# EVALUATION OF EMAIL ALERTS IN PRACTICE: PART 2 – VALIDATION OF THE INFORMATION ASSESSMENT METHOD (IAM).

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*"I think, therefore IAM" (Descartes, Discourse on the Method, 1637)*

**Abstract**

**Rationale and objective:** The *Information Assessment Method* (IAM) permits health professionals to systematically document the relevance, cognitive impact, use, and health outcomes of information objects delivered by or retrieved from electronic knowledge resources. The companion review paper (Part 1) critically examined the literature, and proposed a 'Push-Pull-Acquisition-Cognition-Application' evaluation framework, which is operationalized by IAM. The purpose of the present paper (Part 2) is to examine the content validity of the IAM cognitive checklist when linked to email alerts.

**Methods:** A qualitative component of a mixed methods study was conducted with 46 physicians reading and rating research-based synopses sent on email. The unit of analysis was a physician's explanation of a rating of one item regarding one synopsis. Interviews with participants provided 253 units that were analyzed to assess concordance with item definitions.

**Results and conclusion:** The content relevance of seven items was supported. For three items, revisions were needed. Interviews suggested one new item. This study has yielded a 2008 version of IAM.

## INTRODUCTION

As mentioned in the companion review paper (Part 1), the *Information Assessment Method (IAM)* may enhance the evaluation of electronic knowledge resources, two-way knowledge exchanges between information users and providers, and continuing professional development. The product of an 8-year research and development program, IAM is used in both

pull (information retrieval) and push (information delivery) contexts. In the present paper, our objective is to examine the content validity of the cognitive component of IAM for systematically assessing research-based email alerts (push).

## BACKGROUND

IAM combines computerized momentary assessment with a multi-dimensional questionnaire [1]. A selected IAM bibliography is presented on our website [2]. Within IAM, a 10-item checklist evaluates the cognitive impact of information objects delivered by or retrieved from electronic knowledge resources. The IAM cognitive checklist has evolved since its conception in 2001. Initially, qualitative research, a systematic literature review and a cohort study yielded a checklist of 10 types of cognitive impact [3-5]. Substantive validity refers to the theoretical rationale of assessment tools [6], and the proposed 'Push-Pull-Acquisition-Cognition-Application' conceptual framework supports the substantive validity of IAM in an information context (see companion review paper – Part 1).

Initially developed in a pull context, the IAM cognitive checklist has undergone some validation in a push context. With respect to email alerts, the convergent and discriminant evidence from multitrait-multimethod comparisons suggests IAM cognitive items can be seen as different factors [7]. In the present paper, we report the content validity of the IAM cognitive checklist.

In a pilot content validity exercise, 28 clinicians were interviewed in 2006. During interviews, clinicians used the 10-item IAM cognitive checklist to rate three research-based synopses (InfoPOEMs®) on paper, and explained their ratings. High concordance between our definitions and clinicians' understanding of items was found for five items. For two items, there was lower concordance, while for three rarely reported items, no conclusion was possible. Based on this exercise, one item was clarified ('recall'), while no decision was made regarding the other item ('no impact'). Most importantly, this exercise emphasized the need to re-examine the content validity of all items. The 2006 version of the checklist is presented in Table 1 with proposed definitions for each item. The present study is a follow-up on our pilot exercise. Our research question is: what is the content validity of the cognitive component of IAM for systematically assessing information objects delivered on email? We interviewed 46 physicians to compare their understanding of our checklist items against our proposed definitions.

## METHODS

A mixed methods study was conducted following a sequential explanatory design [8]. The qualitative data collection and analysis followed and explained quantitative results, and served as a basis for content validation. A mixed methods sampling strategy was followed [9]. Participants of the quantitative component were invited to participate in the qualitative component. The quantitative component is presented elsewhere [7]. In this longitudinal quantitative component, research-based synopses called InfoPOEMs® (POEM standing for Patient Oriented Evidence that Matters) were delivered as daily email to 12,800 physicians by Practice Solutions (a Canadian Medical Association company). Each email contained a link to an IAM webpage presenting a checklist of 10 cognitive items. For each InfoPOEM®, physicians were invited to check all applicable item(s). For each rated InfoPOEM®, members of the College of Family Physicians of Canada automatically received 0.1 M1 MainPro credits for Continuing Medical Education (CME). Between September 2006 and February 2007, 1,007 family physicians submitted 61,493 ratings of 'cognitive impact' (completed checklists).

In the present qualitative component, the unit of analysis was a physician's follow-up explanation of one item of cognitive impact based on their rating of an InfoPOEM®, which are appraised synopses of peer-reviewed published research, selected for validity and relevance to clinicians in primary care. InfoPOEMs® contain a bottom-line (one or two sentences), a clinical question, a structured synopsis (about 200 words), and a corresponding reference linked to PubMed. For each InfoPOEM®, more than one item of cognitive impact could be checked. Forty-six physicians agreed to an interview, and explained their ratings of 253 units. Physicians were recruited with the help of Practice Solutions using one invitation email. Semi-structured telephone interviews were conducted between May and June 2007 (approximately 25 minutes in length). Our goal was to obtain 30 explanations or units for each item, for a total of 300 units. Since some items were infrequently endorsed, 253 units were obtained. We collected 30 or more units for four frequently endorsed items, between 20 and 30 units for five other items, and five units for one rarely endorsed item. Ethical approval was obtained from McGill University.

To better understand the context of physician ratings, interviewees were asked if they were in practice and worked in an academic setting, about how often they read InfoPOEMs®, and whether they typically read the whole text or just the bottom line (one or two sentences

summarizing the text). Interviewees were questioned about their overall satisfaction with InfoPOEMS® (regarding the quality and usefulness of the information) in comparison to other educational resources; and whether they had concerns about how InfoPOEMs® were written. Data consisted of archives (InfoPOEMs®), documents (reports on interviewees' ratings of InfoPOEMs®), field notes, and interview transcripts. With respect to content validation, our interview guide is presented in Box 1. One question permitted us to better understand the cognitive impact of three InfoPOEMs® recently rated by the interviewee, and one question explored potentially new items of cognitive impact.

A deductive thematic analysis of interview transcripts was carried out. Data were imported into NVivo7® software for computer assisted qualitative data analysis. Each IAM cognitive impact item was a theme. For each unit, extracts of interview transcripts explaining the rating were assigned to the corresponding theme. Then, each unit was assigned to one of three categories: (1) 'fit' when the explanation was concordant with the proposed definition of the item; (2) 'misfit' when it was not; or (3) 'unclear'. Four researchers independently reviewed assignments, and indicated their agreement or disagreement. Disagreements were resolved by discussion and consensus, or arbitration by a third party. In addition, extracts of interview transcripts were assigned to new emerging themes as suggested by the data.

According to Messick's constructionist definition of validity, content validity is based on professional judgments, and includes evidence of content relevance and representativeness [6, 10]. IAM items were derived from a qualitative research with physicians and a systematic literature review. The present study examined the relevance of items from a physicians' perspective, and scrutinized potentially new items that could increase the representativeness of IAM items with respect to our content domain, i.e., the cognitive impact of email alerts. For each unit, we interpreted participants' interview transcripts as concordant (supporting the item: 'fit'), discordant (matching another proposed item or suggestive of a new item: 'misfit'), or unclear. A unit was considered unclear when the verbatim interview was confusing or provided no explanation, e.g., when asked why the item 'I learned something new' was checked, a participant answered "I learned something [pause], means I learned something". Qualitative findings are presented below by type of cognitive impact.

**RESULTS**

Forty family physicians and six other specialists were interviewed (average age 50 years). Of 46 interviewees, seven (15%) worked in an academic setting, 29 (63%) were male, and 17 (37%) were female. Forty-five interviewees were physicians in practice, while one was retired. With respect to InfoPOEMs®, all interviewees (100%) reported always reading the bottom line section, 12 (26%) stated they always read the complete InfoPOEM®, while 23 (50%) mentioned they read all components only when the InfoPOEM® was "interesting". The 46 interviewees were not representative of the 1,873 Canadian physicians who rated InfoPOEMs® during the same period. While interviewees rated more InfoPOEMs® (average 117 vs. 95) and reported positive cognitive impact more frequently, they were also more critical. Interviewees checked more frequently 'My practice was (will be) improved' (22.1% vs. 12.9%), 'I learned something new' (51.5% vs. 39.4%), and 'I disagree with this information' (1.2% vs. 0.5%). The participant perspective on benefits and pitfalls of InfoPOEMs® is presented in Box 2.

With respect to content validation, 174 of the 253 units were concordant with proposed definitions. Of 57 discordant units, 37 referred to cognition and 20 to the acquisition or application of information. Findings by item are presented in Table 2. With respect to content relevance, results support the validity of seven items (more than 75% of units being concordant with proposed definitions), while they do not support the validity of three other items, and suggest revisions as described in the next section. With respect to content representativeness, interviews suggest one new item.

*Item 1: Practice improvement*

Of 34 units, 26 (*77%)* were concordant with our proposed definitions, seven were discordant, and one was unclear. By way of illustration, a participant read and rated an InfoPOEM® entitled 'long-term proton pump inhibitor use increases hip fracture risk', and stated "we [physicians] all have large numbers of patients who are taking protein pump inhibitors, and sometimes for a long period of time, so [this information] would make me more vigilant in making sure that people get extra calcium supplementation and have bone mineral densities done." This unit was interpreted as concordant to the proposed definition since it suggested a

commitment to change ("would make me more vigilant") and improvement of practice. However, the seven discordant units matched another cognitive item, specifically 'confirmation' (this information confirmed I did (will do) the right thing), which suggested physicians did not necessarily associate the term 'improvement' with some degree of practice change.

*Item 2: Learning*

Of 34 units, 30 (*88%)* were concordant with our proposed definition, one was discordant, and three were unclear. For instance, a participant read and rated an InfoPOEM® entitled 'surgery superior to conservative treatment for first-time anterior shoulder dislocation', and said "I wasn't aware, nor were the two surgeons we work with, that there was this hugely different benefit to doing acute surgery if it is possible; so in this respect, I learned something new." This unit was interpreted as concordant to the proposed definition. The discordant unit matched the 'confirmation' cognitive item.

*Item 3: Recall*

Of 30 units, only four (*13%)* were concordant with our proposed definitions, while 19 were discordant, and seven were unclear. For example, a participant read and rated one InfoPOEM® entitled 'Cyclophosphomide reduces dyspnea in scleroderma lung disease', and stated "what I remembered was that Cyclophosphomide sometimes causes people to feel depressed or confused; this is something that I would not have remembered [without this information object]." This unit was interpreted as concordant to the proposed definition since it suggested email alerts stimulated memory about something that the participant knew, but forgot. The 19 discordant units referred to two situations. On the one hand, three units suggested InfoPOEMs® stimulated memory about something that was not contained in the information object. For example, one participant said an InfoPOEM® reminded him of a time when he had to prescribe a certain drug before it was available over the counter at the pharmacy. On the other hand, 16 units suggested InfoPOEMs® stimulated memory about something that participants knew and did not forget. For instance, a participant read and rated one InfoPOEM® entitled 'increased use of COX-2 [cyclooxygenase isoenzyme] inhibitors is associated with more overall gastrointestinal bleeds', and said "I did know some of this information, i.e., that gastrointestinal

complications are not absent and can be dangerous, so this is what I recalled; I did not forget it, but it was not really in the forefront [of my memory]."

*Item 4: Confirmation*

Of 24 units, 21 (*88%)* were concordant with our proposed definitions, one was discordant, and two were unclear. By way of illustration, a participant read and rated an InfoPOEM® entitled 'diet, exercise, drugs may prevent diabetes in high-risk patients', and stated "[this information object] confirmed I did and do the right thing; we do this anyways, but it is nice to have a study behind you; it makes you feel smart." This unit was interpreted as concordant to the proposed definition. The discordant unit referred to the application of information.

*Item 5: Reassurance*

Of 30 units, 29 (*97%)* were concordant with our proposed definitions, none was discordant, and one was unclear. For example, a participant read and rated an InfoPOEM® entitled 'Misoprostol = PGE2 [gives similar results compared to prostaglandin E2] for induction of labor at term with unfavorable cervix', and said "you never know if you are doing the right thing, do you? Now I know that I was not making a crazy choice; it does not tell me I am clever, it just tells me what I was doing was appropriate, while at that time some people were telling us it was inappropriate." This unit was interpreted as concordant to the proposed definition.

*Item 6: Too much information and frustration*

Of five units, only one (*20%)* was concordant with our proposed definitions, two were discordant, and two were unclear. For example, a participant read and rated an InfoPOEM® entitled 'Letrozole = [gives similar results compared to] Clomiphene for achieving pregnancy in PCOS [normal-weight women with polycystic ovary syndrome]', and said "there is a lot of information [in this InfoPOEM®] that does not seem to apply in any way (laugh): the menstrual cycles, intention to treat analysis, … there is just a lot of stuff that I do not see how it ties in to the findings." This unit was interpreted as concordant to the proposed definition. The discordant units referred to a problem concerning the format of InfoPOEMs®.

*Item 7: Not enough information and frustration*

Of 23 units, 20 (*87%)* were concordant with our proposed definitions, one was discordant, and two were unclear. For example, a participant read and rated an InfoPOEM® entitled 'Smaller benefit of statins without heart disease', and stated "They didn't really give enough information about other risk factors and how they might interact with the lowering of cholesterol; like for example smoking, blood pressure control, and so on." This unit was interpreted as concordant to the proposed definition. The discordant unit referred to a problem associated with the original study (e.g., inadequate sample size), not the InfoPOEM® per se.

*Item 8: Disagreement*

Of 24 units, 19 (*79%)* were concordant with our proposed definitions, four were discordant, and one was unclear. For example, a participant read and rated an InfoPOEM® entitled 'acupuncture possibly effective for ulcerative colitis', and said "the study [sample] seemed too small to actually give a significant outcome [N=29], and it was not really clear that [acupuncture] helped at all; [the InfoPOEM®] said that acupuncture is possibly effective for ulcerative colitis; I would not say it is possibly effective, I would say it was probably not effective." This unit was interpreted as concordant to our proposed definition. The four discordant units referred to three types of situation. In one unit, the participants said that there was no real disagreement. Another unit referred to a different cognitive impact (not enough information). The final two discordant units referred to the acquisition (no relevance) and application (no use) of information.

*Item 9: Potentially harmful*

Of 22 units, 21 (*96%)* were concordant with our proposed definitions, none was discordant, and one was unclear. For example, a participant read and rated an InfoPOEM® entitled 'morphine improves chronic, intractable cough', and stated that "the study was poorly done, and the [InfoPOEM®] did not define what improvements were important, and we are dealing with a potentially addictive substance, with a substantial risk in terms of side effect and interaction with other medications." About the same InfoPOEM®, other participants said "the assessment instrument was not well enough developed to know if improvements were clinically meaningful, and I would not use a controlled narcotic based on something that is not clinically

meaningful", and "the side effects of morphine outweigh the benefits on cough, it is so constipating and addictive, and it causes nausea; I see a lot of drug seekers, and this could cause big problems if people start coming in with the chief complaint of cough, and if [morphine] is the standard of care." This unit was interpreted as concordant to the proposed definition.

*Item 10: No impact*

Of 27 units, only three (11%) were concordant with our proposed definitions, while 22 were discordant, and two were unclear. For example, a participant read and rated an InfoPOEM® entitled 'morphine improves chronic, intractable cough', and stated that "well, I've used that for patients for example with lung cancer, who have a very irritating cough, and it seems to be more effective than codeine for example; so I've known that; it wasn't new to me, that's all; this was old knowledge." This unit was interpreted as concordant to the proposed definition (no cognitive impact). The 22 discordant units revealed the ambiguity of this item, and referred to two types of situation. On the one hand, five units referred to some cognitive impact, e.g., participants disagreed with the study that was summarized in the InfoPOEM®. On the other hand, 17 units referred to acquisition (no relevance) and application (no use) of information.

*New item: Motivation to learn*

In addition, interviews suggested one new item 'I am motivated to learn more'. When asked about a potentially new item that was not listed on the checklist under scrutiny, three participants explained that InfoPOEMs® revealed unknown information needs, and stimulated their curiosity and personal interest. As stated by one participant, "[it is] like if you have limited information and you want to learn more about it". Another participant said "I think that one [new] impact you could have is 'I was motivated to find more information', [something like] a stimulation that makes the reader want to go further". With respect to an InfoPOEM®, a third participant explained that it "stimulates interest and curiosity; we will ask a colleague in charge of grand rounds to invite a specialist for discussing this topic, and decide whether this [information] is applicable to our patients; [this InfoPOEM®] will help in this sense, but simply receiving such information and say 'OK, tomorrow, I will do this' [use it for a specific patient], no."

## DISCUSSION

Overall, these results support the content validity of the IAM cognitive checklist, and have yielded a revised 11-item version with corresponding definitions (Table 3). Results support the content relevance of seven items (practice improvement, learning, confirmation, reassurance, frustration, disagreement and potential harm), and led us to revise three items. Results support the content representativeness of the items, and they suggest only one new item (motivation to learn). Since physicians did not necessarily associate the term 'improvement' with some degree of practice change, we have modified the wording of the first item to make the dimension of change more explicit, and replaced 'My practice was (will be) improved' with 'My practice was (will be) changed and improved'. With respect to the 'recall' item, the 20 concordant and discordant units suggested email alerts stimulated memory about something the participant already knew and had not necessarily forgotten. Thus, we replaced the item 'I recalled something' with 'I am reminded of something I already knew'. Since one 'frustration' item was rare and problematic, we merged 'frustration' items into two new generic items for addressing (1) the potential for frustration (I am dissatisfied), and (2) problems associated with the content or the format of email alerts ('There is a problem with this information'). The rationale for this distinction was that finding a potential problem related to an email alert does not necessarily result in dissatisfaction. In addition, results led us to clarify and revise the item 'no impact' as 'This information has no impact at all on me or my practice', and to address the 'acquisition' and 'application' issues by proposing new items as described in the next section.

The new item 'motivation to learn more' may trigger subsequent learning activities, e.g., pondering and critically examining information using individual learning programs of the College of Family Physicians of Canada (Pearls, Linking Learning to Practice), and the Royal College of Physicians and Surgeons of Canada (Personal Learning Projects). The ability of email alerts and IAM to trigger individual learning may have important unanticipated benefits. Email alerts may reveal unknown information needs, and physician responses to the new item 'motivation to learn more' may refine targeting of future educational needs. Assuming these responses can be transmitted to educational bodies, the IAM/alert combination can at least partially overcome the usual barrier for a CME needs assessment, and address the question 'how can physicians know what they do not know?' According to Sackett et al. [11], continuing professional development "only works when you don't want it" (p. 621). Therefore, revealing

unknown information needs through email alerts may at least partially address this issue. Finally, reports derived from the IAM assessment tool may help to build portfolios of reflective learning.

In sum, the present paper and our previous work support three aspects of the validity of the IAM cognitive checklist for assessing email alerts (1) content relevance and representativeness, (2) substantive validity, (3) convergent and discriminant evidence from multitrait-multimethod comparisons. The present results add mixed methods evidence to support the validity of this checklist, an important issue considering there exists "poor validity evidence for evaluation methods in medical education" (p. 280) [12]. These results led us to refine the checklist, an essential step in developing clinical assessment instruments [13].

The refined 'acquisition-cognition-application' version of IAM establishes a chain of evidence between email alerts, and health professionals' evaluation of relevance, cognitive impact, use and expected health outcomes. The present results led to this refinement as follows. With respect to the item 'no impact', 63% of units referred to the acquisition (no relevance) and the application (no use) of information. To decrease such ambiguity, we revised this item, and developed new 'acquisition' and 'application' components of IAM in accordance with our framework. Thus, the 2008 version of IAM contains additional items regarding the relevance of information objects for specific patients, their use and expected patient health outcomes [1]. The literature on 'research utilization' was mobilized to identify four types of behaviours associated with the use of information (e.g., 'modifying patient management'). In addition, the literature suggests five types of patient health outcomes that may be associated with information use in primary care (e.g., 'improving patient health or functioning or resilience'). The refined version of IAM is presented in Figure 1, and was used by Canadians physicians in 2008 to complete 170,827 ratings of relevance, cognitive impact, potential use, and expected health outcomes of InfoPOEMs®.

While our work suggests IAM is a comprehensive, generic, systematic and validated tool, the present validation study nevertheless faces four limitations. Firstly, the study was done with a convenience sample of physicians who consented to interview. Our results might not be the same with a representative sample of physicians or with other health professionals. Secondly, further analysis of the construct validity of the 2008 IAM cognitive checklist is needed as its factor structure may differ from the 2006 version [7]. Thirdly, qualitative research and qualitative components of mixed methods research are usually based on in-depth examination of multiple

sources of evidence (e.g., archives, documents, interviews and observations), and we were unable to conduct observations. We nonetheless had access to multiple sources of data, i.e., archives (InfoPOEMs®), documents (reports on interviewee ratings of InfoPOEMs®), field notes, and interview transcripts. Fourthly, while the validity of the 'cognitive' component of IAM was examined, the validity of 'information use' and 'health outcomes' components is presently under scrutiny, and so the latter two components must be used with caution.

Finally, our results support and contribute to the literature with respect to the benefits and pitfalls of email alerts (see the companion review paper – Part 1). Overall, results suggest research-based email alerts, such as InfoPOEMs®, are stimulating, time saving and useful (Box 2). Relevance comes first, and the usage of email alerts is associated with trust in the validity of information. For instance, interviewees stated they were rarely concerned about the relevance, accuracy, and comprehensiveness of InfoPOEMs®. The usage of email alerts is associated with incentives, and results show only two interviewees (4%) did not need IAM-related CME credit. While email alerts can be associated with information overload, which may lead to email apprehension [14], 34 interviewees (74%) were never overloaded because of InfoPOEMs® in our study. However, health-related clinical emailing channels (email alert services) are burgeoning, and our results may not be confirmed in future research if email apprehension increases.

In addition, our results suggest pitfalls that were not mentioned in the literature (Box 2). First, some interviewees experienced technical problems, as they did not have automatic access to the corresponding database when they subscribed to the InfoPOEMs® email service. Only seven (15%) interviewees were able to search the InfoPOEMs® database to retrieve InfoPOEMs® they previously received on email. Others claimed alternative search strategies, but this may cause retrieval failure and frustration. Second, with respect to potential improvement of email alerts, 35 interviewees (76%) answered that colleagues' feedback, using IAM-collected data for instance, would influence how they read and used the information from InfoPOEMs®. In particular, they would re-read the information, or think more carefully about it. Colleagues' feedback would add another perspective, and help the reader to be more critical, and focus on important issues.

## CONCLUSION

The present paper and our previous work support the validity of the IAM cognitive checklist for systematically assessing email alerts. As mentioned in the companion review paper, IAM may contribute to (1) research for systematically assessing and comparing the relevance, cognitive impact, use and expected health outcomes associated with email alerts, (2) continuing professional development for documenting brief individual e-learning activities, and (3) two-way knowledge exchange between information providers and clinicians for improving email alerts. Ongoing research will permit further scrutiny of the validity of all components of the 2008 version of IAM in both push and pull contexts.

### Abbreviations

- CME: Continuing medical education
- IAM: Information Assessment Method

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### Competing interests

All authors hereby declare they have no financial relationship with InfoRetriever®, InfoPOEMs® or their publisher (John Wiley and Sons).

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The Information Assessment Method (IAM) is protected by Registered Copyrights (2008): # CA 1057518 "A scale to assess the cognitive impact, relevance and use of information hits derived

from electronic resources", and # CA 1057519 "Une échelle pour évaluer l'impact cognitif, la pertinence et l'utilisation des informations issues de ressources électroniques"

**References**

1. Pluye, P., Grad, R. M., Repchinsky, C., Farrell, B., Johnson-Lafleur, J., Bambrick, T., et al. (2009) IAM: a comprehensive and systematic information assessment method for electronic knowledge resources. In Handbook of Research on IT Management and Clinical Data Administration in Healthcare (ed. A. Dwivedi), pp. 521-548. Hershey: IGI Publishing.

2. Information Technology Primary Care Research Group. (2009) The Information Assessment Method. McGill University, Department of Family Medicine, retrieved on June 29, 2009 from http://iam2009.pbworks.com/FrontPage, archived by WebCite® at http://www.webcitation.org/5gsxVzICm

3. Grad, R. M., Pluye, P., Meng, Y., Segal, B. & Tamblyn, R. (2005) Assessing the impact of clinical information-retrieval technology in a family practice residency. *Journal of Evaluation in Clinical Practice*, 11 (6), 576-86.

4. Pluye, P. & Grad, R. M. (2004) How information retrieval technology may impact on physician practice: an organizational case study in family medicine. *Journal of Evaluation in Clinical Practice*, 10 (3), 413-30.

5. Pluye, P., Grad, R. M., Dunikowski, L. & Stephenson, R. (2005) Impact of clinical information-retrieval technology on physicians: a literature review of quantitative, qualitative and mixed-method studies. *International Journal of Medical Informatics*, 74 (9), 745-68.

6. Messick, S. (1995) Validity of psychological assessment: validation of inferences from persons' responses and performances as scientific inquiry into score meaning. *American Psychologist*, 50 (9), 741-9.

7. Grad, R. M., Pluye, P., Mercer, J., Marlow, B., Beauchamp, M., Shulha, M., et al. (2008) Impact of research-based synopses delivered as daily email: a prospective observational study. *Journal of the American Medical Informatics Association*, 15 (2), 240-5.

8. Creswell, J. & Plano-Clark, V. (2007) Designing and conducting mixed methods research. Thousand Oaks: Sage.

9. Teddlie, C. & Yu, F. (2007) Mixed methods sampling: a typology with examples. *Journal of Mixed Methods Research*, 1 (1), 77-100.

10. Messick, S. (1989) Validity. In Educational measurement (ed. R. Linn), pp. 13-103. New York: Macmillan.

11. Sackett, D. & Rosenberg, W. (1995) The need for evidence-based medicine. *Journal of the Royal Society of Medicine*, 88, 620-4.

12. Ratanawongsa, N., Thomas, P., Marinopolos, S., Dorman, T., Wilson, L., Ashar, B., et al. (2008) The reported validity and reliability of methods for evaluating continuing medical education: a systematic review. *Academic Medicine*, 83 (3), 274-83.

13. Smith, G. & McCarthy, D. (1995) Methodological considerations in the refinement of clinical assessment instruments. *Psychological Assessment*, 7 (3), 300-8.

14. Wrench, J. & Punyanunt-Carter, N. (2007) The relationship between computer-mediated-communication competence, apprehension, self-efficacy, perceived confidence, and social presence. *Southern Communication Journal*, 72 (4), 355-78.

**Table 1. The 2006 IAM Cognitive Checklist**

| Cognitive impact items | Proposed definitions |
|---|---|
| *What is the impact of this InfoPOEM®? Check all that apply:* | *The cognitive impact of the information object received on email can be linked to:* |
| ☐ My practice was (will be) improved | • a positive change in decision-making with respect to a patient (or a commitment to change); |
| ☐ I learned something new | • a positive change in knowledge; |
| ☐ I recalled something (because of this InfoPOEM) | • a change in decision-making or knowledge, or a reinforcement of decision-making; |
| ☐ This information confirmed I did (will do) the right thing | • a reinforcement of decision-making (positive effect or influence on the professional, but no change); |
| ☐ I was reassured | • an increased comfort in decision-making, or a decrease of conflict in decision-making (positive effect or influence on the professional, but no change); |
| ☐ I was frustrated as there was too much information | • a feeling of dissatisfaction because an information need is not satisfied (negative effect or influence on the professional, and no change); |
| ☐ I was frustrated as there was not enough information or nothing useful | • a feeling of dissatisfaction because an information need is not satisfied (negative effect or influence on the professional, and no change); |
| ☐ I disagree with this information | • a suspicion and potential loss of confidence in the electronic knowledge resource; |
| ☐ I think this information is potentially harmful | • a negative effect on decision-making with respect to a situation where this information might be used; |
| ☐ No impact | • no cognitive impact at all (none of the above impacts, and no other cognitive impact). |

**Table 2. The IAM Cognitive Checklist 2006: Validity by Item**

| Cognitive impact items | Concordance | Interpretation | Decision |
|---|---|---|---|
| • My practice was (will be) improved | 76.5% (N=34) | Valid | Refine |
| • I learned something new | 88.2% (N=34) | Valid | No change |
| • I recalled something (because of this POEM) | 13.3% (N=30) | Problematic | Revise |
| • It confirmed I did (will do) the right thing | 87.5% (N=34) | Valid | No change |
| • I was reassured | 96.7% (N=30) | Valid | No change |
| • I was frustrated as there was too much information | 20.0% (N=5) | Problematic | Merge |
| • I was frustrated as there was not enough information or nothing useful | 87.0% (N=23) | Valid | Merge |
| • I disagree with this information | 79.2% (N=24) | Valid | No change |
| • I think this information is potentially harmful | 95.5% (N=22) | Valid | No change |
| • No impact | 11.1% (N=27) | Problematic | Revise |

**Table 3. The Revised 2008 Version of the IAM Cognitive Checklist**

| | | **Revised cognitive item**<br>What is the impact of this information object? | **Revised item definitions**<br>The cognitive impact of the information object received on email can be linked to: |
|---|---|---|---|
| *YES* | *NO* | *Check YES or NO for each item* | |
| ☐ | ☐ | My practice is (will be) changed and improved | • a change in decision-making with respect to a patient (or a commitment to change); |
| ☐ | ☐ | I learned something new | • a change in knowledge; |
| ☐ | ☐ | I am motivated to learn more | • an educational or information need; |
| ☐ | ☐ | This information confirmed I did (am doing) the right thing | • a reinforcement of decision-making; |
| ☐ | ☐ | I am reassured | • increased comfort in decision-making; |
| ☐ | ☐ | I am reminded of something I already knew | • another information source (change in decision-making or knowledge, or reinforcement of decision-making); |
| ☐ | ☐ | I am dissatisfied | • dissatisfaction because an information need is not satisfied; |
| ☐ | ☐ | There is a problem with this information | • one or more content/format issues; |
| ☐ | ☐ | I disagree with the content of this information | • a potential loss of confidence; |
| ☐ | ☐ | I think this information is potentially harmful | • a situation where potential harms exceed benefits; |
| ☐ | ☐ | This information has no impact at all on me or my practice | • the absence of any cognitive impact (none of the above impacts and no other cognitive impact). |

Note: We recommend using the above 'yes-no' version of the IAM cognitive checklist rather than a 'Check all that apply' version (Figure 1). The 'yes-no' version is likely to be more reliable for structuring clinicians' reflection. For instance, we have observed the 'yes-no' version documents more types of cognitive impact compared to a 'Check all that apply' version.

**Box 1. Interview Guide**

**Content validity**

First, I would like to ask you a few questions about three specific POEMs that you rated.

POEM #1:

Do you remember reading the POEM entitled (read title)? *[ read bottom line when needed]*

*If NO: ask about another POEM with impact.*

If YES: On (read date), you rated this POEM as (read impact items under scrutiny).

In what specific ways (ask all that apply):

- did this POEM improve your practice?
- did you learn something new?
- what did you specifically recall by reading this POEM?
- did this POEM confirm that you did (will do) the right thing?
- were you reassured?
- was there really nothing positive or nothing negative about this POEM?
- what led you to feel frustrated with this POEM as related to information overload?
- what led you to feel frustrated with this POEM as related to an absence of useful information?
- what led you to disagree with this POEM?
- what led you to report that this POEM was potentially harmful?

POEMs # 2 and #3: Same questions

Can you think of another type of item that we should add to our list of impacts?

**Box 2. Participants' perspective on benefits and pitfalls of the email alerts understudy**

**Overall satisfaction with InfoPOEMs® and IAM**

Interviewees found InfoPOEMs® stimulating (N=42), time saving (N=39), and providing good (N=43) and useful (N=42) clinical information. They were rarely concerned about the accuracy (N=1), comprehensiveness (N=4), and relevance (N=5) of InfoPOEMs®. Although 34 interviewees (74%) reported they were never overloaded because of InfoPOEMs®, 10 (22%) were occasionally overloaded, and two (4%) often felt overloaded. Furthermore, 36 interviewees (78%) never experienced technical problems, while 10 (22%) did. Three interviewees (7%) noticed InfoPOEMs® with missing sentences, and two (4%) experienced difficulties with the automated transfer of CME credit.

**Reading/rating patterns**

Twenty nine interviewees (63%) reported they regularly read one InfoPOEM® per day, 12 (26%) usually read many InfoPOEMs® at the same time, while five (11%) said their patterns varied. Twenty seven interviewees (59%) reported they always rated InfoPOEMs® they read. Regarding reasons for not rating InfoPOEMs®, 15 interviewees (33%) said they did not rate irrelevant or uninteresting InfoPOEMs®, 12 (26%) stated they did not rate InfoPOEMs® when they were short of time, and four did not read email (9%) when they felt overloaded. Only two interviewees (4%) said they did not like the IAM rating method, and did not need IAM-related CME credit.

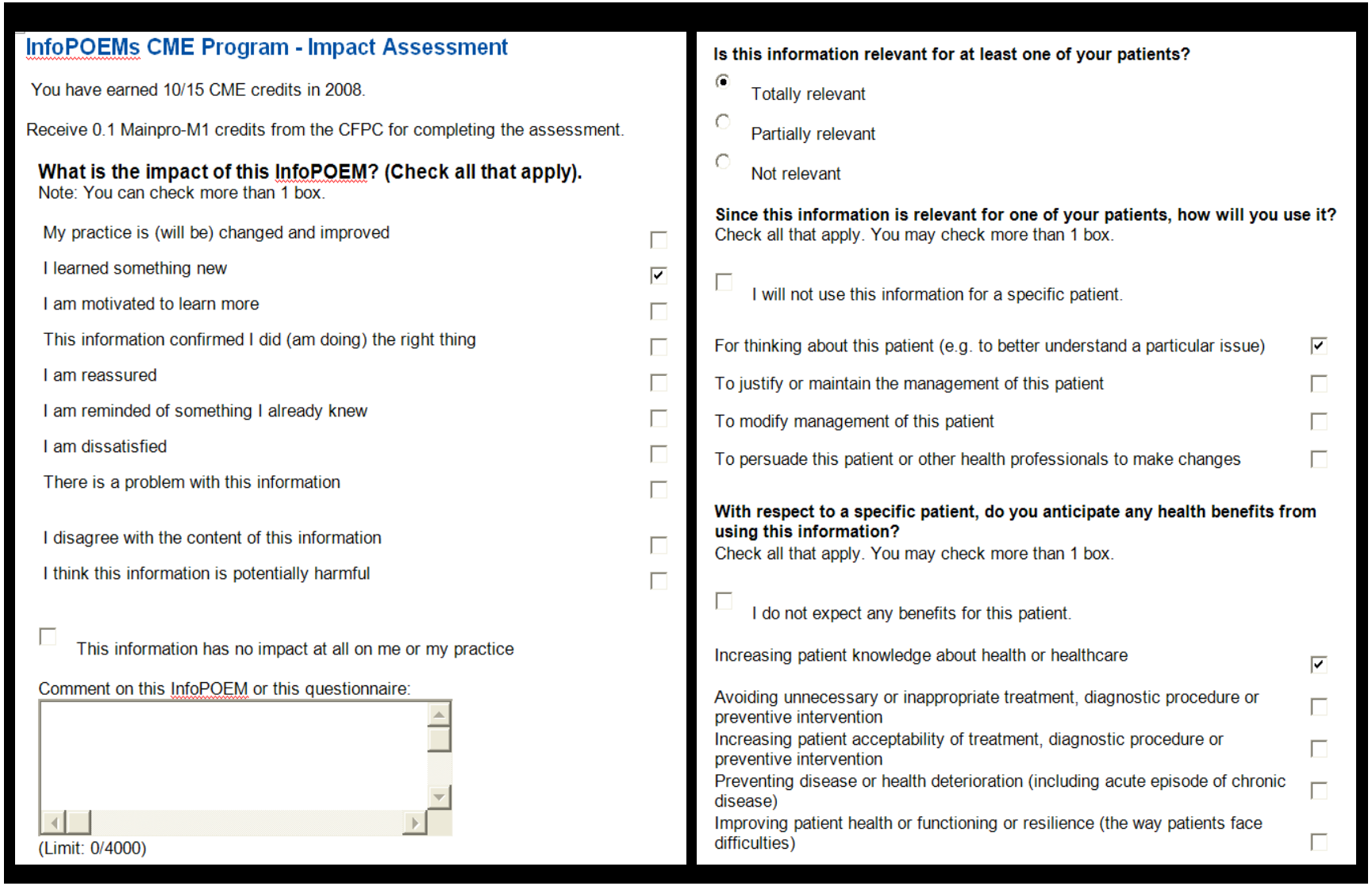
**Push-pull issue**

InfoPOEMs® were associated with a pull database, InfoRetriever®, for their retrieval if interviewees had access to the database through an individual or institutional licence. Thus, only seven (15%) interviewees said they used InfoRetriever® to retrieve InfoPOEMs®. Of the 39 interviewees (85%) who did not use InfoRetriever®, eight (17%) said they retrieved InfoPOEMs® as archived email, three (7%) said they used the Canadian Medical Association website for retrieval, while one (2%) printed InfoPOEMs® and stored them on paper for re-reading as needed.

**Potential improvements**

With respect to potential improvements, 35 interviewees (76%) answered yes to the following question: "*In the future imagine that when you read an InfoPOEM®, you can also read feedback provided by other colleagues. Would such feedback influence the way you read and use the information from InfoPOEMs®?"* Of these interviewees, 15 (33%) thought they would re-read the InfoPOEM®, or think about it more carefully if peer ratings would differ from their rating. In addition, 13 interviewees (28%) said peer feedback would influence them by bringing another perspective to InfoPOEMs®, nine (20%) stated that they could be more critical, and nine (20%) that colleagues' feedback could help them to focus on important issues.

**Figure 1. The Revised 2008 Version of the Information Assessment Method (IAM) for Evaluating Email Alerts**



InfoPOEMs CME Program - Impact Assessment

You have earned 10/15 CME credits in 2008.

Receive 0.1 Mainpro-M1 credits from the CFPC for completing the assessment.

**What is the impact of this InfoPOEM? (Check all that apply).**
Note: You can check more than 1 box.

- [ ] My practice is (will be) changed and improved
- [x] I learned something new
- [ ] I am motivated to learn more
- [ ] This information confirmed I did (am doing) the right thing
- [ ] I am reassured
- [ ] I am reminded of something I already knew
- [ ] I am dissatisfied
- [ ] There is a problem with this information
- [ ] I disagree with the content of this information
- [ ] I think this information is potentially harmful
- [ ] This information has no impact at all on me or my practice

Comment on this InfoPOEM or this questionnaire:

(Limit: 0/4000)

**Is this information relevant for at least one of your patients?**

- (•) Totally relevant
- ( ) Partially relevant
- ( ) Not relevant

**Since this information is relevant for one of your patients, how will you use it?**
Check all that apply. You may check more than 1 box.

- [ ] I will not use this information for a specific patient.
- [x] For thinking about this patient (e.g. to better understand a particular issue)
- [ ] To justify or maintain the management of this patient
- [ ] To modify management of this patient
- [ ] To persuade this patient or other health professionals to make changes

**With respect to a specific patient, do you anticipate any health benefits from using this information?**
Check all that apply. You may check more than 1 box.

- [ ] I do not expect any benefits for this patient.
- [x] Increasing patient knowledge about health or healthcare
- [ ] Avoiding unnecessary or inappropriate treatment, diagnostic procedure or preventive intervention
- [ ] Increasing patient acceptability of treatment, diagnostic procedure or preventive intervention
- [ ] Preventing disease or health deterioration (including acute episode of chronic disease)
- [ ] Improving patient health or functioning or resilience (the way patients face difficulties)