

# Search MEDLINE for Economic Evaluations: Tips to Translate an OVID Strategy into a PubMed One

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MEDLINE<sup>®</sup> is the US National Library of Medicine's (NLM) premier bibliographic database that contains over 20 million references to journal articles in life sciences. Records are indexed following the Medical Subject Headings (MeSH<sup>®</sup>), the NLM's controlled vocabulary thesaurus which consists of sets of terms naming descriptors in a hierarchical structure that permits searching at various levels of specificity (<http://www.nlm.nih.gov/pubs/factsheets/mesh.html>). The MEDLINE database is accessible from different sources. Beside PubMed<sup>®</sup> (<http://www.ncbi.nlm.nih.gov/pubmed/>), the free access to MEDLINE provided by the NLM, several commercial companies provide their own interface, among them Wolters Kluwer Health with OvidSP (<http://gateway.ovid.com>).

**1. MEDLINE search filters** Search filters are collections of search terms designed to retrieve records reporting study designs, such as economic evaluations [1]. The InterTASC Information Specialists' Subgroup Search filter resource provides a comprehensive source of filters, including a section on economics (<http://www.york.ac.uk/inst/crd/intertasc/econ.htm>) [2]. In Health Technology Assessment (HTA), researchers usually value high sensitivity to minimize risk of bias by missing relevant articles [1]. The NHS EED filter (available at [http://www.york.ac.uk/inst/crd/intertasc/nhs\\_eed\\_strategies.html](http://www.york.ac.uk/inst/crd/intertasc/nhs_eed_strategies.html)), designed by the Centre for Reviews and Disseminations (CRD), is one of the most sensitive filters in MEDLINE [1].

Search filters are often designed for OVID MEDLINE; some are available with a “translation” for PubMed (e.g.

HIRU Hedges [http://hiru.mcmaster.ca/hiru/HIRU\\_Hedges\\_MEDLINE\\_Strategies.aspx](http://hiru.mcmaster.ca/hiru/HIRU_Hedges_MEDLINE_Strategies.aspx)). Many researchers are familiar with the freely accessible PubMed. Access to OVID MEDLINE is not always provided by their institution, or the access is not known by the researchers. Currently, CRD only provides the OVID MEDLINE version of its economic evaluations search filter. The absence of a PubMed “translation” can entail methodological problems since the search interfaces present important differences in their syntax.

**2. Aim and approach** In our experience, differences in the query language of OVID and PubMed appear often to be unknown. Not taking this into account can result in a huge different number of hits when a “similar” search is conducted in PubMed using the original OVID-MEDLINE strategy. Our aim is thus to provide further insight in the differences between searching OVID MEDLINE and PubMed and to provide a transparent translation of an OVID search strategy for economic evaluations to PubMed in order to improve economic search strategies of those who do not have access to OVID.

First, differences in query language between search interfaces are summarized in a table. Second, CRD's search strategy for identifying economic evaluations ([www.york.ac.uk/inst/crd/intertasc/nhs\\_eed\\_strategies.html](http://www.york.ac.uk/inst/crd/intertasc/nhs_eed_strategies.html)) is applied to OVID MEDLINE. At the same time, a translation of this search filter is developed and applied to PubMed. Results are transparently presented per search term. Both the “quick and dirty” (copy pasting the OVID query in PubMed) and the correct translations (taking into account the specificities of both interfaces) are provided.

**3. From OVID to PubMed** Table 1 provides a short overview of differences in query language, which was used as a reference to build the PubMed translation of the CRD economic evaluation search filter.

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**Table 1** Similarities and differences in MEDLINE OVID and MEDLINE PubMed query language

MEDLINE OVID	MEDLINE PubMed
Searches can be combined with Booleans ‘and’, ‘or’ or ‘not’	
Limitation of searches to specific fields is possible (e.g. limit search to title and abstract)	
Working with limits is possible (e.g. publication year)	
Mesh terms are not exploded by default	Mesh terms are exploded by default
Adjacent operator ‘adjn’ can be used to retrieve records with search terms within <i>n</i> number of words from each other	There is no adjacent operator
Truncation: ‘*’ or ‘\$’	Truncation: only ‘*’
Mandated wildcard: ‘#’	Not available
Optional wildcard: ‘?’	Not available

Remark: similarities and differences in searching both databases are limited to those in the query language that are relevant for the search strategy in this article. Details on other differences (e.g. the types of included citations in both databases) are available elsewhere ([http://www.nlm.nih.gov/pubs/factsheets/dif\\_med\\_pub.html](http://www.nlm.nih.gov/pubs/factsheets/dif_med_pub.html) or [http://www.dartmouth.edu/~library/biomed/guides/which\\_medline\\_chart.html?mswitch-redir=classic](http://www.dartmouth.edu/~library/biomed/guides/which_medline_chart.html?mswitch-redir=classic))

Table 2 provides an overview of the search strategy for economic evaluations in both search engines, including both an incorrect “quick and dirty” translation and a correct translation for PubMed.

Difference in the amount of hits is in the first place explained by the specificities of each database: OVID allows to search MEDLINE (MeSH indexed records) and “In-process and other non-indexed citations” at the same time or separately, depending on the settings selected by the researcher. It is preferred to do this separately since search strategies for indexed citations differ from those for non-indexed citations since MeSH terms cannot easily be applied for the latter. PubMed provides access to MEDLINE and “In-process and other non-indexed citations” at the same time, but also to a small set of supplemental records that will not be included into MEDLINE, and also very recent records ([http://www.nlm.nih.gov/pubs/factsheets/dif\\_med\\_pub.html](http://www.nlm.nih.gov/pubs/factsheets/dif_med_pub.html)).

Another difference lies in the default choice of OVID not to *explode Mesh terms*, while this happens automatically in PubMed (see Tables 1 and 2). Exploding a Mesh term means that all the terms in the thesaurus at a lower level of this Mesh term are automatically included in the search as well. This can make a huge difference as shown in Table 2: instead of about 26,000 hits, almost 474,000 hits are identified in PubMed for the MeSH term “economics” applying the “quick and dirty” translation. To reflect the original OVID search, the researcher needs to explicitly select the option ‘Do not include MeSH terms found below this term in the MeSH hierarchy’ when

searching PubMed through the MeSH database. The second search term illustrates the opposite: the Mesh term “Costs and cost analysis” is explicitly exploded in OVID (prefix “exp”). This is the default option in PubMed, and thus no further action is needed to achieve the same result.

In both OVID and PubMed, searches can be combined with a so-called *boolean* ‘and’, ‘or’, or ‘not’ (Table 1). There is no need to capitalize these operators. If not capitalized in PubMed, the search details show that this is automatically done by the system itself. The only difference is that in PubMed the number sign ‘#’ has to be added to refer to the required line. In OVID, it is also possible to use an *adjacent operator* (adj) that retrieves records with search terms next to each other or within a specified number of words (Table 1). For example, ‘adj4’ retrieves records that contain search terms within four words from each other in any order (<http://ospguides.ovid.com/OSPguides/medline.htm>). In contrast, PubMed does not offer any proximity operator. In the example shown in Table 2 this is not a problem since only ‘adj’ is used: ‘((energy or oxygen) adj cost).ti,ab’ gives exactly the same number of results as ‘(energy cost or oxygen cost).ti,ab’, and can thus be easily translated to PubMed. However, in case of e.g. ‘adj4’ it is not possible to fully translate the OVID strategy into a PubMed one.

Another difference between OVID and PubMed is the *truncation and wildcards* of search terms. In OVID (<http://ospguides.ovid.com/OSPguides/medline.htm>), truncation is supported by both ‘\*’ and ‘\$’. In contrast, PubMed only uses ‘\*’ as a wildcard. Other wildcards, not used in the search strategy for economic evaluations, also differ between OVID and PubMed. A mandated wildcard (#) can be used in the middle of a word. For example, ‘analys#s’ will search for both ‘analysis’ and ‘analyses’. The term mandated refers to the requirement that there needs to be a character at the position of ‘#’. For example ‘human#’ will look for ‘humans’ but not for ‘human’. In that case, an optional wildcard (?) should be used. For example, ‘model?ing’ will retrieve results that contain both ‘modelling’ and ‘modeling’.

The *limitation of searches to specific fields* can be performed in OVID by selecting ‘search fields’; in PubMed, this happens in the ‘PubMed Advanced Search Builder’. For example, limiting search terms to title and abstract is indicated by ‘.ti,ab’ in the OVID search strategy, and ‘[Title/Abstract]’ in PubMed. A major difference, however, is that this can be performed for a combination of terms in OVID, while this is not the case in PubMed. The limitation to specific search fields, such as ‘[Title/Abstract]’, has to be added for each individual search term (see line 8 in Table 2).

Finally, *working with limits* is possible in both OVID and PubMed. However, it should be emphasized that

**Table 2** CRD's search strategy for economic evaluations in OVID MEDLINE, and its didactic translation for PubMed (date: 18 October, 2013)

MEDLINE OVID			MEDLINE PubMed			
Search term	Hits		Quick and dirty translation	Hits	Correct translation	Hits
1	economics/	27,116	<i>"Economics"[Mesh]<sup>a</sup></i>	474,437	"Economics"[Mesh:NoExp]	26,379
2	exp "costs and cost analysis"/	182,544	"Costs and Cost Analysis"[Mesh]	173,176	"Costs and Cost Analysis"[Mesh]	173,176
3	economics, dental/	1,866	<i>"Economics, Dental"[Mesh]</i>	3,916	"Economics, Dental"[Mesh:NoExp]	1,854
4	exp "economics, hospital"/	19,403	"Economics, Hospital"[Mesh]	18,860	"Economics, Hospital"[Mesh]	18,860
5	economics, medical/	8,578	<i>"Economics, Medical"[Mesh]</i>	13,373	"Economics, Medical"[Mesh:NoExp]	8,524
6	economics, nursing/	3,879	"Economics, Nursing"[Mesh]	3,878 <sup>b</sup>	"Economics, Nursing"[Mesh]	3,878 <sup>b</sup>
7	economics, pharmaceutical/	2,605	"Economics, Pharmaceutical"[Mesh]	2,445 <sup>b</sup>	"Economics, Pharmaceutical"[Mesh]	2,445 <sup>b</sup>
8	(economic\$ or cost or costs or costly or costing or price or prices or pricing or pharmaco-economic\$).ti.ab.	427,344	<i>(economic* or cost or costs or costly or costing or price or prices or pricing or pharmaco-economic*)[Title/Abstract]</i>	4	economic*[Title/Abstract] or cost[Title/Abstract] or costs[Title/Abstract] or costly[Title/Abstract] or costing[Title/Abstract] or price[Title/Abstract] or prices[Title/Abstract] or pricing[Title/Abstract] or pharmaco-economic*[Title/Abstract]	444,684
9	(expenditure\$ not energy).ti.ab.	17,552	<i>(expenditure* not energy)[Title/Abstract]</i>	1	expenditure*[Title/Abstract] not energy[Title/Abstract]	17,838
10	value for money.ti.ab.	899	value for money[Title/Abstract]	840	value for money[Title/Abstract]	840
11	budget\$.ti.ab.	17,208	budget*[Title/Abstract]	18,572	budget*[Title/Abstract]	18,572
12	or/1–11	551,847	#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11	483,709	#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11	567,539
13	((energy or oxygen) adj cost).ti.ab.	2,752	<i>(energy cost OR oxygen cost)[Title/Abstract]</i>	0	energy cost[Title/Abstract] OR oxygen cost[Title/Abstract]	2,790
14	(metabolic adj cost).ti.ab.	798	metabolic cost[Title/Abstract]	801	metabolic cost[Title/Abstract]	801
15	((energy or oxygen) adj expenditure).ti.ab.	16,662	<i>(energy expenditure OR oxygen expenditure)[Title/Abstract]</i>	0	energy expenditure[Title/Abstract] OR oxygen expenditure[Title/Abstract]	16,249
16	or/13–15	19,503	#13 or #14 or #15	801	#13 or #14 or #15	19,126
17	12 not 16	547,502	#12 not #16	483,700	#12 not #16	563,162
18	letter.pt.	803,396	letter[Publication Type]	808,627	letter[Publication Type]	808,627
19	editorial.pt.	334,975	editorial[Publication Type]	336,772	editorial[Publication Type]	336,772
20	historical article.pt.	299,710	historical article[Publication Type]	316,603	historical article[Publication Type]	316,603
21	or/18–20	1,423,597	#18 or #19 or #20	1,447,821	#18 or #19 or #20	144,7821
22	17 not 21	519,461	#17 not #21	436,140	#17 not #21	535,685
23	Animals/	5,486,090	<i>animals[mesh]</i>	16,716,384	animals[mesh:noexp]	5,113,606
24	Humans/	13,631,608	humans[mesh]	12,891,976 <sup>b</sup>	humans[mesh]	12,891,976
25	23 not (23 and 24)	3,957,888	#23 not (#23 and #24)	3,824,408	#23 not (#23 and #24)	3,730,824
26	22 not 25	486,075	#22 not #25	432,067	#22 not #25	505,747

The MeSH is indicated by an ending '/' in OVID and a suffix '[Mesh]' in PubMed. These differences in syntax is not a major problem since OVID provides a link to map terms to these subject headings and PubMed also provides the possibility to search the MeSH database

<sup>a</sup> The PubMed search terms in *italics* are incorrect translations of the original OVID search terms

<sup>b</sup> In these cases, there is no difference between exploded or non-exploded Mesh terms since this is the last term in the hierarchical structure

these limits should be used in a sensible way. Limitations to e.g. publication year or publication types (see Table 2) are rather straightforward. On the other hand, limitations such as 'Humans' that only retrieve articles which are in this example about human subjects should be used with caution in a sensitive search strategy. This

may unintentionally exclude articles that are not explicitly indexed as such. A better approach for a detailed search strategy is to work the other way around and exclude articles that are explicitly indexed as animal studies and not as humans (see line 23–26 in Table 2).

At first sight, it might appear that the difference in the total number of identified references is not so big. This is because some search terms provide too much hits while others too few. In the end, it appears that only 45 % of the 505,747 references are found with the ‘quick and dirty’ search strategy (references in “correct translation” AND “quick and dirty” = 229,480), which demonstrates the importance of an appropriate translation.

**4. Conclusion** Basic rules of procedures (searching one term per line, transparency in the documentation of a search strategy, etc.) help to identify inconsistencies in the results of a search strategy, and thus achieve an efficient quality control. While search filters are really helpful to improve sensitivity and specificity of MEDLINE searches, researchers must be very careful when translating this part of the search strategy to another search interface: a good knowledge of the specificities of each search interface is

required to avoid unintentionally inconsistencies and shortcomings in the search strategy. This article provides a transparent translation of CRD’s OVID MEDLINE economic evaluation search filter to PubMed to support less experienced researchers searching for economic evaluations in the freely available PubMed bibliographic database.

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