

Title

The effects of access to information retrieval technology on the competences and professional performance of students/trainees from all health care disciplines.

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Contribution of authors

Karin Hannes drafted the protocol and amended with all comments from co-reviewers. Marc Van Nuland, Jessie McGowan, Filip Staes, Jo Goedhuys and Bert Aertgeerts will assist in the screening process, the critical appraisal and the extraction of data. Bert Aertgeerts will assist with analysing the results and interpreting the data. All reviewers will help evaluating the relevance of the review in formulating some general suggestions on future work in educational programmes on information retrieval technology.

Sources of Support

Internal

Belgian Centre for Evidence-Based Medicine, Belgium
Catholic University Leuven, Belgium
EPOC Editorial Base, Institute of Population Health, Canada
McGill University, Montreal, Canada

External

None

Synopsis

Will be added with the final systematic review

Abstract

Will be added with the final systematic review

Background

Since the early nineties evidence-based medicine has developed itself as a very important way of looking at healthcare. Implicit in the movement towards evidence-based practice is the need for access to current best evidence. The modern health care practitioner has been challenged to use the best available evidence to support decisions towards individual patients. The new information retrieval technology systems streamline the overload of scientific knowledge and are developed to assist health care practitioners in daily practice. Advances in electronic technologies have made health information more available, bringing the latest medical news to those involved in health care in few seconds. They allow clinicians to make more informed choices and allow students to learn these processes (Curtis, Weller, & Hurd, 1997; McKibbin, Wilczynski, Hayward, Walker-Dilks, & Haynes, 1995). Numerous applications of information retrieval technology exist and have the potential to change practitioners' routines. These routines are often based on seeking information from colleagues, pocket notes, paper-based textbooks and journals (Pluye & Grad, 2004). However, little is known about the impact of computerised information retrieval technology on the competences and performance of practitioners. Lately, the use of electronic devices has been infiltrated into medical education programmes, mainly because of the expansive growth of the internet and the rapid development of computer assisted tools (Johnston, Leung, Tin, Ho, Lam, & Fielding, 2004).

The World Wide Web is a convenient way to access health information. It provides a gateway to health information that is available for free or through a subscription. Many guidelines are available on the web and searchable via clearinghouses (Scottish Intercollegiate National Guidelines, Guidelines International Network etc.). Electronic textbooks and manuals, such as Clinical Evidence are frequently updated and made available on CD-ROMS as well as on the internet. Critically appraised and synthesized information can be found in searchable databases such as The Cochrane Library and the ACP Journal Club. Students and practitioners can search for primary research in databases, such as MEDLINE, Embase and Cinahl. They can find full-texts of some journal articles directly in the electronic journals available on the web.

Several portal sites were developed to assist employees and students in health care to find links to medical information resources in one place (Trip Database, SumSearch etc.). In addition, practitioners and students gained access to information written for patients, for example the Cochrane Consumer website and Health Information Online (McGowan, McAuley, Dawes, Grad, Hannes, Judd, Labreque, Leduc, Pluye, Robinson, Wells, & Tugwell, 2004). Although some feel that acceptance and use of information retrieval technology has been slow into coming to clinical settings (Wood, Wallingfort, & Siegel, 1997; Verhoeven, Boerma, & Meyboom-deJong, 1995), their development could be a major step towards a general quality improvement in health care in the long term. The educational process can play a catalytic role in these developments, which is very likely since many students have access to the internet in their educational environment or at home. A recent study of Dorup (2004) revealed that 71,7% of the first-year medical students in Denmark had access to a computer at home. 80% used the internet regularly. However, in some developing countries, for example Nigeria, the use of popular databases as Medline is still very poor due to the lack of computers and awareness and financial constraints (Ogunyade, & Oyibo, 2003), although it is noticed that younger students (age less than 26 years) have significantly better skills than older colleagues in the final year of their education (Odusanya, & Bamgbala, 2002). Furthermore, most of the information sources are offered in English. A recent Scandinavian randomised controlled trial revealed information on the impact of reading non-native language articles on the ability to retain information from articles. This study concluded that practitioners retained medical information best when reading in their mother tongue (Gulbrandsen, Schroeder, Milerad, & Nylenna, 2002). This might be important to consider when evaluating effects of access to information on competences and professional performance of students. The same study also concluded that there was no significant difference between paper and screen versions when evaluating the ability to retain medical information. Overall, students seem to embrace and use information retrieval technology much more than have been reported among practitioners (Peterson, Rowat, Kreiter, & Mandel, 2004)). Students' use of personal digital assistants during the clinical phase of training becomes more common and seems to have a positive effect on their performance (Brock, Scott, & Wick, 2003). If students in the field of health care are trained with extensive exposure to computer-based information resources and decision aids, they will be prepared to make use of these resources in direct application to patient care. These trainees will naturally become agents of change as they graduate and enter the workforce (Vijoy, Friedman, Wildemuth, Downs, Kantrowitz, & Robinson, 2004). Therefore, faculties must intensify their efforts to convey the importance of applying research information to patient care and inform students on ways to access this information after they graduate (Powell, & Case-Smith, 2003).

Several studies demonstrated that students' knowledge base, was augmented through the use of a structured information resource (De Blik, Freidman, Wildemuth, Martz, File, Twarog, & Reich, 1993; Friedman, De Blik, Gilmer, Twarog, & File, 1992; Hersh, Crabtree, Hickam, Sacherek, Rose, & Friedman, 2000). Students also seem to be able to solve a simulated clinical case more accurate while using information retrieval technology (Vijoy, Friedman, Wildemuth, Downs, Kantrowitz, & Robinson, 2004). These examples indicate clearly that to promote evidence-based practice and to make future health care practitioners familiar with the use of information retrieval technology we need

to integrate components of information literacy in undergraduate educational programs. Web-based information resources can provide curriculum support to students for whom access to the library is difficult and time consuming (Tannery, Foust, Greeg, Harman, Kuller, Worona, & Tulsy, 2002), as is expected when they are graduated.

Still, there are some questions to solve, for example does access or attempts to provide electronic access to medical information, as opposed to the more traditional sources of information (print-based material) actually improve professional competences and performance? Does the online availability of information sources impact on these competences and performances? Furthermore, does the type of resource from which the information is accessed has an impact on the competences and professional performance of students? This review aims at understanding how information retrieval technology affects competences and professional performance of students during their educational process. We will focus on

1. Competences and performances of students with access to information retrieval technology compared to those who do not have any access to information sources.
2. Competences and performances of students with access to information retrieval technology compared to those with access to print-based materials only.
3. Competences and performances of students with access to online information retrieval technology compared to those who work with information sources not online available.
4. Comparison of different types of information sources (for example full-text database compared to reference databases or databases compared to help-desk systems etc.)

Definitions:

Information retrieval technology can be defined as a tool that 'provides online, general information (disease prevention, diagnosis, prognosis, treatment,...), which is potentially applicable for decision making about multiple patients. This information may include text documents, images, sound or movies and derives from databases that merge or link digital libraries, computerized clinical practice guidelines or computerized synopses, electronic journals or textbooks, and medical websites (Pluye & Grad, 2004).' Information retrieval technology is restricted to non-programmed decision making. Search engines developed for this kind of decision making 'will interpret your free-text question and find the answer for you' (Wyatt, 2000a).

Decision support systems, on the other hand, 'match information retrieval technology with patient-related data and provide patient specific recommendations' (Wyatt, 2000a) They use 'patient data to drive a reasoned program that searches a knowledge base to assemble a tailored report (Wyatt, 2000b). Decision support systems aim at programmed decision making. Simon (1980) provides a clear definition on both types of decision making.

Non-programmed decision making involves 'general means' and is concerned with new or complex situations, while Programmed decision making refers to 'specific procedures' for solving problems and is concerned with well known situations. The former will be included in this review; the latter can be the subject for a next review on effects of online information resources on the competences and performance of students and trainees in health care. Other non-electronic information retrieval resources include contacts with peers or supervisors, compact disks and print based material such as textbooks, paper versions of journals, pocket notes and leaflets.

Competences can be defined as the capability to *integrate knowledge, skills and attitudes to solve problems*, focused towards an actual implementation in practice (Usher, & Solomon, 1999). Epstein and Hundert (2002) states that professional competence is the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served, and thus, that it builds on a foundation of basic skills, scientific knowledge and moral development. Competence includes a cognitive (knowledge), an integrative (use of biomedical and psychosocial data), an affective/moral (emotional awareness to use skills humanely) and a relational function (communication). It is defined by the ability to manage ambiguous problems, tolerate uncertainty, and make decisions with limited information (Epstein, & Hundert, 2002).

Example: I know about the existence of information retrieval technology to support decision making (knowledge) and I am able to navigate at least the more important ones (skills). I am motivated to consult them on a frequent base (attitude) and to discuss my findings with colleague students when practising my clinical reasoning skills in a seminar (communication).

Professional performance refers to the demonstrated capability to *act adequately in a very specific discipline, using the competences available* (Schol, 2003). In dealing with the competence setting a student must behave to the best of its capabilities to translate his competences towards –in this case- the specific domain of health care. This might refer to a series of parameters such as the knowledge of which (para)medical databases are relevant to find specific

answers in literature, searching and critical appraisal skills to find and interpret (para)medical articles, interpersonal skills that fit communication patterns in health care.

Example: To decide on the best strategy towards a patient with decubitus –in this case my grandfather- I 'd better consult the information source 'Clinical Evidence' or 'Evidence-Based Nursing' instead of 'Evidence-Based Medicine', since the former sources are more likely to address my specific question (knowledge) However, I lack the skill to navigate these specific sources properly (skills), so I will consult a medical librarian to assist me with this process (communication).

Overall, competences can be defined as what a student is capable of doing and professional performance refers to what a student actually does in his day-to-day practice (Senior, 1976; Lloyd, 1979; Miller, 1990), meaning the capability of a health care student to merge his knowledge, skills and attitudes to respond to a specific situation in (para)medical practice.

Objectives

The objective of this study is to determine the effects of information retrieval technology (IRT) on the competences and professional performance of students in health care disciplines during their study period. We will consider the following comparisons:

1. Access to IRT compared to no access to IRT
2. Access to IRT compared to access to print based materials only
3. Access to online IRT compared to access to IRT not available online
3. Comparisons between different types (medium) of IRT

We will consider any objective measure of competences or professional performance, including changes in behaviour or decisions, communication, knowledge, skills and attitudes. We plan to undertake a meta-regression considering the potential effect modifiers where possible, see 'analysis'.

With respect to the usefulness of an answer to the above questions we would like to add that the information gathered could motivate educators and students to choose and incorporate the most effective type of information source in their training environment, to enhance competences and professional performance of students in health care.

Criteria for considering studies for this review

Types of studies

Studies will be included regardless of language of publication or publication status.

We will include:

A. Experimental designs

Randomised controlled trials (RCT's): Trials in which the participants (or other units) were definitely assigned prospectively to one or two (or more) alternative forms of information sources using a process of random allocation.

B. Quasi-experimental designs

Controlled clinical trials (CCT): Trials in which participants (or other units) were definitely or possibly assigned prospectively to one or two (or more) alternative forms of information sources using a quasi-random allocation method
Controlled before and after studies (CBA): Involvement of intervention and control groups other than by random process, and inclusion of baseline period of assessment of main outcomes. All before and after studies must have the same pre and post intervention for the study and control sites and both have to be comparable with respect to possible 'confounding' factors.

Interrupted time series analyses (ITS): A change in trend attributable to the intervention. All time series analysis must have a clearly defined point in time when the intervention occurs and at least three data points before and three after the study.

Types of participants

Students of all health care disciplines are included; physicians, dentists, nurses, physiotherapists, medical assistants, speech and language therapist etc... However disciplines with a non-(para) medical focus, for example social workers and health information specialists, are excluded from this review. Residents or health care providers in training

programmes who already received their official title or working permit are excluded from this review.

Types of interventions

We are considering all information retrieval technologies that improve, provide or increase access to general online medical information, including text documents, databases, helpdesks, electronic libraries, online journals, health communication applications etc. Only studies that have a clear description of what is being accessed for both the intervention and the control groups are enrolled in the systematic review. Access can be provided in the study-environment (including clinics, hospitals, therapy offices, etc.) or at home. We will consider studies that include a training component provided that there is differential access between groups. We will only include information retrieval technology aiming at assisting a non-programmed decision making process. Therefore, decision support systems are excluded, as well as feedback systems, online educational courses and e-mail systems.

Types of outcome measures

Any objective measure of competences: knowledge and understanding (treatments, diagnosis, prognosis etc.), skills (quickly finding answers, efficient use of sources, clinical reasoning etc.), attitudes (expectations, values, well being, satisfaction, emotions etc.) and communication with patients, peers or supervisors, as well as all objective measures of professional performance (specific behaviour, (shared) decision making processes, management of problems etc.) are included. In this review the students' competence and professional performance is the topic of interest. Effects of access to information retrieval technology on patients, peers or supervisors that interact with the students are NOT evaluated.

Search strategy for identification of studies

We will include all studies available at 31December 2004. The following databases will be searched (based on a description of Haig, & Dozier, 2003 and web based online information on the different databases)

The Cochrane Central Register of Controlled Trials (OVID search engine)

CCTR (formerly Cochrane Controlled Trials Register) is a bibliographic database of definitive controlled trials. These controlled trials have been identified by the distinguished contributors to the Cochrane Collaboration. They and others, as part of an international effort to search the world's health care journals (and other sources of information) systematically, have combined results to create an unbiased source of data for systematic reviews. CCTR contains over 300,000 bibliographic references to controlled trials in health care. Access for full text is by subscription.

The Campbell Register of Controlled Trials

The C2 Social, Psychological, Education, and Criminological Trials Registry (C2-SPECTR) serves as an important resource for identifying studies for inclusion in the Campbell Collaboration's systematic reviews. Each record in the registry contains citation and availability information, and usually an abstract. The registry is currently maintained using ProCite 5 software which allows for substantial flexibility in managing this large collection of references. Access to C2-SPECTR is provided free of charge to the public via the internet.

Medline (PubMed search engine)

The National Library of Medicine (USA) produces Medline. It is available through commercial vendors and freely available through numerous websites, notably PubMed. It contains over 300000 citations that are considered educationally relevant.

Embase (Ovid search engine)

This is the second largest medical database and is owned by Elsevier Science, Netherlands. Access is by subscription only. Embase contains over 100.000 citations that are related to education in health care environments. Embase tends to index more European Journals. It indexes several key titles in medical education not covered elsewhere.

CINAHL

The Cumulative Index to Nursing and Allied Health Literature is the world's largest database for nursing and the professions allied to medicine. There are over 100.000 educationally relevant citations that could inform a medical education query. Access is by subscription.

BNI

The British Nursing Index does contain educational material not found in CINAHL. It is an essential source for comprehensive searches in nursing and the professions allied to medicine.

ERIC

The Education Resource Information Centre is the world's largest education database and is freely available on the web or by subscription. Although the emphasis is on primary and secondary education, there are over 17.000 citations relevant to medical education. Many more will be relevant in a supporting context, providing evidence in education that could be applied to medical education.

PsychINFO

While PsychINFO obviously concentrates on psychiatric and psychological content, there are over 100.000 records concerning education in a broader context, as well as teaching and learning. Access is by subscription.

AMED

The Allied and Complementary Medicine Database should be considered for educational searches in complementary medicine, palliative care and all professions allied to medicine, including podiatry, physiotherapy, occupational therapy and rehabilitation.

LISA

The Library and Information Science Abstracts-database is a valuable reference tool for current awareness in information sciences. Comprehensive coverage allows access to past, present and ongoing developments in librarianship, information science, online retrieval, new information technologies and publishing. The database contains data of 500 periodicals, dating from 1969, from over 60 countries along with unpublished academic and institutional research from current research in Library and Information Science Database since 1981.

We will extend our search strategy by including extra sources focussing on grey literature. Grey literature can be defined as that which is produced on all levels of government, academics, business and industry in print and electronic formats, but which is not controlled by commercial publishers (Fourth International Conference on Grey Literature, 1997). We will include all studies available at 31 December 2004.

SIGLE

The system for Information on Grey Literature in Europe is a large grey literature database produced by the European Association for Grey Literature in Europe.

The ongoing trial register

The Current Controlled Trials website has been developed by Current Controlled Trials Ltd, part of the Current Science Group of companies. The Group has its headquarters in London, UK and also has offices in Philadelphia and Tokyo. Although the register is not specifically focused on education it might contain ongoing trials that are relevant to the review topic presented in this protocol.

Dissertation Abstracts

Dissertation Abstracts gives an overview of the most recent two years of dissertations and previews. It contains several trials on the use of technology in education and is therefore considered relevant for this review. A free version is provided by Digital dissertations, but the full text requires a subscription.

We will screen title and abstract from the most relevant journals online were possible, through hand searching were needed. Online searches and hand searches both require large amounts of time and will therefore be conducted by the lead reviewer. We intend to cover the period January 1992 (1992 was the year in which the World Wide Web was officially released and thus the possibility to access and search information online was created) until December 2004. We selected pedagogical and medical journals with a tradition of providing information on evaluations in the target group students/trainees and/or reporting on information retrieval technology that was NOT included in the Journal lists of the important databases:

1. Teaching and teacher's education
2. British Journal of Educational Technology
3. International Journal of Nursing Education
4. Health care informatics

However, some journals have only recently started to have every article indexed. For the following journals an additional hand search will be conducted if the time period is not fully covered:

1. Medical Teacher
2. Academic Medicine
3. Teaching and learning in medicine
4. Journal of Nursing Scholarship
5. BMC medical education
6. Advances in physiology education
7. Journal of the American Medical Information Association
8. International Journal of Medical Informatics
9. Artificial Intelligence in Medicine
10. Computers in Biology and Medicine
11. Computer Methods and Programs in Biomedicine

We will search reference lists of all relevant papers and reviews identified. Authors of relevant studies will be contacted regarding any additional published or unpublished work. More recent relevant references will be retrieved through SCI ('Science Citation Index'). It indexes abstracts and bibliographic information from nearly 4000 journals and makes possible 'cited reference searching'. Web of Science provides unified access to SCI.

In the process of writing from this protocol we did not yet have full access to all information sources listed above. Therefore the search strategy below only provides guidance on the text words we intend to use. Keywords and Mesh terms referring to these text words will be used when provided in the Mesh structure of a database. A detailed description of the terms and strategy used within each database will be provided in the full text of the upcoming systematic review, including the 'wild cards' (to expand terms) each database is familiar with. For the search strategy presented below we used OVID wildcards.

1. Terms to search for the condition of interest

1. (chang\$ adj behavior?r).tw.
2. (chang\$ adj decision\$).tw.
3. shared decision making.tw.
4. communicat\$ and (patient\$ or peer\$ or colleag\$ or teacher\$ or superv\$)tw
5. (professional adj behavior?r or professional adj practice).tw
6. (information seeking behavior?r or help seeking behavior?r).tw.
7. (interactive adj health adj communication).tw.
8. or/1-7
9. competenc\$
10. attitude.tw or exp attitude to health
11. (knowledge or understanding).tw.
12. skill\$.tw.
13. or/9-12
14. (satisfaction or well being).tw.
15. expectation\$
16. value\$
17. (professional adj performance)
18. or/14-17
19. 8 and 13 and 18

2. Terms to search for the interventions evaluated

1. online systems.tw
2. databases, bibliographic/ or databases, factual.tw
3. ((electronic or online or computerized) adj (access or retrieval or technolog\$)).tw.
4. compact disks or cd-rom.tw
5. Internet.tw
6. (internet or CD-ROM or cd-i or cd rom or compact disk\$).tw.
7. multimedia.tw
8. (www or world wide web).tw.
9. (pda or personal digital assistant\$ or handheld or hand held).tw.
10. or/1-9
11. manuals or reference books or textbooks or periodicals.tw
12. (textbook\$ or book\$ or journal\$ or periodical\$ or manual or manuals).tw.
13. Guidelines.tw
14. Information Dissemination.tw

15. or/11-14
16. 10 and 15
17. inforetrieval.tw.
18. "information storage and retrieval"/ or medlars.tw
19. or/17-18
20. access\$.tw.
21. 16 and 19
22. 19 and 20

3. Terms to search for the types of study designs to be included

We choose not to select on study design in the search strategy. Study designs will be considered during the screening process.

Only studies on the target group 'students from health care disciplines' will be taken into account. Information on the target group 'residents' and 'health care professionals who already received their working permit or official title' will soon be available in the Cochrane database of systematic reviews (McGowan, McAuley, Dawes, Grad, Hannes, Judd, Labreque, Leduc, Pluye, Robinson, Wells, & Tugwell, 2004) We will provide information about the exact search performed and record the material retrieved for each search. This information will be used in the identification of Studies Section. No restrictions will be placed on language.

Methods of the review

Screening:

Titles and abstracts will be screened for inclusion independently by two reviewers. Any disagreement will be resolved by discussion between the reviewers. An arbitrator will be involved to solve discussions as necessary. Full text copies of all papers that are potentially relevant will be retrieved.

Quality:

Two reviewers will assess the methodological quality of all included studies independently, using checklists available on the website of the Dutch Cochrane Centre (www.cochrane.nl/downloads) and the EPOC Cochrane Review Group www.epoc.uottawa.ca. Any disagreement will be solved by discussion and where necessary, arbitrage will be considered.

Data abstraction:

Two reviewers will undertake data abstraction independently using a tailored data collection list (in annex). Disagreements will be resolved by discussion. When necessary, an arbitrator will be involved. In case of missing data we will try to locate the author of the article to retrieve the data needed to include the study in the meta-analysis. If missing data cannot be obtained, the study will be excluded.

These processes will be guided by the software programme TrialStat.

Analysis:

This review has a broader focus than one single comparison. Our intention is to collate all studies in the field of health information retrieval technology (IRT)

The following comparisons are to be made:

1. Access to IRT compared to no access to IRT
2. Access to IRT compared to access to print based materials only
3. Access to online IRT compared to access to IRT not available online
3. Comparisons between different types (medium) of IRT

Experimental as well as quasi-experimental studies will be included; mainly because it is proven that for many domains they yield comparable effect sizes (Shadish, Cook, & Campbell, 1991). However, possible threats to the internal validity of these types of studies will be explored and reported (Shadish, Cook, & Levinston, 2002).

To address a potential publication bias a funnel plot will be made. If asymmetry is present the research team will explore possible reasons. Ongoing studies identified will also be described, detailing the primary author, research question(s), methods and outcome measures.

Potential causes of heterogeneity include variability in the student population, interventions and outcomes (clinical heterogeneity) and variability in trial design (methodological heterogeneity). We will consider conducting both bivariate analysis and meta-regression to investigate how clinical and methodological aspects might relate to the results. We do not intend to conduct multi-level analyses. Effects of access to information retrieval technology on patients, peers or supervisors will not be considered, since they are not the target group of this review. Changes in their skills, knowledge, attitude or performance will therefore not be included as an outcome that needs to be measured. However, effects of access to information in students that lead to an improvement of their communication with other groups (patients, peers,...) will be evaluated in the context of this review.

The following effect modifiers will be considered for subgroup analyses:

1. Target group: type of study (university/non-university, medical/nurse/physiotherapist,...), language (native English/non-native English)

2. Intervention: type of information source (database, helpdesk, PDA...)

3. Study design: length of follow-up (<3-months, >3 and <=6 months, >6 and <=1 year, >1 year).

We might also consider a sensitivity analysis on the type of study design (high quality / low quality) and the date of study (before and after the year 2000)

If heterogeneity is acceptable, we will most likely use a random effect model to pool results (DerSimonian, & Laird, 1986). Acceptability will be assessed using a Q-test for homogeneity (available in REVMAN) or a Chi squared test (when using another programme), combined with an eye-ball test on the forest plots generated from REVMAN. In case of unacceptable heterogeneity we will decide not to pool results. However, heterogeneity will be explored by undertaking post-hoc subgroup analyses.

To conduct the meta-analysis we will use the software package REVMAN. We intend to include study designs with different effect measures. Typically, studies in the field of competences and professional behaviour report results on multiple outcome constructs (e.g. knowledge, skills, attitudes, behaviour etc.) All effect measures that can be extracted from a study will be coded. Standardised mean difference effect sizes will be computed and analysed for each outcome construct of interest. For studies with dichotomous data odds ratios will be used and reported. The effect measure for studies with continuous data will be the (standardised) mean difference. For studies with ordinal data the (standardised) mean will be calculated, if possible. Otherwise, results of studies with ordinal data will be translated into a dichotomous effect measure. We plan to provide information on the 95% confidence intervals. The weight of each study will be taken into account for the calculation of the pooled effect. We intend to make a separate analysis for the outcomes on competences and performance.

Description of studies

Not applicable for protocol

Methodological quality of included studies

Not applicable for protocol

Results

Hypothesis:

Students with access to information retrieval technology can perform at a higher level than their counterparts who lack access to such information systems. This finding would reflect favourably on the use of information retrieval technology in training environments. It might put forward the expectation that students will incorporate computer-based information sources into their daily workflow as they complete their training and move forward into practice.

Discussion

We will address any important methodological limitations of included trials that might affect decisions about future actions in the field of health information retrieval technology. We will possibly refer to results and insights of research designs that were excluded for the meta-analysis, for example insights from qualitative research and single participant

research. However, we do not intend to give a complete overview of these study designs in this systematic review. A meta-synthesis of these types of studies might be considered for future updates. In assessing the applicability of the evidence we will draw attention to the spectrum of circumstances to which the evidence is likely to be applicable and predictable variations in effects across different circumstances or different cultures.

Reviewers' conclusions

Implications for practice

We will present all interventions that improve the outcomes we agreed on. We will discuss all interventions that should be abandoned in the educational process of students in light of the available evidence, as well as all interventions that involve important trade-offs between known benefits and known disadvantages.

Implications for research

Interventions for which the evidence is insufficient to provide clear guidelines for practice, but which should influence priorities for research will be discussed. We will include interventions that appear promising but require further evaluation. We will also discuss interventions that have not been shown to have effects but may require further attention. Interventions with reasonable evidence that they are not effective for the purpose for which they have been used will also be presented.

Acknowledgements

We would like to thank all researchers who participated in the construction of this protocol and who engaged themselves to support the development of the systematic review. We appreciate the advice of more experienced reviewers Prof. Dr. Frank Buntinx and Dr. Filip Cools in the process of development.

Potential conflict of interest

None known.

Time frame

Search strategy, retrieval and screening of studies:	January-May 2005
Data abstraction and Quality Appraisal:	October-December 2005
Statistical Analysis:	January-April 2006
Preparation of report:	April-September 2006

The first author will be responsible for updating the systematic review. Updates may be expected every three years.

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The current list contains all references used in this protocol.

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