Supplementary materials

Development and validation of search filters to identify articles on family medicine in online medical databases

D.H.J. Pols[1], W.M. Bramer[2], P.J.E. Bindels[1], F.A. van de Laar[3], A.M. Bohnen[1]

1. Department of Family Medicine, Erasmus MC, University Medical Center Rotterdam

2. Medical Library, Erasmus MC, University Medical Center Rotterdam

3. Department of Primary and Community Care, Radboud University Medical Center, Nijmegen

Corresponding author:

D.H.J. Pols

Dept. of Family Medicine

Erasmus MC, University Medical Center Rotterdam

PO Box 2040, 3000 CA Rotterdam, The Netherlands

Telephone: +31-10-7044824

Email: d.pols@erasmusmc.nl

Website: http://www.erasmusmc.nl/huisartsgeneeskunde/research

A detailed description of the methods used and results presented by Pols et al. is presented below.

Methods

WONCA definition

"General practitioners/family doctors are specialist physicians trained in the principles of the discipline. They are personal doctors, primarily responsible for the provision of comprehensive and continuing care to every individual seeking medical care irrespective of age, sex and illness. They care for individuals in the context of their family, their community, and their culture, always respecting the autonomy of their patients. They recognize they will also have a professional responsibility to their community. In negotiating management plans with their patients they integrate physical, psychological, social, cultural and existential factors, utilizing the knowledge and trust engendered by repeated contacts. General practitioners/family physicians exercise their professional role by promoting health, preventing disease, providing cure, care, or palliation and promoting patient empowerment and self-management. This is done either directly or through the services of others according to their health needs and resources available within the community they serve, assisting patients where necessary in accessing these services. They must take the responsibility for developing and maintaining their skills, personal balance and values as a basis for effective and safe patient care." [1]

Based on an analysis of the submitted answers to the questionnaire, the WONCA definition was shortened as followed:

General practice/family medicine is the frontline of health care. It is a place where a patient can go without referral. This specifically trained physician can be consulted for acute and chronic health-related matters. Family medicine is considered to be out-of-hospital (together with the emergency department) care.

Development of reference standard

Using Scopus, a list of 160 journals (in order of relevance for family medicine) was compiled. Five journals with a high rating (top 20) and five journals with a low rating were randomly taken from this list (table 3). From the obtained list of journals, 1000 articles published in the randomly selected year 2009, with abstracts and MeSH terms, were randomly selected. These articles were imported in EndNote and anonymized, showing only the titles, abstracts and keywords to the reviewers. Two independent reviewers (DP and FvdL) classified the articles as being relevant or irrelevant to family medicine using the shortened definition based on the WONCA definition. If the anonymized information was not sufficient for a classification, all bibliographic data or even the full text was provided. Articles that refer to family medicine were tagged 'positives'. From this reference standard, two random sets were derived: a term identification set containing 1/3 of the reference standard and a development set containing 2/3 of the reference standard.

Generating a list of potentially useful terms

Using specialized software (PubReMiner[2] and AntConc[3]) candidate filter terms and phrases were derived in the term identification set from the bibliographic information of positive articles based on frequency of occurrence. Each retrieved term (MeSH term, text word or text phrase) was subsequently combined with various PubMed field codes ([mh]; [mh:noexp]; [mj]; [mj:noexp]; [sh]; [all fields]; [ad]; [tw]; [tiab]; [ti]). We included candidate filter terms for further analysis if that term retrieved at least 5% of the positive articles. Furthermore, the ratio between the percentage of positive articles containing the term and the percentage of negative articles containing the term had to be ≥ 1, and this ratio had to be significant (Chi-square test: $p<0.05$).

Creating and validating a sensitive and specific filter

With a list of candidate terms and phrases retrieved during the process described above, optimal search filters were created in the development set. The sensitive filter was created by sorting the

search terms by accuracy. One by one, the items were meticulously added to the filter, whilst monitoring its performance. When an added term did not contribute to the overall accuracy of the filter, the item was excluded.

The specific filter, with a target specificity of at least 95%, was created by discarding all search terms that had a specificity of ≤ 95%. Search terms that scored a specificity of 100% formed the basis of the filter. The remaining search terms were then sorted by accuracy, and were added one by one to the existing filter. When an added term did not contribute to the overall accuracy of the filter, the item was excluded.

The obtained filters were then validated in different validation sets (see below), calculating sensitivity and specificity. Finally, all the false negatives, missed by the sensitive filter, were manually screened by two independent reviewers (DP and AB) to identify unique extra terms that could be added to the sensitive filter in order to improve its performance. These terms were then tested on both development and validation sets and included if they improved the overall accuracy of the sensitive filter.

Development of validation sets

In addition to the reference standard, two external validation sets were created. The first was created during the screening process of a family medicine relevant systematic review on atopic disorders in children (review standard). The search for this review was not limited to family medicine, but all the references found for this review were also scored by two independent reviewers (DP and E. van Alphen) to classify articles as being relevant or irrelevant to family medicine. Relevance to general practice referred to any research article that explicitly indicated it was completed in a FM/GP setting as defined for the reference standard.

The second validation set was created by sending an e-mail to the list of the Cochrane Primary Healthcare Field (questionnaire standard). In this e-mail the participant was asked to send a

reference of an article that they considered to be relevant for ‘primary care’, in particular for family medicine. These 500 references are considered to be positives. The negatives were collected from a random sample of articles from PubMed that were manually reviewed by two independent reviewers (FvdL and D. Al Rashad), creating 1,000 negatives.

Results

Development of reference standard

A total of 2,215 articles were found in the selected journals. Of these articles, 60% (1,337) included an abstract and MeSH terms. From this latter group, we randomly selected 1000 articles.

Creating and validating the filters

A total of 126 terms and phrases were considered as candidate filter terms. The original sensitive filter that was constructed missed a total of 35 'positives' in both the reference set and in the two validation sets. Manual evaluation of these 35 false negative references led to our decision to add three more terms to the sensitive filter to increase its performance, i.e. 'GP' 'GPs' and 'general pract*' were added; this substantially improved the filter. There are two important arguments for manually improving the sensitive filter. In order for this methodology to create a completely objective filter without manual improvement, it was estimated that about 30,000 articles had to be scored. Manually evaluating the false negatives overcomes the use of a relatively small 'reference standard'. Furthermore, in order for AntConc to find phrases, the 126 candidate filter terms were used. Words like 'general' and 'practice' did not meet the requirements for inclusion in the list of candidate filter terms, because the words themselves are not specific enough.

In the original article, Table 1 shows the strings of the sensitive and specific filters that were constructed using this methodology, including the translation for use in different search engines (see also page 8-9 of this document). Translating the search strategies developed for PubMed to the syntax of the other databases (Ovid, Embase and Cochrane), carries a small risk of losing some sensitivity and specificity. Ideally, one would use the candidate filter terms and start constructing the search filter using the different interfaces. Unfortunately, the other databases did not have an 'application programming interface' (a set of routines, protocols, and tools for building software

applications) that allowed communication with the software programs that were used for the development of these search filters. Instead the filters were directly translated into the syntax of the other databases, without optimization for that specific database.

In the original article, Table 2 presents the results of a comparison between the performance of our filters and that of other published search filters[4-7]. In Table 4 the performance of our filters is compared to a combination of relevant Mesh terms (General Practice[Mesh] OR General Practitioners [Mesh] OR Physicians, Family [Mesh] OR physicians, primary care [mh]), i.e. a strategy used by many physicians in daily practice. Furthermore, the filter was tested against five search strategies used for general practice relevant Cochrane Reviews [8-12].

Sensitive filter:

Pubmed:

("family"[all fields] OR physician*[all fields] OR practice*[tw] OR "primary care"[all fields] OR "Primary Health Care"[mh] OR primary[tw] OR general pract*[tiab] OR gp[tiab] OR gps[tiab])

Ovid (Medline/Embase):

(family.af. OR physician$.af. OR practice$.mp. OR primary care.af. OR exp Primary Health Care/ OR primary.mp. OR general pract$.af. OR gp.tw. OR gps.tw.)

Embase.com:

(family OR physician* OR practice*:de,it,lnk,ab,ti OR 'primary care' OR 'Primary Health Care'/exp OR primary:de,it,lnk,ab,ti OR (general NEXT/1 pract*) OR gp:ab,ti OR gps:ab,ti)

Cochrane:

("family" OR physician* OR practice*:ti,ab,kw,pt OR "primary care" OR [mh "Primary Health Care"] OR "primary":ti,ab,kw,pt OR general pract*:ab,ti OR "gp":ab,ti OR "gps":ab,ti)

Specific filter:

Pubmed:

("Primary Health Care"[mh] OR "primary care"[all fields] OR "Physicians, Family"[mh] OR general pract*[all fields] OR "family"[ad] OR family pract*[all fields] OR family physician*[tw])

Ovid (Medline/Embase):

(exp Primary Health Care/ OR primary care.af. OR exp Physicians, Family/ OR general pract$.af. OR family.in. OR family pract$.af. OR family physician$.mp.)

Embase.com:

('Primary Health Care'/exp OR 'primary care' OR (general NEXT/1 pract*) OR family:ad OR (family NEXT/1 pract*) OR (family NEXT/1 physician*):de,it,lnk,ab,ti)

Cochrane:

([mh "Primary Health Care"] OR "primary care" OR [mh "Physicians, Family"] OR general pract* OR family pract* OR family physician*:ti,ab,kw,pt)

Table 3: Journal titles randomly selected from Scopus.

Rank in Scopus	Journal title	Hits on FM/GP* in Scopus	Hits in 2009 in PubMed	With an abstract	Included in the reference standard
2	British Journal of Family Medicine	5309	246	97 (39%)	63
3	Journal of Family Practice	3712	170	78 (46%)	44
5	American Family Physician	3404	260	104 (40%)	73
10	Canadian Family Physician	2669	264	89 (34%)	58
12	Family Practice	2288	119	112 (94%)	77
108	Age and Ageing	391	213	117 (55%)	79
121	Journal of Clinical Psychiatry	371	373	272 (73%)	188
128	Palliative Medicine	363	129	109 (84%)	73
144	Emergency Medicine Journal	305	367	217 (59%)	146
148	Intensive Care Medicine	280	415	303 (73%)	199
Total			**2556**	**1498**	**1000**

* FM: family medicine; GP: general practice

Table 4: Performance of our search filters compared with that of other search strategies

Used standard		Sensitive filter	Specific filter	Relevant Mesh	Cochrane 1 [8]	Cochrane 2 [9]	Cochrane 3 [10]	Cochrane 4 [11]	Cochrane 5 [12]
Review	**Sensitivity**	100%	90.7%	44.2%	91.1%	88.9%	88.9%	88.9%	71.1%
	Specificity	69.2%	97.9%	99.8%	99.0%	95.7%	93.1%	98.5%	96.4%
Reference	**Sensitivity**	95.4%	83.9%	56.7%	68.9%	70.2%	71.1%	68.5%	66.6%
	Specificity	69.5%	94.8%	99.9%	98.0%	88.4%	90.8%	96.4%	70.9%
Questionnaire	**Sensitivity**	97.4%	96.0%	75.8%	92.4%	92.8%	93.0%	92.0%	86.6%
	Specificity	89.5%	99.3%	99.7%	99.4%	97.5%	97.8%	99.3%	95.6%
Overall	**Sensitivity**	96.8%	90.3%	67.1%	84.1%	84.0%	84.3%	83.1%	74.8%
	Specificity	74.9%	97.4%	99.7%	98.8%	93.9%	93.9%	98.1%	87.6%

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	PubMed	**Ovid (MEDLINE/ Embase)**	**Embase.com**	**Cochrane**
Truncation	*	$	*	*
Word or phrase anywhere in the record	[all fields]	.af.	[no field codes]	[no field codes]
Word or phrase in meaningfull text	[tw]	.mp.	:de,it,lnk,ab,ti	:ti,ab,kw,pt
Term in thesaurus terms	[mh]	exp … /	… /exp	[mh …]
Word or phrase title of abstract	[tiab]	.tw.	:ab,ti	:ab,ti
Word or phrase in address	[ad]	.in.	:ad	[not searchable]
Explanation of specific field codes	Tw: title, abstract, other abstract, MeSH terms, MeSH Subheadings, Publication Types, Substance Names, Personal Name as Subject, Corporate Author, Secondary Source, Comment/Correction Notes, and Other Terms	.mp.: title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier .tw.: title, abstract	de: descriptor it: publication type lnk: link (free-floating subheading) ab: abstract ti: title	ti: title ab: abstract kw: keyword pt: publcation type