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A Novel Search Builder to Expedite Search Strategies for Systematic Reviews

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Abstract

Objectives—Developing a search strategy for use in a systematic review is a time-consuming process requiring construction of detailed search strings using complicated syntax, followed by iterative fine-tuning and trial-and-error testing of these strings in online biomedical search engines.

Methods—Building upon limitations of existing online-only search builders, a user-friendly computer-based tool was created to expedite search strategy development as part of production of a systematic review.

Results—Search Builder 1.0 is a Microsoft Excel®-based tool that automatically assembles search strategy text strings for PubMed (www.pubmed.com) and Embase (www.embase.com), based on a list of user-defined search terms and preferences. With the click of a button, Search Builder 1.0 automatically populates the syntax needed for functional search strings, and copies the string to the clipboard for pasting into Pubmed or Embase. The offline file-based interface of Search Builder 1.0 also allows for searches to be easily shared and saved for future reference.

Conclusions—This novel, user-friendly tool can save considerable time and streamline a cumbersome step in the systematic review process.

Keywords

Systematic review; Software tool; Microsoft Excel; Search builder

Supplementary Material: Supplementary Files 1 and 2 http://dx.doi.org/10.1017/S0266462315000136

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A key step in the systematic review process is the development of a search strategy to identify all pertinent research studies (1;2). This process comprises several exhaustive steps, including brainstorming relevant search terms and iteratively modifying the search query to produce a targeted yet comprehensive citation list. To assemble error-proof queries for use in commonly used biomedical search engines, such as PubMed (www.pubmed.com) and Embase (www.embase.com), users must have prior knowledge of field codes (i.e., text word = [tw], medical subject headings = [MeSH Terms], publication type = [pt], language = [la]), Boolean operators (i.e., “AND”, “OR”, and “NOT”), and rules for proper parenthetical grouping. For example, for a review investigating the association of migraine headaches with incident stroke, a PubMed search string limited to research manuscripts in the English language could appear as follows: (“migraine headache” [tw] OR headache [MeSH Terms]) AND (“cerebrovascular disorders” [MeSH Terms] OR stroke [MeSH Terms]) NOT (review[pt]) AND (english[la]) AND (humans[All Fields]). Without detailed knowledge of search syntax and phraseology, constructing such a string could be time-consuming, confusing, and prone to typographical errors.

Despite these complexities, few automated tools currently exist to assist users with the syntax involved in the assembly of search strings. Moreover, the available builder tools offered from PubMed and Embase, which can be accessed using “Advanced” links on their respective homepages, do not allow users to easily share search stings. Such limitations subsequently add time and complicate the systematic review search process (3;4), and may discourage co-authors from assisting each other on this lengthy task.

Development

Context

Search Builder version 1.0 was created by a member of the authorship team (B.B.K.) as part of a systematic review and meta-analysis course at the Johns Hopkins Bloomberg School of Public Health in Baltimore, Maryland. During this course, four- to five-member student teams produced systematic review manuscripts with guidance from skilled experts in systematic review methodology. For the search strategy process, the student teams were instructed to use traditional search methods, including manually listing relevant search terms (using keywords from literature on the topic, medical subject headings [“MeSH”] indexed on PubMed and search strategies from previous systematic reviews), constructing a search text string using appropriate syntax, and iteratively testing the search string in online biomedical search engines such as PubMed and Em-base. Because all team members were expected to perform this step, individual efforts to construct search strings resulted in person-to-person variability in search terms included syntax used and observed search results, thus slowing an already cumbersome process. Moreover, attempted use of available online search builder tools offered by PubMed and Embase revealed them to be inefficient for use as a group, and difficult to save due to the online-only, login-required interface.

To overcome the inconveniences of the search strategy process, the first author (B.B.K.) created a file in Microsoft Excel® that could automatically add search string syntax to a user-provided list of search terms. A prototype-version of this file was quickly adopted by the systematic review team and lauded as a valuable time-saving tool due to features such as

offline usage, rapid inclusion and exclusion of search terms, and the ability to save, share, and repeatedly edit versions of the search string. After successful use of the search builder prototype for the systematic review course, the first author (B.B.K.) received assistance from an engineer and Microsoft Excel® expert (B.S.K.) who fine-tuned the builder program, and a team of research associates (P.A.S., S.S., J.O.) tested the builder product. After completion of pilot testing, Search Builder 1.0 was finalized for public dissemination.

Description

Search Builder 1.0 is a Microsoft Excel® tool that takes a user-defined list of search terms and automatically assembles a search string that can be copied and pasted into PubMed or Embase (see Table 1). Users of Search Builder 1.0 enter desired search terms into the spreadsheet and subsequently assign each with a "PICO" (Population, Intervention, Comparison group, and Outcome) category, limit (i.e., language, article type, species), or a custom user-defined category, and a field code (i.e., PubMed: title/abstract = [tiab], [All Fields], medical subject headings = [MeSH Terms], Embase: explosion = /exp, synonym = / syn, title/abstract = :ti,ab). Once the term list is populated simple buttons on the spreadsheet instantly sort and group the terms, assign Boolean operators, create the search string, and copy the string to the clipboard for pasting into PubMed or Embase. For search terms not falling under traditional "PICO" categories, users can manually enter custom category labels for Search Builder 1.0 that can automatically be sorted grouped and processed in a similar manner as PICO terms. Once the search string is generated, users may quickly add or subtract terms to the string using a yes/no option, facilitating the rapid iterative search string edits necessary to reach a desired search result. Importantly, users do not need to directly edit the search string text, minimizing the possibility of parenthetical and Boolean typographical errors that may cause search errors. To ensure the reproducibility of search strategies for future searches, the user can save, archive, and share the search string file at any time, and in any location on their personal computer.

Discussion

Search Builder 1.0 is a tool that streamlines the time-consuming process of using complicated syntax to assemble search strings for systematic reviews. Given its straightforward user interface and Microsoft Excel® file-based platform, Search Builder 1.0 is a simple freestanding alternative to existing Web-based builders that require users to login to save searches and lack tools for search string sharing. While Search Builder 1.0 is designed for use with searches in PubMed or Embase, future versions may include other biomedical search engines such as CINAHL, PsychInfo, and Web of Science.

At this time, we are pleased to offer Search Builder 1.0 (Microsoft Excel® file with User Guide) to the readers of the *International Journal of Technology Assessment in Health Care* (Supplementary Files 1 and 2). Users of Search Builder 1.0 must have a macro-enabled version of Microsoft Excel® (version 2003 and later for Personal Computer (PC), version 2011 for Macintosh). The PC and Macintosh versions of Search Builder 1.0 are available at: hopkinsmedicine.org/pulmonary/research/outcomes_after_critical_illness_surgery/oacis_publications.html#SysReviewMeta.

Conclusion

Search Builder 1.0 is a novel Microsoft Excel®-based tool used to generate, archive, and share complex search strings for use in PubMed and Embase. This user-friendly tool can save considerable time in the systematic review process.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Karimi S, Pohl S, Scholer F, Cavedon L, Zobel J. Boolean versus ranked querying for biomedical systematic reviews. BMC Med Inform Decis Mak. 2010; 10:58. [PubMed: 20937152]
2. McGowan J, Sampson M. Systematic reviews need systematic searchers. JMedLibr Assoc. 2005; 93:74–80.
3. Montori VM, Swiontkowski MF, Cook DJ. Methodologic issues in systematic reviews and meta-analyses. Clin Orthop Relat Res. 2003; 413:43–54. [PubMed: 12897595]
4. Allen IE, Olkin I. Estimating time to conduct a meta-analysis from number of citations retrieved. JAMA. 1999; 282:634–635. [PubMed: 10517715]

Table 1
Developing a Search Strategy for Systematic Review

Step	Details	Helpful Search Builder 1.0 Feature
Assign general terms to “PICO” or user-defined custom categories	Determine essential terms for a given search for “Population,” “Intervention” (or “Exposure”), “Comparison Group,” “Outcome,” or a user-defined category	“Category/Limit” column with dropdown menu to assign PICO or user-defined categories to each search term, and subsequently sort and group similar terms
List synonyms for each search term	Brainstorm potentially relevant terms from publication keyword lists, medical subject headings (available in PubMed), previous systematic reviews, and dictionaries	Populate list of up to 300 terms, decide on whether to include or exclude individual terms by typing or deleting the word “No” in the “Use Term?” column
Assign field codes to each term	Field codes include [MeSH] (medical subject headings) and [All Fields] in PubMed, and /exp (explosion) and :ti,ab (search for term within titles and abstracts only) in Embase	Dropdown menu of popular field codes eliminates the need to enter codes manually
Group synonymous search terms	Use parenthetical grouping and Boolean operators “OR” to link synonyms, “AND” to link groups of terms, and “NOT” to exclude specific terms	“Sort” button allows for synonymous terms to be listed together and “Create String” button automatically groups terms using parentheses and Boolean operators
Define essential search inclusions and exclusions	Article type (i.e., exclude review articles), species (i.e., humans), language (i.e., English)	Detailed instructions provided for use of dropdown menus to append inclusion/exclusion criteria to search string
Assemble search string	Combine search terms, Boolean operators, and parenthetical syntax	Performed automatically with click of “Create String” button
“Fine tuning” of final of search string	Cut-and-paste search string into biomedical search engine, iteratively deconstruct and rebuild before settling on final string	Type “No” in “Use Term?” column to exclude term. Delete “No” to include term. Press “Copy Search String” button to automatically copy string to clipboard for pasting into search engine