

CADTH Methods and Guidelines

PRESS Peer Review of Electronic Search Strategies: 2015 Guideline Explanation and Elaboration (PRESS E&E)

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Conflicts of Interest

The authors have declared no conflicts of interest.

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ACRONYMS AND ABBREVIATIONS

| | |
|---------------|---|
| AHRQ | Agency for Healthcare Research and Quality |
| CER | comparative effectiveness research |
| EBC | evidence-based checklist |
| HTA | health technology assessment |
| IOM | Institute of Medicine |
| IQWiG | Institut für Qualität und Wirtschaftlichkeit im Gesundheitswesen (Institute for Quality and Efficiency in Health Care) |
| MA | meta-analysis |
| MeSH | Medical Subject Headings |
| NICE | National Institute for Health and Care Excellence |
| NNR | number needed to read (the inverse of precision) |
| PICO | population/problem, intervention/exposure, comparison, and outcome |
| PRESS | Peer Review of Electronic Search Strategies |
| PRISMA | Preferred Reporting Items for Systematic Reviews and Meta-analyses |
| RCT | randomized controlled trial |
| SR | systematic review |

KEY MESSAGES

- In preparing systematic review (SR) and health technology assessment (HTA) reports, researchers aim to provide comprehensive, unbiased, and high-quality distillations of relevant evidence. This is only possible if the evidence has been sought in a comprehensive, unbiased, and high-quality approach. One step in assuring the integrity of the searching process is peer review of the work of the librarian or information specialist who is seeking the evidence for the researchers.
- In 2008, CADTH published a *Peer Review of Electronic Search Strategies (PRESS)*, including a practical checklist, to formalize the peer-review process for librarians or information specialists who are members of teams writing SR and HTA reports. *PRESS* provides a second set of expert eyes, reviewing the work of the principal librarian once a draft search strategy has been developed.
- The 2015 update of the *PRESS* processes involved an updated SR, a Web-based survey of experts, and a consensus meeting to update the *PRESS* tools. In addition, it was determined that the *PRESS* guidance would be formatted into a set of practical guidelines.
- The original *PRESS* tool included guidance in seven important elements of the search strategy development process, and the 2015 updating process confirmed the utility of the first six elements — which led to suggested improvements — but eliminated the seventh.

| Original PRESS Element | Changes Suggested During the Update Process | Consensus Decision |
|--------------------------------------|---|---|
| Translation of the research question | New wording has been captured in updated documents: “ <i>PRESS Assessment Form Tips</i> ” AND “ <i>PRESS Worksheet and Submission Form</i> ” | Retain the element with suggested modifications |
| Boolean and proximity operators | | |
| Subject headings | | |
| Text word searching (free text) | | |
| Spelling, syntax, and line numbers | | |
| Limits and filters | | |
| Search strategy adaptations | Remove as a <i>PRESS</i> element | Leave to the discretion of individual searchers |

PRESS = Peer Review of Electronic Search Strategies.

- *PRESS: Peer Review of Electronic Search Strategies: 2015 Guideline Explanation and Elaboration (PRESS E&E)* incorporates four components:
 - six *PRESS* 2015 recommendations for librarian practice
 - four *PRESS* 2015 implementation strategies
 - an updated *PRESS* 2015 evidence-based checklist
 - an updated *PRESS* 2015 assessment form.

EXECUTIVE SUMMARY

The Issue

It is believed that quality is enhanced when there is peer review of the electronic search strategies developed for systematic review (SR) and health technology assessment (HTA) reports. The *PRESS Guideline* provides a set of recommendations concerning the information that should be used by librarians and other information specialists when they are asked to evaluate these electronic search strategies. This guideline updates and expands upon the 2008 CADTH report *PRESS: Peer Review of Electronic Search Strategies*, as well as *An Evidence Based Checklist for the Peer Review of Electronic Search Strategies (PRESS EBC)*, published in the *Evidence Based Library and Information Practice* journal in 2010.

Objectives

The objectives of this document are, as follows:

- an SR to identify the evidence base regarding elements to guide an evaluation of electronic search strategies
- a Web-based survey to assess expert opinion regarding elements to guide an evaluation of electronic search strategies
- a consensus forum meeting to obtain consensus among experts regarding elements to include in proposed recommendations and guidance regarding the evaluation of electronic search strategies
- developing recommendations and guidance for librarians and other information specialists
- updating the *PRESS Evidence Based Checklist*
- knowledge translation including producing a CADTH report.

In addition, the authors of this report intend to publish in the medical literature.

Methods

The SR, Web-based survey and consensus meeting explored the following questions:

- Are there any existing checklists that evaluate or validate the quality of literature searches in any discipline?
- What elements relate to quality or errors in search strategies?ⁱ
- The SR search focused on primary research and secondary reports on electronic search strategies within a health science context. For this update, the following databases were searched: Ovid MEDLINE and MEDLINE In-Process (January 2005 to April, week 1, 2015) on April 4, 2015 and the Cochrane Methodology Register and Cochrane methodology reviews (the Cochrane Library online) on May 29, 2015. Grey literature was identified by contacting information specialists and other experts. There were no language restrictions. Bibliographic records retrieved by the literature searches were assessed for their relevance to the peer review process. A calibration exercise was used for the assessment of eligibility. Potentially relevant articles were retrieved, and two reviewers assessed each of the full reports for eligibility. Abstracted information was recorded in DistillerSR SR software using a standardized form adapted from the form used in the original review. Data were summarized descriptively and synthesized narratively.

A Web-based survey of expert SR searchers was undertaken using a PRESS survey tool developed by the project team and reviewed by CADTH staff. The survey was launched after

ⁱ This research evidence needs to specify performance indicators or measures such as recall or relevance.

the completion of the SR, enabling those search strategy elements identified in the review to be included in the survey of experts. When these results were available, a consensus forum discussed the results of the SR and survey. Recruitment for the survey included sending messages to mailing lists, personal email invitations to authors of relevant publications, and messages to PRESS consensus forum teleconference participants. Data were analyzed quantitatively using Excel, and the narrative responses will be qualitatively analyzed.

Findings

Systematic Review

From the literature search, 6,608 records were identified for screening, of which 389 full-text articles were reviewed and 39 deemed eligible for some portion of the SR. There were no new relevant Boolean searching elements and there was no evidence refuting the existing seven elements. Results suggested that structured peer reviews are able to find search errors and offer enhancements to the selection of subject headings and text words, leading to the retrieval of additional studies. Peer reviewers deemed structured peer review to be both beneficial and preferable to the use of unstructured reviews. Seven studies covered the employment of the *PRESS Evidence Based Checklist*, or a similar checklist, for quality assurance of HTA or SR searches or manufacturers' assessments.

Web-Based Survey of Experts

A total of 174 surveys were received, of which 117 were valid and 108 were completed in full. Respondents had an average of 10 years of experience in completing searches for SRs or HTAs. Most felt that peer review of searches should be performed after the MEDLINE search has been prepared but before it has been translated to other databases. Most respondents were librarians or information specialists. There was much agreement the importance of all the original PRESS elements and their potential negative impact on both recall and precision for all the elements. There was also agreement that the peer review of the search should be done "once the MEDLINE search is developed but before other database searches are developed," and that "recognition through acknowledgement on published report" was the most important.

Consensus Forum

The objective was to create recommendations related to the existing PRESS checklist items based on updated SR evidence and survey findings. The outcome was that, of the seven existing PRESS elements, six were retained and one ("Search strategy adaptations") will no longer be a PRESS element. These six elements were recommended for PRESS inclusion:ⁱⁱ

- translation of the research question
- Boolean and proximity operators
- subject headings
- text word search (free text)
- spelling, syntax, and line numbers
- limits and filters.

Conclusions

A recent SR, Web-based survey of experts and a consensus forum upheld the six of the seven elements of the PRESS tool for peer review, while adding adjustments to the existing guidance for searchers and peer reviewers.

ⁱⁱ See Table 7 for full recommendations and guidance.

The evidence suggests that introducing Boolean and proximity operators cuts errors, enhances the quality of comprehensiveness of the search results compared to searches that are not peer reviewed, and saves time over unstructured peer reviews. This update incorporates the consensus of a community of expert searchers and confirms earlier work identifying the key elements that must be correct in order to design effective Boolean searches, while adding new evidence to the guidance on employing these elements.

One element, though supported by the evidence and the Web-based survey of experts, was withdrawn from the PRESS checklist: skilled translation of the Boolean search strategy to additional databases. The consensus forum participants agreed unanimously that this was an essential feature of high-quality search strategy design but considered, after some discussion, that it did not belong as a PRESS checklist element. They were of the view that the PRESS checklist is intended for use as a decision aid when peer reviewing a single search strategy for a specific database, and at that point it may be impossible to judge whether the strategy under review had been or would be adequately translated to additional databases. It was felt that the submission for peer review of search strategy translations to other databases should be left to the discretion of searchers. It was noted, however, that the timing of the peer review is extremely important to ensure that this process can happen.

The new *PRESS 2015 Guideline* incorporates four components:

- six PRESS 2015 recommendations for librarian practice
- four PRESS 2015 implementation strategies
- an updated *PRESS 2015 Evidence Based Checklist*
- an updated *PRESS 2015 Assessment Form*.

PRESSforum (pressforum.pbworks.com) — the Web platform developed by the project team to enable librarians to obtain peer review — will continue in its present form until the launch of an improved platform that will allow searchers and reviewers to submit strategies and peer reviews via Web forms. Additionally, the *PRESS: Peer Review of Electronic Search Strategies 2015 Guideline Statement (PRESS 2015 Guideline Statement)* was produced as a companion document.¹

1. INTRODUCTION

1.1 A Peer Review Guideline for Electronic Searches

A sound evidence base is important for SR and HTA reports. A high-quality electronic search of information resources helps to ensure the accuracy and comprehensiveness of the evidence base. Without a comprehensive and bias-free evidence foundation, the most reliable estimate of outcomes in SRs and HTA reports cannot be ascertained.

Today, the concept of peer reviewing search strategies is recognized to a much greater extent than it was in 2005, when CADTH funded the original study and report. For example, the US Institute of Medicine (IOM) guidance for SRs now advocates the use of “an independent librarian or other information specialist to peer review the search strategy.”² Within the evidence synthesis and information retrieval community, including within Cochrane, there is wide recognition of the value of peer reviewing search strategies. The Cochrane Information Retrieval Methods Group has proposed that authors of Cochrane reviews report whether or not their search strategies have been peer reviewed (Carol Lefebvre, personal communication January 22, 2015).

A validated process for evaluating the quality and completeness of the electronic search strategy should improve the accuracy of SRs and HTA reports. The *PRESS Guideline*³ will provide a set of recommendations regarding the process and information that should be used to evaluate an electronic search strategy. It is, therefore, timely to formalize the original *PRESS Evidence Based Checklist*⁴ into a practice guideline for peer review, for librarians and other information specialists who perform electronic literature searches.

1.2 Updating the Evidence

This is an update of the report, *Peer Review of Electronic Search Strategies*, published by CADTH in 2008⁵ and the subsequently published *Evidence Based Checklist (PRESS EBC)*.⁴ The objectives of the original report⁵ were:

- to suggest improvements in the methods utilized for developing and evaluating search strategies to clearly enhance the applicability of HTA reports
- to ascertain the influence on the resulting evidence base of faults in the various elements of electronic search strategies
- to establish which elements are associated with comprehensive, accurate evidence bases identified via electronic search strategies for various research topics and to employ this insight in the development of HTA reports.

In order for librarians, information specialists, and others to have confidence in the peer-review process for electronic search strategies, and in particular in the previously published *PRESS EBC*, it is necessary to address the following:

- Has any new evidence been published, since the original search, to underpin the systematic literature review conducted in 2005?
- Have there been any changes or developments in expert opinion regarding important elements to guide an evaluation of an electronic search strategy since the peer-review forums were held as part of the original project?
- What lessons from those using the *PRESS EBC* could inform future developments?

This report expands on previous work and presents a guideline for peer review. A summary of previous *PRESS* work is found in Appendix A.

Publications about PRESS:

- Sampson M, McGowan J, Lefebvre C, Grimshaw JG, Moher D. PRESS: Peer Review of Electronic Search Strategies. Ottawa: Canadian Agency for Drugs and Technologies in Health; 2008.⁵
- Sampson M, McGowan J, Cogo E, Grimshaw J, Moher D, Lefebvre C. An evidence-based practice guideline for the peer review of electronic search strategies. *J Clin Epidemiol* 2009;62(9):944-52.³
- McGowan J, Sampson M, Lefebvre C. An Evidence Based Checklist for the Peer Review of Electronic Search Strategies (PRESS EBC). *Evidence-based librarianship and Information Practice* 2010;5(1):149-54.⁴

1.3 Target Users of the Guideline

This work is intended to direct librarians and other information specialists in conducting and reviewing electronic search strategies for use in SR and HTA reports.

2. CONTEXT

It should be noted that PRESS focuses on the quality of the Boolean search and is only one aspect of a comprehensive search for SRs and HTAs. Other important aspects include the search plan, search validation, and search reporting (Figure 1).

The search plan is tailored to the topic and the resources available to the review team. It will generally include a range of bibliographic databases selected to provide good subject coverage. As well, study registries, grey literature sources, citation databases, related article searching, contacting experts, and manufacturers may be specified.⁶ The plan may include multiple iterations and updates.

Per unit of time, the Boolean search is typically the core element in the search plan, identifies the majority of relevant evidence and is the most productive method of identifying relevant studies. Peer review of the search strategy is a quality assurance step, and provides a subjective validation.ⁱⁱⁱ Other validation approaches include reaching data saturation,^{7,8} testing the search of the main database against eligible studies identified from any source at the conclusion of the screening process or prior to updating,⁹ and testing using a related article and simple search protocol.¹⁰

Estimating the true number of relevant articles using capture-recapture rates has been proposed.^{8,11} Finally, accurate reporting of all aspects of the search is necessary to facilitate critical appraisal and to allow replication and updating of the search.¹²⁻¹⁵

ⁱⁱⁱA review of current experience with peer review of search strategies was conducted as part of the SR.

FIGURE 1: COMPONENTS OF AN SR SEARCH



3. OBJECTIVE

The main objective of this project was to develop a practice guideline for the peer review of electronic search strategies for librarians and other information specialists who perform electronic literatures searches. The steps in the project included:

- an SR to identify the evidence base regarding elements to guide an evaluation of electronic search strategies
- a Web-based survey to assess expert opinion regarding elements to guide an evaluation of electronic search strategies
- a consensus forum meeting to obtain consensus among experts regarding elements to include in proposed recommendations and guidance for evaluating electronic search strategies
- developing recommendations and guidance for librarians and other information specialists
- updating the *PRESS Evidence Based Checklist*
- knowledge translation including producing a CADTH report and publishing in the medical literature.

4. METHODS

4.1 Methods for the SR

4.1.1 Research questions

The SR addressed the following questions:

- Are there any existing checklists that evaluate or validate the quality of literature searches in the health sciences discipline? In particular, we were interested to learn if there are any existing validations of the *PRESS Evidence Based Checklist* eligible for inclusion for this question.
- What are the elements that relate to quality or errors in search strategies? Specifically, we were interested in performance indicators or measures such as recall or relevance.

4.1.2 Protocol and registration

A PRESS protocol for the SR was developed (Appendix B). The protocol was not registered prospectively because the Cochrane Methodology Register was closed pending decisions within Cochrane as to its maintenance and further development. Furthermore, as a methodological review, it was not eligible for registration in PROSPERO (an international prospective register of SRs).^{iv}

4.1.3 Eligibility criteria and search strategy

Whereas the original review considered research evidence from any field, we limited the search in this review to a health science context for two reasons:

- the availability of an increased volume of health-science-specific searching research
- the understanding that fundamental aspects of Boolean searching, which had been drawn from the wider field of information retrieval science for the original PRESS project, would remain unchanged.

We updated the search from 2005 to April 2015; for the MEDLINE search, this was based on database entry date plus publication date (to ensure continuity). There were no language restrictions. No study design or publication status restrictions were imposed.

The electronic search strategy was initially developed in the bibliographic database MEDLINE. The previous PRESS MEDLINE search was reviewed and redeveloped by EC, DS, MS, and JM. Two external peer reviewers reviewed the MEDLINE search and required no revisions (see acknowledgements). DS translated the search for the Cochrane Library. The previous searches ended in May 2005. The search was updated by using the entry date for MEDLINE and including the full year publication year of 2005 in the Cochrane Methodology Register. Thus, the databases searched were the Cochrane Methodology Register and Cochrane methodology reviews (The Cochrane Library online) on May 29, 2015 and MEDLINE (Ovid interface) 2005 to April week 1, 2015 on April 4, 2015 (Appendix C).

Grey literature was identified through correspondence with information specialists and other experts; searching the Cochrane Methodology Register, which contains conference abstracts; and searching our CADTH personal databases of information science research accrued over the years including unpublished material such as presentations, dissertations, etc. References citing any of the three reports^{3,5,16} related to the original PRESS were sought from Web of Science. References were imported into a Reference Manager database and duplicate records were removed. The remaining records were uploaded to DistillerSR, a Web platform for managing SRs.

^{iv}See: <http://www.crd.york.ac.uk/PROSPERO/>

4.1.4 Selection criteria

Bibliographic records retrieved by the literature searches were assessed for their relevance to peer reviewing electronic search strategies. Articles eligible for inclusion in the SR had to present either an evaluation checklist for search strategies, primary evidence on the impact of searching techniques on search results, or a theoretical discussion on the impact of searching techniques. Articles in languages other than English were included if they could be translated using Google Translate in order to mitigate potential language bias in a feasible manner. Google Translate is a free tool that has been shown to have value, in some languages, for use in SRs.¹⁷

A calibration exercise was used for the assessment of eligibility. For Level 1 screening, forms were adapted from the original PRESS review and tested by having each reviewer screen the first 20 records imported to DistillerSR. Results of the exercise were discussed on a conference call and forms were amended accordingly prior to the commencement of Level 1 screening. Titles and abstracts were screened by one reviewer for potential eligibility and then a second reviewer was required to confirm ineligibility before a record could be excluded (EC, DS, MS, and JM did the screening). Potentially relevant articles were retrieved and two reviewers assessed each of the full reports for eligibility.

4.1.5 Data extraction

Abstracted information, as well as the classification of each report as a checklist, was recorded in DistillerSR using a standardized form adapted from the form used in the original review. The evidence types were abstracted as research, theory, or frequency of error, with the latter referring to errors found in a particular setting/population, such as catalogue searches by undergraduate students or searches by medical residents to answer clinical queries. Calibration was performed by having both reviewers abstract the first six articles passed through previous screening levels. After discussion, the data abstraction form was finalized (Appendix D). Remaining data extraction was then completed by one investigator and verified by another one of the investigators.

4.1.6 Data synthesis

In the previous SR, a list of seven search errors (or elements) was developed and formed the basis of the original PRESS checklist:

- translation of the research question
- Boolean and proximity operators
- subject headings
- text word searching
- spelling, syntax, and line numbers
- limits and filters
- search strategy adaptations.

The original PRESS review found evidence that each of these elements, if incorrectly employed in the search, would have a negative impact on one or more outcomes such as recall, precision, or cost. This list of elements was used to guide the data analysis and determine which elements of the electronic search were addressed within eligible research reports. For those cases where a novel finding associated with the element was reported, this finding was reviewed by a second reviewer and then summarized for presentation in the SR results. In making these determinations, the reviewers considered whether the finding might call into question any element, or guidance associated with an element; whether the finding might be the basis for additional guidance; or whether the finding appeared to refute any element or the guidance associated with it. Consideration was also given to whether new elements germane to the peer review of a search strategy were evident. Evidence in support of existing elements and

guidance (confirmatory evidence) was not treated in detail for this update, as the principles of Boolean searching are well-established and the elements were expected to be stable. DS, MS, and JM completed data analysis. Data were summarized descriptively and synthesized narratively. No meta-analyses were planned.

4.2 Methods for the Web-Based Survey of Experts

The purpose of the survey was to ask practicing librarians and information specialists about their opinion on conducting a peer review. It was an independent activity from the SR, and built upon the results. A survey tool was developed by JM; reviewed by CL, DS, MS, and CADTH staff; and pilot-tested by 10 information specialists. This information from the pilot testing was used to clarify the language and readability of the survey tool.

Those eligible to participate in the survey included librarians, information specialists, and information scientists involved in performing searches for HTA reports and SRs. Recruitment for the survey included sending messages to mailing lists (see Table 1), personal email invitations to authors of relevant publications, and messages to PRESS consensus forum teleconference participants (see Appendix E). Some individuals would have received the same message if they subscribed to more than one list cited in Table 1. The survey was available for one week. One reminder was scheduled. Data were analyzed quantitatively using the count, proportion, and mean functions in Excel, and a descriptive summary was developed.

A copy of the survey can be found in Appendix G. The demographic information included the participant's current employment role, country of origin, training, years of experience, and involvement in HTA reports and SRs. Other questions explored the participants' views on the current PRESS elements, including their importance and their potential negative impact on both recall and precision. Questions were also asked about the participants' views on the peer-review process including when a peer review should be done, turnaround times, compensation, and the number of peer reviewers required.

TABLE 1: MAILING LISTS USED IN PRESS SURVEY RECRUITMENT

| PRESS Survey Recruitment |
|---|
| Canadian Health Libraries Association (Canada) |
| Chartered Institute of Library and Information Professionals, Health Libraries Group (UK) |
| Cochrane Information Retrieval Methods Group (International) |
| Cochrane Trials Search Coordinators list (International) |
| Clinical Librarians and Evidence-based Health Care of the Medical Library Association (US/ International) |
| Evidence-based libraries (UK) |
| Medical Library Association expert searching list (US/International) |
| International Federation of Library Associations and Institutions: Health and Biosciences Libraries Section (International) |
| Health Technology Assessment international Information Resources group (International) |
| Medical Library Association (US/International) |
| Ottawa Valley Health Libraries Association (Canada) |
| Upstate New York and Ontario Chapter of the Medical Library Association (US/International) |

A consensus process will be conducted to support the development of recommendations. The meeting will bring together leading experts in literature searching methodology to ensure that the *PRESS Guideline* items are based on best evidence and grounded in the needs of

knowledge users. Potential participants were recruited from CADTH (three representatives), the Cochrane Trial Search Coordinators (TSCs) Executive (one representative), the Information Retrieval Methods Group (IRMG) (one representative), a PRESS user selected from the membership of PRESSforum (one representative), the Health Technology Assessment international interest subgroup — the Information Resources group (HTAi IRG) — (one representative), and one additional member at large. The goals for the meeting are to:

- review information obtained from an updated literature search and survey of experts
- reach consensus on changes in the original 2008 *PRESS Guideline* recommendations
- discuss a knowledge translation strategy to disseminate and endorse PRESS.

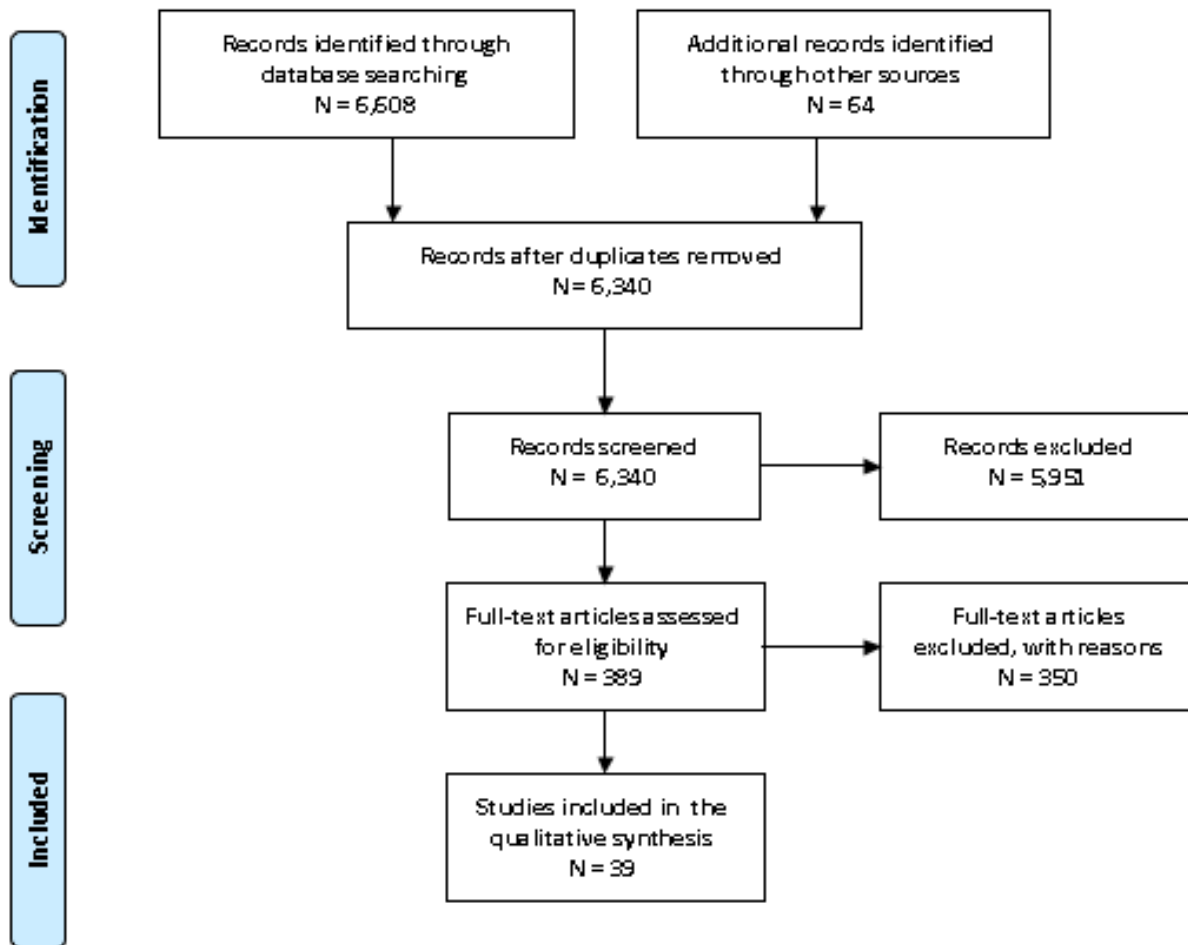
5. RESULTS

5.1 Systematic Reviews

5.1.1 Article selection

In this update, 6,340 records were identified after deduplication, of which 389 full-text articles were reviewed and 39 articles were deemed to be eligible for some aspect of the SR (Figure 2).

FIGURE 2: PRISMA FLOW DIAGRAM¹⁸



These 39 articles are considered relative to the 113 included articles of the original PRESS systematic review.⁵ The current SR update results in Table 2 below (N= 39) are generally quite consistent with the results of the original PRESS SR (n = 113) report⁵ (see Appendix A). The most commonly addressed element in both sets of included studies was subject headings (index terms), and both SRs found that the main impacts discussed were recall and precision. Similarly, the most common evidence type in both was research. We considered three types of evidence — research on the impact of a certain search element, theoretical considerations of the impact, and frequency of error in the use of search elements. Research evidence predominated in both the original and the updated review. Thirteen of the 39 studies (33%) were published from 2005 to 2010, whereas 26 of 39 studies (67%) were from the past five years (2011 to 2015). Table 3 below presents a summary of the evidence from the 39 included studies.

TABLE 2: EVIDENCE FROM INCLUDED AUTHORS (N = 39)

| First Author | Year | Title | Element(s) ^a | Evidence Type ^b | Main Impact(s) Discussed |
|--------------------------|------|---|-------------------------|----------------------------|---|
| Craven and Levay | 2011 | <i>Recording database searches for systematic reviews — what is the value of adding a narrative to peer-review checklists?: a case study of NICE interventional procedures guidance</i> | 1, 2, 3, 4, 5, 6, 7 | R | Recall, precision |
| Relevo and Paynter | 2012 | <i>Peer Review of Search Strategies: a methods research report</i> | 1, 2, 3, 4, 5, 6, 7 | R, T | Recall, precision, specificity, cost/time, peer reviewing |
| Wong et al | 2013 | Assessing searches in NICE single technology appraisals: practice and checklist | 1, 2, 3, 4, 5, 6, 7 | R, T, F | Recall, precision, peer reviewing |
| Damarell et al. | 2013 | OvidSP MEDLINE-to-PubMed search filter translation: a methodology for extending search filter range to include PubMed's unique content | 2, 3, 4, 5, 6, 7 | R, T | Recall, precision |
| Younger and Boddy | 2009 | <i>When is a Search Not a Search? A Comparison of Searching the AMED Complementary Health Database Via EBSCOhost, OVID and DIALOG</i> | 2, 3, 4, 5, 6, 7 | R | Recall |
| Karimi et al. | 2010 | <i>Boolean Versus Ranked Querying for Biomedical Systematic Reviews</i> | 2, 3, 4, 5, 6, 7 | R, T, F | Recall, precision, specificity, cost/time |
| Bak et al. ¹⁹ | 2009 | A pragmatic critical appraisal instrument for search filters: introducing the CADTH CAI | 2, 3, 4, 5, 6, 7 | R, T | Recall, precision |
| Sladek and Tieman | 2008 | <i>Applying Evidence in the Real World: A Case Study in</i> | 3, 4, 7 | R | Recall, precision, specificity |

| First Author | Year | Title | Element(s) ^a | Evidence Type ^b | Main Impact(s) Discussed |
|-----------------------|------|---|-------------------------|----------------------------|---|
| | | <i>Library and Information Practice</i> | | | |
| Waffen-schmidt et al. | 2013 | <i>Simple Search Techniques in PubMed Are Potentially Suitable for Evaluating the Completeness of Systematic Reviews</i> | 1, 2, 6, 7 | R | Recall, precision |
| Mitchell et al. | 2005 | <i>Performance of Published Search Strategies for Studies of Diagnostic Test Accuracy (SDTAs) in MEDLINE and Embase</i> | 6, 7 | R, T | Recall, precision, Specificity |
| Iansavichus et al. | 2015 | <i>High-performance information search filters for CKD content in PubMed, Ovid MEDLINE, and EMBASE</i> | 2, 3, 4, 5, 6 | R | Recall, precision, specificity, cost/time |
| Allen et al. | 2011 | Appraisal of search strategies in industry submissions for technology appraisal (ASSIST): reviewing search methods of industry submissions to NICE using a structured checklist | 3, 4, 5, 6 | Can't tell | Can't tell |
| Rana et al. | 2011 | <i>A Validated Search Assessment Tool: Assessing Practice-Based Learning and Improvement in a Residency Program</i> | 1, 2, 3, 4, 6 | R | Peer reviewing |
| Bertaud et al. | 2007 | <i>The Value of Using Verbs in MEDLINE Searches</i> | 2, 3, 4 | R | Recall, precision |
| Leeflang et al. | 2006 | <i>Use of Methodological Search Filters to</i> | 2, 3, 4, 6 | R, F | Recall, precision, Specificity |

| First Author | Year | Title | Element(s) ^a | Evidence Type ^b | Main Impact(s) Discussed |
|---------------------|------|--|-------------------------|----------------------------|---|
| | | <i>Identify Diagnostic Accuracy Studies Can Lead to the Omission Of Relevant Studies</i> | | | |
| Minguet | 2014 | <i>Characterization of the Medical Subject Headings thesaurus for pharmacy</i> | 2, 3, 4 | R, T | Precision, specificity |
| Hausner et al. | 2015 | <i>Development of Search Strategies for Systematic Reviews: Validation Showed the Non-Inferiority of the Objective Approach</i> | 2, 3, 4 | R, T | Recall, peer reviewing |
| Sampson and McGowan | 2011 | <i>Inquisitio validus Index Medicus: A simple method of validating MEDLINE systematic review searches</i> | 2, 3, 4, 6 | R, T, F | Recall, peer reviewing |
| Schardt et al. | 2007 | <i>Utilization of the PICO Framework to Improve Searching PubMed for Clinical Questions</i> | 1, 3, 4, 6 | R, T | Precision, cost/time |
| Doust et al. | 2005 | Identifying studies for systematic reviews of diagnostic tests was difficult due to the poor sensitivity and precision of methodologic filters and the lack of information in the abstract | 3, 4, 6 | R | Recall, precision, specificity, cost/time |
| Chang et al. | 2006 | Searching the literature using medical subject headings versus text word with PubMed | 3, 4, 6 | R | Recall, precision, specificity |
| Vedula et al. | 2011 | <i>A Snowballing Technique to Ensure Comprehensiveness</i> | 3, 4 | R | Recall, precision |

| First Author | Year | Title | Element(s) ^a | Evidence Type ^b | Main Impact(s) Discussed |
|------------------|------|--|-------------------------|----------------------------|------------------------------|
| | | <i>s of Search for Systematic Reviews: A Case Study</i> | | | |
| Ruotsalainen | 2007 | Increasing efficiency in search strategies in Cochrane systematic reviews | 3, 4 | R | Recall, precision |
| Bekhuis et al. | 2013 | <i>Comparative Effectiveness Research Designs: An Analysis of Terms and Coverage in Medical Subject Headings (MeSH) and Emtree</i> | 3, 4 | R, T | Precision |
| Hausner et al. | 2015 | <i>Development of Search Strategies for Systematic Reviews: Validation Showed the Non-Inferiority of the Objective Approach</i> | 2, 3 | R | Recall |
| Hausner et al. | 2012 | <i>Routine Development of Objectively Derived Search Strategies</i> | 1, 3, 6 | R | Specificity |
| Tai et al. | 2011 | <i>Accuracy of the MeSH term "Breast Neoplasms": Ten Years On</i> | 3 | R, F | Recall |
| Mann and Gilbody | 2012 | <i>Should Methodological Filters for Diagnostic Test Accuracy Studies Be Used in Systematic Reviews of Psychometric Instruments? A Case Study Involving Screening for Postnatal Depression</i> | 3, 6 | R, F | Recall, precision |
| Duffy et al. | 2015 | Is it possible to focus Emtree without loss of | 3 | R | Recall, precision, cost/time |

| First Author | Year | Title | Element(s) ^a | Evidence Type ^b | Main Impact(s) Discussed |
|-------------------|------|---|-------------------------|----------------------------|--------------------------------|
| | | sensitivity when searching Embase for systematic reviews? | | | |
| Glanville et al. | 2015 | <i>Pruning EMTREE: Does Focusing Embase Subject Headings Impact Search Strategy Precision and Sensitivity?</i> | 3 | R | Recall, precision |
| Layton and Clarke | 2014 | <i>Accuracy of Medical Subject Heading Indexing of Dental Survival Analyses</i> | 3 | R | Recall, precision |
| Wilczynski et al. | 2011 | <i>Search Filter Precision Can Be Improved By NOTing Out Irrelevant Content</i> | 2, 6 | R | Recall, precision, specificity |
| Edinger and Cohen | 2013 | <i>A Large-Scale Analysis of the Reasons Given for Excluding Articles That are Retrieved By Literature Search During Systematic Review</i> | 1 | R, T, F | Recall, precision |
| Golder and Loke | 2012 | <i>Sensitivity and Precision of Adverse Effects Search Filters in MEDLINE and EMBASE: A Case Study of Fractures With Thiazolidinediones</i> | 6 | R | Recall, precision, cost/time |
| Ritchie et al. | 2007 | <i>Do Published Search Filters to Identify Diagnostic Test Accuracy Studies Perform Adequately?</i> | 6 | R | Recall, precision |
| McKibbon et al. | 2009 | <i>Retrieving Randomized Controlled Trials From MEDLINE: A Comparison of 38 Published Search Filters</i> | 6 | R, T | Recall, precision, specificity |
| Spry et al. | 2013 | <i>Peer Review of</i> | Other (peer | R, T | Recall, precision, |

| First Author | Year | Title | Element(s) ^a | Evidence Type ^b | Main Impact(s) Discussed |
|----------------|------|---|-------------------------|----------------------------|---|
| | | <i>Literature Search Strategies: Does It Make a Difference?</i> | review) | | specificity, peer reviewing |
| Whiting et al. | 2011 | <i>Inclusion of Methodological Filters in Searches for Diagnostic Test Accuracy Studies Misses Relevant Studies</i> | 6 | R, F | Recall, precision, specificity, cost/time |
| Beynon et al. | 2011 | A systematic review of studies that develop or evaluate search filters for the retrieval of diagnostic studies in MEDLINE | 6 | R | Recall, precision, specificity |

AMED = Allied and Complementary Medicine Database; CKD = chronic kidney disease; NICE = National Institute for Health and Care Excellence; PICO = population/problem, intervention/exposure, comparison, outcome.

^aElements Codes:

1=Translation of the research question

2=Boolean and proximity operators

3=Subject headings

4=Free text terms (text words)

5=Spelling, syntax, and line numbers

6=Limits and filters

7=Search strategy adaptation

^bType of evidence: research (R), theory (T), and frequency of error (F).

5.1.2 Results of the systematic review: Published evidence about peer review

This section reviews any existing checklists that evaluate or validate the quality of literature searches in the health science discipline. As well, it reviews the elements that relate to quality or errors in search strategies. Specifically, we were interested in performance indicators or measures such as recall or relevance.

Seven studies reported on the use of the PRESS EBC, or a similar checklist, for quality control of searches for SRs, HTAs, or manufacturers' assessments. Topics addressed by the studies included the effectiveness of peer review, errors and limitations in search strategies, and PRESS and other validated peer review tools.

a) Effectiveness of peer review

Spry et al. studied 47 searches developed for CADTH rapid review reports related to health devices, medical procedures, and pharmaceuticals.²⁰ All searches had been peer reviewed. Retrievals from the peer reviewed version were tested to determine whether the retrievals identified additional studies included in the final report that were not found by the original un-reviewed versions. Peer review was found to have yielded additional relevant retrievals in 20 of 47 searches (43%), and was judged to have improved the number of relevant articles found.

b) Errors and limitations in search strategies

Wong et al. examined searches for manufacturers' assessments that were submitted to the National Institute for Health and Care Excellence (NICE).²¹ Using a broader checklist than PRESS, they assessed electronic search strategies, sources used, and search reporting.

Searches for 83 reports that included clinical and cost-effectiveness evidence were studied. The common limitations of the search strategies were found to be lack of use of, or missing, subject headings or thesauri terms (28 reports), the omission of free text terms including synonyms (28 reports), and errors in syntax or Boolean operators (48 reports). Note that many searches did not report a search strategy or omitted important details; thus, denominators are uncertain. Only four of the reports indicated that they used PRESS to critically appraise the search strategies used. Hypothesized reasons for the limited adoption of PRESS were:

- most of the appraisals were undertaken before the publication of the PRESS checklist
- NICE methods guidance does not require use of PRESS
- PRESS does not address broader aspects such as quality of reporting, sources used, techniques applied, and comprehensiveness of the searches.

c) PRESS and other validated peer-review tools

An abstract by Allen et al. described the development of a PRESS-like EBC, noting that some elements were derived from PRESS and that the scale, based on this preliminary report, seemed able to detect typographical errors, incorrectly combined line numbers, inappropriate subject heading explosions, and errors in the use of study design filters.²²

Revelo and Paynter compared peer review using the PRESS tool with free-form peer review for a set of 25 comparative effectiveness research (CER) protocols for the Agency for Healthcare Research and Quality (AHRQ)'s Effective Health Care Program.²³ Of 11 respondents using PRESS, 9 (82%) regarded it as helpful, 2 (18%) were neutral, and none found it limiting. The reviews performed using the PRESS tool contained more recommendations on the whole, often with suggestions on improving recall, precision, or reporting. These structured reviews also appeared to detect more specific issues regarding spelling or syntax that appeared to indicate that a mistake had been made. Although protocols were reviewed, in most cases those searches, and often the entire review, had been completed before the searches were peer reviewed. Indeed, 97% of the original searchers indicated that they did not alter the searches as a result of feedback. This suggests timing of peer review should be early in the review process to facilitate making changes and avoid delaying the review process. Most reviewers (9/11 or 91%) reported that it took two hours or less to undertake the review, and reviewers reported that the reviews done using PRESS required less time than the free-form review.

In a study of objectively derived search strategies, Hausner et al. noted that a median time of three hours was needed to use PRESS and ensure correct application of the guideline for quality assurance purposes. The authors did not explore the time needed to use PRESS without also considering the Institut für Qualität und Wirtschaftlichkeit im Gesundheitswesen — Institute for Quality and Efficiency in Health Care (IQWiG) guideline.²⁴

Craven and Levay described a checklist used internally by NICE to evaluate search strategies.²⁵ The checklist pre-dated PRESS by several years, and included a large number of elements. The internal NICE process is reported as usually allowing 14 days for designing a search, peer reviewing, performing the search, and downloading results. The authors acknowledged overlap with PRESS.²⁶ They argued that searches cannot be reviewed in isolation but rather the searcher should provide contextual information such as the background to the search and how various search-related decisions were reached, thereby enabling the peer reviewer to more effectively evaluate the subjective elements of the search. Although no evidence or evaluation of the other elements is reported, the ongoing use of this tool by NICE suggests some measure of construct validity.

Rana et al. presented a validated scale with both good inter-rater reliability (Pearson's correlation coefficient = 0.962, $P < 0.0001$) and the ability to distinguish the quality of end-user searches by their level of training and search experience (Wilcoxon chi-square = 4.09, $P = 0.043$).²⁷ The authors refined an initial item pool by using item-total correlations to identify terms that could be removed without reducing the overall effectiveness of the rating tool. The end-users were first-year residents, physicians who had recently completed their residency training, and faculty members who had expertise in evidence-based medicine. Although a validated scale, its purpose is to provide an overall score to assess learning; i.e., the tool is not designed for peer-to-peer use by expert searchers. No determination was made of the association of scores with recall or precision relative to a gold standard.

d) Summary

Seven studies reported on the use of the PRESS EBC, or a similar checklist, for quality control of searches for SRs, HTAs, or manufacturers' assessments. Structured peer review facilitated the detection of errors in searches, and peer reviewers suggested improvements in term selection that appeared to result in the identification of more and higher-quality studies. It was found useful by peer reviewers and was preferred over unstructured review. Experience from the field suggests that peer review requires two hours or less to complete. Some groups supplemented the PRESS EBC with other quality control measures, increasing the time needed to complete peer review.

5.1.3 New evidence for existing PRESS EBC items

Table 3 presents a summary of the amount and type of evidence identified from the literature review for each element within the original *PRESS Guideline*. Note that not all evidence identified casts new light (beyond what was already found in the original review) on the conduct of SR searches, and thus not all evidence is summarized in the table. For example, while nine studies considered the impact of spelling, syntax, or line numbers, results regarding the impact of peer review based on this element are described in the table in detail for only two of those, and then only briefly.

Table 3: Evidence for Elements Identified From the Systematic Review

| Elements | N | Evidence Type ^a | | | Main Impact |
|---|----|----------------------------|----|---|---|
| | | R | T | F | |
| Translation of the research question | 8 | 8 | 4 | 2 | Recall |
| Boolean and proximity operators | 17 | 16 | 8 | 4 | Recall, precision, specificity |
| Subject headings | 29 | 26 | 10 | 6 | Recall, precision, specificity, cost/time, peer reviewing |
| Free text terms | 22 | 20 | 10 | 4 | Recall, precision |
| Spelling, syntax, and line numbers | 9 | 8 | 5 | 2 | Recall, precision |
| Limits and filters | 25 | 8 | 3 | 2 | Recall, precision |
| Search strategy adaptation | 10 | 10 | 6 | 2 | Recall, precision |

^aType of evidence: research (R), theory (T), and frequency of error (F).

a) Translation of the research question

Five studies focused on translating the research question into a search query.

In a study examining accuracy in the assignment of the MeSH term "Breast Neoplasms," Tai et al.²⁸ found that 21 of 501 (4.2%) articles on topics relevant to breast cancer patients (such as reconstructive surgery) did not have the term "Breast Neoplasms" assigned. This suggested that care is needed in the formulation of the search.

Across 25 SRs on drugs, Waffenschmidt et al. demonstrated that, while a simple Boolean search using the two most characteristic PICO — population/problem, intervention/exposure, comparison, outcome — elements of the question (usually disease and active ingredient of the therapy) achieved recall of 0.902 overall, recall in individual reviews ranged from 0.41 to 1.00.²⁹ This indicated that a formulaic interpretation of the study question had low reliability, achieving excellent results in some cases but unacceptable results in others. Of note, this team found that pairing the simple-structured Boolean search with a PubMed-related articles search achieved a consistently high level of recall (0.98 or higher) with moderate precision (0.037 or higher).

Edinger and Cohen analyzed the exclusion reasons from a pool of 6,743 Cochrane reviews and found that the most consistent reason for exclusion (and we interpret an excluded study as lowered precision) was a lack of adequate comparison.³⁰ This accounted for 18,143 exclusions (65%). Population accounted for 2,145 (~8%), intervention for 4,037 (~15%), and outcome accounted for 3,072 exclusions (~11%). Other reasons not related to PICO elements accounted for about 2% of exclusions. Edinger and Cohen's several possible issues depending on the reviews' eligibility criteria — such as the placebo, incorrect active control, the study methodology — did not provide rigorous enough experimental control (e.g., the study was not a randomized controlled trial [RCT], etc.).

Schardt et al. conducted an RCT comparing three interfaces for PubMed.³¹ Thirty-one interns and residents were randomized to either the native PubMed interface or one of two interfaces that provided a PICO template. Each participant searched three questions. Although there were no significant differences between search conditions, participants using a PICO template showed higher precision for each question than those using the standard PubMed interface. For question 1, precision was 35% and 28% for the PICO interfaces and only 20% for the standard PubMed system. For questions 2 and 3, precision results were only slightly higher for the PICO templates (5% and 6% versus 4%; 1% and 1% versus 0%) suggesting that structuring questions using PICO may aid precision but more evidence may be needed.

In a series of experiments on a collection of 15 SRs of drug-related topics, supplemented by a set of 12 reviews on a variety of topics used to validate their findings, Karimi et. al studied Boolean versus ranked queries.³² In one experiment, they examined unnecessary complexity in search strategies. Finding that their attempts to replicate the published search strategies resulted in an average recall of only 27%, they broadened (simplified) the searches by removing limits such as publication types and dates, and broadened some terms (of note, where a MeSH term was exploded, they removed the “explode”). They found that the simplified queries improved recall from 27% to 79%. Although retrievals were larger, precision was maintained because more relevant records were retrieved. Exploding terms did not increase the effectiveness.

In other experiments reported in the same paper, Karimi et al. examined Boolean searches where the retrieval was subsequently ranked using experimental ranking algorithms, and screened using a protocol where screening was discontinued when a tolerance threshold of non-useful records was reached. This approach yielded an opportunity to reduce the work of screening and provided an indication of result set quality.³²

To summarize, translating the research question into a search query is often done using the PICO structure. Such structuring may aid precision, but a formulaic application of the approach leads to variable results. Subtleties such as distinguishing survivors of a disease from the disease itself are necessary. While a lack of adequate comparison is a major reason for

excluding studies from SRs, simplified queries can improve recall, in some cases finding enough new relevant studies to actually improve precision.

b) Boolean and proximity operators

One report by Wilczynski et al.³³ examined Boolean and proximity operators in detail. Although “NOT” is used with caution in searches designed for high recall, the authors provided a method to use the Boolean “NOT” operator to increase precision without a drop in recall. They analyzed false-positives retrieved by the McMaster Hedges filters for treatment, diagnosis, etiology, and prognosis to identify text words and subject headings not also present in any of the true-positives. The results were tested by running each of the filters, with and without the identified terms NOTed out, against a database containing relevant articles from 161 clinical journals indexed in MEDLINE, 135 indexed in Embase, and 75 indexed in CINAHL. Substantial improvements in precision (including from 10.0% to 15.2% for the sensitive treatment search filter, from 1.1% to 4.5% for the sensitive diagnosis filter, from 1.6% to 4.8% for the sensitive prognosis filter, and from 1.4% to 3.5% for the sensitive etiology filter) were obtained for all filters in all databases, with no decline in recall. Precision doubled for all but the treatment filter. This presents a novel method to enhance search precision and seems to be a useful technique for filter development; however, caution is warranted when using this method to develop subject searches, as the gains in precision are highly correlated with the ratio of terms NOTed out to the number of true-positives. Operating characteristics may be sample-dependent.

c) Terminology, subject headings and free text, and their use in combination

Thirteen papers looked at terminology, subject headings, and free text in detail, six of which focused on the suitability of a MeSH descriptor for specific situations.

These topics, comprising the majority of evidence in PRESS 2008,⁵ continue to receive significant attention in research on search methods for SRs. For instance, one could expect that all of the search filter studies would have investigated the optimal combination of subject headings and terms appearing in fields such as title and abstract. Reported here are research findings that inform the approach to the use of the search features or identification of terms.

Duffy et al.³⁴ and Glanville et al.³⁵ studied the effects of focusing subject headings in Embase. In a retrospective study of four reviews, Duffy et al. found that precision was increased with no loss of recall for strategies that had high recall originally but noted some drop in recall in reports where the original searches had not retrieved all known relevant studies. In a retrospective study of 50 HTA reports from five HTA groups, Glanville et al. examined the effects of focusing the EMTREE terms for one or more PICO elements. Again, some gains (ranging from 0.0% to 7.1%) in precision were seen, but, consistent with Duffy's finding, these authors concluded that poorly performing search strategies (that is, showing poor recall) were weakened further when this technique was used and urged caution. The mean improvement in precision increased from 1.0% to 1.1%.

Hausner et al. adapted an approach to filter development for use in routine search strategy development, where previous well-conducted SRs on the topic exist. Included studies from the previous reviews were used as the test set in a case study of brachytherapy in patients with prostate cancer.³⁶ Thirty-eight relevant studies were identified from three previous SRs. These were divided into development and validation sets. Term frequency from the development set — both text word and subject headings — was used to guide term selection. An existing validated filter was used for study design.

In a subsequent publication, Hausner et al. compared the “conceptual approach” to the traditional approach to developing SR searches.³⁷ In the conceptual approach, synonyms and related terms are identified by consulting a variety of sources such as entry terms of the MeSH thesaurus. The searcher must subjectively determine which terms to include. The authors argued that, as well as being subjective, the conceptual approach makes it difficult to determine when the strategy is complete. Objectively derived searches were prepared for 13 Cochrane reviews according to a standard operating procedure. Subject headings and terms from the titles and abstracts of a portion of the known studies were ranked by frequency and the terms markedly over-represented (compared with a population set) were selected. These were formed into search strategies and quality checked using PRESS and IQWiG guidelines. The searches were then tested for retrieval of relevant records in a test sample of known relevant references. The objectively derived searches showed good recall of known relevant studies indexed in MEDLINE (0.96 across all reviews), while the original Cochrane searches showed relative recall of 0.86. In both cases, most missed studies were of non-drug interventions. A major advantage of the objective approach was evident in the analysis of unidentified references — it produced stable results across all searches, whereas the conceptual approach showed more variation across topics.

Vedula et al. created a search strategy for an SR based on text words and subject headings associated with 19 known articles.³⁸ Additional material was retrieved using this search and examined for additional terms. The search was revised and re-run using what the authors called a “snowball” approach (although subsequent results were not presented).

Sladek and Tieman explored the use of text word (.tw.) and multiple posting (.mp.) field delimiters in Ovid MEDLINE for a subject search for palliative care.³⁹ They also tested the more inclusive field delimiter “all fields” (.af.) that include journal name and author address among other fields searched. This improved recall from 87.5% to 100% for a gold standard of more than 700 relevant references, largely due to terms such as “palliative” or “hospice” appearing in the journal name or in the author’s institution name but not in the title, abstract, or subject headings.

Schardt et al., in an RCT comparing structured versus native PubMed interfaces used by residents, found that initial term selection that mapped to narrow MeSH terms was the single biggest cause of failed searches in the three test questions used.³¹ In the question “Is an ACE inhibitor alone better than a diuretic alone for reducing hypertension in African American patients?” many searchers used the phrase “African Americans,” which maps to the MeSH “African Americans.” Searching with the entry term “blacks” maps to the broader MeSH term “African continental ancestry group” and retrieves about 60% more citations, suggesting that consulting the thesaurus rather than relying on term mapping can improve term selection.

Chang et al. examined 10 common otolaryngology topics, exploring the performance of MeSH and text words in PubMed.⁴⁰ They concluded that, because of the entry terms and mapping used by PubMed, MeSH terms were able to identify all relevant and exclude more irrelevant articles than did a combination of MeSH and text words. Thirty-seven articles were found using MeSH terms, whereas 113 were retrieved by the text word search.

Six studies of the adequacy of a MeSH descriptor for particular purposes were identified:

- Layton and Clarke looked at the indexing of studies that performed survival or time-to-event analysis using a sample of 95 studies from dental journals.⁴¹ Of those reporting a Kaplan-Meier or life-table analysis, for example, only 42% were indexed as such. Such inconsistency of terminology impairs recall and necessitates a broader search.

- Bekhuis et al. identified limitations in subject heading coverage in both Embase and MEDLINE for research designs of interest in CER.⁴² Using terminology derived from reports produced by five HTA agencies, they identified terms used by all agencies for further study. They found gaps in the formal representation of designs that methodologists classify using negation (e.g., “nonrandomized studies”) or describe with longer phrases (e.g., “head-to-head study”) and terms important in CER (e.g., “pragmatic trial”) that failed to map in MeSH and Emtree. Twenty-nine terms were covered exactly by Emtree and only 15 by MeSH. The authors developed what they describe as a cross-walk for use by searchers needing to address such designs.
- Minguet explored the MeSH thesaurus for completeness of pharmacy-specific terms throughout the MeSH structure, comparing the representation of pharmacy-specific terms to nursing- and dentistry-specific terms.⁴³ Pharmacy-specific terms were less frequent (26 terms) and they appeared in proportionately fewer (44) locations in the MeSH tree than for the comparison professions. Dentistry-specific terms were found most frequently (145 times in 270 positions in the MeSH tree), whereas the corresponding results for nursing terms were 94 and 173. The hypothesized missing terms related to professional issues such as audit, evidence-based practice, and professional-patient relations, as examples. This work illustrates a method of evaluating the completeness of subject headings relating to health professions.
- Bertaud et al. explored the value of using verbs in two MEDLINE searches, comparing searches of MeSH only with those using MeSH and conjugated verbs.⁴⁴ Verbs representing “to confirm” and those representing “to show” were employed. Adding these indicative verbs moved precision from 0.53 to 0.74, with recall of 0.83 relative to the MeSH-only search.
- Ruotsalainen looked at increasing the efficiency of Cochrane SRs, investigating two of their own completed reviews to see if the searches could be re-engineered to more efficiently find the included relevant studies.⁴⁵ In one case, recall could be improved, whereas in the other precision could be improved by using more specific MeSH terms, although with an unacceptable decline in recall.
- Sampson and McGowan demonstrated — in a sample of six updated Cochrane reviews — that in cases where a comprehensive search was performed, the relative recall of the MEDLINE search in identified included studies of an SR could be used to determine if the search was adequate or should be revised prior to being used to update the evidence base (i.e., prior to publication of a new review or before updating a previously published review).⁴⁶ In particular, records indexed in MEDLINE but not retrieved by the MEDLINE search could be examined to determine if adding subject headings or other terms to the search could improve recall without undue loss of precision.

d) Spelling, syntax, and line numbers

As expected, little new evidence (two reports published in 2009) on the impact of spelling errors, incorrect system syntax, or the combination of incorrect line numbers on search performance was found.

McKibbin et al. noted that Ovid is sensitive to spelling variants such as randomized and randomised, whereas PubMed's international spelling rules produce the same result regardless of the form used.⁴⁷

Younger and Boddy cautioned that text search strings performed differently in OvidSP, EBSCOhost and DIALOG DataStar because of system differences.⁴⁸ Running identical searches in each database, the authors' retrieved 29 (100% of potential) references in DIALOG, 14 via Ovid (48%), and only eight via EBSCOhost (28%). It was necessary to adjust truncation

and search fields to produce equivalent results. The authors concluded that researchers must be confident in the database interface they are using.

e) Limits and filters

Search filters are specially designed search strategies that focus on one aspect of a question — often the type of methodology used but sometimes the clinical topic. While individual filter development studies were not included unless they provide some specific insights into the Boolean search, it was evident in screening that there has been considerable growth in studies of the development and evaluation of search filters since the original PRESS report was prepared. This interest is not surprising given Edinger and Cohen's finding that the most common reason for the exclusion of studies screened for SRs was that the comparison (generally the comparison method) did not match the inclusion criteria.³⁰ While we at CADTH we don't enumerate all filters discovered in screening, we refer readers to InterTASC — an excellent resource for those seeking search filters.⁴⁹

We consider, here, three SRs of filters of a particular type:

- Harbour et al. reviewed the reporting of search filter comparisons, including some of the studies reported in this report and drew attention to many issues that should be considered by those deciding whether to use a methodological filter as part of a search strategy.¹³
- Iansavichus et al. developed filters for chronic kidney disease in several databases, achieving specificity of 97% for filters optimized for specificity, and sensitivity of 99% for filters optimized for sensitivity. They noted that terms used in this disease area evolve as the understanding of pathogenesis grows.⁵⁰ Definitions also change, so the filter will need periodic reassessment. This situation may occur in clinical concepts, whereas the terminology used in methodological filters may be relatively more stable over time.
- McKibbin et al. examined the performance of 38 published search filters for retrieving RCTs from MEDLINE.⁴⁷ They noted that recall was 0.93 for the single term “randomized controlled trial.pt.” and that multiple filters achieved recall of at least 0.99, albeit with precision lower than the benchmark of 0.564 with the single term. Their test database was the relevant articles from 161 hand-searched clinical journals. The work provides the operating characteristics for these filters and guidance on the selection of a filter.

Several teams examined the performance of filters for diagnostic studies and discussed whether they should be used when performing SRs:^{51,52,53,54,55,56,57}

- Whiting et al. derived a reference set of 506 test accuracy studies indexed in MEDLINE from seven SRs.⁵² They tested the subject searches of the SRs with and without each of 22 filters. Side-by-side forest plots clearly arrayed the range of operating characteristics and the trade-off between recall and precision. The best performing filters resulted in the loss of some studies relative to the unfiltered searches, with corresponding increases in precision. A number of the filters resulted in the loss of 20% to 50% of relevant studies. Of interest, all of the records identified by the subject searches were also identified by at least one of the diagnostic filters, eight were missed by all the best performing filters, whereas seven of these were found by at least one of the poorer performing strategies despite there being no obvious similarities among these records. It was also noted that the better performing strategies, from the perspective of preserving recall, were also among the shortest, containing the fewest terms. Whiting et al. concluded that filters for diagnostic studies may have a role in scoping reviews and rapid assessment.
- Ritchie et al. tested 23 diagnostic test accuracy search filters combined with a broad subject search against the 160 MEDLINE-indexed included studies of a single SR.⁵⁵ Consistent with other such studies, Ritchie found a performance range across the filters tested that ranged from 1.0% to 9.4% for precision and from 20.6% to 86.9% for sensitivity. The authors

concluded that SRs of diagnostic studies should not use filters but rather should seek sufficient resources to allow for screening the retrieval from a broad search. They also recommended improvements in study description by authors and the introduction of additional specific indexing terms for diagnostic test studies in the major biomedical databases. It was noted that, while their test records came from a single large review, there is heterogeneity in diagnostic techniques and strategies, and diagnostic test studies employ a variety of methods that may account for the variation in filter performance seen in other studies.

- For an SR, Beynon et al. identified 56 filters from nine filter development studies and six filter evaluation studies.⁵³ In 28 of 33 (84.8%) cases, recall was higher in the development studies compared with the evaluation studies, and estimates of precision were lower in 5 of 10 (50%) cases. The authors concluded that none of the filters had consistently high recall in the evaluation studies.
- Leeflang et al. examined the performance of 12 filters against a reference set derived from 27 SRs representing a variety of clinical fields that had not used filters in their search.⁵⁶ All filters were tested in PubMed and converted from Ovid MEDLINE, where necessary. Filters were characterized as sensitive, accurate, or specific, based on operating characteristics. The authors noted the tendency for filters to perform better over time; i.e., the proportion of diagnostic studies not found by the sensitive filters declined in a linear fashion from 1970 to 1999. They recommended against the use of diagnostic filters for SR searches, finding that 39% to 42% of the studies found in the 27 SRs did not pass the sensitive search filters.
- Doust et al. examined the performance of two filters in two SRs, again with inconsistent performance, although one resulted in complete identification of relevant papers from the gold standard in one review, and recall above 0.92 in the other, with precision of 0.040 in both cases.⁵⁴ Poor performance was attributed to lack of information in the abstracts.
- Mann and Gilbody reported a case study of two filters for diagnostic test accuracy studies in postpartum depression. The comparison was with the results of an unfiltered search, and results showed full recall with precision of 0.052 for one (University of York Centre for Reviews and Dissemination) but poor recall for the other (Vincent et al. filter search).⁵¹
- Mitchell et al. established a gold standard by hand-searching three top-ranking kidney journals and tested nine filters identified as having the best operating characteristics of a larger set.⁵⁷ None performed adequately in MEDLINE or Embase, with recall ranging from 0.37 to 0.83 in MEDLINE and 0.43 to 0.84 in Embase. Mitchell attributed the poor performance to inadequate indexing of methodological terms.

Collectively, these studies suggest that search filters for diagnostic studies must always be validated against samples different from those on which they are developed, and that caution is warranted when generalizing across health areas. Improvements appear necessary in the reporting of the abstract and in indexing completeness.

Golder and Loke reviewed adverse effects search filters in MEDLINE and Embase in a case study of fractures in patients on thiazolidinediones.⁵⁸ They compared the performance of 11 MEDLINE filters against a set of 19 relevant included studies for an SR, and three Embase filters against a set of 24 included studies, providing the operating characteristics for each. Sensitivity ranged from 0.827 to 1.00, and precision (when measured) ranged from 0.007 to 0.011. Filters with sensitivity greater than 0.95 had precision less than 0.03 in all cases. The authors noted that their results documented performance in the case of named adverse effects, "while a case study of a safety profile SR, in which all adverse effects are searched for, may have given different results."⁵⁸

f) Search strategy adaptations

Two case studies examined the question of search strategy translations, both focusing on the adaptation of strategies from MEDLINE to PubMed.

Although conversion of strategies between PubMed and other MEDLINE interfaces is not a top concern for most searchers, several articles noted differences, such as the use of international spelling rules in PubMed.⁴⁷ Text word searches are needed to retrieve material from PubMed that has not been indexed for MEDLINE.

Using a case study of a search for heart failure, Damarell et al. illustrated a method of translating searches designed in Ovid MEDLINE for use in PubMed.⁵⁹ Simply running subject headings as text terms resulted in incomplete retrieval. When MeSH terms were run as text words, 12% of citations that had previously been retrieved were lost. The authors also demonstrated how the analysis of studies indexed for MEDLINE, but not retrieved by simply translating the MeSH terms to text word terms, identified additional productive text words to add to the search for use in the un-indexed subsets of PubMed.

Duffy et al. also focused on optimizing retrieval from the un-indexed PubMed content not found in Ovid MEDLINE and MEDLINE In-Process databases.⁶⁰ The authors identified a search string limiting the text word-only searches to the un-indexed material, allowing increased recall and improving the timeliness of the review without the loss of precision that could occur if the text word search was run against all PubMed subsets.

5.2 Survey Results

The PRESS survey was conducted between June 24 and July 2, 2015 via the Web-based survey tool FluidSurveys. A reminder was sent on June 28. Most of the survey responses were gathered by day six, with few responses after day seven. Eligible participants included librarians, information specialists, and information scientists involved in performing searches for HTA reports and SRs.

Survey submissions totalled 174; however, we only included responses in our analysis if at least one response beyond the demographic data were completed ($n = 117$) and 108 were fully completed. The average time spent completing the survey was 12.3 minutes. Most respondents described themselves as “librarian/information,” “specialist/information,” “scientist” (90%). The remainder were described as “researcher” (5%) and “clinician,” “educator,” “student,” or “retired” (5%). Close to half of respondents (44%) worked in a university or other academic institution. The next largest groups were research/knowledge production organizations (26%) and hospitals (20%). Most respondents (76%) described their training as MLIS/MA/MSc in Library/Information Studies. Other responses included Bachelor Degree in Library Science or equivalent (19%), library technician or college equivalent (11%), and other (14%). The “other” responses were all unique and included a PhD in Sports Science, a dentist, and a PhD in Library and Information Science. It should be noted that more than one response was allowed for this question.

Respondents were primarily from Canada (32%), the US (25%), and the United Kingdom (24%). The remaining 19% were from Algeria, Australia, Bosnia and Herzegovina, Germany, India, Ireland, Malaysia, the Netherlands, Norway, and Tajikistan. The average number of years of experience in searching SRs or HTAs was 10, whereas the average number of years of experience in doing SRs or HTAs was six. The average number of SRs or HTAs that respondents were involved in was 47.

Table 4 shows the results for the question about specific PRESS elements. The previous fifth and sixth PRESS elements were combined in the survey. There was much agreement on the

importance of all the elements and their potential negative impact of both recall and precision for all the elements (with 50% of the responses scoring either 1 or 2, with 1 being most important).

TABLE 4: PRESS ELEMENTS SURVEY RESULTS

| PRESS Elements | How Important Do You Feel This Element Is?* | The Potential Negative Impact of This Element on Recall Is: ^a | The Potential Negative Impact of This Element on Precision Is: ^a |
|---|--|---|---|
| | Total Responses (n = 117) | Total Responses (n = 117) | Total Responses (n = 117) |
| Translation of the research question (Example: Has the research question been translated correctly into search concepts? [e.g., PICO]; i.e., does the search strategy match the research question?) | 1 = 95 (81%) 2 = 13 (11%) 3 = 5 (4%) 4 = 4 (3%) | 1 = 68 (58%) 2 = 32 (27%) 3 = 12 (10%) 4 = 5 (4%) | 1 = 66 (56%) 2 = 25 (21%) 3 = 18 (15%) 4 = 8 (7%) |
| Boolean and proximity operators (Example: Are there any mistakes in the use of Boolean or proximity operators?) | 1 = 91 (78%) 2 = 18 (15%) 3 = 2 (2%) 4 = 6 (5%) | 1 = 90 (77%) 2 = 19 (16%) 3 = 4 (3%) 4 = 4 (3%) | 1 = 78 (67%) 2 = 28 (24%) 3 = 12 (10%) 4 = 8 (7%) |
| Subject headings (Example: Are the subject headings relevant or are subject headings missing? Are any subject headings too broad or too narrow? Are subject headings exploded where necessary and vice versa?) | 1 = 54 (46%) 2 = 46 (39%) 3 = 11 (9%) 4 = 6 (5%) | 1 = 50 (43%) 2 = 46 (39%) 3 = 16 (14%) 4 = 5 (4%) | 1 = 45 (38%) 2 = 44 (38%) 3 = 18 (15%) 4 = 10 (9%) |
| Natural language (also free text or text word) (Example: Does the search miss any spelling variants in free text? Does the search miss any synonyms? Does the search miss truncation or truncate at the wrong point?) | 1 = 55 (47%) 2 = 44 (38%) 3 = 12 (10%) 4 = 6 (5%) | 1 = 57 (49%) 2 = 46 (39%) 3 = 7 (6%) 4 = 7 (6%) | 1 = 41 (35%) 2 = 45 (38%) 3 = 25 (21%) 4 = 6 (5%) |
| Spelling, syntax, and line numbers limits and filters (Examples: Do any of the limits used seem unwarranted? Are any filters used appropriate for the topic?) | 1 = 57 (49%) 2 = 41 (35%) 3 = 15 (13%) 4 = 4 (3%) | 1 = 53 (45%) 2 = 39 (33%) 3 = 19 (16%) 4 = 6 (5%) | 1 = 48 (41%) 2 = 39 (33%) 3 = 22 (19%) 4 = 8 (7%) |
| Search strategy adaptations (Example: Does the searcher indicate that the search strategy has been adapted for additional databases and/or interfaces?) | 1 = 50 (43%) 2 = 40 (34%) 3 = 21 (18%) 4 = 6 (5%) | 1 = 45 (38%) 2 = 35 (30%) 3 = 26 (22%) 4 = 11 (9%) | 1 = 39 (33%) 2 = 34 (29%) 3 = 31 (26%) 4 = 13 (11%) |

*1=most important- 4=least important.

Respondents were given the opportunity to describe other errors that should be considered. Suggestions are presented in Table 5, which we have categorized as within (i.e., for consideration) or outside the scope of peer reviewing electronic search strategies.

TABLE 5: SUGGESTED NEW ELEMENTS

| Elements for Consideration | Elements Out of Scope |
|---|--|
| <p>Related to translation of the research question:</p> <ul style="list-style-type: none"> • Does the search use the most appropriate facets from PICO? <p>Related to limits and filters:</p> <ul style="list-style-type: none"> • Date ranges • Filter choice and rationale <p>Related to subject headings:</p> <ul style="list-style-type: none"> • Correct use of database's automatic translation mapping or synonym mapping • Inclusion of previous indexing (could have an impact on recall in that older, potentially relevant studies could be missed) <p>Search strategy adaptations:</p> <ul style="list-style-type: none"> • Translation between databases and in which database the strategy is initially developed • Number of databases searched • Appropriateness of database choice <p>Other:</p> <ul style="list-style-type: none"> • Background "search notes" detailing rationale for inclusion/exclusion of certain terms (e.g., acronyms for a test that spell out a word; terms not appearing to be searched but included, as they are lower in the hierarchy and an exploded/major heading has been used; list of any key papers used in formulating the search) | <ul style="list-style-type: none"> • Reporting of a post-search sensitivity calculation • Grey literature • Validation of the search strategy with references from known systematic reviews • Citation searching / pearl harvesting • Search strategy is poorly described. This doesn't necessarily impact recall or precision, but when searches need to be reproducible, they must be clearly laid out in the text or appendices of the review. Too many reviews provide only a laundry list of subject heading/keyword combinations, along with a list of databases. This is ineffectual for evaluating how well the search has been executed. |

PICO = population/problem, intervention/exposure, comparison, outcome.

The PRESS survey also looked at questions related to the process used for peer review. The majority of respondents (57%) were in agreement that the peer review of the search should be done "once the MEDLINE search is developed but before other database searches are developed," and 27% felt it should be done "after all database searches have been developed." There were also some interesting comments regarding when the peer review of the search should be conducted that were noted in the category "Other responses" (17%) including the following: "after MEDLINE and periodically check additional searches to ensure translation is correct," "after each database," "once the primary search strategy has been developed," and "after each new iteration of the search strategy following adaptation for each database/search interface and after publication."

When asked about compensation, respondents agreed that "recognition through acknowledgement on published report" was the most important (71%). Table 6 outlines the overall responses in order of preference (multiple answers were allowed).

TABLE 6: ACCEPTABLE COMPENSATION FOR PEER REVIEWING

| Response | Percentage |
|--|------------|
| Recognition through acknowledgement on published report | 71% |
| Reciprocal service | 65% |
| Part of standard work duties | 56% |
| Voluntary | 49% |
| Continuing education credits | 33% |
| Payment (honorarium) | 27% |
| Payment (with an invoice) | 25% |
| Other, please specify (examples included: co-authorship, anonymous acknowledgement, something to put on your Curriculum Vitae) | 13% |

When asked about the number of peer reviewers necessary to peer review the search strategy, the majority of respondents (53%) felt that one peer reviewer was sufficient, followed by 28% indicating that two peer reviewers are necessary. When asked about the appropriate turnaround time to do a PRESS review, there was less agreement. The results were variable, with 36% indicating one week, 16% indicating three days, 15% indicating two weeks, and 12% indicating two days. The final question asked how often the search should be peer reviewed. There was less agreement on this question, with (49%) of respondents answering twice (if any substantial issues need to be addressed) and 21% answering once (the searchers make any changes at their discretion). Other responses accounted for the final 30% of the answers. Examples of these “other responses” included: “twice but with a fast second turn-around,” “after any changes have been made,” and “the searcher should decide if they need further review.”

5.3 Summary of SR and Survey Results

Thirty-nine new studies from the health sciences literature confirmed the findings of the original PRESS development efforts. No new elements relevant to effective Boolean searching were identified, and no evidence questioned the guidance associated with the existing seven elements. Operationalization of the research question by translating it into search concepts, sound use of Boolean and proximity operators, selection of subject headings, and free-text terms, correct spelling, database syntax, and line numbers along with appropriate selection and use of search limits and filters appear to remain the foundation of effective Boolean searching.

The survey presented these same elements to respondents, asking about the importance and perceived nature of the impact of the elements on the search results. Again, the existing PRESS elements were confirmed. Suggestions for additional elements generated useful input into the interpretation of the existing elements, and were brought forward to the consensus forum for discussion. A new element, “search notes,” was suggested. This would provide an explanation to help the peer reviewer understand the evolution of the search under review, explaining why certain terms were selected or omitted, and other information. A number of other suggestions were considered to be outside the scope of PRESS (see Table 4).

5.4 Consensus Building

A consensus process was conducted to support the development of recommendations. The forum participants engaged in a meeting (in person or by teleconference) on Thursday July 9, 2015, from 9:00 a.m. to 13:00 p.m. EDT at CADTH in Ottawa (the sponsoring institution).

The meeting brought together leading experts in literature searching methodologies to ensure that the *PRESS Guideline* items are based on best evidence and grounded in the needs of

knowledge users. The list of final consensus participants and the meeting agenda can be found in Appendix F.

All participants were expected to have familiarized themselves thoroughly with all of the pre-meeting materials prior to the consensus meeting, to ensure that the meeting time could be efficiently used to reach consensus for the new guideline. This expected level of engagement and time commitment was made clear to all participants at the time they were invited to participate in the consensus process.

The pre-meeting materials, which were sent to all consensus participants ahead of time by email and also made available in a Dropbox folder, consisted of:

- the meeting agenda
- the PowerPoint slides
- the *PRESS Guideline Assessment Form*, the PRESS full checklist tips, the SR results (draft), the preliminary survey data (draft), the *Evidence-based Checklist for the Peer Review of Electronic Search Strategies — 2010*, and the CADTH PRESS *Peer Review of Electronic Search Strategies* report.

Vicki Foerster, an independent medical consultant, facilitated the consensus process. She introduced each checklist item and led structured discussions around which items to include, modify, or remove from the original PRESS guidance. Relevant SR and survey results were presented for each checklist item. The final decision for inclusion or exclusion of an item was determined by voting.

Consensus was reached on each item following a brief discussion. Consensus was defined a priori as a majority vote, but for each item the vote was unanimous. Voting to include or exclude each item was undertaken at the point that it appeared from discussion that consensus had been reached. Voting was open (i.e., not-blinded). The option for recording dissent from the consensus was offered but was not required.

For the first six elements of the checklist, consensus was reached rapidly, with little detailed discussion. The seventh element (skilled translation of the Boolean search strategy to additional databases), however, — though supported by the evidence and the Web-based survey of experts — was withdrawn from the PRESS checklist. The consensus forum participants agreed unanimously that this was an essential feature of high-quality search strategy design but considered, after some discussion, that it did not belong as a PRESS checklist element. They were of the view that the PRESS checklist is intended for use as a decision aid when peer reviewing a single search strategy for a specific database and at that point it may be impossible to judge whether the strategy under review had been or would be adequately translated to additional databases. It was felt that the submission for the peer review of search strategy translations to other databases should be left to the discretion of searchers. It was noted, however, that the timing of the peer review is extremely important to ensure that this process can happen.

Table 7 is the result of the discussion of PRESS elements and the final consensus decision. The final recommendations are found in section 8.

TABLE 7: PRESS ELEMENTS UPDATE — RESULTS OF DISCUSSION

| PRESS Element | Consensus Decision |
|---|--|
| Translation of the research question | Agree to retain, with suggested modifications |
| Boolean and proximity operators | Agree to retain, with suggested modifications |
| Subject headings | Agree to retain, with suggested modifications |
| Text word searching (free text) — formerly “natural language” | Agree to retain, with suggested modifications |
| Spelling, syntax, and line numbers | Agree to retain, with suggested modifications |
| Limits and filters | Agree to retain, with suggested modifications |
| Search strategy adaptations | Remove as a PRESS element (for discussion around this element, see previous section 5.4) |

6. KNOWLEDGE TRANSLATION

The experts assembled for the consensus process meeting also discussed how to disseminate the PRESS guidance including:

- Publish the CADTH report and user-friendly versions as guideline statements.
- Ensure that those knowledgeable about the tool act as “ambassadors” by sharing with colleagues; e.g., at conferences, presentations, teaching sessions, etc.
- Develop a set of continuing education slides to be used at a local level.
- Arrange educational sessions for those who commission or fund SRs and HTAs.
- Develop webinars and online courses, etc., for broad educational dissemination.
- Co-present at conferences with the researchers who wrote the resulting SRs or HTAs.
- Approach Cochrane about adopting PRESS as a standard method.

7. RECOMMENDATIONS

Consensus forum participants discussed the PRESS recommendations in detail. At the end of the consensus forum, the PRESS team and the consensus forum participants agreed that the project team would update the final *PRESS Guideline* recommendations with the information collected. The final *PRESS Guideline* recommendations were updated and are subsequently presented in Table 8.

TABLE 8: PRESS 2015 GUIDELINE RECOMMENDATIONS FOR LIBRARIAN PRACTICE

| | Recommendation | Guidance |
|---|--|--|
| 1 | Translation of the research question: <i>Assess whether the research question has been correctly translated into search concepts.</i> | Ideally, the primary search strategy is submitted for peer review to ensure conceptual accuracy. The research question, typically formatted according to some variation of PICO and fine points of how the search was informed by the reference interview, should be submitted with the search strategy. |
| 2 | Boolean and proximity operators:* <i>Assess whether the elements addressing the search question have</i> | Review the search for any instances where mistakes occurred in Boolean operators; e.g., OR may have been unintentionally substituted for AND (or vice versa), or AND may have been used to link phrases or words (e.g., as a conjunction) rather than as a Boolean operator. Note that where NOT has been used, there is the possibility |

| | Recommendation | Guidance |
|---|---|--|
| | <p><i>been correctly combined with Boolean and/or proximity operators.</i></p> <p>*Note that proximity operators vary based on search service.</p> | <p>of unintentional exclusions, and another device (e.g., employing a subject heading, check tag, or limit) could produce an equivalent outcome.</p> <p>Ensure that the use of nesting within brackets is logical and has been applied, as needed. Also note whether the use of a proximity operator (adjacent, near, within) instead of AND could increase precision.</p> <p>If proximity operators are employed, consider whether or not the chosen width is too narrow to capture all anticipated instances of the search terms, which may vary depending on whether or not the database being searched recognizes stop words. Consider whether the width is too broad.</p> <p>If restrictions are included (e.g., human or elderly populations), ensure that the appropriate construction has been used.</p> |
| 3 | <p>Subject headings (database-specific):</p> <p><i>Assess whether there is enough scope in the selection of subject headings to optimize recall.</i></p> | <p>Examine the following elements of subject heading usage: missing or incorrect headings, relevance/irrelevance of terms, and correct use of explosion to include relevant narrower terms.</p> <p>Consider the use of floating subheadings which are in most instances preferable to using subheadings attached to specific subject headings (e.g., in MEDLINE, "Neck Pain/ and su.fs." rather than "Neck Pain/su"). Note that subject headings and subheadings are database-specific.</p> |
| 4 | <p>Text word search (free text):</p> <p><i>Assess whether search terms without adequate subject heading coverage are well-represented by free text terms, and whether additional synonyms or antonyms (opposites) and related terms are needed.</i></p> | <p>Free text terms are typically employed to cover missing database subject headings. Consider elements of free text usage such as too narrow or too broad, relevance of terms, and whether synonyms or antonyms have been included.</p> |
| 5 | <p>Spelling, syntax and line numbers:</p> <p><i>Assess correct use of spelling, correct use of syntax and correct search implementation.</i></p> | <p>Review the search strategy for misspelled words and for errors in system syntax that are not easily found by spell-checking.</p> <p>Check each line number and combinations of line numbers to ensure that the search logic was correctly implemented.</p> |
| 6 | <p>Limits and filters:</p> <p><i>Assess whether the limits used (including filters) are appropriate and have been applied correctly.</i></p> | <p>Review the search strategy to see if limits that are not relevant to the eligible study designs or to the clinical question have been applied, as these could potentially introduce epidemiological bias.</p> <p>Check that methodological search filters have been properly applied; e.g., that SRs of economic evaluations are not restricted to RCTs.</p> |

PICO = population/problem, intervention/exposure, comparison, outcome; RCT = randomized controlled trials.

8. UPDATED *PRESS* GUIDELINE

There was much discussion at the consensus forum using the previously developed updated *PRESS Guideline Checklist* and the specific wording. The final updated *PRESS Guideline Checklist* is found in Table 9. At the end of the consensus forum, the *PRESS* team and the consensus forum participants agreed that the project team would finalize the updated *PRESS Guideline Checklist* with the information collected.

CADTH staff piloted the updated *PRESS Guideline* and *PRESS Assessment Form* (see subsequent section 9) for three weeks. Feedback and comments resulted in revisions to the *PRESS Guideline* and the *PRESS Guideline Assessment Form*. The *PRESS Guideline Checklist* is to be used to help complete the *PRESS Guideline Assessment Form* (see Table 9).

TABLE 9: PRESS 2015 EVIDENCE-BASED CHECKLIST

| | |
|---|--|
| Translation of the research question | <ul style="list-style-type: none"> • Does the search strategy match the research question/PICO? • Are the search concepts clear? • Are there too many or too few PICO elements included? • Are the search concepts too narrow or too broad? • Does the search retrieve too many or too few records? (Please show number of hits per line.) • Are unconventional or complex strategies explained? |
| Boolean and proximity operators (these vary based on search service) | <ul style="list-style-type: none"> • Are Boolean or proximity operators used correctly? • Is the use of nesting with brackets appropriate and effective for the search? • If NOT is used, is this likely to result in any unintended exclusions? • Could precision be improved by using proximity operators (e.g., adjacent, near, within) or phrase-searching instead of AND? • Is the width of proximity operators suitable (e.g., might adj5 pick up more variants than adj2)? |
| Subject headings (database-specific) | <ul style="list-style-type: none"> • Are the subject headings relevant? • Are any relevant subject headings missing; e.g., previous index terms? • Are any subject headings too broad or too narrow? • Are subject headings exploded where necessary and vice versa? • Are major headings (“starring” or restrict to focus) used? If so, is there adequate justification? • Are subheadings missing? • Are subheadings attached to subject headings? (Floating subheadings may be preferred.) • Are floating subheadings relevant and used appropriately? • Are both subject headings and terms in free text (see below) used for each concept? |

| | |
|--|--|
| Text word searching (free text) | <ul style="list-style-type: none"> • Does the search include all spelling variants in free text (e.g., UK versus US spelling)? • Does the search include all synonyms or antonyms (e.g., opposites)? • Does the search capture relevant truncation (i.e., is truncation at the correct place)? • Is the truncation too broad or too narrow? • Are acronyms or abbreviations used appropriately? Do they capture irrelevant material? Are the full terms also included? • Are the keywords specific enough or too broad? Are too many or too few keywords used? Are stop words used? • Have the appropriate fields been searched; e.g., is the choice of the text word fields (.tw.) or all fields (.af.) appropriate? Are there any other fields to be included or excluded (database-specific)? • Should any long strings be broken into several shorter search statements? |
| Spelling, syntax and line numbers | <ul style="list-style-type: none"> • Are there any spelling errors? • Are there any errors in system syntax; e.g., the use of a truncation symbol from a different search interface? • Are there incorrect line combinations or orphan lines (i.e., lines that are not referred to in the final summation that could indicate an error in an AND or OR statement)? |
| Limits and filters | <ul style="list-style-type: none"> • Are all limits and filters used appropriately and are they relevant given the research question? • Are all limits and filters used appropriately and are they relevant for the database? • Are any potentially helpful limits or filters missing? Are the limits or filters too broad or too narrow? Can any limits or filters be added or taken away? • Are sources cited for the filters used? |

PICO = population/problem, intervention/exposure, comparison, outcome; UK = United Kingdom.

9. IMPLEMENTING THE *PRESS* GUIDELINE

In addition to the PRESS EBC, a *PRESS Guideline Assessment Form* was updated to help assist the peer-review process (see Table 10). At the end of the consensus forum, the PRESS team and the consensus forum participants agreed that the project team would finalize the updated *PRESS Guideline Assessment Form* with the information collected.

TABLE 10: PRESS GUIDELINE ASSESSMENT FORM

PRESS Guideline — Search Submission & Peer Review Assessment

SEARCH SUBMISSION: THIS SECTION TO BE FILLED IN BY THE SEARCHER

| | |
|-----------------|---|
| Searcher: | Email: |
| Date submitted: | Date requested by: <i>[Maximum = 5 working days]</i> |

Systematic Review Title:

| |
|----------|
| |
|----------|

This search strategy is...

| | |
|--|---|
| | My PRIMARY (core) database strategy — First time submitting a strategy for search question and database |
| | My PRIMARY (core) strategy — Follow-up review NOT the first time submitting a strategy for search question and database. If this is a response to peer review, itemize the changes made to the review suggestions |
| | SECONDARY search strategy— First time submitting a strategy for search question and database |
| | SECONDARY search strategy — NOT the first time submitting a strategy for search question and database. If this is a response to peer review, itemize the changes made to the review suggestions |

Database

(i.e., MEDLINE, CINAHL...): *[mandatory]*

| |
|----------|
| |
|----------|

Interface

(i.e., Ovid, EBSCO...): *[mandatory]*

| |
|----------|
| |
|----------|

Research Question

(Describe the purpose of the search) *[mandatory]*

| |
|--|
| |
|--|

PICO Format

(Outline the PICOs for your question — i.e., Patient, Intervention, Comparison, Outcome, and Study Design — as applicable)

| | |
|----------|--|
| P | |
| I | |
| C | |
| O | |
| S | |

Inclusion Criteria

(List criteria such as age groups, study designs, etc., to be included) *[optional]*

| |
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| |
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Exclusion Criteria

(List criteria such as study designs, date limits, etc., to be excluded) *[optional]*

| |
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| |
|--|

Was a search filter applied?Yes No

**If YES, which one(s) (e.g., Cochrane RCT filter, PubMed Clinical Queries filter)?
Provide the source if this is a published filter. [mandatory if YES to previous
question — textbox]**

Other notes or comments you feel would be useful for the peer reviewer? [optional]

**Please copy and paste your search strategy here, exactly as run, including the number of
hits per line. [mandatory]**

(Add more space, as necessary.)

PEER REVIEW ASSESSMENT: THIS SECTION TO BE FILLED IN BY THE REVIEWER

| | | |
|------------------|---------------|------------------------|
| Reviewer: | Email: | Date completed: |
|------------------|---------------|------------------------|

| 1. TRANSLATION | | | |
|-----------------------|--------------------------|--------------------------|--|
| | A. No revisions | <input type="checkbox"/> | |
| | B. Revision(s) suggested | <input type="checkbox"/> | |
| | C. Revision(s) required | <input type="checkbox"/> | |

If "B" or "C," please provide an explanation or example:

| 2. BOOLEAN AND PROXIMITY OPERATORS | | | |
|---|--------------------------|--------------------------|--|
| | A. No revisions | <input type="checkbox"/> | |
| | B. Revision(s) suggested | <input type="checkbox"/> | |
| | C. Revision(s) required | <input type="checkbox"/> | |

If "B" or "C," please provide an explanation or example:

| 3. SUBJECT HEADINGS | | | |
|----------------------------|--------------------------|--------------------------|--|
| | A. No revisions | <input type="checkbox"/> | |
| | B. Revision(s) suggested | <input type="checkbox"/> | |
| | C. Revision(s) required | <input type="checkbox"/> | |

If "B" or "C," please provide an explanation or example:

| 4. TEXT WORD SEARCHING | | | |
|-------------------------------|--------------------------|--------------------------|--|
| | A. No revisions | <input type="checkbox"/> | |
| | B. Revision(s) suggested | <input type="checkbox"/> | |
| | C. Revision(s) required | <input type="checkbox"/> | |

If "B" or "C," please provide an explanation or example:

| 5. SPELLING, SYNTAX, AND LINE NUMBERS | | | |
|---------------------------------------|--------------------------|--------------------------|--|
| | A. No revisions | <input type="checkbox"/> | |
| | B. Revision(s) suggested | <input type="checkbox"/> | |
| | C. Revision(s) required | <input type="checkbox"/> | |

If “B” or “C,” please provide an explanation or example:

| 6. LIMITS AND FILTERS | | | |
|-----------------------|--------------------------|--------------------------|--|
| | A. No revisions | <input type="checkbox"/> | |
| | B. Revision(s) suggested | <input type="checkbox"/> | |
| | C. Revision(s) required | <input type="checkbox"/> | |

If “B” or “C,” please provide an explanation or example:

| 7. OVERALL EVALUATION (Note: If one or more “revision required” is noted above, the response below must be “revisions required”.) | | | |
|---|--------------------------|--------------------------|--|
| | A. No revisions | <input type="checkbox"/> | |
| | B. Revision(s) suggested | <input type="checkbox"/> | |
| | C. Revision(s) required | <input type="checkbox"/> | |

Additional comments:

At the PRESS consensus forum, the use of the *PRESS Checklist* was discussed. As well, issues around how to make the PRESS guidance easier to use were discussed. The discussion hinged around the survey questions 10 to 14:

- When should PRESS be done?
- What types of compensation would be acceptable for peer reviewing?
- How many peer reviewers are necessary to peer review the search strategy?
- What should the turnaround time be for a PRESS review?
- How often should the search be peer reviewed?

There was much discussion about the process a librarian would use to conduct a peer review guided by the aforementioned questions. The consensus participants were in full agreement with the results of the survey. Based on the results from the survey and discussion from the PRESS consensus forum, the following implementation strategies were developed:

TABLE 11: PRESS 2015 IMPLEMENTATION STRATEGIES

| Implementation Strategy | Guidance |
|-------------------------|---|
| 1 | The “primary search”* should be peer reviewed. Depending on the findings of the peer review and the complexity of translation to other databases and/or interfaces, further peer review may be desirable. Any time an SR or HTA is being updated, the updated search should also be peer reviewed. *Note: The primary search is determined by the searcher as the most important database to be searched and normally where the first search strategy is developed. |
| 2 | One peer review is acceptable using the <i>PRESS Guideline</i> . A second review may be recommended in some cases; e.g., the project scope or research question(s) change OR complex new interfaces are involved OR the peer reviewer specified that there are required revisions. The peer-review process should be documented. |
| 3 | Peer reviewers should be recognized. At a minimum, the peer reviewer should be recognized through acknowledgement in the publication (anonymous if the reviewer so wishes). The database searched and the service provider should be specified; e.g., MEDLINE on OvidSP. |
| 4 | The turnaround time for a peer review of a search should be a maximum of five working days. A shorter turnaround time could be negotiated. |

PRESSforum (pressforum.pbworks.com) is the Web platform developed by the project team to enable librarians to obtain a peer review of their SR searches. Since its launch in 2010, PRESSforum has grown to a community of more than 225 members. At present, membership is open to health librarians and information specialists, and all Cochrane Trials Search Coordinators. Future plans include the launch of an enhanced platform that will enable members to submit strategies and peer reviews via Web forms.

10. FUTURE RESEARCH

The principles of effective Boolean searching are well-established, as evidenced by the stability of elements over the span of nearly 10 years since the development and publication of the original PRESS EBC. The area of text-mining approaches is an active field of research (see O'Mara-Eves et al. 2015 for a review).⁶¹ If such an approach proves practical for SRs and HTAs, the focus of Boolean searching may shift from maximizing recall, while still maintaining a manageable search precision and number needed to read to simply maximizing recall. Text-mining relevance ranking and empirically derived and robust stopping rules for screeners might be able to eventually take the place of the need to maintain precision. Thus, the interface between Boolean searching and these new technologies may be a rich area for study. It is hoped that, in the future, we can evaluate the use of PRESS, and in particular the supplementary guidance and materials.

11. LIMITATIONS

The SR for this update was focused on the health science databases. Although the original *PRESS Guideline*⁵ was informed by research and theory from all fields of library science, and was designed for peer reviewing any important search, uptake of the *PRESS Guideline* appears to be confined to SR and HTA searches, thus this narrowed focus seemed warranted. The only risk is potentially missing health-related research published in library journals not indexed in the biomedical databases. Grading of strength of recommendations was not done. The SR was an update, and risk of bias and strength of evidence assessments would have required revisiting the studies included in the original PRESS SR. However, no guidance in the original PRESS was overturned by new evidence, or the expert opinions of survey respondents or consensus forum participants, adding significantly to confidence in these findings. Piloting of the revised *PRESS Guideline* was undertaken by only one agency (CADTH), the sponsor of this research.

12. CONCLUSIONS

Research has demonstrated that the peer review of electronic search strategies using PRESS reduces errors, improves the quality and comprehensiveness of the search retrieval relative to un-reviewed searches, and saves time over unstructured review. This exercise updated the PRESS guidance first published in 2008.⁵ A Web-based survey of experts supported the seven existing PRESS elements, while introducing subtleties that provide potentially useful guidance for both the searcher and peer reviewer. The material was taken forward to a consensus forum of experts for development of recommendations. Meanwhile, a community of experts has come to consensus on the effective use of PRESS and the development of its guidance.

The elements that are important to get right for effective Boolean searches have been confirmed, with new evidence incorporated into guidance on using the elements. These include:

- translation of the research question
- Boolean and proximity operators
- subject headings
- text word search (free text)
- spelling, syntax, and line numbers
- limits and filters.

Although consensus participants agreed that the previous element #7 — “Skilled adaptation of the Boolean search strategy to other databases”— did not meet the PRESS criteria and the element was removed from the checklist for the nature and timing of quality control efforts related to any adaptations.

In its entirety, the *PRESS Guideline* now includes the following items:

- six PRESS 2015 Recommendations for Librarian Practice
- four PRESS 2015 Implementation Strategies
- an updated *PRESS 2015 Evidence-Based Checklist*
- an updated *PRESS 2015 Assessment Form*.

In addition to this *PRESS Guideline*, PRESSforum (pressforum.pbworks.com) will continue to be operational until the launch of an enhanced platform that will enable members to submit strategies and peer reviews via Web forms. Additionally, the *PRESS: Peer Review of Electronic Search Strategies 2015 Guideline Statement (PRESS 2015 Guideline Statement)* was produced as a companion document.¹ Together, the *PRESS 2015 Guideline Statement* and the PRESS E&E will be used to support the *Peer Review of Electronic Search Strategies*.

GLOSSARY

Adjacency operators: See proximity operators.

Boolean logic: System of logical operators to join sets. Standard Boolean operators used in searching are “AND,” “OR,” and “NOT.” Proximity operators imply “AND” and are another form of logical operator. Named after George Boole, a self-educated English mathematician.

Boolean search: A search strategy comprised of multiple search terms, usually divided into multiple search statements or sets (lines of terms), where the individual terms and search statements are combined using one or more of the Boolean operators (AND, OR, and NOT).

Checklist: In this report, the term is used synonymously for other forms of evaluation such as questionnaires, scales, tools, and instruments.

Citation searching: A search method that can be done forward or backward in time. Forward citation searching retrieves records that have cited an item, also known as “cited by”; it is available from various resources. Backward citation searching involves records that an item has cited, also known as “checking references.” See also “pearl harvesting.”

Check tag: A term routinely considered for use in indexing. In MEDLINE, it is usually included in the Medical Subject Headings (MeSH) term field (but this is up to the vendor).

Controlled vocabulary: A consistent collection of terms chosen for specific purposes, with explicit logical constraints on intended meanings and relationships in a database.

Descriptors: See subject headings.

Duplicate: A redundant record pointing to the same full-text article. Records are usually not identical, because they may come from different databases and may differ in the treatment of authors’ names or journal titles, indexing, and special fields.

Explode: Subject headings are arranged hierarchically in many thesauri. To explode a subject heading involves including a selected subject heading and all of the narrower terms that are below it in the hierarchy.

Filter: Search parameters designed to limit subject areas to a particular concept (focus of peer review should be to determine if use of filter is warranted, given the question.)

Fields: Searchable items in a database; for example, authors’ names, institutions, controlled vocabulary, titles, or abstracts.

Floating subheadings: Floating subheadings look for any subject heading that uses that subheading irrespective of which subject heading it is assigned to.

Free text: Normally words, phrases, or terms sought in a title, abstract, or full text of a document, but this varies by database and vendor. See also “natural language” or “text words.”

Guideline: A statement that includes recommendations for a field of practice. It should be informed by a systematic review and experience from a group of experts in the related field.

Irrelevant: In this report, “irrelevant” means “not meeting inclusion criteria of systematic review or HTA for which search is developed.”

Limit: A system-based addition to a search that is designed to exclude certain material not relevant to the review. Examples include publication date, document type, and age group. (The focus of the peer review should be to determine if use of limit is warranted, given the question.)

Listserv: Electronic mailing list, where messages are distributed to all who subscribe to the list. Most are based on a topic of mutual interest to subscribers.

Major heading: A subject heading designated as representing a main subject of the document being indexed. In some interfaces, the intention to retrieve only records where a term is assigned as a major heading is indicated by putting an asterisk in front of the term — sometimes known as “starring.” Other interfaces may use terminology such as “restrict to focus.”

Modal rating: The most common rating.

Natural language term: Words, phrases, or terms sought in title, abstract, or full text of the document. See also “free text” or “text words.”

Negative impact on precision: A search error reduces the ratio of accurate search results to inaccurate search results that are retrieved.

Negative impact on recall: A search error reduces the number of relevant results that are retrieved.

Null retrieval: A search retrieval set with no records.

Operating characteristics: The performance attributes, in this case, of a search strategy. Factors such as recall, precision and specificity are usually considered in the assessment of search performance.

Pearl harvesting (or pearl growing): A search technique that uses known relevant records to identify other key reports or search terms; also known as snowballing or related article searching. See also “citation searching.”

Peer review: Process of subjecting research work to an independent scrutiny of qualified experts (peers); may be evaluated against certain standards (such as authorship guidelines).

Positive predictive value: An epidemiological term that usually refers to the accuracy of the diagnostic test. A computational equivalent of precision.

Precision: The proportion of retrieved items that is relevant. Equivalent to positive predictive value.

Proximity operators: (Also called adjacency operators.) Logical operators that specify the connected elements must not only both be present but must also be within a specified proximity. Exact operators and their functions vary by system and include “NEAR,” “WITH,” “SAME,” and “ADJ.”

Recall: (Also called sensitivity.) The proportion of relevant items in a database retrieved by a search; usually known only in experimental situations, although it can be estimated by statistical methods such as capture-mark-recapture. Most searches for systematic reviews and HTA try to achieve the highest practical recall, often at the expense of precision.

Redundant: A search element that retrieves no additional records.

Relevant: In this report, defined as meeting inclusion criteria of systematic review or HTA for which a search is developed.

Retrieval set: Records retrieved by the search statement.

Search: In this report, “search” is an electronic search strategy designed for retrieval from bibliographic or abstracting and indexing databases. Other elements of a search plan for systematic review or HTA are database selection and selection of additional sources such as registries, hand or electronic searches of full text of journals and conference proceedings, communications with authors and manufacturers, Web searching, and electronic or manual checking of cited references.

Search performance: In this report, a measure of recall, precision, specificity, cost, or time.

Search query: See “search statement.”

Search statement: One line in an electronic search strategy.

Search result: An anticipated or actual outcome of a search term, statement, or strategy.

Specificity: An epidemiological term referring to accuracy of a diagnostic test at correctly classifying negative cases as negative. Sometimes reported in assessments of accuracy of search strategies but it is not equivalent to precision.

Strength of research evidence: Validity of research underpinning any statement. If research evidence is strong, we can assume that the underlying research is valid and based on appropriate research design.

Subheadings: Terms (sometimes called qualifiers) used with Medical Subject Headings (MeSH).

See also “floating subheadings.”

Subject headings: Terms that make up the controlled vocabulary of a bibliographic database. In MEDLINE, these are called Medical Subject Headings (MeSH).

Subject search: That part of a search developed by the searcher to address a question (includes information about review topic). Filters and limits not developed by the searcher may be added to this. A subject search should be the main focus of peer review.

Text words: Words, phrases, or terms sought in a title, abstract, or full text of a document. See also “free text” or “natural language.”

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APPENDIX A: SUMMARY OF PREVIOUS PRESS WORK

In 2005, CADTH funded a project to develop a process for peer reviewing electronic search strategies for SRs and HTAs. The project involved a systematic literature review, a web-based survey of experts, and two peer review forums. The aim was to reach consensus on which elements of the search process have significant impact on the overall comprehensiveness of the resulting evidence base.

The systematic review identified evidence related to quality issues and errors in complex electronic search strategies. A web-based survey of individuals experienced in SR searching was conducted to gather expert opinion regarding the impact of search elements on the search results and the importance of each element. The survey was conducted after the literature review was completed, so that elements identified as potentially important in the literature review could be addressed in the survey. Finally, two peer review forums of experts were held to discuss the results of the literature review and the survey, and to solicit expert opinion from other librarians.

There was strong consensus about six elements of search strategies that are important to check in peer review: (1) accurate translation of the research question into search concepts, (2) correct choice of Boolean operators, (3) accurate line numbers, (4) adequate translation of the search strategy for each database, (5) inclusion of relevant subject headings, and (6) absence of spelling errors. Seven additional elements received partial support. An annotated checklist known as the PRESS Evidence-Based Checklist (EBC) was subsequently published in 2008. Since then, the PRESS EBC has been disseminated including use as a tool in teaching sessions for health care librarians and information specialists worldwide.

A web-based site, PRESSforum (pressforum.pbworks.com), was created by the PRESS project team as a platform for librarians / information specialists to obtain peer review of their SR and HTA searches. Launched in 2010, PRESSforum membership is open to health librarians and Cochrane Trials Search Coordinators.

APPENDIX B: PRESS PROTOCOL

An update of PRESS: Peer Review of Electronic Search Strategies: a systematic review protocol

March 31, 2015

APPENDIX C: SEARCH STRATEGIES

MEDLINE

1. (search*.ti. and search*.ab.) or ((query* or queries).ti. and (query* or queries).ab.)
2. search*.ab. /freq=2 or query*.ab. /freq=2 or queries.ab. /freq=2 or (query* and queries).ab.
3. 1 or 2
4. Peer Review/ or search engine/ or Libraries, Medical/st [Standards]
5. "Information Storage and Retrieval"/ or MEDLINE/ or PubMed/ or Databases, Bibliographic/ or "Sensitivity and Specificity"/ or "Abstracting and Indexing as Topic"/ or Subject Headings/ or Medical Subject Headings/ or Vocabulary, Controlled/ or Databases as Topic/
6. (precision or recall or sensitivity or relevance or specificity or press or peer review*).tw,kf.
7. 4 or 5 or 6
8. 3 and 7
9. ((search* or query* or queries) adj3 (quality or error* or mistake*)).tw,kf.
10. 8 or 9
11. Data Compression/ or exp computational biology/ or exp Molecular Sequence Data/
12. (molecular or DNA or RNA or computation* or genome or proteomic* or genomic* or spectra or spectro* or chromatog*).tw,kf.
13. "cochrane database of systematic reviews".jn.
14. ("a meta analysis" or "a systematic review and meta analysis").tw.
15. 11 or 12 or 13 or 14
16. 10 not 15
17. limit 16 to yr="2005 -Current"
18. (2005\$ or 2006\$ or 2007\$ or 2008\$ or 2009\$ or 2010\$ or 2011\$ or 2012\$ or 2013\$ or 2014\$ or 2015\$).ed.
19. 16 and 18
20. 17 or 19

The Cochrane Library – Cochrane Methodology Register

- 1 (search*.ti. and search*.ab.) or ((query* or queries).ti. and (query* or queries).ab.) (413)
- 2 search*.ab. /freq=2 or query*.ab. /freq=2 or queries.ab. /freq=2 or (query* and queries).ab. (1314)
- 3 1 or 2 (1342)
- 4 search engine?.tw. (120)
- 5 (medical adj (librarian? or libraries or library)).tw. (96)
- 6 (information adj (retrieval or storage)).tw. (83)
- 7 (MEDLINE or PubMed).tw. (1826)
- 8 bibliographic database?.tw. (155)
- 9 abstracting.tw. (22)
- 10 indexing.tw. (195)
- 11 subject heading?.tw. (106)
- 12 controlled vocabul\$.tw. (21)
- 13 (precision or recall or sensitivity or relevance or specificity or press or peer review\$).tw,kf. (2231)
- 14 or/4-13 (3775)
- 15 3 and 14 (1032)

- 16 ((search\$ or query\$ or queries) adj3 (quality or error\$ or mistake\$)).tw,kf. (69)
- 17 15 or 16 (1061)
- 18 (molecular or DNA or RNA or computation* or genome or proteomic* or genomic* or spectra or spectro* or chromatog*).tw,kf. (158)
- 19 "cochrane database of systematic reviews".jn. (12)
- 20 ("a meta analysis" or "a systematic review and meta analysis").tw. (493)
- 21 18 or 19 or 20 (651)
- 22 17 not 21 (1010)
- 23 limit 22 to yr="2005 -Current" (508)

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Title

An update of PRESS: Peer Review of Electronic Search Strategies: a systematic review protocol

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Background and rationale

One of the key factors that affect the quality of health technology assessment (HTA) reports and systematic reviews (SRs) is the evidence base from which the data was derived. The evidence base is created by gathering information from many sources and performing literature searches. Performing a high quality search of information resources will ensure the accuracy and completeness of the evidence base used in HTA reports and SRs. From a management perspective, there are resource implications linked to search quality for the conduct of a report or review, based on the number of records retrieved and screened.

Checklists, scales, and instruments (henceforth, instruments) for validating some aspects of the search-reporting methods of the systematic review process have been developed, and some address aspects of the overall search plan but none evaluated the overall process. We have reviewed these and published on this.¹

We have already conducted a systematic review and published guidance and a checklist.²⁻⁴ The SR identified evidence related to quality issues and errors in complex electronic search strategies. We considered evidence from any context, not only from research in systematic reviews and HTA searching. The key points from our previous SR include:

- Errors in the electronic search strategy have been demonstrated to reduce the effectiveness of electronic searches in systematic reviews and health technology assessment reports.

- Evidence supported aspects of electronic search strategies have an impact on search performance. From this evidence, a peer-review process checklist was developed to evaluate electronic search strategies for use in systematic reviews and health technology assessment reports.
- The electronic search strategy for systematic reviews and health technology assessment reports should be peer reviewed before the evidence base is created and reviewed.
- Librarians and other information specialists should conduct the evidence-based peer review of electronic search strategies.

Objectives

The SR update will re-visit the following two questions:

- Are there any existing checklists that evaluate or validate the quality of literature searches in any discipline? Validations of the PRESS Checklist will be eligible for inclusion for this question.
- What are the elements that relate to quality or errors in search strategies? This research evidence needs to specify performance indicators or measures (such as recall or relevance).

Methods

Eligibility criteria

In the update, we will focus the search on the literature about search strategies within health science context, whereas the original review considered research evidence from any field that involved searching. This is a pragmatic decision based on the low yield of relevant evidence from beyond the health science context and the requirement for a more-focused update.

We will update the search from 2005 to present, based on database entry date in addition to publication date to ensure continuity. Articles published in languages other than English will be included if they can be translated using Google Translate.⁵ There will be no language restrictions.

All research on electronic database searching in health care will be eligible. Any original article of any design will be included. Editorials will be excluded. Eligible studies must be primary research or secondary reports presenting evidence (such as recall or precision) relevant to electronic search strategies for health science.

Eligible articles will be reviewed and an evaluation checklist will be extracted as well, primary evidence on the impact of searching techniques on search results (the influencing factor, measure used, and result), or theoretical discussion on the impact of searching techniques will be abstracted.

Search strategy and information sources

We will re-test and re-develop the original literature search strategies based on included studies from the previous review. We will search the following databases:

- Cochrane Methodology Register & Cochrane Methodology Reviews: 2005 – present
- MEDLINE (Ovid interface): 2005 - present

Two independent librarians will peer review the MEDLINE search using the PRESS checklist. A draft of the MEDLINE literature search is found in Appendix A.

Grey literature will be identified through correspondence with information specialists and other experts (including CADTH librarians); by searching The Cochrane Methodology Register, which contains conference abstracts; and by searching our personal databases of information science research accrued over the years, including material such as conference presentations and dissertations.

Data management

We will manage our data using an electronic program for SRs called DistillerSR™ as well as in a shared Dropbox™ file.

Selection process

Initially, the bibliographic records (title, abstract, and indexing terms) retrieved by the literature searches will be assessed for their relevancy (or non-relevancy) to peer review of electronic search strategies, and reports of primary research or secondary reports (review articles, tutorials) citing supporting evidence (such as recall or precision) will be selected.

For the assessment of eligibility, following a calibration exercise, the titles and abstracts will be screened by one reviewer for potential eligibility, but a second reviewer will be needed to confirm ineligibility before a record could be excluded. Articles appearing to be potentially relevant will be retrieved, and two reviewers will assess each of the full reports, arriving at consensus on eligibility.

Data collection process

Abstracted information, as well as classification as checklist, research evidence, or theory, will be recorded in DistillerSR™. Data extraction will be reviewed by one of the investigators and if warranted, a different reviewer will abstract some articles a second time.

Data items

A list of purported search errors (elements) was developed in the previous SR and this list will be used to guide the data analysis for this update, however new elements with research evidence of their impact on recall or precision will be added. For each included study, we will determine which elements of the electronic search were addressed.

Outcomes and prioritization

An assessment of the literature will be based on the elements included in the current PRESS Checklist, as presented in the article published in 2010 in Evidence-Based Librarianship and Information Practice.³ For each final element, a summary of the evidence and the focus for evidence-based peer review will be prepared.

Risk of bias in individual studies

Two review authors will independently extract data and assess the risk of bias for each study. We will use GRADE to assess the quality of quantitative study designs (such as RCTs, quasi-randomized studies).

Data synthesis

For the primary analysis, all studies with elements included in the current PRESS Checklist will be grouped together and results will be summarized by outcome category. Data will be summarized descriptively and synthesized narratively.

We don't expect to find any significant methodological, or statistical homogeneity, and therefore, we don't anticipate that data will be pooled.

Meta-bias(es) and confidence in cumulative evidence

Advice will be sought from experts in the field as to any necessary assessment of meta-bias(es) and of the strength of the body of evidence during the consultation process.

Ethics

As the study does not involve primary research, it does not require formal ethical approval.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

JM, MS and CL conceived and designed the protocol. JM drafted the protocol and CL, MS, EC and DS reviewed and revised it. JM, MS, EC and DS drafted the search strategy. All authors read and approved the final protocol.

Protocol registration

It is no longer possible to register protocols for methodology reviews in the Cochrane Methodology Register, pending decisions within Cochrane as to its maintenance and further development. PROSPERO is an international database of prospectively registered systematic reviews. While this is a methodological review, it doesn't have a clinical or patient related outcome and so it is not eligible for inclusion in PROSPERO.

Acknowledgements

The authors would like to thank CADTH for the funding of this protocol.

References

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Appendix A: Literature Search

Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R)
1946 to Present

Search Strategy:

| | Searches | Results |
|----|--|---------|
| 1 | (search*.ti. and search*.ab.) or ((query* or queries).ti. and (query* or queries).ab.) | 9892 |
| 2 | search*.ab. /freq=2 or query*.ab. /freq=2 or queries.ab. /freq=2 or (query* and queries).ab. | 56987 |
| 3 | 1 or 2 | 60487 |
| 4 | search engine/ or Libraries, Medical/st [Standards] | 1012 |
| 5 | "Information Storage and Retrieval"/ or MEDLINE/ or PubMed/ or Databases, Bibliographic/ or "Sensitivity and Specificity"/ or "Abstracting and Indexing as Topic"/ or Subject Headings/ or Medical Subject Headings/ or Vocabulary, Controlled/ or Databases as Topic/ | 319574 |
| 6 | (precision or recall or sensitivity or relevance or specificity).tw. | 996530 |
| 7 | 4 or 5 or 6 | 1193233 |
| 8 | 3 and 7 | 9746 |
| 9 | ((search* or query* or queries) adj3 (quality or error*)).tw. | 871 |
| 10 | 8 or 9 | 10486 |
| 11 | Data Compression/ or Bioinformatics/ or exp computational biology/ or exp Molecular Sequence Data/ | 881772 |
| 12 | (molecular or DNA or RNA or computation* or genome or spectra or spectro* or chromatog*).tw. | 2431772 |
| 13 | "cochrane database of systematic reviews".jn. | 11092 |
| 14 | ("a meta analysis" or "a systematic review and meta analysis").tw. | 37004 |
| 15 | 11 or 12 or 13 or 14 | 2921519 |
| 16 | 10 not 15 | 7013 |
| 17 | limit 16 to yr="2005 -Current" | 5028 |
| 18 | (2005\$ or 2006\$ or 2007\$ or 2008\$ or 2009\$ or 2010\$ or 2011\$ or 2012\$ or 2013\$ or 2014\$ or 2015\$).ed. | 8785197 |
| 19 | 16 and 18 | 4845 |
| 20 | 17 or 19 | 5197 |

APPENDIX D: PRESS DATA ABSTRACTION FORM

SUBMIT FORM and go to **Next Form, New Instance - This reference** or [Skip to Next](#)

1. Is this a tool?

- Yes- Reporting guideline
- Yes- Tool for evaluation training
- Yes- Tool for peer review
- Yes- Tool for quality assessment
- Yes- Other (specify) _____
- Exclude- How to search/Filter
- Exclude- not relevant

2. Which of the following are discussed? (check all that apply)

- Translation of the research question
- Boolean and proximity operators
- Subject headings
- Natural language (also free-text or text-word)
- Spelling, syntax and line numbers
- Limits and filters
- Search strategy adaptations or the search plan (such as choice of databases or non-electronic methods)
- Other (specify) _____
- Other (specify) _____
- Other (specify) _____
- Other (specify) _____

3. This paper presents: (check all that apply)

- Research evidence regarding search performance
- Theoretical rationale for impact on search performance
- Frequency of error in a particular population
- Can't tell
- None of the above

4. The major impact discussed is: (check all that apply)

- Recall (sensitivity)
- Precision
- Specificity
- Cost/time
- Peer reviewing
- Other (describe)
- Can't tell
- None of the above

5. Summarize the evidence, noting page number after each statement. Place cut/paste in quotations please. Provide enough detail that the full article will not need to be consulted to write up the results.

6. Is it validated?

- Yes
- No

7. Is it evidence-based?

- Yes (describe / cite evidence)
- No

8. Should this paper be flagged for our introduction or discussion section?

- Yes
- No

SUBMIT FORM

and go to

Next Form, New Instance - This reference



or [Skip to Next](#)

APPENDIX E: INVITATION TO PRESS UPDATE 2015 DELPHI FORUM TELECONFERENCE

June 3, 2015

Dear xxx

I am sending you this invitation to request your participation in a Delphi Forum teleconference about PRESS (Peer Review of Electronic Search Strategies). The date of the teleconference is Thursday July 9, 2015, from 9:00 to 1:00 EDT (at CADTH, the host institution, in Ottawa). The goal of the forum is to help with updating the PRESS guideline.

On behalf of the Canadian Agency for Drugs and Technologies in Health (CADTH), we will be updating our 2008 systematic review on identifying the evidence base regarding which factors have an impact on search results (such as recall and precision). The Delphi Forum teleconference will be informed by updated literature searches. These will form the evidence base along with the results of a survey of librarians and information specialists involved in performing searches for health technology assessment reports and systematic reviews. The survey will be conducted in late June 2015.

The results will be summarized in a CADTH report and written up in the form of a manuscript for publication.

As a panel member, your role would include the following:

- Familiarize yourself with PRESS materials (which we will provide)
- Participate in the PRESS survey
- Participate in the PRESS Delphi Forum teleconference on July 9, 2015
- Review any materials that result from the PRESS meeting.

In recognition of your work, we would be pleased to acknowledge you as a contributor in the report. If you are willing to participate, please let me know by Tuesday, June 9, 2015 and send me a signed version of the attached participant form by email. I hope very much that you will be able to accept this invitation. If you have any questions, please feel free to contact me.

Sincerely,

Jessie McGowan, PhD, AHIP
Principal investigator
jessiemgowan@rogers.com
Carol Lefebvre
Co-lead Investigator
carol@lefebvreassociates.org
Margaret Sampson
Advisor
msampson@iname.com

APPENDIX F: PRESS DELPHI FORUM PARTICIPANT LIST AND AGENDA

We gratefully acknowledge the work of the PRESS Delphi Forum participants.

ON SITE AT CADTH:

Jessie McGowan (Principal investigator)
 Margaret Samson (Advisor)
 Vicki Foerster (Facilitator)
 Sarah Calder (CADTH – MLIS student – recorder)
 David Kaunelis (CADTH)
 Shaila Mensinki (CADTH)
 Lindsay Sikora (U of Ottawa)
 Carolyn Spry (CADTH)

VIA TELECONFERENCE:

Carol Lefebvre (Co-lead investigator)
 Deirdre Beecher (UK)
 Su Golder (UK)
 Kate Misso (UK)
 Linda Slater (U of Alberta, Edmonton)

AGENDA

| Item | Time | Documents |
|---|---------------|--|
| Introductions and overview | 9:00 – 9:15 | PRESS Delphi teleconference final.ppt (needed throughout) |
| Results of pre-meeting activities and relevant evidence | 9:15 – 9:45 | <ul style="list-style-type: none"> • PRESS forum - Worksheet and Submission Form • PRESS full checklist tips |
| Break | | |
| Discussion and consensus building | 10:00 – 11:15 | <ul style="list-style-type: none"> • Systematic review results - draft July 6, 2015 • Preliminary survey data - draft July 6, 2015 |
| Other aspects of the peer review process | 11:15 – 12:15 | Systematic review results - draft July 6, 2015 |
| Knowledge translation strategy and wrap-up | 12:30 – 1:00 | <ul style="list-style-type: none"> • An evidence based checklist for the peer review of electronic search strategies – 2010 • CADTH PRESS peer review electronic search strategies |

APPENDIX G: PRESS SURVEY

Survey Instructions

PRESS Update 2015 Survey

Thank you for your interest in our survey and project to update the PRESS checklist. We are conducting this survey on behalf of CADTH. CADTH is an independent, not-for-profit organization responsible for providing Canada's health care decision-makers with objective evidence to help make informed decisions about the optimal use of drugs and medical devices in our health care system. CADTH receives funding from Canada's federal, provincial, and territorial governments, with the exception of Quebec.

You are being asked to participate in a web-based survey to discuss your experiences in searching for health technology assessment (HTA) reports and systematic reviews (SRs).

You will never be personally identified as a participant in this study. Information will generally be presented in summary form, but some individual responses may be presented as part of the findings. Individual responses will be included as direct quotations, with no identifying information provided.

Participation is entirely voluntary. Your consent to participate will be implied once you proceed with the survey.

What is PRESS

PRESS is: Peer Review of Electronic Search Strategies. PRESS includes a checklist of search elements that have been empirically shown to have an impact on search results. The importance of the search quality in a SR or HTA report is to ensure an accurate and complete evidence base is used. Therefore, a validated process for evaluating the quality and completeness of the evidence base for systematic reviews, including HTA reports, is important.

What is the goal of this survey?

To obtain an understanding of experiences and perspectives related to the use of the PRESS checklist and the items included in it.

Who can participate?

Librarians, Information Specialists and information scientists who are involved in performing searches for HTA reports and systematic reviews.

How will the information be used?

Findings from this survey will be used to inform the agenda for the upcoming PRESS Update 2015 survey on July 9, 2015. Results from this survey will be shared at the meeting.

What is involved?

You will be asked to complete an online web-based survey. The survey includes items about your experience using the PRESS checklist and peer reviewing literature searches.

How long will it take?

The survey takes approximately 15 minutes to complete.

How can I get a summary of the study results?

We will present the results at the PRESS Update 2015 survey on July 9, 2015. We will summarize the results in a CADTH report that will be posted on www.cadth.ca and results from the survey will be written up in the form of a manuscript for publication.

Who can I contact if I have questions?

If you have any questions please contact Jessie McGowan, Principal investigator, at jessiemcgowan@rogers.com.

Question 1: What best describes your current position? (Please select one best answer).

- Librarian/ Information Specialist/ Information scientist
- Researcher
- Clinician
- Educator
- Student
- Other, please specify... _____

Question 2: Which of these best describes your place of work? (Please select one best answer).

- University (or other Academic Institution)
- Hospital
- Research / Knowledge Production Organization
- Service Provider Organization (community)
- Other, please specify... _____

Question 3: What is your formal training/degree? (Pick all that apply)

- MLIS / MA / MSC in Library / Information Studies
- Bachelor degree in library science or equivalent
- Library technician or college equivalent
- PhD Epidemiology
- MD (physician)
- MSc Epidemiology
- Other, please specify... _____

Question 4: How many years of experience do you have in searching for systematic reviews (SRs) or health technology assessments (HTAs)?

Question 5: How many years of experience do you have doing systematic reviews (SRs) or health technology assessments (HTAs)?

Question 6: How many systematic reviews (SRs) or health technology assessments (HTAs) have you been involved in?

Question 7: What country are you responding from?

- Canada
- United Kingdom
- United States
- Other, please specify... _____

PRESS elements

Please note the following definitions for this section. Recall: Proportion of relevant items in database retrieved by search. Also called sensitivity. Most searches for systematic reviews (SRs) and health technology assessment (HTAs) try to achieve highest practical recall, often at expense of precision. Precision: Proportion of retrieved items that is relevant. Equivalent to positive predictive value.

Question 8: PRESS element

For each for the PRESS elements, we are asking you to tell us about how important you feel each element is and its impact on recall and precision.

| | How important do you feel this element is? (1=most important-4=least important) | The potential negative impact of this element on recall is (chose one): Rating (1=most important- 4=least important) | The potential negative impact of this element on precision is (chose one): Rating (1=most important-4=least important) |
|--|--|---|---|
| Translation of the research question (Example: Has the research question been translated correctly into search concepts (e.g. PICO), i.e. does the search strategy match the research question?) | <input type="radio"/> 1 | <input type="radio"/> 1 | <input type="radio"/> 1 |
| | <input type="radio"/> 2 | <input type="radio"/> 2 | <input type="radio"/> 2 |
| | <input type="radio"/> 3 | <input type="radio"/> 3 | <input type="radio"/> 3 |
| | <input type="radio"/> 4 | <input type="radio"/> 4 | <input type="radio"/> 4 |
| Boolean and proximity operators (Example: Are there any mistakes in the use of Boolean or proximity operators?) | <input type="radio"/> 1 | <input type="radio"/> 1 | <input type="radio"/> 1 |
| | <input type="radio"/> 2 | <input type="radio"/> 2 | <input type="radio"/> 2 |
| | <input type="radio"/> 3 | <input type="radio"/> 3 | <input type="radio"/> 3 |
| | <input type="radio"/> 4 | <input type="radio"/> 4 | <input type="radio"/> 4 |
| Subject headings (Example: Are the subject headings relevant or are subject headings missing? Are any subject headings too broad or too narrow? Are subject headings exploded where necessary and vice versa?) | <input type="radio"/> 1 | <input type="radio"/> 1 | <input type="radio"/> 1 |
| | <input type="radio"/> 2 | <input type="radio"/> 2 | <input type="radio"/> 2 |
| | <input type="radio"/> 3 | <input type="radio"/> 3 | <input type="radio"/> 3 |
| | <input type="radio"/> 4 | <input type="radio"/> 4 | <input type="radio"/> 4 |

Natural language (also free-text or text-word) - Example:
Does the search miss any spelling variants in free-text?
Does the search miss any synonyms? Does the search miss truncation or truncate at the wrong point?

- 1 1 1
- 2 2 2
- 3 3 3
- 4 4 4

Spelling, syntax and line numbers Limits and filters
(Examples: Do any of the limits used seem unwarranted?
Are any filters used appropriate for the topic?)

- 1 1 1
- 2 2 2
- 3 3 3
- 4 4 4

Search strategy adaptations (Example: Does the searcher indicate that the search strategy has been adapted for additional databases and / or interfaces?)

- 1 1 1
- 2 2 2
- 3 3 3
- 4 4 4

Question 9: Please describe other errors that should be considered (this question is optional, please skip if you have no suggestions). Please describe the element and add information on the following: a) The potential negative impact of this additional element on recall is b) The potential negative impact of this additional element on precision is:

New element 1

New element 2

Question 10: When should peer review of electronic search strategies (PRESS) be done? (Please select one best answer).

- Once the MEDLINE search is developed but before other database searches are developed
- After all database searches have been developed
- Never
- Other, please specify... _____

Question 11: What types of compensation would be acceptable for peer reviewing? Please check all that seem reasonable.

- Payment (with an invoice)
- Payment (honorarium)
- Continuing education credits
- Voluntary
- Reciprocal service (I do one for you, you do one for me)
- Part of standard work duties
- Recognition through acknowledgement on published report
- Other, please specify... _____
- Other, please specify... _____

Question 12: How many peer reviewers are necessary to peer review the search strategy? (Please select one best answer).

- One
- Two
- Unsure
- Peer review unnecessary
- Other, please specify... _____

Question 13: What should the turn-around time be for a PRESS review? (Please select one best answer).

- One day
- Two days
- Three days
- One week
- Two weeks
- One month
- Other, please specify... _____

Question 14: How often the search should be peer reviewed? (Please select one best answer).

- Once - the searcher makes any changes at their discretion.
- Twice - if any substantial issues need to be addressed.
- Other, please specify... _____

Thank-you for completing this survey!