Using PubMed for Evidence-Based Dentistry

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Quickly finding high-quality scientific studies is an important part of the evidence-based process. PubMed, which is a free gateway to journal literature for the health sciences, is a common platform used by dentists and dental hygienists for this purpose. This article highlights lesser-known features of PubMed that can greatly improve a clinician's ability to find high-quality evidence. *Int J Evid Based Pract Dent Hygienist 2016;2:159–163. doi: 10.11607/ebh.94*

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PubMed (http://www.pubmed.gov) is a popular gateway to the health sciences literature. It is commonly taught as a resource in dentistry and dental hygiene programs and effectively connects users to articles published in health sciences journals. Anyone who is able to get online can search PubMed freely. This ease of access contributes to its popularity and to the large volume of searches it handles each year (2.8 billion in 2015).[1]

While PubMed is relatively easy to search, there is no all-encompassing strategy that ensures perfect result sets. Inevitably, clinicians will at some point be confronted with results that are either too numerous or too scant. In both scenarios, the clinician is in a quandary, particularly when pressed for time and in need of an article to inform a decision. In this article, I highlight three features that can make the hunt for strong evidence in PubMed more successful.

Clinical Queries

The most important PubMed feature for the practice of evidence-based dentistry is the Clinical Queries feature, which separates primary clinical studies and systematic reviews in the results (Fig 1). As seen in Forrest and Gurenlian's search for evidence on electronic cigarettes for smoking cessation,[2] the benefit of this visual breakdown is that the studies that provide a higher form of evidence—the systematic reviews—are easily visible to clinicians. While these studies would appear in a regular PubMed search, they would fall within the same set of results as all other studies, making them more difficult to find.

In addition to systematic reviews, Clinical Queries also highlights primary clinical studies and lets you focus your search on the studies most appropriate for your question. From the page shown in Fig 1, you can do this by using the "Category" menu to select your question type. "Therapy" is the default option, but you can choose "etiology," "diagnosis," "prognosis," and "clinical prediction guides" as well. The "Scope" menu loosely

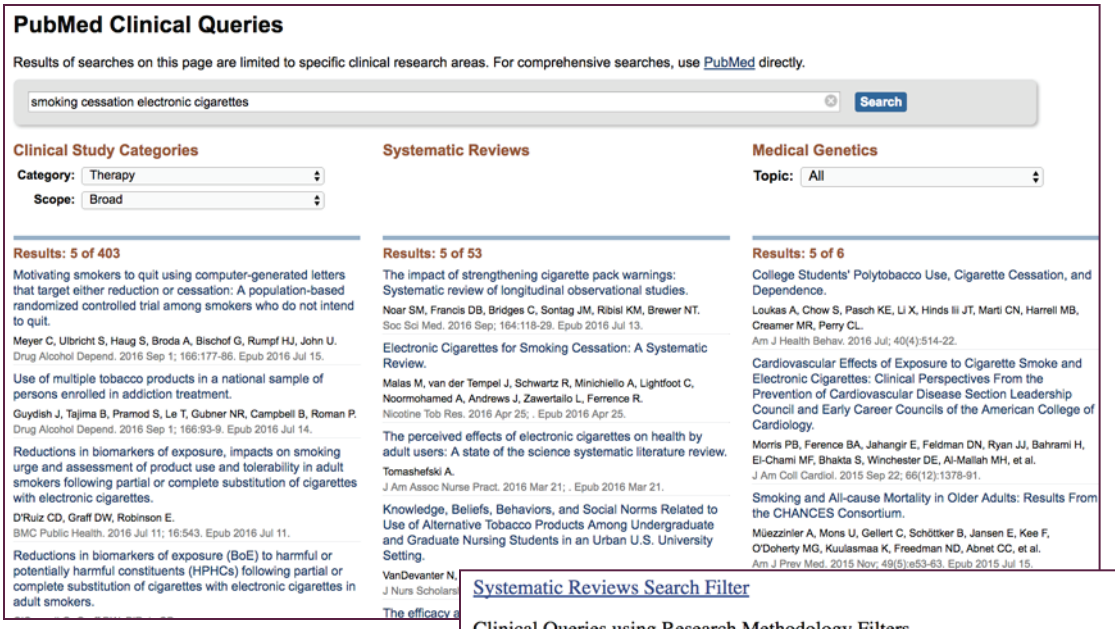


Fig 1 (above) *PubMed Clinical Queries.*

Fig 2 (right) *The methodologic filter in Clinical Queries for "therapy/broad" and "therapy/narrow."*

Systematic Reviews Search Filter

Clinical Queries using Research Methodology Filters

Category	Optimized For	Sensitive/ Specific	PubMed Equivalent
therapy	sensitive/broad	99%/70%	((clinical[Title/Abstract] AND trial[Title/Abstract]) OR clinical trials as topic[MeSH Terms] OR clinical trial[Publication Type] OR random*[Title/Abstract] OR random allocation[MeSH Terms] OR therapeutic use[MeSH Subheading])
	specific/narrow	93%/97%	(randomized controlled trial[Publication Type] OR (randomized[Title/Abstract] AND controlled[Title/Abstract] AND trial[Title/Abstract]))

translates to the number of citations you want to appear in your results. Your selections correspond to a filter that is automatically applied to your search, and depending on your choices, you will retrieve different citations.

Figure 2 shows an example of this filter. If we are looking for studies on the use of electronic cigarettes for smoking cessation, we select the category "therapy," because in this instance the use of an electronic cigarette is a therapeutic intervention. If we select this category with the "broad" scope, we will retrieve a broad selection of clinical trials. If we select it with a "narrow" scope, we will retrieve randomized controlled trials specifically (we know this because the definition of the filters is available in PubMed's help documentation[3]). The filter information in Fig 2 can be difficult to interpret, but once understood tells you exactly what Clinical Queries is doing in every search.

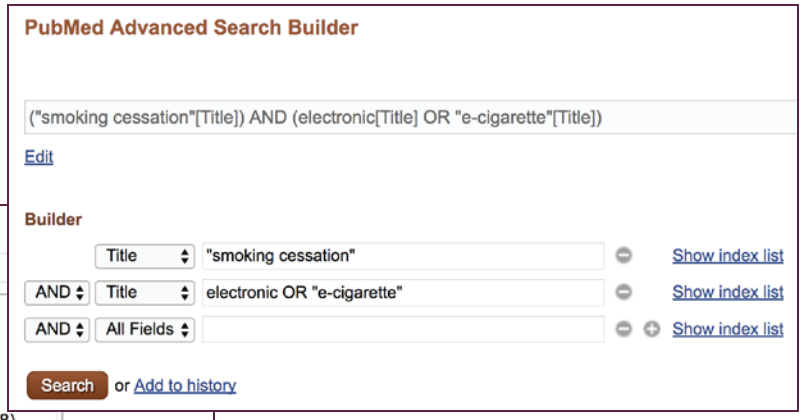
Search Builder

By default, PubMed searches an assortment of fields including "article title," "journal title," "authors," "affiliations," "abstracts," "subject headings," and others. While a search of these fields is useful, I often force PubMed to narrow its focus to the fields most likely to return relevant results: "article title" and "abstract." The benefit of this approach is that we will only retrieve citations that have our search terms in the title or abstract while the downside is that we rely completely on the author's use of our search terms in those fields. If the authors use a different phrase to refer to our search concept, then we will miss their study. Even still, this approach leads to smaller and more precise result sets.

To force a search in a specific field, PubMed offers the Search Builder, which is accessible from the

Fig 3 (right) *Example title search in Advanced Search Builder.*

Fig 4 (below) *Example MeSH search in Advanced Search Builder.*



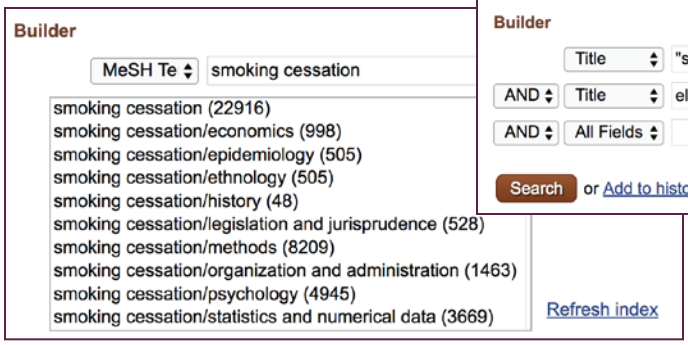


TABLE 1 Useful PubMed field tags for clinical searches

Field tag	PubMed translation	PubMed example	Interpretation
Title	[title] [ti]	caries[title] caries[ti]	Retrieves citations with *caries* in the article title
Title/abstract	[title/abstract] [tiab]	caries[title/abstract] caries[title]	Retrieves citations with *caries* in the title and/or abstract
MeSH	[mesh] [mh]	"dental caries"[mesh] "dental caries"[mh]	Retrieves citations indexed with the *dental caries* MeSH term
Dental journals	jsubsetd[text]	smoking cessation AND jsubsetd[text]	Retrieves citations published in dental journals
Journal	[journal]	caries AND "j dent hyg"[journal]	Retrieves citations published in a specific journal
Language	[language] [la]	caries AND english[la]	Retrieves citations published in a specific language
Date of publication	[dp]	caries AND 2011 : 2016[dp]	Retrieves citations published within a specific date range

advanced search page (Fig 3). In the pull-down menu, which is defaulted to "All Fields," select, as an example, "Title." If we still want to find studies on the use of electronic cigarettes for smoking cessation, then we can begin by seeing only those studies that have "smoking cessation" and "electronic" in their titles by filling out the Builder (in this search, I use "electronic" instead of "electronic cigarette" because I assume the former largely implies the latter when coupled with smoking cessation; this also allows for studies that might use similar but broader phrases such as "electronic nicotine delivery system"). I also use phrase searching, truncation, and the word OR in this example. For more information about this type of searching, please refer to the earlier article "Four Strategies for Finding Good Evidence Efficiently."[4]

As you experiment with the Builder, you may notice that your search terms automatically appear in the search box with a qualifier in square brackets. As we see at the top of Fig 3, typing *"smoking cessation"* in the search bar shows *("smoking cessation"[title])* above. The square bracket text is the code that informs PubMed of your intention to search a specific field. Once you memorize a few of these codes, or field tags as they are known in PubMed, you can bypass the Builder altogether and place them directly in your PubMed search. In Table 1, I include the field tags I use most frequently.

MeSH

Another component of PubMed that you will see in the Builder is MeSH. MeSH stands for Medical Subject Headings and is a formal tagging system, or controlled vocabulary, that is used to uniformly describe the majority of citations in PubMed. These tags, or controlled terms, are assigned to citations soon after

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("smoking cessation"[mh] OR
"smoking cessation"[ti]) AND
("electronic cigarettes"[mh] OR
electronic[ti] OR
"e-cigarette*"[ti])
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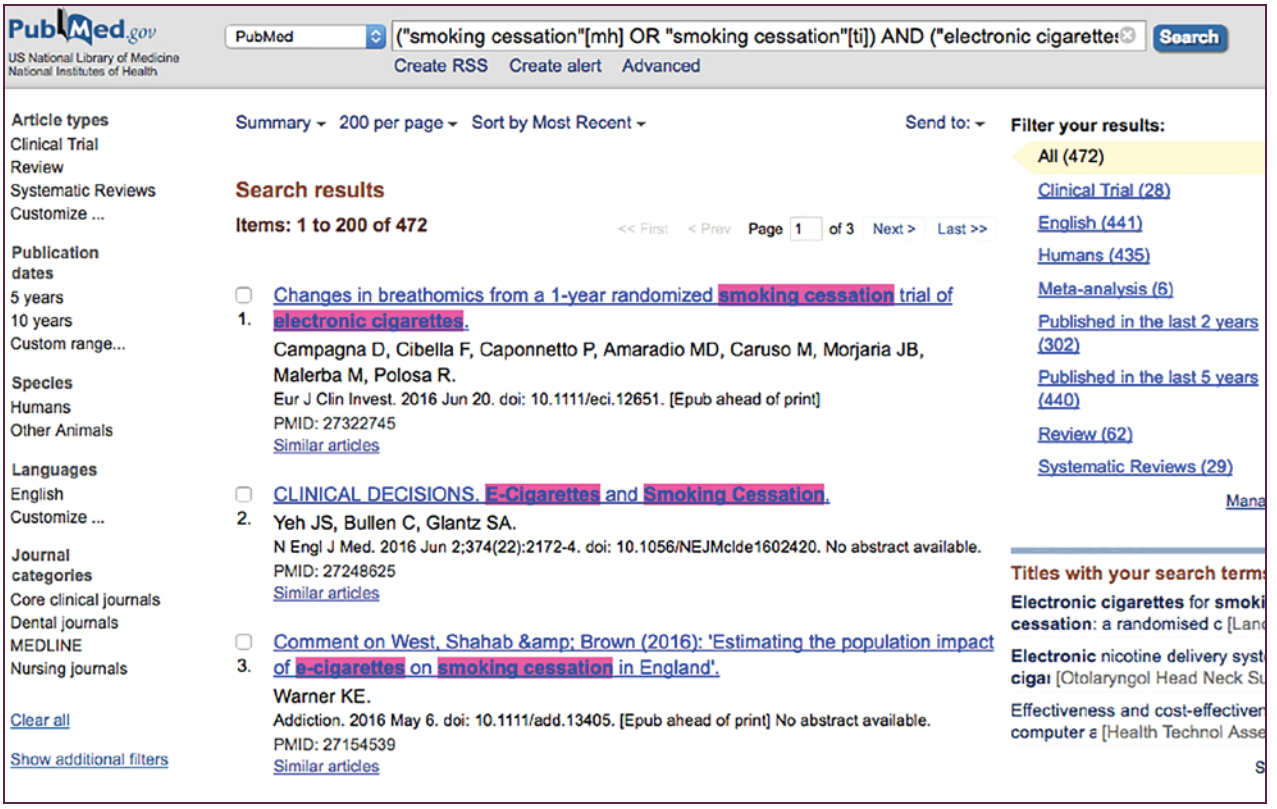
Fig 5 (left) *Example search with both MeSH and title field tags.*

Fig 6 (below) *PubMed search result page with standard filters* (left), *customized filters* (right), *and search term highlighting* (center).



they become available in PubMed. The strength of this vocabulary is that one controlled term equals one concept. In other words, studies on electronic cigarettes, regardless of the phrases authors use to refer to that concept, will be assigned the same controlled term and be indexed according to that term. In this case, the appropriate MeSH term for electronic cigarettes is, conveniently, electronic cigarettes. You can identify MeSH terms in the Builder by selecting "MeSH Terms" in the pull-down menu and clicking "Show index list" (Figs 3 and 4).

While you can usually search PubMed effectively without knowingly using MeSH, I tend to create searches that use a combination of the techniques already described (Fig 5). For example, if the goal of my search is to be precise with a low number of results and an understanding that relevant citations will be missed, I force PubMed to search the "title" field alone, as in Fig 3. However, if I want to cast a wider net, I combine the "title" search with a MeSH search, as in Fig 4. This search will retrieve more studies and will be more representative of the scientific evidence. The precision we achieve in Fig 3 comes at the cost of missed citations.

Neither approach is objectively better than the other; they both help you find relevant evidence. Ideally, you will learn to leverage both techniques to suit whatever your evidence need is at the time.

Filters

One of the strengths of PubMed, especially when compared to Google Scholar, is the depth of its indexing. A perfect example is MeSH, which, as described above, is the use of controlled terms to describe citations, making it easier to identify similar studies. Citations in PubMed are assigned MeSH terms and also categorized by their fundamental attributes, making it easier to apply meaningful parameters to your search. You can apply these parameters by using filters, which are options that appear alongside your results.

After running a search, you can quickly filter your results by article type, publication date, study subjects, and, if you click on "Show additional filters" at the bottom of the column, you can also filter by language, journal categories, and ages (Fig 6). The filters I find most useful within an evidence-based context are described in Table 1, along with shorthand for quick integration into PubMed searches. If you create an account in PubMed, you can create a custom set of filters that will appear to the right of your results. With a PubMed account you can also save searches, set up email alerts for new studies, change the number of results per page, have your search terms highlighted for easier scanning (as shown in Fig 6), and generally customize your PubMed display.

I should note that the more filters you apply to your search, the more likely you will miss relevant citations. This is in part because new citations are not immediately indexed with this information; that process takes time. Thus, by using the "humans" filter, you will miss human studies that have not yet gone through the indexing process. Nevertheless, the filters do allow for quick refinement and can help you hone in on quality evidence.

Conclusions

The developers at the National Library of Medicine (NLM) have done a wonderful job with PubMed over the years, making it an extraordinarily accessible resource for the health sciences journal literature. The features described in this article illustrate why the search for evidence in PubMed is becoming more straightforward and manageable, even as the number of articles published each year increases. The NLM has created a series of short online tutorials demonstrating how these and other PubMed features can be used effectively, and are available on the PubMed tutorials page (https://learn.nlm.nih.gov/rest/training-packets/T0042010P.html). By becoming facile with these core components of PubMed, clinicians will become better capable of integrating good science into their clinical work.

Acknowledgments

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