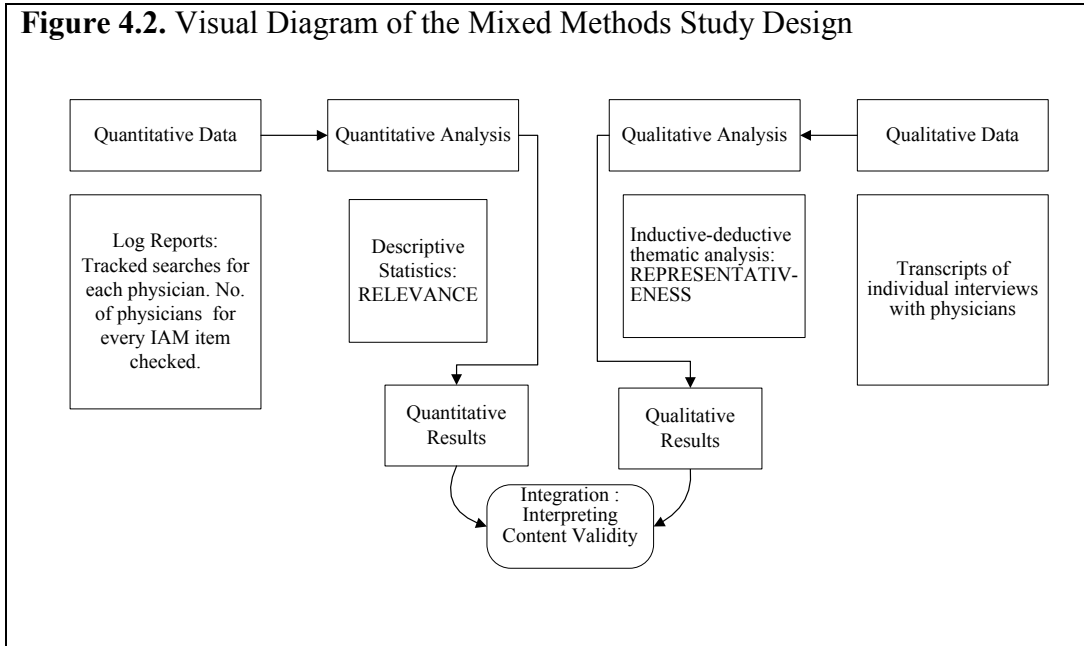
#### **4.1.2 Design of the mixed methods study.**

A convergence model of a mixed methods triangulation design was used for this study. Triangulation is the most common and well known approach to mixed methods. The convergence model represents the traditional model of a mixed methods triangulation design (Creswell & Clark, 2007). The purpose of triangulation is to obtain different but complimentary data on the same topic (Morse, 1991). The convergence model enables separate data collection and analysis of the same phenomenon. Subsequently, the different results are converged (by comparing and contrasting quantitative and qualitative results) during interpretation. A visual diagram of the mixed methods study is presented in Figure 4.2.

#### **4.1.3 Participants.**

A convenience sample of 40 Canadian family physicians were recruited from personal contact with IAM developers at medical conferences (e.g. Family Medicine Forum or the EBM Teachers Group of the College of Family Physicians of Canada) or through advertisements in e-newsletters sent by the College of Family Physicians of Canada. All participants were offered a hand-held device (Personal Digital Assistant) for participating in this CIHR funded research. In exchange for their participation, they were also offered continuing medical

**Figure 4.2.** Visual Diagram of the Mixed Methods Study Design



education credits. All participants were practicing family physicians and some were university faculty. Moreover, a representative sample of the targeted population is not needed for content validity assessment. For example, Vogt et al. (2004) suggested three to six focus groups with five to 10 participants in each group are sufficient. While very few (4%) studies have involved users in the assessment of content validity, we involved the end-users (FPs) to get their perspective on IAM and how they understood the items.

#### **4.1.4 Intervention.**

The participants were asked to respond to the IAM questionnaire every time they retrieved information from Essential Evidence Plus © resource. This resource along with the IAM software was provided to them on their handheld device (See Figure 4.3).

#### 4.1.5 Quantitative data collection.

A longitudinal observational study was conducted over an average of 320 days during 2008-2009. During this period, participants searched for information on their hand held devices in routine clinical practice. Searches for information contained various information objects, e.g., clinical synopses (InfoPoems), guidelines, Cochrane reviews, etc. When a participant opened one information object and responded to the IAM questionnaire, it was defined as a 'rated hit'. The IAM software generated log reports which included: (1) date and time of information searches including all 'hits', (2) titles of information objects, and (3) IAM item responses by physician linked to specific 'hits'. The IAM item responses were collected for: Search objectives (search level), cognitive impacts ('hit' level) and, information use for a specific patient (yes-no response format). The IAM item responses form the pool of quantitative data. A total of 1,767 rated searches were performed by the MDs during the study period which comprised of 3,300 rated 'hits'.

**Figure 4.3.** *The hand held device with access to the Essential Evidence+ database*



#### 4.1.6 Qualitative data collection.

A multiple case study was conducted, where a case was defined as one search performed by one physician. Participants were interviewed to explain a purposeful sample of their rated information 'hits'. The emphasis was on 'purposively selecting information-rich' cases (Teddlie & Yu, 2007). As a result, the purposeful sample consisted of 'hits' with information use for a specific patient or with a negative cognitive impact. A physician's explanation for checking one IAM item, for one information 'hit' was defined as a 'unit'.

The interviewer was an anthropologist with experience in conducting interviews. Interviews were conducted based on a semi-structured questionnaire with open and closed ended questions (See Appendix 2). Individual log reports

were e-mailed to the physicians as an *aide memoire*, before the interview. The interviews were recorded with permission of each participant. Most interviews were conducted by telephone and lasted 30 to 45 minutes. Each physician was interviewed twice during the data collection phase.

During the interview, physicians were reminded of their search for information and their IAM item responses, in terms of: ‘Search objectives’ and ‘Cognitive impacts’. The physicians provided explanations as to why they checked a particular IAM item during a search for information. Additionally, open questions sought explanations as to how the information was used for a specific patient (if applicable) and to describe any patient health benefits (perceived or witnessed during follow-up contact). If the physicians described any information use or health outcome, further questions were asked based of items on information use for a specific patient and patient health outcome in the interview guide. These items from the interview guide were also being tested for content validity.

#### **4.1.7 Data transformation.**

Since types of ‘Use of information’ and ‘Patient health benefits’ were not collected during the quantitative data collection phase, we transformed the explanations collected during the interviews i.e., ‘units’, into quantitative data. ‘Quantification’ is the process of transforming qualitative data into quantitative data for analysis (O’Cathain, Murphy, & Nicholl, 2010). We ‘quantified’ the explanation provided by physicians i.e., ‘units’ into numerical values (1 and 0) for each of the items for all constructs. When an interview item of ‘Use of information’ and ‘Patient health benefits’ was responded to as YES it was transformed to 1 and when the response was NO, it was transformed to 0. The values from the data transformation were used in the quantitative data analysis to evaluate the relevance of items.

#### **4.1.8 Quantitative data analysis.**

For each of the four constructs, item relevance ( $R$ ) was calculated using the formula



$$R = \frac{\text{Number of times the item was rated or explained}}{\text{Total number of ratings or explanations}}$$

Table 4.1 indicates the sources and levels of the quantitative data used to calculate *R* for each of the four constructs. When *R* < 10% then the relevance of an item is questionable.

**Table 4.1.**

*Sources of Quantitative Data Used to Calculate Relevance*

<b>CONSTRUCT</b>	<b>RATINGS used to calculate R</b>	<b>EXPLANATIONS used to calculate R</b>	<b>Levels at which R was calculated</b>
Search objective	YES	NO	SEARCH LEVEL
Cognitive Impact: Positive	YES	NO	‘HIT’ <sup>a</sup> LEVEL
Cognitive Impact: Negative	NO	YES	UNIT <sup>b</sup> LEVEL (data transformation)
Information Use for a specific patient	NO	YES	UNIT LEVEL (data transformation)
Patient Health Benefit	NO	YES	UNIT LEVEL (data transformation)

*Note.* *R* = Relevance of an item on the assessment instrument.

<sup>a</sup>A ‘hit’ occurred when an information object was opened and IAM items were rated.

<sup>b</sup>A ‘unit’ was one physician's explanation for checking one IAM item during the interview.

*Example:* Number of times “Address a clinical question” was rated = 1310

Total ratings for all seven Search Objectives (Address + Look up + Share... etc) = 4253

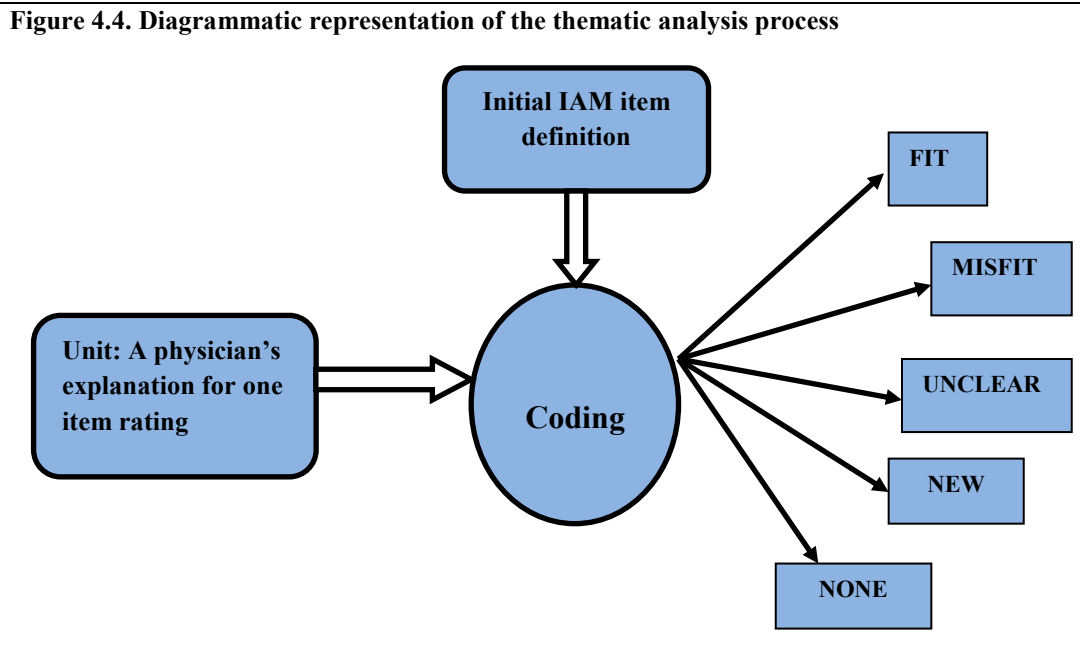
$$= \frac{1310}{4253} \times 100 = 31\%$$

Therefore, *R* for this item is 31%. Thus, this item is deemed to be relevant.

We chose  $R < 10\%$  as the cut-off for questioning relevance of items because there is no agreed upon criterion or universal cut off to determine the extent of content validity (Carmines & Zeller, 1979). Since the IAM items have been based on 10 years of research in a focused context, it was likely that many items would be relevant. Hence, in order to identify items that have very low relevance we chose the arbitrary cutoff of 10%.

#### **4.1.9 Qualitative data analysis.**

Qualitative data analysis was used to evaluate representativeness of IAM items. We used computer assisted qualitative data analysis software – NVivo7. An inductive-deductive thematic analysis of the interviews was carried out using IAM items as initial themes (Fereday & Muir-Cochrane, 2008). Each unit or a physician’s explanation for one rated IAM item was coded to the respective theme based on the IAM item definitions as presented in Appendix B. There were four possibilities: (1) a unit was a ‘FIT’ when the physician’s explanation was concordant with the definition of the IAM item, (2) ‘MISFIT’ when it was concordant with the definition of another IAM item, (3) ‘UNCLEAR’, when an explanation was provided, but was not clear, (4) ‘NEW’ when an explanation did not correspond to any of the current IAM item definitions and was a potential new item, and (5) ‘NONE’, when no explanation was provided. Figure 4.4 provides a visual description of the coding process. We coded a total of 3,199 units during the thematic analysis process. An item was considered representative if the number of ‘FIT’ units was  $\geq 80\%$  of all responses (FIT + MISFIT + UNCLEAR + NEW + NONE). There is no agreed upon criterion for determining the extent to which a measure has attained content validity. Nunnally (1978) noted that “inevitably content validity rests mainly on appeals to reason regarding the adequacy with which important content has been cast in the form of test items.”



#### **4.1.10 Integration of quantitative and qualitative methods.**

The integration of the quantitative and qualitative methods occurred at the stage of interpreting quantitative (relevance) and qualitative (representativeness) results. Integration of relevance and representativeness enabled us to understand the status of content validity for items on IAM 2008 and identify problematic items that needed modification.

## **4.2 STEP 2**

### **4.2.1 Item analysis.**

As a result of Step 1 we concluded that 16 items were relevant and representative, six items were relevant but not representative, and three items were not relevant. We examined the problematic items by drawing evidence from our data and from our literature review. For each IAM item we applied the Guiding Principles of Crafting Items (See Box 3) to identify possible unclear items that were missed by the results from Step 1. We analyzed all items by using an analysis grid based on the guiding principles (See Appendix 2 for analysis

grid) and made necessary modifications to problematic items. This enabled us to increase the representativeness of items that required modification. We drafted the modified items for the draft version of IAM 2011 (See Table 5).

From three sources (Clark & Watson, 1995; Comrey, 1988; Dillman, Smyth, & Christian, 2008) we compiled a list of 10 recommendations or guiding principles on how to compose good questionnaire items (See Box 2).

#### **BOX 2. Guiding Principles of Crafting Items**

1. The item should apply to the respondent and the situation.
2. Use simple yet concrete words.
3. The language should be simple, straightforward and appropriate for the reading level of the scale's target population. The language chosen for items should avoid slang, technical wording (jargon), trendy expressions and rare words.
4. The item should be a simple sentence. Avoid complex sentences. Long convoluted items are difficult for respondents to read and understand.
5. The item may be in the form of a statement or in the form of a question.
6. Ask one question at a time. Avoid double barreled items that actually assess more than one characteristic such as “This information maintained or justified my management of this patient.”
7. Avoid items that apply virtually to everyone (ceiling effect).
8. Avoid items that apply virtually to no one (floor effect).
9. Avoid double negation.
10. Special care must be taken with negatively stated item stems to avoid ambiguity.

### **4.3 STEP 3**

#### **4.3.1 Expert panel discussion.**

We subjected the proposed version of IAM 2011 (draft) to the discussion of a panel of seven researchers. This was a multidisciplinary panel of researchers

who are experts in studying the value of information. This panel consisted of family physician-researchers, librarians, information scientists and an anthropologist. Nunnally and Bernstein (1994) noted that results from such an exercise can guide judgments about the content validity of the items that need modification or need to be omitted.

The panel members evaluated each item based on a 3-point Likert scale questionnaire (See Appendix D for questionnaire). Each IAM item was evaluated for its relevance to the construct, representativeness to the item definition, clarity, language and response format. When an item was VERY [Relevant / Representative / Clear / Appropriate Language] it was given a score of 3. When an item was SOMEWHAT [Relevant / Representative/ Clear / Appropriate Language] it was given a score of 2 and when an item was NOT AT ALL [Relevant / Representative / Clear / Appropriate Language] it was given a score of 1. The experts also made suggestions in the open comments box provided in the questionnaire. Based on the responses to the questionnaire and open comments, we modified items on the proposed draft of IAM. Step 3 resulted in the development of IAM 2011, the content validated version of IAM.

# 5 RESULTS

We present our results corresponding to the three steps listed in our methods section. Participating physicians performed an average of 44.2 searches with an average of 82.5 rated hits for each physician. The average age of participants was 45 years; there were 17 women and 23 men.

## 5.1 Results from Step 1

The relevance and representativeness for each IAM item is presented in the table below. Relevance was calculated based on the formula mentioned in the methods section 4.1.8, while representativeness was based on the number of FIT units. The cut-off for questioning relevance is  $R < 10\%$  and for representativeness it is  $\geq 80\%$  FIT units. The results from Step 1 are presented in Table 5.1. In addition, we found one new item concerning the use of information in a discussion with a patient or health professional. This item was reported 53 times in 30 searches of information. Users also reported that retrieved information helped to decrease patient anxiety, 21 times in 16 information searches.

**Table 5.1**

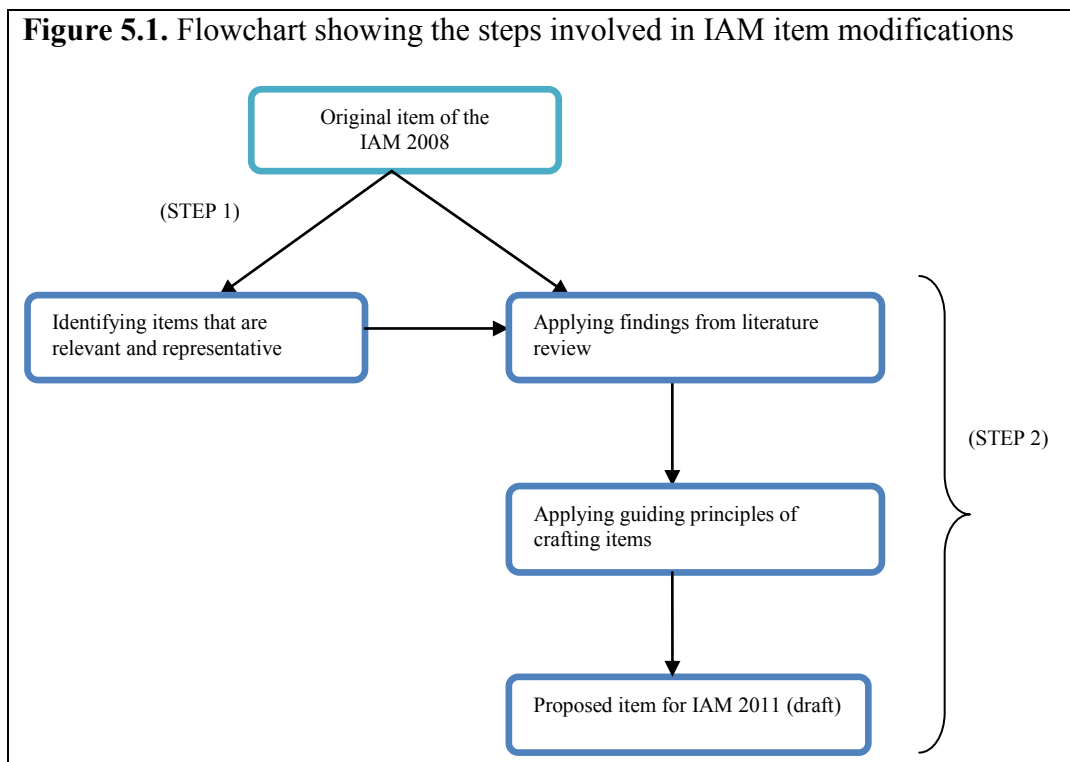
Results from Step 1 showing relevance and representativeness for each IAM item

Items	Relevant?	Representative?	Decision
<b>Reasons for Information Search</b>	Number of ratings = 4253		
1. Address a clinical question/problem/decision-making about a specific patient	YES 31%	YES 98%	Retain
2. Fulfill an educational or research objective	YES 10%	YES 98%	Retain
3. Search in general or for curiosity	YES 12%	YES 97%	Retain
4. Look up something I had forgotten	YES 16%	YES 88%	Retain
5. Share information with a patient/ caregiver	YES 15%	YES 93%	Retain
6. Exchange information with other health professionals	YES 12%	YES 97%	Retain
7. Plan, manage, coordinate, delegate or monitor tasks with other health professionals	NO 5%	YES 86%	Consider removal
<b>Cognitive Impact</b>			

<b>Items of Positive Impact</b>	Number of ratings = 6329		
1. My practice was (will be) changed and improved	YES 15%	YES 83%	<b>Retain</b>
2. I learned something new	YES 30%	YES 80%	<b>Retain</b>
3. This information confirmed I did (I am doing) the right thing.	YES 24%	YES 88%	<b>Retain</b>
4. I was reassured	YES 23%	YES 90%	<b>Retain</b>
5. I recalled something	YES 18%	NO 78%	<b>Consider modification</b>
<b>Items of Negative Impact</b>	Number of ratings = 166		
6. I was dissatisfied as this information had no impact on my practice	YES 47%	YES 83%	<b>Retain</b>
7. I was dissatisfied as there was a problem with this information	YES 40%	YES 83%	<b>Retain</b>
8. I disagree with this information	NO 4%	NO 66%	<b>Consider removal</b>
9. I think this information is potentially harmful	NO 8%	YES 80%	<b>Consider removal</b>
<b>INFORMATION USE for a SPECIFIC PATIENT</b>	Number of units =737		
1. To modify the management of this patient	YES 19%	NO 53%	<b>Consider modification</b>
2. To justify or maintain the management of this patient	YES 39%	YES 92%	<b>Retain</b>
3. To better understand a particular issue related to this patient	YES 28%	YES 97%	<b>Retain</b>
4. To persuade other health professionals or patients to make changes	YES 14%	NO 79%	<b>Consider modification</b>
<b>PATIENT HEALTH BENEFIT</b>	Number of units = 766		
1. Increasing patient knowledge about health or healthcare	YES 23%	YES 96%	<b>Retain</b>
2. Avoiding unnecessary or inappropriate treatment, diagnostic procedure or preventative intervention	YES 21%	YES 88%	<b>Retain</b>
3. Increasing patient acceptability of treatment, diagnostic procedure or preventative intervention	YES 18%	NO 3%	<b>Consider modification</b>
4. Preventing disease or health deterioration (including acute episodes of chronic diseases)	YES 17%	NO 64%	<b>Consider modification</b>
5. Improving patient health or functioning or resilience (i.e., how well the patient faces difficulties)	YES 20%	NO 66%	<b>Consider modification</b>

## 5.2 Results from Step 2

Based on our item analysis from step 2 of the methods section (incorporating findings from our literature review and then applying the Guiding Principles of Crafting Items (Box 2), we propose the items for the draft version of IAM 2011. The proposed draft will continue to employ the YES-NO response format, for the use of IAM in the research context. The process for scrutinizing items based on findings arising from our data, the literature review and the guiding principles of crafting items is represented in Figure 5.1 below.



The 22 relevant items of the IAM were subjected to the above processes which lead to identify 17 problematic items. These items were not explicit enough in representing the facet they were assessing, were unclear, double barreled, contained low frequency words (acceptability and resilience). Modifications of these IAM items were done such that they can better represent the corresponding facet for the target constructs. Based on our findings from the literature review and qualitative data analysis we also suggest a new item for IAM 2011(draft)



which were subjected to the guiding principles of crafting items. Here we present the results of item analysis on these problematic items and the one new item.

(1) *Item: Fulfill an educational or research objective*

This item was considered to be a double barreled item assessing two reasons for information search: (1) for the purpose of one's own learning and (2) for the purpose of research related tasks. We propose two items to assess the two facets - "To meet a research related task" and "To fulfill a personal educational objective"

(2) *Item: Search in general or curiosity*

This item was considered to be a double barreled item as well as assessing two reasons for information search: (1) for searching in general and (2) for personal curiosity. Based on examples from data and literature we considered merging this item as "to search for personal interest or curiosity"

(3) *Item: Share information with a patient/caregiver*

The term 'caregivers' was considered ambiguous. The developers' of IAM had conceptualized 'caregivers' as a non-health professional, a family member or a home health aide. During the thematic analysis of interviews, we found that participants often thought of caregivers as other health professionals. We suggest resolving this confusion by using the MeSH definition for a care provider who is not a health professional, such as a home health aide (<http://www.ncbi.nlm.nih.gov/mesh/68018576>). Thus we modified this item as "share information with a patient, their family or home health aides".

(4) *Item: I recalled something*

Although this item was found to fit all criteria of the Guiding Principles of Crafting Items, the term 'recall' was referred to as 'remind' by the participants. Evidence from our literature review shows us that the facet 'information that refreshed one's memory' is assessed as 'reminded of something that one already knew or had seen before'. Hence we suggest the following change "I was reminded of something that I already knew".

(5) *Item: I was dissatisfied as this information had no impact on my practice*

This negative item was considered to be ambiguous because of the presence of two negative terms ‘dissatisfied’ and ‘no impact’. We considered shortening this negative item to reduce its ambiguity. Hence we suggest “*I was dissatisfied*”.

(6) *Item: I was dissatisfied as there was a problem with this information*

This negative item was also considered to be ambiguous because of the two terms that imply negation – ‘dissatisfied’ and ‘problem’. We considered modifying this item to “*There was a problem with this information.*”

(7) *Item: I disagree with this information*

This item was considered to be unclear and needed to emphasize that disagreement was with reference to the content of the information. Hence we suggested the following modification “*I disagree with the content of this information*”.

(8) *Item: I think this information is potentially harmful*

Although this item matched all the criteria of the Guiding Principles of Crafting Good Items (Box 2) we considered using the fewest possible words for this item of cognitive impact. We suggested modifying this item to “*This information is potentially harmful*”.

(9) *Item: To modify the management of this patient*

This item matched all the criteria of the Guiding Principles. The item however does not explicitly convey that the use of information is with respect to a specific patient. In order to make this explicit we suggested the following modification – “*As a result of the information I managed (or will manage) this patient differently*”

(10) *Item: To justify or maintain the management of this patient*

This item was considered to be a multi barreled item that assessed three components: (1) information use for choosing between management options (for example choosing between Plan A, Plan B, Plan C), (2) information use to maintain the management of a specific patient (for example, information sustains the initial plan), and (3) information use to make a management plan in the absence of an initial plan. In addition this item did not explicitly convey the use of information for a specific patient. Hence we considered splitting this item into its

three components: (1) *“I did not know what to do, and I used (will use) this information to manage this patient”, (2) “I thought I knew what to do, and I used this information to be more certain about the management of this patient”, and (3) “I hesitated between options for this patient, and I used (will use) this information to justify a choice”.*

(11) *Item: To better understand a particular issue related to this patient*

Although this item agreed with all the criteria of the Guiding Principles of Crafting Items, this item did not explicitly specify that this was a use of the information for a specific patient. Hence we suggested the following modification - *“I used this information to better understand a particular issue related to this patient”.*

(12) *Item: To persuade other health professionals or patients to make changes*

This item agreed to all the criteria of the Guiding Principles of Crafting Items. The item however did not emphasize that this was the use of information related to a specific patient. Hence we considered the following modification- *“I used this information to persuade this patient or other health professionals to make changes”.*

(13) *Item: Increasing patient knowledge about health or health care*

This item agreed with all criteria of the Guiding Principles of Crafting Items. However, this item did not emphasize this patient health outcome was related to the information. Hence we suggested the following changes – *“This information helped to increase knowledge about health or healthcare for this patient or their family or home health aides”*

(14) *Item: Avoiding unnecessary or inappropriate treatment, diagnostic procedure or preventative investigation.*

With the focus of this item as ‘avoidance, this item agreed with all criteria of the Guiding Principles of Crafting Items. However, like the previous item, this item did not emphasize the link between information and patient health benefit. Hence we suggested the following changes – *“This information helped to avoid (will avoid) unnecessary or inappropriate treatment, diagnostic procedure, preventative interventions or referral to another specialist for this patient”.*

(15) *Item: Increasing patient acceptability of treatment, diagnostic procedure or preventative intervention*

The term ‘acceptability’ measures focus on patient satisfaction with services received, as well as overall population satisfaction with, and confidence in, health care services (Broemeling, et al., 2006). Keeping the central focus of this item as ‘patient acceptability’, we found that it agreed to all criteria of the Guiding Principles of Crafting Items expect the criteria on using low-frequency words. Furthermore our literature review reveals that this facet was assessed using terms such as ‘satisfaction with care’ or ‘relieving anxiety’ (Lindberg, et al., 1993; Rothschild, Lee, Bae, & Bates, 2002). This is supported by our data analysis from Step 1 where physicians reported (21 times in 16 searches) that the information helped to decrease in patient worries. Hence taking into account the definitions and interpretations from the literature we suggest the following modifications – “*This information helped to decrease this patient’s worries about a treatment, diagnostic procedure or preventative intervention*”.

(16) *Item: Preventing disease or health deterioration (including acute episodes of chronic diseases)*

This item was found to be complex and not straightforward because it seemed to possess a shifting focus from preventing disease to disease complications. In order to maintain the focus we replaced the term ‘health’ with ‘disease. We suggested the following modification – “*This information prevented a disease or disease deterioration (including acute episodes of chronic disease)*.”

(17) *Item: Improving patient health or functioning or resilience (i.e., how well the patient faces difficulties)*

We found that the term ‘resilience’ was a low frequency word and warrants a more explicit explanation. We suggested a modification for the explanation of the word resilience in this item. In accordance with the MeSH definition for resilience, we made the following change – “*This information was used to improve a patient’s health or functioning or resilience (i.e., ability to adapt to significant life stressors)*.”

*New item: I used (will use) this information to promote discussion with this patient or other health professionals.* Our literature review as well as data analysis revealed this new facet that we considered as an item for IAM 2011- draft (See below). Physicians can use information to enhance discussions with their patients or their colleagues about a patient without persuading them. We crafted this item with laying emphasis on the information use for a specific patient.

### **IAM 2011 (draft)**

#### **Search Objectives**

- (1) To address a clinical question/problem/decision-making about a specific patient
- (2) To fulfill a personal educational objective
- (3) To achieve a research related task
- (4) To search for personal curiosity or interest
- (5) To look up something I had forgotten
- (6) To share information with a patient, their family or home health aides
- (7) To exchange information with other health professionals (e.g., a colleague)
- (8) To manage aspects of patient care with other health professionals

#### **Cognitive Impacts**

- (1) My practice was (will be) changed and improved
- (2) I learned something new
- (3) This information confirmed I did (will do) the right thing
- (4) I was reminded of something that I already knew
- (5) I was dissatisfied
- (6) There was a problem with this information
- (7) I disagree with the content of this information
- (8) This information is potentially harmful

#### **Use of Information for a Specific Patient**

- (1) As a result of this information I did (or will) manage this patient differently
- (2) I hesitated between options for this patient, and I used this information to justify a choice
- (3) I did not know what to do, and I used this information to manage this patient
- (4) I thought I knew what to do, and I used this information to be more certain

about the management of this patient

- (5) I used this information to better understand a particular issue related to this patient
- (6) I used (will use) this information to promote discussion with this patient or other health professionals
- (7) I used (will use) this information to persuade this patient or other health professionals to make changes

**Patient health benefits**

- (1) This information helped to improve (will help to improve) this patient's health or functioning or resilience (i.e., ability to adapt to significant life stressors)
- (2) This information helped to prevent (will help to prevent) a disease or worsening of disease for this patient
- (3) This information helped to avoid (will help to avoid) unnecessary or inappropriate treatment, diagnostic procedures, preventative interventions or referral to another specialist, for this patient
- (4) This information helped to decrease (will help to decrease) this patient's worries about a treatment, diagnostic procedure or preventative intervention
- (5) This information helped to increase knowledge about health or healthcare for this patient or their family or home health aides

### 5.3 Results from Step 3

Based on quantitative data obtained from responses to the Likert scale we identified four items from IAM 2011 (draft) that received different responses from Panel members on the Likert scale for relevance, representativeness, language, and clarity. The quantitative data of these four items are presented in Table 5.3. These four items needed further modification and the decision for further modification was based on the open comments of the panel members. The open comments on IAM 2011 (draft) also identified four more items that required modifications based on relevance, representativeness, clarity and language.

**Table 5.3. Likert Scale Responses to problematic items in the Expert Panel Discussion**

<p><i>Item: To address a clinical question/problem/decision about a specific patient</i></p> <p>Relevance: Rated 3 (Very relevant) by 7/7 experts          Representativeness: Rated 3 (Very representative) by 7/7 experts          Clarity: Rated 3 (Very Clear) by 7/7 experts  <b>Language:</b> Rated 3 (Very appropriate) by 6/7 experts. Rated 2 by 1 expert who suggested a grammatical modification</p>
<p><i>Item: I used (will use) this information to promote discussion with this patient or other health professionals</i></p> <p>Relevance: Rated 3 (Very relevant) by 7/7 experts          Representativeness: Rated 3 (Very representative) by 7/7 experts  <b>Clarity:</b> Rated 3 (Very Clear) by 3/7 expert. Rated 2 (somewhat clear) by 4 experts who suggested a modifications with respect to discussion about a specific patient with health professionals          Language: Rated 3 (Very appropriate) by 7/7 experts.</p>
<p><i>Item: I used (will use) this information to persuade this patient or other health professionals to make changes</i></p> <p>Relevance: Rated 3 (Very relevant) by 7/7 experts          Representativeness: Rated 3 (Very representative) by 7/7 experts  <b>Clarity:</b> Rated 3 (Very Clear) by 5/7 expert. Rated 2 (somewhat clear) by 2 experts who pointed out confusion with respect to the types of changes          Language: Rated 3 (Very appropriate) by 7/7 experts</p>
<p><i>Item: This information helped to increase knowledge about health or healthcare for this patient or their family or home health aides</i></p> <p>Relevance: Rated 3 (Very relevant) by 7/7 experts          Representativeness: Rated 3 (Very representative) by 7/7 experts  <b>Clarity:</b> Rated 3 (Very Clear) by 3/7 expert. Rated 2 (somewhat clear) by 4 experts who pointed out confusions with the item and suggested modifications          Language: Rated 3 (Very appropriate) by 7/7 experts.</p>

(1) *Item: To address a clinical question/problem/decision about a specific patient*

Experts commented that the item was not clear because one cannot ‘address a decision’. Thus the following modification was suggested: “*To address a clinical question (problem) about a specific patient*”.

*(2) Item: To achieve a research related task*

Experts commented that ‘research’ is a broad term that can encompass many research related activities. We drew evidence from the data in Step 1 which suggested that physicians rarely search for information in a clinical database for research related tasks. Since the relevance for this item is very low, the panel suggested removing this item.

*(3) Item: To search for personal interest or curiosity*

Experts commented on substituting the word ‘search’ with another verb for the sake of clarity. The suggested modification was: *“To satisfy curiosity or for personal interest”*.

*(4) Item: There was a problem with this information*

Experts commented that the wording of this information might be an overlap with ‘dissatisfaction’. Furthermore, it does not emphasize problems with respect to structure and amount of information. Thus we considered modifying the item to *“There is a problem with the presentation of this information”*.

*(5) Item: “I used (will use) this information to promote discussion with this patient or other health professionals”*

Experts commented on the poor clarity of the item and the loss of emphasis on conveying the use of the information to discuss about a specific patient with other health professionals. Thus the panel suggested the following modification: *“I used (will use) this information in a discussion with this patient or with other health professionals about this patient”*

*(6) Item: I used (will use) this information to persuade this patient or other health professionals to make changes*

Experts commented that the item was not clearly focusing on the information related changes that other health professionals would make with regards to a specific patient. The panel suggested the following: *“I used (will use) this information to persuade this patient or to persuade other health professionals to make a change for this patient”*



(7) Item: *This information helped to improve (will help to improve) this patient’s health or functioning or resilience (i.e., ability to adapt to significant life stressors)*

Experts commented that the clarity of the item could be improved. Improving health is a very broad and general concept. The focus of the item is information related improvement in health conditions or conditions associated with decreased functioning and resilience. Thus the panel suggested the following modification: “*This information helped to improve (will help to improve) this patient’s health status or functioning or resilience (i.e., ability to adapt to significant life stressors)*).

(8) Item: *This information helped to increase knowledge about health or healthcare for this patient or their family or home health aides*

Experts commented that the wording of this item might confuse the user. The wording might indicate an increase in knowledge for the doctor about health or healthcare of a patient or their family. Hence they suggested an explicit form of the item as follows: “*This information helped to increase this patient’s knowledge, or their family or home health aides’ knowledge*”

The final and content validated version of IAM – IAM 2011 is presented below in a logical sequence which can be linked to EKR.

<b>IAM 2011</b>		
<b>Q1. Why did you do this search for information?</b>		
<b>Select all that apply. A 'Yes' response is required for at least one of the following objectives:</b>		
	<b>Yes</b>	<b>No</b>
To address a clinical question ( problem) about a specific patient	<input checked="" type="radio"/>	<input type="radio"/>
<b>TEXT BOX: What was your question?</b>		
To fulfill a personal educational objective	<input type="radio"/>	<input checked="" type="radio"/>
To satisfy curiosity or for personal interest	<input type="radio"/>	<input checked="" type="radio"/>
To look up something I had forgotten	<input type="radio"/>	<input checked="" type="radio"/>
To share information with a patient, their family, home health aides	<input type="radio"/>	<input checked="" type="radio"/>
To exchange information with other health professionals (e.g., a colleague)	<input type="radio"/>	<input checked="" type="radio"/>
To manage aspects of patient care with other health professionals	<input type="radio"/>	<input checked="" type="radio"/>

**Q2. Did you find relevant information that met (completely or partially) your objective(s)?**

- Yes  
 No

**Answering "No" to question 2 disables subsequent questions.**

**LOGIC: MUST ANSWER YES or POSSIBLY AT LEAST ONCE** Yes No

My practice was (will be) changed and improved

*If Yes, what aspect was (will be) changed or improved?*

- *Diagnostic approach?*
- *Therapeutic approach?*
- *Disease prevention or health education?*
- *Prognostic approach?*
- *Other? TEXT BOX with mandatory comment*

I learned something new

This information confirmed I did (will do) the right thing

I was reassured

I was reminded of something I already knew

I was dissatisfied

There is a problem with the presentation of this information

*If Yes, what problem do you see?*

- *Too much information?*
- *Not enough information?*
- *Information poorly written?*
- *Too technical?*
- *Other? TEXT BOX with mandatory comment*

I disagree with the content of this information

This information is potentially harmful

**TEXT BOX with mandatory comment**

**Q5. Will you use this information for a specific patient?** Yes No Possibly

- 

**Answering "No" or "Possibly" to question 5 will disable question 6.**

As a result of this information I did (or will) manage this patient differently

I hesitated between options for this patient, and I used (will use) this information to justify a choice

I did not know what to do, and I used this information to manage this patient

I thought I knew what to do, and I used this information to be more certain about the management of this patient

I used this information to better understand a particular issue related to this patient

I used(will use) this information in a discussion with this patient or other health professionals about this patient

I used this information to persuade this patient or other health professionals to make changes for this patient

**Q6. For this patient do you expect any health benefits as a result of applying this information?** **Yes** **No** **Possibly**

If YES, what are these benefits? Check 'Yes' or 'Possibly' for at least one item.

**Yes** **No**

This information helped to improve (will help to improve) this patient's health status or functioning or resilience (i.e., ability to adapt to significant life stressors)

This information helped to prevent (will help to prevent) a disease or worsening of disease for this patient

This information helped to avoid (will help to avoid) unnecessary or inappropriate treatment, diagnostic procedures, preventative interventions or referral to another specialist, for this patient

This information helped to decrease this patient's worries about a treatment, diagnostic procedure or preventative intervention

This information helped to increase this patient's knowledge or their family or home health aides' knowledge

**Comment on this information or this questionnaire.**

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# 6 DISCUSSION

For the assessment of the content validity of the IAM we followed the summary of two guidelines (See Box 1) on content validation (Carmines & Zeller, 1979; Haynes, et al., 1995). We have covered these guidelines in Step 1, 2 and 3 of the study. Where our findings from Step 1 supported the content validity of 16 items, they did not support the content validity of nine items. Our findings from Step 2 allowed us to refine or revise 18 items. From Step 3, we found that six items needed further modification. In addition, our literature review revealed one new facet that we incorporated into the final version of IAM. This led us to propose a content validated version of the IAM that we call IAM 2011. The IAM 2011 contains 28 items (seven items for Search Objectives, nine items for Cognitive Impacts, seven items for Information Use for a Specific Patient, and five items for Patient health benefit).

## 6.1 Modifications from IAM 2008 to IAM 2011

### (Draft)

Figure 5.1 schematically represents the process of item analysis from Steps 1 to 2. We found three types of patterns for items from their original form in IAM 2008 to their form in IAM 2011 (draft).

*Pattern 1: Items that were representative and agree with the criteria of the Guiding Principles of Crafting Items (See Box 2)*

We found 7 items that followed this pattern. These items had high representativeness in Step 1 and agreed with the Guiding Principles in Step 2. Thus, these 7 items were retained within the IAM 2011 (draft). These are:

- (1) Look up something I had forgotten
- (2) Exchange information with other health professionals (e.g., a colleague)
- (3) My practice was (will be) changed and improved
- (4) I learned something new
- (5) This information confirmed I did (I am doing) the right thing
- (6) I was reassured

*Pattern 2: Items that were representative and did not agree with the criteria of the Guiding Principles of Crafting Items*

We found 10 items that were representative in Step 1 but did not agree with one or more criteria of the Guiding Principles. This guided us in making necessary modifications to these items. The modified items were incorporated in the IAM 2011 (draft). The items with their modifications are presented in Table 6.1.

**Table 6.1** Table showing items following Patten 2

<b>Original item of the IAM 2008</b>	<b>Modification(s) of the item in the IAM 2011 (draft)</b>
To address a clinical question/ problem/ decision-making about a specific patient	To address a clinical question/ problem/ decision about a specific patient
To fulfill an educational or research objective	To fulfill a personal educational objective
	To achieve a research related task
To search in general or for curiosity	To search for personal curiosity or interest
To share information with a patient or caregiver	To share information with a patient or their family or home health aides
To plan/ manage/ co-ordinate/delegate or monitor tasks with other health professionals	To manage certain aspects of patient care with other health professionals
To justify or maintain the management of this patient	I hesitated between options for this patient, and I used this information to justify a choice
	I did not know what to do, and I used this information to manage this patient
	I thought I knew what to do, and I used this information to be more certain about the management of this patient
To better understand a particular issue related to this patient	I used this information to better understand a particular issue related to this patient
Increasing patient knowledge about health or healthcare	This information helped to increase knowledge about health or healthcare for this patient or their family or home health aides
Avoiding unnecessary or inappropriate treatment, diagnostic procedure or preventative intervention	This information helped to avoid (will help to avoid) unnecessary or inappropriate treatment, diagnostic procedures, preventative interventions or referral to another specialist, for this patient

*Pattern 3: Items that were not representative and did not agree with the criteria of the Guiding Principles of Crafting Items*

We found 7 items that followed this pattern. These items were found to be not representative in Step 1 and the rationale behind this was found in Step 2. These items were double barreled, unclear and used low frequency words. This was probably the reason why participants did not clearly understand these items, as revealed by the low representativeness. The items with their modifications are presented in Table 6.2.

**Table 6.2** Table showing items following Pattern 3

<b>Original item of the IAM 2008</b>	<b>Modified item of the IAM 2011 (draft)</b>
I recalled something	I was reminded of something I knew but had forgotten
To modify the management of this patient	As a result of this information I did (or will) manage this patient differently
To persuade other health professionals or patients to make changes	I used this information to persuade this patient or other health professionals to make changes
Increasing patient knowledge about health or healthcare	This information helped to increase knowledge about health or healthcare for this patient or their family or home health aides
Increasing patient acceptability of treatment, diagnostic procedure or preventative intervention	This information helped to decrease(will help to decrease) patient worries about a treatment, diagnostic procedure or preventative intervention
Preventing disease or health deterioration (including acute episodes of chronic diseases)	This information helped to prevent (will help to prevent) a disease or disease deterioration
Improving patient health or functioning or resilience (i.e., how well the patient faces difficulties)	This information helped to improve (will help to improve) a patient's health or functioning or resilience (i.e., ability to adapt in the face of trauma or ongoing life stressors)

## **6.2 IAM Items that were not Relevant in STEP 1**

*Item: Plan, manage, coordinate, delegate or monitor tasks with other health professionals*

In 1,800 rated searches for information, 4,253 reasons were selected by participants, from which this item was chosen only 197 times. This suggests that its relevance is approximately 5%. Although this item was highly representative, participants did not commonly rate this item as a reason to search. Participating

MDs rated this item if they were teaching or supervising a resident or when they had to collaborate with a nurse, pharmacist, respiratory therapists, rheumatologist, hematologist or a patient's family doctor. We considered the following as possible causes for the low relevance of this item: (1) the EKR that was used in the study might not have contained information for the purposes of collaborating with other health professionals around patient care. Hence, the frequency of rating this item was low, (2) the item was a double barreled question that offered more than one reason to search (plan or manage or coordinate or delegate), and (3) a 'power issue' maybe be present because the participants of the study were physicians. Physicians might not feel the need to search for information to coordinate tasks with other health professionals. However, we believe that other health professionals such as nurses, physiotherapists, psychologists and pharmacists would more frequently search for information to co-ordinate tasks with their physician colleagues. These are the three possible barriers in rating this item, thus leading to low item relevance. Taking these issues into consideration, we retained the item, but with the following modification - *"To manage aspects of patient care with other professionals"*.

*Item: "I disagree with this information" and*

*Item: "I think this information is potentially harmful"*

These two items of negative cognitive impact had very low relevance (4% and 8%). This implies that participating MDs rarely disagreed with the information they retrieved and did not think that it was harmful. One explanation for this is that participants used an EKR (Essential Evidence Plus ©) that contained information filtered for validity and relevance. Thus, harmful or problematic information was rarely identified by participants. Although these two items were not relevant in this study, they can potentially contribute to research on the value of clinical information and help identify harmful information in EKRs. Thus we decided to retain these two items of negative cognitive impact.

## 6.3 New item

*Item: I used (will use) this information in a discussion with this patient or other health” professionals*

Example:

Interviewer:

Uh, would you say this information would have any consequences for the patient?

MD25:

.... Uh, well, it might, we might have...it, *I would probably have a discussion with the patient* about the therapeutic options if the diagnosis was confirmed, so, you know. (...) they would probably have more information before going ahead to meet a specialist (...).

This item of information use was not present in IAM 2008. This item was identified as a new item from the thematic analysis of qualitative data. We found many situations during the data analysis that participants used the information in a discussion or to promote a discussion with a patient or their colleagues about specific patient. In addition, the facet supporting this item was also found in our comprehensive review of literature.

## 6.4 Limitations of the Study

We discuss the limitations of this study under two sections: limitations of the study design and limitations encountered with data analysis.

### 6.4.1 Study design limitations.

The mixed methods research design for the study can impose certain limitations. We discuss quantitative and qualitative limitations separately.

#### 6.4.1.1 Quantitative limitations.

The set of participants whose IAM ratings contributed to the quantitative data pool was a convenience sample of 40 family physicians. As mentioned in Section 4.1.3, this is sufficient for content validation purpose (Vogt et al., 2004), while item ratings may be different and more generalizable from a larger, random sample of family physicians. However, a sufficiently large sample of 3,300 rated



hits was obtained for the purpose of content validation. A few technical issues related to tracking searches and ratings were also reported during the study. Technical issues led to the loss of some IAM item ratings in an unknown manner. Our ability to study the validity of items of negative cognitive impact was limited by the type of EKR that was used (Essential Evidence Plus). This EKR contained information filtered for relevance to family physicians.

#### **6.4.1.2 Qualitative limitations.**

The number of days between a search for information on the PDA and telephone interviews varied from 1 to 250. This could have created a recall bias with respect to older searches that were explored during the interviews. We tried to overcome this bias by excluding searches that participants could not clearly remember. It is possible that the value of forgotten searches may be different from those that were not forgotten.

#### **6.4.2 Data analysis limitations.**

We chose  $R < 10\%$  as our cut-off to question the relevance of IAM items and the number of 'fit' Units  $\geq 80\%$  as the cut-off for considering representativeness. Since there is no agreed upon value or criteria to calculate content validity, the adequacy of content validity depends on the appeal to reason of the relevance and representativeness of items in a particular assessment context (Carmines & Zeller, 1979). During the interpretation of results, we saw that items that had a lower relevance compared to other items had an  $R$  value  $< 10\%$ . Thus, choosing  $R < 10\%$  to question relevance of an item seemed to be justified.

If we had chosen different cut-off values such as 20% or 70% the relevance and representativeness of the items would vary and the content validity might not be supported for a larger number of items. In order to overcome any potential bias as a result cut-offs, we conducted Step 2 (analysis of IAM items based on Guiding Principles) and Step 3 (panel discussion on item relevance and representativeness). This enabled a comprehensive content validation process without placing undue emphasis on numerical values of relevance and representativeness.

## **6.5 Strengths Relative to Other Studies**

### **6.5.1 Comprehensive review of literature.**

In our process of content validation we comprehensively reviewed existing literature on how IAM's four target constructs and their facets are understood. We used 'citation tracking' to broaden our search strategy for potentially relevant references. We guided our search with three systematic literature reviews and synthesized 71 relevant references. We thematically analyzed each relevant reference for facets of all four target constructs of IAM. Thus, the literature review ensures the content validation of IAM is comprehensive and contemporary.

### **6.5.2 Use of mixed methods research.**

Quantitative and qualitative methods were used to collect data on relevance and representativeness of IAM items. Mixed methods research is suited for addressing complex research questions, which require context and outcomes, meaning and trends, and narratives and numbers. Thus mixed methods is a strength relative to other studies on content validation.

### **6.5.3 Consulting members of the target population.**

The members of IAM's target population (health professionals) were consulted in this study. They were consulted when they were responding to IAM in a real world setting (routine clinical practice). This enabled longer use of the questionnaire that helped users (also called ecological experts) to provide a better perspective on IAM items. This is better compared to a focus group discussion that would have provided only a snapshot of the collective opinion of the users. According to Haynes et al., (1995), carefully structured, open-ended interviews with members of the target population can increase the chance that items are content valid for their intended purpose and can also suggest additional facets and the need for construct refinement. In addition to refining items we also identified one new facet from our consultations with the users. Since the content validation procedure for IAM involved consulting members of the target population or

ecological experts, we can say that we addressed the content ecological validity of IAM.

#### **6.5.4 Expert panel discussion.**

We finalized item modifications by subjecting IAM 2011 (draft) to the discussion of a multi-disciplinary panel of experts who are researchers on the value of information. The items were judged on a 3 point Likert scale for their relevance to the target construct, their representativeness to the item definition, clarity, language, and response format. Expert panel discussion is a core component of the Content Validation Guidelines (Haynes, et al., 1995). We found that four items received varying responses on the Likert scale of clarity and representativeness. This shows that heterogeneity in judgement can help to capture different interpretations of clarity and representativeness and identify problematic items.

#### **6.5.5 Contribution to Continuing Medical Education**

This masters' thesis project is making an important contribution to the field of Continuing Medical Education (CME). It has resulted in the content validation of an information assessment tool that is already used by Canadian family physicians within CME programs. For each search for information in *Dynamed* through the *cma.ca* portal, members of the Canadian College of Family Physicians and of the Royal College of Physicians and Surgeons of Canada can obtain CME credits when they use the validated version of IAM for evaluating the found information.

# 7 CONCLUSION

## 7.1 In a Nutshell

This MSc project has taken the first step in examining the content validity of IAM in the PULL context. With IAM 2011, it is now possible to systematically and comprehensively evaluate EKR in the PULL context. This content validated version of IAM can be used as a feedback system by information providers (e.g., EBM databases like Essential Evidence Plus© and Dynamed) at the point of information access. This could help maintain and enhance the quality of such clinical databases. Furthermore, a validated IAM will ensure that the data collected is not an over or underrepresentation of the target constructs. Thus, the data collected through IAM 2011 can be used for research associated with the value of information.

## 7.2 Knowledge Translation (KT) plan

The KT plan is an end-of-project type of knowledge translation plan. We intend to adopt different modes of disseminating IAM 2011 to potential stakeholders. Poster presentations at international and national conferences such as NAPCRG (North American Primary Care Research Group) and FMF (Family Medicine Forum) provide a platform to interact with other researchers interested in studying the value of clinical information. Our publications will provide a venue to increase awareness about IAM 2011 among health professionals and EKR developers.

## 7.3 Looking Ahead with IAM 2011

Content validity is an integral component of construct validity. Construct validity is the degree to which an assessment instrument measures the targeted construct (Haynes, et al., 1995). Construct validity for IAM was previously assessed in the context of receiving information (PUSH) (Pluye, et al., 2010). Future research should be done to examine the construct validity of IAM 2011 in the context of information retrieval (PULL), e.g., using factor analysis.

IAM 2011 can be extended to study the value of information in the context of other health professionals such as pharmacists, nurses, psychologists, physiotherapists. This will also help to maintain and enhance databases used by them. Prior research has shown that there are systems for health professionals to document self-perceived information needs within EKR's (Ely et al., 1997). IAM 2011 can be incorporated into such systems and aid in creating a learning portfolio for health professionals. Through IAM 2011, health professionals would be able to keep track of their searches, why they did a particular search, what type of cognitive impact it had, how they used the information for a specific patient and the types of patient health benefits. Thus, with IAM 2011, we can open doors to further research.

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## 9 APPENDICES

### Appendix A

**Table A1**

Characteristics (methods and modes of data collection) of the 71 retained studies in the literature review.

First author-last name	Year of publication	Quantitative Methods	Qualitative	Mixed	Data Collection	Search Objectives	Cognitive impact	Information use for a specific patient	Information related patient health benefit
Axelson	2003		1		Focus Group; Individual interviews			1	
Barley	2009	1			Questionnaire (User feedback/search rate)	1			
Bennett	2004	1			Questionnaire	1			
Bennett	2006	1			Questionnaire	1			
Bryant	2004			1	Administrative data (audit records)+ In-depth individual interviews+Group discussions	1			
Butzalff	2003	1			Pre tested questionnaires	1	1		

First author-last name	Year of publication	Quantitative Methods	Qualitative	Mixed	Data Collection	Search Objectives	Cognitive impact	Information use for a specific patient	Information related patient health benefit
D'Alessandro	2004	1			Telephone survey with modified critical incident technique	1		1	
Medernach	2007	1			Questionnaire	1			
Ranson	2007		1		PDA usage survey, interview transcripts, CCAF written comments (Virginia Board of Medicine Continuing Competency and Assessment Form )	1	1	1	
Collen, M. F	1985	1			Questionnaire	1			
King, D. N.	1987	1			Questionnaire	1	1	1	
Markert R.J	1989	1			Questionnaire	1			
Wilson	1989		1		Telephonic interview (An adaptation of the critical incident technique)	1			
Angier J.J	1990	1			Questionnaire	1		1	
Haynes R.B	1990	1			Search records + structured interview (questionnaire survey)	1		1	
Silver H	1990	1			Questionnaire	1			

First author-last name	Year of publication	Quantitative Methods	Qualitative	Mixed	Data Collection	Search Objectives	Cognitive impact	Information use for a specific patient	Information related patient health benefit
Haynes R.B	1991	1			Questionnaire + Interviews	1		1	
Hsu P.P	1991	1			Questionnaire	1			
Veenstra R.J	1992	1			Questionnaire	1			
Lindberg DA	1993		1		See Wilson		1	1	1
Gorman P.N	1994	1			Interviews+ Search reports		1		1
Klein MS	1994	1			Administrative data				1
Haux R	1996	1			Search reports +Questionnaire	1			
Chambliss M.L	1996	1			Questionnaire + Interviews	1			
Jousimaa J	1998	1			Log files tracking	1	1	1	
Sackett D.L	1998	1			Log reports on use, impact etc + Questionnaire (survey form)	1		1	
Abraham VA	1999	1			Log reports		1		
D'Alessandro M. P	1999	1			Questionnaire + Interviews	1		1	1
Ely J.W	1999	1			Observation + search reports	1			
Hayward J.A	1999	1			Search reports( form for brief clinical history) + Telephone interviews	1		1	
Eberhart-Philips J	2000	1			Questionnaire (Postal)	1	1		
Scott I	2000	1			Questionnaire	1	1	1	

First author-last name	Year of publication	Quantitative Methods	Qualitative	Mixed	Data Collection	Search Objectives	Cognitive impact	Information use for a specific patient	Information related patient health benefit
Wilson	2000		1		Focus groups	1			
Baker	2001	1			Administrative data, Patient charts			1	
Brassey	2001	1			Questionnaire		1		
Del Mar C.B	2001	1			Questionnaire	1			
Lapinsky S.E	2001	1			Direct observation	1			
Martin S	2001	1			Questionnaire	1			
Richwine M	2001	1			Questionnaire + Interviews	1		1	1
Swinglehurst	2001	1			Questionnaire + Interviews	1	1	1	
Taylor H	2001	1			Questionnaire	1	1		
Arroll B	2002	1			Direct Observation + Questionnaire	1			
Casebeer L	2002	1			Questionnaire	1			
Cullen R. J	2002			1	Questionnaire + Interviews	1	1	1	
Jousimaa J	2002	1			Direct recording + questionnaires	1			
Rothschild J.M	2002	1			Questionnaire		1		1
Crowley S.D	2003	1			Self reported searches			1	
Gosling A.S	2003		1		Web log analysis + Focus groups+ interviews	1		1	
Ramos K	2003	1			Direct observation +Self report	1			

First author-last name	Year of publication	Quantitative Methods	Qualitative	Mixed	Data Collection	Search Objectives	Cognitive impact	Information use for a specific patient	Information related patient health benefit
Schwartz K	2003	1			Questionnaire	1	1	1	
Brilla R	2004	1			Questionnaire	1			
McAlearney, A. S	2004		1		Focus groups (Eight)	1			
Pluye P	2004		1		Interviews		1		1
Sintchenko V	2004	1			Search reports + questionnaire	1	1		
Westbrook	2004	1			Web log analysis + questionnaire	1			1
Williams J.G	2004	1			Patient notes + interviews			1	
Alper B.S	2005	1			Questionnaire			1	
Ketchell D.S	2005	1			Portal entry + Questionnaire	1	1		1
Magrabi F	2005	1			Usage data logs			1	
Schilling L.M	2005	1			Questionnaire	1	1	1	1
Westbrook J. I	2005	1			Questionnaire		1	1	
Honeybourne	2006	1			Questionnaire			1	
Maviglia S.M	2006	1			Questionnaires			1	
Rothschild J.M	2006	1			Questionnaire	1		1	1
Rudkin S.E	2006	1			Questionnaire		1		
Leon S.A	2007	1			Questionnaires + search log reports		1		1
McCord G	2007	1			Questionnaire	1			
Van Duppen D	2007	1			Search logs	1	1	1	
Westbrook J. I	2007		1		Interviews Critical Incident + journey mappings	1		1	1
Phua J	2008	1			Questionnaire			1	1
Schifferdecker,	2008	1			Questionnaire	1			

**Table A2****Studies addressing items of the Search Objective construct**

AF1 (Item 1): Address a clinical question/problem/decision-making about a specific patient

AF2 (Item 2): Fulfill an educational or research objective

AF3 (Item 3): Search in general or for curiosity

AF4 (Item 4): Look up something I had forgotten

AF5 (Item 5): Share information with a patient/ caregiver

AF6 (Item 6): Exchange information with other health professionals

AF7 (Item 7): Plan, manage, coordinate, delegate or monitor tasks with other health professionals

First author- last name	Year of Publication	AF1	AF2	AF3	AF4	AF5	AF6	AF7
Axelson	2003							
Barley	2009	1	1				1	
Bennett	2004	1	1					
Bennett	2006	1	1					
Bryant	2004	1	1	1		1		
Butzalff	2003	1		1				
D'Alessandro	2004	1	1	1			1	
Medernach	2007	1	1					
Ranson	2007	1					1	
Collen, M. F	1985	1	1	1				
King, D. N.	1987	1						
Markert R.J	1989	1	1	1				
Wilson	1989	1	1	1	1	1	1	1
Angier J.J	1990	1		1				
Haynes R.B	1990	1	1					
Silver H	1990	1	1					
Haynes R.B	1991	1	1	1			1	
Hsu P.P	1991	1	1				1	
Veenstra R.J	1992							
Lindberg DA	1993	1	1	1	1	1		
Gorman P.N	1994							

First author- last name	Year of Publication	AF1	AF2	AF3	AF4	AF5	AF6	AF7
Klein MS	1994							
Haux R	1996	1	1	1				
Chambliss M.L	1996	1		1				
Jousimaa J	1998	1						
Sackett D.L	1998	1						
Abraham VA	1999							
D'Alessandro M. P	1999	1						
Ely J.W	1999	1						
Hayward J.A	1999	1						
Eberhart-Philips J	2000		1			1	1	
Scott I	2000	1					1	
Wilson	2000	1					1	
Baker	2001							
Brassey	2001							
Del Mar C.B	2001	1						
Lapinsky S.E	2001	1						
Martin S	2001	1						
Richwine M	2001	1	1			1		
Swinglehurst	2001			1		1	1	
Taylor H	2001		1					
Arroll B	2002	1						
Casebeer L	2002	1	1	1				
Cullen R. J	2002	1				1		
Jousimaa J	2002	1						
Rothschild J.M	2002							
Crowley S.D	2003	1						
Gosling A.S	2003	1	1					
Ramos K	2003	1						
Schwartz K	2003	1		1			1	

First author- last name	Year of Publication	AF1	AF2	AF3	AF4	AF5	AF6	AF7
Brilla R	2004							
McAlearney, A. S	2004	1						
Pluye P	2004							
Sintchenko V	2004	1						
Westbrook	2004	1	1	1		1	1	
Williams J.G	2004							
Alper B.S	2005							
Ketchell D.S	2005	1	1			1		
Magrabi F	2005							
Schilling L.M	2005	1						
Westbrook J. I	2005							
Honeybourne C	2006		1					
Maviglia S.M	2006							
Rothschild J.M	2006	1	1					
Rudkin S.E	2006							
Leon S.A	2007							
McCord G	2007	1						
Van Duppen D	2007	1						
Westbrook J. I	2007							
Phua J	2008							
Schifferdecker, K. E	2008					1		



**TABLE A3****Studies addressing items of the Cognitive Impact construct**

CF1: My practice was (will be) changed and improved

CF2: I learned something new

CF 3: This information confirmed I did (I am doing) the right thing.

CF 4: I was reassured

CF 5: I recalled something

CF 6: I was dissatisfied as this information had no impact on my practice

CF 7: I was dissatisfied as there was a problem with this information

CF 8: I disagree with this information

CF 9: I think this information is potentially harmful

First author- last name	Publn. Year	CF1	CF2	CF3	CF4	CF5	CF6	CF7	CF8	CF9
Axelson	2003									
Barley	2009									
Bennett	2004									
Bennett	2006									
Bryant	2004									
Butzalff	2003		1							
D'Alessandro	2004									
Medernach	2007									
Ranson	2007									
Collen, M. F	1985									
King, D. N.	1987		1		1	1				
Markert R.J	1989									
Wilson	1989	1	1	1	1	1	1	1	1	1
Angier J.J	1990									
Haynes R.B	1990									
Silver H	1990									
Haynes R.B	1991									
Hsu P.P	1991									
Veenstra R.J	1992									

First author- last name	Publn. Year	CF1	CF2	CF3	CF4	CF5	CF6	CF6	CF8	CF9
Lindberg DA	1993		1	1						
Gorman P.N	1994									
Klein MS	1994									
Haux R	1996									
Chambliss M.L	1996									
Jousimaa J	1998								1	
Sackett D.L	1998									
Abraham VA	1999									
D'Alessandro M. P	1999									
Ely J.W	1999									
Hayward J.A	1999									
Eberhart-Philips J	2000	1								
Scott I	2000	1	1							
Wilson	2000									
Baker	2001									
Brassey	2001	1		1				1		
Del Mar C.B	2001	1	1							
Lapinsky S.E	2001		1							
Martin S	2001									
Richwine M	2001									
Swinglehurst	2001				1					
Taylor H	2001		1							
Arroll B	2002									
Casebeer L	2002									
Cullen R. J	2002	1		1						
Jousimaa J	2002									

First author- last name	Publn. Year	CF1	CF2	CF3	CF4	CF5	CF6	CF6	CF8	CF9
Rothschild J.M	2002	1	1							
Crowley S.D	2003									
Gosling A.S	2003									
Ramos K	2003									
Schwartz K	2003	1								
Brilla R	2004									
McAlearney, A. S	2004									
Pluye P	2004	1	1		1	1				
Sintchenko V	2004	1								
Westbrook	2004									
Williams J.G	2004									
Alper B.S	2005									
Ketchell D.S	2005	1								
Magrabi F	2005									
Schilling L.M	2005	1								
Westbrook J. I	2005		1	1						
Honeybourne C	2006									
Maviglia S.M	2006									
Rothschild J.M	2006									
Rudkin S.E	2006	1								
Leon S.A	2007									
McCord G	2007									
Van Duppen D	2007		1							
Westbrook J. I	2007		1		1					
Phua J	2008	1	1							
Schifferdecker, K. E	2008									

**Table A4**

## Studies addressing information use for a specific patient

ApF1 (Ma): To maintain the management of this patient

ApF1 (Lj): To justify or maintain the management of this patient

ApF2: To modify the management of this patient

ApF3: To better understand a particular issue related to this patient

ApF4: To persuade other health professionals or patients to make changes

ApF-New: To promote discussion with a patient or a colleague

First author- last name	Publn. Year	ApF1(Ma)	ApF1 (Lj)	ApF2	ApF3	ApF4	ApF-NEW
Axelson	2003						1
Barley	2009						
Bennett	2004						
Bennett	2006						
Bryant	2004						
Butzalff	2003						
D'Alessandro	2004	1			1		
Medernach	2007						
Ranson	2007						1
Collen, M. F	1985						
King, D. N.	1987	1		1	1		1
Markert R.J	1989						
Wilson	1989	1	1	1	1	1	1
Angier J.J	1990			1	1		
Haynes R.B	1990	1	1		1		
Silver H	1990						
Haynes R.B	1991	1			1		
Hsu P.P	1991						
Veenstra R.J	1992						
Lindberg DA	1993	1	1	1	1	1	

First author- last name	Publn. Year	ApF1(Ma)	ApF1 (Lj)	ApF2	ApF3	ApF4	ApF-NEW
Gorman P.N	1994						
Klein MS	1994						
Haux R	1996						
Chambliss M.L	1996						
Jousimaa J	1998	1					
Sackett D.L	1998	1	1		1		
Abraham VA	1999						
D'Alessandro M. P	1999				1		
Ely J.W	1999						
Hayward J.A	1999				1		
Eberhart-Philips J	2000						
Scott I	2000				1		1
Wilson	2000						
Baker	2001				1		
Brassey	2001						
Del Mar C.B	2001					1	
Lapinsky S.E	2001						
Martin S	2001						
Richwine M	2001				1		
Swinglehurst	2001						1
Taylor H	2001						
Arroll B	2002						
Casebeer L	2002						
Cullen R. J	2002			1	1		
Jousimaa J	2002						
Rothschild J.M	2002						
Crowley S.D	2003	1			1		
Gosling A.S	2003						

First author- last name	Publn. Year	ApF1(Ma)	ApF1 (Lj)	ApF2	ApF3	ApF4	ApF-NEW
Ramos K	2003						
Schwartz K	2003				1		
Brilla R	2004						
McAlearney, A. S	2004						
Pluye P	2004						
Sintchenko V	2004						
Westbrook	2004						
Williams J.G	2004						
Alper B.S	2005				1		
Ketchell D.S	2005						
Magrabi F	2005				1	1	
Schilling L.M	2005			1	1		
Westbrook J. I	2005						
Honeybourne C	2006						
Maviglia S.M	2006				1		
Rothschild J.M	2006				1		
Rudkin S.E	2006						
Leon S.A	2007						
McCord G	2007						
Van Duppen D	2007				1		
Westbrook J. I	2007			1			1
Phua J	2008						
Schifferdecker, K. E	2008						

**TABLE A5****Studies that address information related patient health benefit**

OF1: Increasing patient knowledge about health or healthcare

OF2: Avoiding unnecessary or inappropriate treatment, diagnostic procedure or preventative intervention

OF3: Increasing patient acceptability of treatment, diagnostic procedure or preventative intervention

OF4: Preventing disease or health deterioration (including acute episodes of chronic diseases)

OF5: Improving patient health or functioning or resilience (i.e., how well the patient faces difficulties)

First author- last name	Year of publication	OF1	OF2	OF3	OF4	OF5
Axelson	2003					
Barley	2009					
Bennett	2004					
Bennett	2006					
Bryant	2004					
Butzalff	2003					
D'Alessandro	2004					
Medernach	2007					
Ranson	2007					
Collen, M. F	1985					
King, D. N.	1987					
Markert R.J	1989					
Wilson	1989	1	1	1	1	1
Angier J.J	1990					
Haynes R.B	1990					
Silver H	1990					
Haynes R.B	1991					
Hsu P.P	1991					
Veenstra R.J	1992					
Lindberg DA	1993	1	1	1	1	1
Gorman P.N	1994					
Klein MS	1994		1			

<b>First author- last name</b>	<b>Year of publication</b>	<b>OF1</b>	<b>OF2</b>	<b>OF3</b>	<b>OF4</b>	<b>OF5</b>
Haux R	1996					
Chambliss M.L	1996					
Jousimaa J	1998					
Sackett D.L	1998					
Abraham VA	1999					
D'Alessandro M. P	1999		1			
Ely J.W	1999					
Hayward J.A	1999					
Eberhart-Philips J	2000					
Scott I	2000					
Wilson	2000					
Baker	2001					
Brassey	2001					
Del Mar C.B	2001					
Lapinsky S.E	2001					
Martin S	2001					
Richwine M	2001		1			
Swinglehurst	2001					
Taylor H	2001					
Arroll B	2002					
Casebeer L	2002					
Cullen R. J	2002					
Jousimaa J	2002					
Rothschild J.M	2002			1	1	
Crowley S.D	2003					
Gosling A.S	2003					
Ramos K	2003					
Schwartz K	2003					
Brilla R	2004					



<b>First author- last name</b>	<b>Year of publication</b>	<b>OF1</b>	<b>OF2</b>	<b>OF3</b>	<b>OF4</b>	<b>OF5</b>
McAlearney, A. S	2004					
Pluye P	2004		1			
Sintchenko V	2004					
Westbrook	2004					1
Williams J.G	2004					
Alper B.S	2005					
Ketchell D.S	2005					
Magrabi F	2005					
Schilling L.M	2005		1			
Westbrook J. I	2005					
Honeybourne C	2006					
Maviglia S.M	2006					
Rothschild J.M	2006		1		1	
Rudkin S.E	2006					
Leon S.A	2007					
McCord G	2007				1	
Van Duppen D	2007					
Westbrook J. I	2007	1	1		1	1
Phua J	2008					
Schifferdecker, K. E	2008					

**Table A7**

Table showing the definitions of IAM items

<b>ITEM</b>	<b>ITEM DEFINITION</b>
<b>Search Objective</b>	
1. To address a clinical question/problem/decision about a specific patient	A search to solve a problem in clinical care such as information on etiology, diagnosis, investigations, interpreting test results, drug information, disease staging and prognosis.
2. To fulfill a personal educational objective	A search for the purposes of educating oneself.
3. To satisfy curiosity or personal interest	A search for gathering general information for the purposes of personal interest and general knowledge.
4. To look up something I had forgotten	A search for previously known information which was forgotten
5. To share information with a patient or their family or home health aides	A search to share information with patients, their families or caregivers at home.
6. To exchange information with other health professionals	A search to share information with other health professionals.
7. To manage aspects of patient care with other health professionals	A search to plan/manage/coordinate tasks related to patient care with other health professionals.
<b>Cognitive Impacts</b>	
1. My practice was (will be) changed and improved	A change in decision-making with respect to a patient (or a commitment to change).
2. I learned something new	A change in knowledge.
3. This information confirmed I did (I am doing) the right thing	A reinforcement of decision-making.
4. I was reassured	A state of increased comfort.
5. I was reminded of something that I already knew	A prompt that stimulated memory.
6. I was dissatisfied	Dissatisfaction because an information need is not satisfied.
7. There is a problem with the presentation of this information	Dissatisfaction because of issues with the content such as too much information, too little information or format issues with the information;
8. I disagree with the content of this information	Disagreement with the content of the information.
9. This information is potentially harmful	A situation where information is perceived to be harmful.

<b>Use of Information for a Specific Patient</b>	<b>Definition</b>
1. As a result of this information I did (or will) manage this patient differently.	Information directly modifies a management plan for a specific patient.
2. I hesitated between options for this patient, and I used this information to justify a choice	Information used to make a choice between two or more options for a specific patient.
3. I did not know what to do, and I used this information to justify a choice	Information used to make a decision in the absence of an initial plan, for a specific patient.
4. I used this information to better understand a particular issue related to this patient	Information used to change “awareness, thinking, or understanding of specific issues”.
5. I thought I knew what to do, and I used this information to be more certain about the management of this patient	Information sustaining the planned management in the absence of an initial plan, for a specific patient.
6. I used this information to persuade a specific patient or other health professionals to make changes	Information used to persuade others for modifying action.
7. I used (will use) this in a discussion with this specific patient or other health professionals	Information used to promote discussion with a specific patient or health professionals about a specific patient.
<b>Patient health outcomes</b>	<b>Definition</b>
1. This information helped to increase this patient’s knowledge(or their family or home health aides) about health or healthcare	Increased knowledge of health and health care enables individuals to maintain or improve their own health, as well as the health and well-being of others;
2. This information helped to avoid (will help to avoid) unnecessary or inappropriate treatment, diagnostic procedure, preventative interventions or referral to another specialist, for this patient	Appropriateness of place and provider reflects primary health care’s key roles: providing the right service by the right person at the right time, and acting as a source of first-contact care and referral to specialty services
3. This information helped to decrease (will help to decrease) patient’s worries about a treatment, diagnostic procedure or preventative intervention	Patient satisfaction with health care provided, including decreasing patient anxiety;
4. This information prevented (will help to prevent) a disease or worsening of disease for this patient	Reduced risk, duration and effects of acute and episodic conditions and reduced risks and effects of continuing or chronic conditions;
5. This information helped to improve (will help to improve) this patient’s health status or functioning or resilience (i.e., ability to adapt to significant life stressors)	Improved patient health, functioning and resilience (i.e., ability to adapt in the face of trauma or ongoing significant life stressors)

# Appendix B

**Table B1**

Table showing calculations for relevance and obtained from STEP 1

Items	Item Ratings	R
<b>Search Objective</b>	<b>4253</b>	
1. Address a clinical question/problem/decision-making about a specific patient	<b>1310</b>	<b>30.8%</b>
2. Fulfill an educational or research objective	<b>434</b>	<b>10%</b>
3. Search in general or curiosity	<b>496</b>	<b>15%</b>
4. Look up something I had forgotten	<b>672</b>	<b>15%</b>
5. Share information with a patient/caregiver	<b>624</b>	<b>14%</b>
6. Exchange information with other health professionals	<b>520</b>	<b>12%</b>
7. Plan, manage, coordinate, delegate or monitor tasks with other health professionals	<b>197</b>	<b>4%</b>

Cognitive Impact	Item Ratings	R
<b>(Items of Positive Impact)</b>	<b>6329</b>	
1. My practice was (will be) changed and improved	<b>963</b>	<b>15%</b>
2. I learned something new	<b>1246</b>	<b>30%</b>
3. This information confirmed I did (I am doing) the right thing.	<b>1516</b>	<b>24%</b>
4. I was reassured	<b>1468</b>	<b>23%</b>
5. I recalled something	<b>1136</b>	<b>18%</b>
<b>(Items of Negative Impact)</b>	<b>166</b>	
6. I was dissatisfied as this information had no impact on my practice	<b>79</b>	<b>47%</b>
7. I was dissatisfied as there was a problem with this information	<b>67</b>	<b>40%</b>
8. I disagree with this information	<b>7</b>	<b>4%</b>
9. I think this information is potentially harmful	<b>13</b>	<b>8%</b>

<b>Items</b>	<b>Transformed item ratings</b>	<b>R</b>
<b>Use of Information for a specific patient</b>	<b>737</b>	
1. To modify the management of this patient	<b>140</b>	<b>19%</b>
2. To maintain or justify the management of this patient	<b>288</b>	<b>39%</b>
3. To better understand specific issues regarding this patient	<b>207</b>	<b>28%</b>
4. To persuade the patient or other health professionals to make changes	<b>102</b>	<b>14%</b>
<b>Patient Health Benefit</b>	<b>766</b>	
1. Increased patient knowledge about health or healthcare	<b>173</b>	<b>23%</b>
2. Avoided unnecessary or inappropriate treatment, diagnostic procedure or preventative intervention	<b>163</b>	<b>21%</b>
3. Increased patient acceptability of treatment, diagnostic procedure or preventative intervention	<b>140</b>	<b>18%</b>
4. Prevented disease or health deterioration	<b>124</b>	<b>17%</b>
5. Improved patient health or functioning or resilience	<b>156</b>	<b>20%</b>

**Table B2**

Table showing calculations for representativeness and obtained from STEP 1

Items	UNITS	'FIT' Units	Representativeness
<b>Search Objective</b>			
1. Address a clinical question/problem/decision-making about a specific patient	347	353	98%
2. Fulfill an educational or research objective	90	89	99%
3. Search in general or curiosity	92	89	97%
4. Look up something I had forgotten	171	150	88%
5. Share information with a patient/caregiver	212	197	93%
6. Exchange information with other health professionals	116	113	97%
7. Plan, manage, coordinate, delegate or monitor tasks with other health professionals	49	42	86%
<b>Cognitive Impact</b>			
	UNITS	'FIT' Units	Representativeness
<b>(Items of Positive Impact)</b>			
1. My practice was (will be) changed and improved	256	212	83%
2. I learned something new	284	227	80%
3. This information confirmed I did (I am doing) the right thing.	370	324	88%
4. I was reassured	332	300	90%
5. I recalled something	274	213	78%
<b>(Items of Negative Impact)</b>			
6. I was dissatisfied as this information had no impact on my practice	23	19	83%
7. I was dissatisfied as there was a problem with this information	30	25	83%
8. I disagree with this information	3	2	66%
9. I think this information is potentially harmful	10	8	80%
<b>Use of Information for a specific patient</b>			
	UNITS	'FIT' Units	Representativeness
1. To modify the management of this patient	151	80	53%
2. To maintain or justify the management of this patient	309	284	92%
3. To better understand specific issues regarding this patient	220	213	97%
4. To persuade the patient or other health professionals to make changes	110	87	79%

<b>Patient Health Benefit</b>	<b>UNITS</b>	<b>'FIT' Units</b>	<b>Representativeness</b>
1.Increased patient knowledge about health or healthcare	<b>192</b>	<b>185</b>	<b>96%</b>
2.Avoided unnecessary or inappropriate treatment, diagnostic procedure or preventative intervention	<b>170</b>	<b>150</b>	<b>88%</b>
3.Increased patient acceptability of treatment, diagnostic procedure or preventative intervention	<b>149</b>	<b>5</b>	<b>3%</b>
4.Prevented disease or health deterioration	<b>134</b>	<b>86</b>	<b>64%</b>
5.Improved patient health or functioning or resilience	<b>166</b>	<b>110</b>	<b>66%</b>

# APPENDIX C

## STEP 1 – QUALITATIVE INTERVIEW GUIDE

### PULL INTERVIEW GUIDE: VERSION 2008.11.02

#### **PART A. Introduction**

*(Interviewer presents herself)*

So before we begin, maybe I can briefly explain the context of the interview?

As you might already know we are doing this study to document the impact of databases like *Essential Evidence+*<sup>®</sup>, and to validate our information impact assessment method. So my plan for today is to review your most recent searches for information and your ratings. When you searched *Essential Evidence+*<sup>®</sup> and answered questionnaires, a report of your answers was provided to me. So we'll use this report to stimulate your memory. It may not be easy but we'll try to recall the context of a few searches, as well as the relevance, impact and use of the information you found. If you can't remember, it's ok, we will just move on to the next search.

So this interview may last about 60 minutes. Is that ok? *(Reschedule the interview if needed)*

- Before we start, do you have any questions?

#### **GENERAL QUESTIONS**

QA1. Do residents or colleagues use your PDA?

QA2. Do you use the latest version of IAM & *Essential Evidence+*<sup>®</sup>?

**Probe:** If not, can I ask you why?

QA3. On the report, I see that when you searched with *Essential Evidence+*<sup>®</sup> on your PDA, X (*Nb of deleted hits*) opened *Essential Evidence+*<sup>®</sup> pages were deleted, so not rated. Can you explain to me why you delete items, in general?

QA4. On the report, I see that (like most MDs in this study), you only rated a CDSS X (*Nb of times, e.g., once*) (*Read titles if necessary*). Do you use these on another computer besides your PDA?

QA5. Do you ever retrieve POEMs using *Essential Evidence+*<sup>®</sup> on another computer besides your PDA?

**Probe:** If yes, do you remember retrieving a POEM that you previously received on email?

QA6. And in general, would you say you prefer pulling information or the information being pushed to you?

QA8 Do you think the push POEMs (on email) had any effect on your pull behavior (*in EE+ or elsewhere*)?

QA7. Do you have any comment to make on the questionnaire?

**Probe:** Did the length of the questionnaire discourage you to rate information items?

#### **PART B. ACQUISITION = RELEVANCE = Questions at the SEARCH LEVEL**

First, I would like to ask you a few questions about a search, that is to say a set of opened *Essential Evidence+*<sup>®</sup> pages that you retrieved and rated.

QB1. Do you remember that on (*read PULL date and time*) you did a search on (*read keyword-s*)? [If needed: you retrieved (*read information hits titles*)?]

- **IF NO:** ask if interviewee has residents using the PDA or ask about another search.

QB2. Did you do this search by yourself or in the presence of someone else?

QB3. Do you remember where you were when you did this search?

QB4. (*If clinical situation*) Did you search before, after, or during an encounter with a patient?

QB5. Can you tell me the story around this search, e.g., do you remember what triggered this search?

**Note:** Continue the interview when SQ2 to SQ5 are clearly answered (clear search). Stop the interview about this search when one or more than one of these questions remain(s) unanswered,



or when the interviewee maintains that he or she does not remember this search (forgotten search).

QB6. According to my report, you searched for the following reason(s) (*read log-report*).

- C1 = Address a clinical question / problem / decision-making about a specific patient
- C2 = Fulfill an educational or research objective
- C3 = Search in general or for curiosity
- C4 = Look up something I had forgotten
- O1 = Share information with a patient / caregiver
- O2 = Exchange information with other health professionals
- O3 = Plan, manage, coordinate, delegate or monitor tasks with other health professionals

...and you said that this search (*did or did not*) meet your objective(s) (*according to report*). Is that correct?

QB7. Can you explain to me what led you to rate (*read each search objective one at a time and wait for answer*)?

QB8. Did you search in another source of information? For example did you seek information from colleagues, Internet, journals, textbooks, personal notes or library services?

- **IF NO**, go to PART B2

QB9. What was this source (or what were these sources), and what did you find?

QB10. Was this information (from source X) in agreement with or in conflict with *Essential Evidence+*®?

QB11. Was this information more relevant, equally relevant, or less relevant compared to *Essential Evidence+*®, given your objective(s)?

**PART C. COGNITION = IMPACT = Questions at the HIT LEVEL**

Second, I would like to ask you a few questions about the opened *Essential Evidence+*® page(s) that you retrieved and rated in this search. When you did a search on (*read keyword-s*), you opened X (*read Nb of hits*) *Essential Evidence+*® pages (*read information hits titles and types, e.g. POEM*).

QC1. For the **first** *Essential Evidence+*® page entitled (*read title*), you reported the following impacts (*read log-report*).

1. My practice was (will be) changed and improved. (+2<sup>nd</sup> screen=Diagnosis, Treatment, Health Education or Prognosis)
2. I learned something new.
3. This information confirmed I did (I am doing) the right thing.
4. I was reassured.
5. I recalled something.
6. I was dissatisfied as this information had no impact on my practice.
7. I was dissatisfied as there was a problem with this information. (+2<sup>nd</sup> screen=TMI, NEI, PoorInfo, TooTech, Other)
8. I disagree with this information.
9. I think this information is potentially harmful.
10. This information had no impact at all on me or my practice.

In what specific ways did this page have the following impact “(*read impact*)”?

- *Repeat the question for each impact*

(*According to log report, ask QD1 or QD2-QD3-QE1-QE2*)

**PART D. APPLICATION = USE = LCIS = Questions at the HIT LEVEL (or search level, if all hits used the same way)**

<b>N</b> <b>O</b> <b>U</b> <b>S</b> <b>E</b>	QD1. You reported that this <i>Essential Evidence+</i> ® page was NOT applied for a specific patient. But even though you didn't use it for a specific patient, did you use it in any other way? <ul style="list-style-type: none"><li>• <b>PROBE</b>. For example, would you say that this <i>Essential Evidence+</i>® page changed your (awareness) or (thinking) or (understanding) of a specific issue?</li></ul>
--	--

**Then ask HQ1 second hit**

**OR**

<b>U</b>	QD2. You reported that this <i>Essential Evidence+</i> ® page was applied for a specific patient.
<b>S</b>	Was this information applied <b>unchanged</b> or was it <b>modified</b> ( <i>if so, how</i> )?
<b>E</b>	<ul style="list-style-type: none"><li>• E.g. to fit the specific circumstances of the patient or local clinical setting</li></ul>
	QD3. Can you tell me the story around the use of this <i>Essential Evidence+</i> ® page for this patient?
	<b>Probe 1:</b> What happened after you found the information?
	<b>Probe 2:</b> What happened since then?
	<b>Probe 3:</b> Did you have a follow-up with this patient?
	Just to make sure I understand correctly, can you answer to the following questions by Yes or No?
	Did this <i>Essential Evidence+</i> ® page:
	<b>I</b> = ...change the management of this patient?
	<b>Probe 1:</b> <i>Imagine that you did not find this information. Would the patient have been managed differently?</i>
	<b>Probe 2:</b> <i>What was the planned action or management before you found this information?</i>
	<b>L</b> = ...maintain or justify the management of this patient?
	<b>C</b> = ...change your awareness or thinking or understanding of specific issues regarding this patient?
	<b>S</b> = ...was used to persuade the patient or other health professionals to make changes?
	<b><i>If other, please explain (e.g., “no use” or “NA” or other)</i></b>

**PART E. OUTCOMES = Questions at the HIT LEVEL**

QE1. In summary, did this *Essential Evidence+*® page have any patient outcomes? If yes, what specific patient outcomes?

- *What was the clinical situation before you find this information?*
- *What was the clinical situation after you applied this information?*
- *Imagine that you did not find this information. Would the health of the patient have been different?*

QE2. Just to make sure I understand correctly, can you answer to the following questions by Yes or No?

This *Essential Evidence+*® page:

- Increased patient knowledge about health or healthcare?
- Avoided unnecessary or inappropriate treatment, diagnostic procedure or preventive intervention?
- Increased patient acceptability of treatment, diagnostic procedure or preventive intervention?
- Prevented disease or health deterioration (including acute episode of chronic disease)
- Improved patient health or functioning or resilience (the way patient faces difficulties)?

[If needed]

QC1. For the **second** *Essential Evidence+*® page entitled (*read title*), you reported the following **impacts** (*read log-report*).

In what specific ways did this page have the impact “(*read impact*)”?

*Etc. (each impact + Application...)*

**PART C. REPEAT ALL QUESTIONS FOR ANOTHER SEARCH...**

Finally, thank you very much and I would like to know whether you have any comment about the study, the data collection process or this interview.

**Table C1**

Step 2 - Guidelines Grid – Items of Search Objectives

Guiding principles	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7
The item should apply to the respondent and the situation.	✓	✓	✓	✓	✓	✓	✓
Use simple yet concrete words.	✓	✓	✓	✓	✓	✓	✓
The language should be simple, straightforward and appropriate for the reading level of the scale’s target population. The language chosen for items should avoid slang, technical wording (jargon), trendy expressions and rare words.	✓	✓	✓	✓	x ‘caregiver’	✓	✓
The item should be a simple sentence. Avoid complex sentences. Long convoluted items are difficult for respondents to read and understand.	✓	✓	✓	✓	✓	✓	x
The item may be in the form of a statement or in the form of a question.	✓	✓	✓	✓	✓	✓	✓
Ask one question at a time. Avoid double barreled items that actually assess more than one characteristic such as “This information <u>maintained</u> or <u>justified</u> my management of this patient.”	✓	x ‘education or research’	x ‘general or curiosity’	✓	✓	✓	x ‘plan/ manage/ delegate/ coordinate’
Avoid items that apply virtually to everyone (ceiling effect).	✓	✓	✓	✓	✓	✓	✓

Guiding principles	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7
Avoid items that apply virtually to no one (floor effect).	✓	✓	✓	✓	✓	✓	✓
Avoid double negation.	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Special care must be taken with negatively stated item stems to avoid ambiguity.	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note. Item 1: Address a clinical question/problem/decision-making about a specific patient

Item 2: Fulfill an educational or research objective

Item 3: Search in general or for curiosity

Item 4: Look up something I had forgotten

Item 5: Share information with a patient/ caregiver

Item 6: Exchange information with other health professionals

Item 7: Plan, manage, coordinate, delegate or monitor tasks with other health professionals

**Table C2**

Step 2 - Guidelines Grid – Items of Cognitive Impact

Guiding principles	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9
The item should apply to the respondent and the situation.	✓	✓	✓	✓	✓	✓	✓	✓	✓
Use simple yet concrete words.	✓	✓	✓	✓	✓	✓	✓	✓	✓
The language should be simple, straightforward and appropriate for the reading level of the scale’s target population. The language chosen for items should avoid slang, technical wording (jargon), trendy expressions and rare words.	✓	✓	✓	✓	✗ ‘recalled’	✓	✓	✓	✓
The item should be a simple sentence. Avoid complex sentences. Long convoluted items are difficult for respondents to read and understand.	✓	✓	✓	✓	✓	✓	✗	✓	✓
The item may be in the form of a statement or in the form of a question.	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ask one question at a time. Avoid double barreled items that actually assess more than one characteristic such as “This information <u>maintained</u> or <u>justified</u> my	✓	✓	✓	✓	✓	✓	✓	✓	✓

management of this patient.”									
Avoid items that apply virtually to everyone (ceiling effect).	✓	✓	✓	✓	✓	✓	✓	✓	✓
Avoid items that apply virtually to no one (floor effect).	✓	✓	✓	✓	✓	✓	✓	✓	✓
Avoid double negation.	N/A	N/A	N/A	N/A	N/A	✗ ‘dissatisfied + no impact’	✗ ‘dissatisfied + problem’	✓	✓
Special care must be taken with negatively stated item stems to avoid ambiguity.	✓	✓	✓	✓	✓	✗	✗	✓	✓

Note. Item 1: My practice was (will be) changed and improved

Item 2: I learned something new

Item 3: This information confirmed I did (I am doing) the right thing.

Item 4: I was reassured

Item 5: I recalled something

Item 6: I was dissatisfied as this information had no impact on my practice

Item 7: I was dissatisfied as there was a problem with this information

Item 8: I disagree with this information

Item 9: I think this information is potentially harmful

**Table C3**

## Step 2 - Guidelines Grid – Items of Information Use for a Specific Patient

Guiding principles	Item 1	Item 2	Item 3	Item 4
The item should apply to the respondent and the situation.	✓	✓	✓	✓
Use simple yet concrete words.	✓	✓	✓	✓
The language should be simple, straightforward and appropriate for the reading level of the scale's target population. The language chosen for items should avoid slang, technical wording (jargon), trendy expressions and rare words.	✓	✓	✓	✓
The item should be a simple sentence. Avoid complex sentences. Long convoluted items are difficult for respondents to read and understand.	✓	✓	✓	✓
The item may be in the form of a statement or in the form of a question.	✓	✓	✓	✓
Ask one question at a time. Avoid double barreled items that actually assess more than one characteristic such as "This information <u>maintained</u> or <u>justified</u> my management of this patient."	✓	✗ 'justify or maintain or'	✓	✓
Avoid items that apply virtually to everyone (ceiling effect).	✓	✓	✓	✓
Avoid items that apply virtually to no one (floor effect).	✓	✓	✓	✓
Avoid double negation.	N/A	N/A	N/A	N/A
Special care must be taken with negatively stated item stems to avoid ambiguity.	N/A	N/A	N/A	N/A

Note. Item 1: To modify the management of this patient

Item 2: To justify or maintain the management of this patient

Item 3: To better understand a particular issue related to this patient

Item 4: To persuade other health professionals or patients to make changes

**Table C4**

Step 2 - Guidelines Grid – Items of Information Related Patient Health Benefit

Guiding principles	Item 1	Item 2	Item 3	Item 4	Item 5
The item should apply to the respondent and the situation.	✘ 'information related benefit is not clear'	✘ 'information related benefit is not clear'	✘ 'information related benefit is not clear'	✘ information related benefit is not clear'	✘ information related benefit is not clear'
Use simple yet concrete words	✓	✓	✓	✓	✓
The language should be simple, straightforward and appropriate for the reading level of the scale's target population. The language chosen for items should avoid slang, technical wording (jargon), trendy expressions and rare words.	✓	✓	✓	✓	✘ 'resilience'
The item should be a simple sentence. Avoid complex sentences. Long convoluted items are difficult for respondents to read and understand.	✓	✓	✓	✓	✓
The item may be in the form of a statement or in the form of a question.	✓	✓	✓	✓	✓
Ask one question at a time. Avoid double barreled items that actually assess more than one characteristic such as "This information <u>maintained or justified</u> my management of this patient."	✓	✓	✓	✓	✓
Avoid items that apply virtually to everyone (ceiling effect).	✓	✓	✓	✓	✓
Avoid items that apply	✓	✓	✓	✓	✓



virtually to no one (floor effect).					
Avoid double negation.	N/A	✓	N/A	N/A	N/A
Special care must be taken with negatively stated item stems to avoid ambiguity.	N/A	✓	N/A	N/A	N/A

Note. Item 1: Increasing patient knowledge about health or healthcare

Item 2: Avoiding unnecessary or inappropriate treatment, diagnostic procedure or preventative intervention

Item 3: Increasing patient acceptability of treatment, diagnostic procedure or preventative intervention

Item 4: Preventing disease or health deterioration (including acute episodes of chronic diseases)

Item 5: Improving patient health or functioning or resilience (i.e., how well the patient faces difficulties)

# Appendix D

## Step 3- Expert Panel Data collection form

### Examining the content validity of the Information Assessment Method

#### Expert (Information Technology Primary Care Research Group) Feedback Form

Dear ITPCRG member,

In this feedback form we present items of the proposed IAM 2011 for your expert judgement and evaluation. Each item needs to be evaluated for its relevance, representativeness, clarity, language and response formats. Please feel free to provide your suggestions and comments. Your feedback will be used towards the content validated version of IAM – IAM 2011. Please don't hesitate to contact me if you have any questions.

THANK YOU!

Contact:

Soumya Sridhar

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Cell: 514-621-3084

The Information Assessment Method contains items that enable the assessment of four target constructs:

- (1) Search Objective
- (2) Cognitive Impact
- (3) Information use for a specific patient
- (4) Information related patient health benefit

#### **Definitions:**

- i. A construct refers to the concepts, attributes or variables that are the targets of assessments (Haynes, Richard & Kubany, 1995).
- ii. Each construct is composed of facets. Facets are essential components to assess a particular construct. The items on a questionnaire reflect the facets of the target construct.
- iii. Content validity is defined as “the degree to which elements of an assessment instrument are relevant to and representative of the targeted construct for a particular assessment purpose.” (Haynes, Richard & Kubany, 1995, p. 238)
- iv. Relevance refers to the appropriateness of the elements of an instrument to assess the target constructs.
- v. Representativeness refers to the extent to which the elements represent the facets to be assessed.

(Example for 1 item)

Name of panel member:

Date:

**CONSTRUCT: SEARCH OBJECTIVE**

<b>Item : To address a clinical question / problem / decision about a specific patient</b>	
Q01. <b>Relevance:</b> How relevant is this item to the construct ' <i>search objective</i> '?	<input type="radio"/> Very relevant <input type="radio"/> Somewhat relevant <input type="radio"/> Not at all relevant
Q02. <b>Representativeness:</b> Is this item representative of the facet definition - ' <i>A search to solve a problem in clinical care such as etiology, diagnosis, investigations, interpreting test results, drug information, treatment and prognosis</i> '?	<input type="radio"/> Very representative <input type="radio"/> Somewhat representative <input type="radio"/> Not at all relevant
Q03. <b>Clarity:</b> Is this item clearly written?	<input type="radio"/> Very clear <input type="radio"/> Somewhat clear <input type="radio"/> Not at all clear
Q04. <b>Language:</b> Regarding this item, is the language appropriate for IAM users?	<input type="radio"/> Very appropriate <input type="radio"/> Somewhat appropriate <input type="radio"/> Not at all appropriate
Q05. <b>Response format:</b> Is the Yes-No response format adequate?	<input type="radio"/> Yes <input type="radio"/> No
Q06. If the item is not very clear or contains inappropriate language, please suggest modifications:	
Other comments and suggestions:	