

Assessment of publication output in the field of general practice and family medicine and by general practitioners and general practice institutions

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Purpose. The discipline of family medicine (FM) lacks a comprehensive methodology, which can be applied as a standard for assessing overall research output in both the field of FM and by general practitioners (GPs)/general practice institutions. It was the aim of this study to develop a sensitive search strategy for assessing publication output in the field of FM independent of the author's profession or affiliation and by GPs/general practice institutions independent of their field of scientific interest.

Methods. Literature searches limited to the year 2005 were conducted in PubMed and ISI Web of Sciences (ISI WoS). In PubMed, all relevant MeSH terms were used. Search terms possibly contained in the author's affiliations have been collected. In ISI WoS, the same entry terms including their abbreviations and plural forms were applied. The final queries were validated by manual review and matching results with selected FM journals.

Results. A comprehensive list of combined search terms could be defined. For the field of general practice/FM more publications could be retrieved in PubMed. Almost twice as many publications by GPs/general practice institutions could be retrieved in ISI WoS, where—in contrast to PubMed—the affiliation is documented for all authors.

Conclusions. To quantitatively assess publication output in the field of FM, PubMed was identified as the preferable database. To assess publication output by GPs/general practice institutions, the ISI WoS is recommended as the preferable database. Apparently, the ISI WoS is more suitable to compare the research productivity of different countries, authors or institutions.

Keywords. Family medicine, general practice, medical databases, publication output, search terms.

Introduction

The importance of family doctors/GPs to the provision of efficient health care has been well recognized both in western countries¹ and in other regions of the world.² In comparison to other medical specialities, however, general practice as a discipline has still to fight for academic recognition.³ Therefore, several attempts have been made to document scientific productivity in the field of general practice and family medicine (FM): this ranges from general to quantitative and qualitative analyses of clinical research published within 1 year,⁴ to comparing research output between different countries⁵ or reviewing national trends of research in general practice and primary health care.⁶

Assessing scientific output in the field of FM faces the following challenges: GPs can be involved in research projects together with other specialists or they collaborate in non-clinical fields, such as social programmes, training or education.⁷ On the other hand, experts from other specialities or sciences (i.e. psychologists, social workers, etc.) may contribute to research projects conducted in FM and may publish in field-specific journals.⁸

Assessment and measurement of research output are also important for the following reasons. Research funding institutions allocate their resources primarily on the basis of the scientific output of publications as assessed by the accumulated scientific impact factor of published research papers.^{8,9} In addition, assessing an individual's performance by the same mechanism to

a large extent influences the academic careers of scientists and the recruitment policies at medical universities.¹⁰ This is especially challenging for the 'soft' sciences, new scientific fields and those that are of an integrative or interdisciplinary nature, such as public health, gender medicine and general practice.^{11,12}

In contrast to other medical specialities,^{13–17} the discipline of FM so far lacks a comprehensive methodology, which can be applied as a standard for assessing overall research output in both the field of FM and by GPs/general practice institutions.^{4,18}

It was the aim of our study, therefore, to develop appropriate search strategies for assessing publication output in both the field of FM independent of the author's affiliation or profession and by GPs/general practice institutions independent of their field of scientific interest.⁶

Methods

Data sources

For assessment of publication output, we conducted literature searches in two selected databases—the US National Institutes of Health free digital archive of biomedical and life sciences journal literature 'PubMed Central' (PubMed) and Thomson Reuters Web of Science, which is part of its ISI Web of Knowledge 'ISI Web of Science' (ISI WoS).^{19–21}

Search strategies

PubMed. For our search in the field of general practice/FM, we used the following relevant MeSH terms: 'Family Practice', 'Physicians, Family', 'Primary Health Care', 'Rural Health', 'Rural Health Services', 'Comprehensive Health Care' and 'Community Health Services'.

Since the term 'FM' is not listed as a MeSH term, it was separately included (Table 1).

The PubMed website cites that the affiliation [ad] field may include the institutional affiliation and address (including email address) of the first author of the article as it appears in the journal. Furthermore, it states that this field can be used to search for work done at specific institutions (e.g. Cleveland [ad] AND clinic [ad]).

We, therefore, constructed the following search terms covering exclusively this field to retrieve publications by GPs/general practice institutions: general practice [ad], family practice [ad], family medicine [ad], primary health care [ad], community medicine [ad], community health care [ad], primary care [ad], rural health services [ad].

ISI WoS. In order to determine the most suitable search query that would parallel the one used in PubMed to retrieve publications in the field of general practice/FM, a detailed list of all used entry terms—MeSH terms

with all applied 'subheadings'²²—was compiled for our study (Table 1).

In the ISI WoS database, two fields can be used to search for an author's affiliation: the 'author's organization' (OG) and the 'author's address' (AD). The same entry terms as in PubMed were used including their abbreviations.

Publication period

For practical reasons, our query was limited to the year 2005.

Development and validation of the final queries

Development by trial and error. Potentially suitable search terms were collected by brainstorming in a peer group of experts and with reference to previous publications.^{7,23} To assure appropriateness of our final query for publications in the field of general practice/FM, each entry term identified was examined separately in both databases.²⁴ The first 50 publications found were individually and independently checked by two of the authors for validity regarding predefined inclusion criteria based on the definition of the discipline.²⁵ If the selected publications did not meet these criteria or could be retrieved by using another entry term, the applied entry term was discarded.

When searching for the author's affiliation or institution, plural word forms and changed positioning of the words were tested but without relevant results. Additional entry terms such as 'research network', 'Royal College of General Practitioners', 'EGPRN' or 'IFPCRN' were used. The first 50 publications found were individually checked by two of the authors for validity of the search query. If the selected publications did not contain a general practice/GP institution as an affiliation (inclusion criteria) or could be retrieved by using another entry term, the search term was discarded.

Validation of retrieved articles by the final queries. Using the final queries adapted for each database, we selected the first 100 articles found for the year 2005. Abstracts and the corresponding affiliations of the retrieved articles were printed out and checked for appropriateness independently by two of the authors.

Validation of articles published in selected journals. Furthermore, two relevant journals from the field of FM (*Family Practice* and *Family Medicine*) were selected;²⁶ for each journal, the table of content published in the year 2005 was printed out and manually compared to the result of our search strategy.

Results

General aspects

The two databases differ in many ways: 'MeSH terms' and subheadings (PubMed) or 'topics' (ISI WoS) have

TABLE 1 PubMed MeSH terms and subheadings concerning the field of FM

Family Practice [MeSH] Family Practices Practice, Family Practices, Family General Practice General Practices Practice, General Practices, General	Primary Health Care [MeSH] Care, Primary Health Health Care, Primary Primary Healthcare Healthcare, Primary Primary Care Care, Primary	Physicians, Family [MeSH] Family Physician Family Physicians Physician, Family Generalists Generalist GPs GP Practitioner, GPs General Primary Care Physicians Physician, Primary Care Physicians, Primary Care Primary Care Physician	Rural Health [MeSH] Health, Rural
Rural Health Services [MeSH] Health Services, Rural Health Service, Rural Rural Health Service Service, Rural Health Services, Rural Health Rural Health Center Center, Rural Health Centers, Rural Health Health Center, Rural Health Centers, Rural Rural Health Centers	Community Health Services [MeSH] Health Services, Community Community Health Service Health Service, Community Service, Community Health Services, Community Health Community Health Care Care, Community Health Health Care, Community Community Healthcare Community Healthcares Healthcare, Community Healthcares, Community	Comprehensive Health Care [MeSH] Health Care, Comprehensive Comprehensive Healthcare Healthcare, Comprehensive	

to be considered, abbreviations or plural forms used as entry terms are relevant in the ISI WoS, as well as the order and separation of terms by a comma; the way how and when articles are added to the respective database differs and there are different possibilities to search for given time periods (limits).

PubMed. Table 1 shows the MeSH terms used and their respective subheadings. Table 2 shows the results of our search query using each entry term separately and combined.

As can be seen, the MeSH terms 'Community Health Services' and 'Comprehensive Health Care' retrieved a disproportionately high number of articles. Detailed analyses during our validation process revealed many primary care associated themes but no clear relation to the discipline of FM: e.g. health financing, prevention of disease, screening, health promotion, community development and medical ethics. Likewise, a query using Comprehensive Health Care [MeSH] as an individual entry term resulted in the retrieval of articles from subfields, such as nursing, social work, forensic medicine and public health. As the term FM did not exist as a MeSH term in PubMed but did retrieve additional publications when added to our query.

According to the results of our validation process, we compiled the following search term: 'Family Practice' [MeSH] OR 'Physicians, Family' [MeSH] OR 'Primary Health Care' [MeSH] OR 'Rural Health' [MeSH] OR 'Rural Health Services' [MeSH] OR

'Comprehensive Health Care' [MeSH] OR 'Community Health Services' [MeSH] OR 'Family Medicine' AND 2005:2005 [dp]

A total of 27 077 publications in the field of general practice/FM could be retrieved for the year 2005 (Table 2). When the MeSH terms Comprehensive Health Care and Community Health Services were omitted, 7604 results could be retrieved.

In this database, only the affiliation of the first author of an article is provided.¹⁸ The profession, speciality, affiliation or nationality of the co-authors are not available.⁷ Our assessment of the first 100 articles revealed a variety of research topics associated with primary health care. Among these articles, 11 were published by colleagues affiliated with non-university institutions.

Finally, the following search term covering the 'Affiliation [AD]' filed and restricting the time span was compiled: 'General practice' [ad] OR 'Family practice' [ad] OR 'Family medicine' [ad] OR 'Primary health care' [ad] OR 'Primary care' [ad] OR 'Community medicine' [ad] OR 'Community health care' [ad] OR 'Rural Health' [ad] OR 'Rural Health Services' [ad] AND 2005:2005 [dp].

By this approach, a total of 3399 publications by GPs or general practice institutions could be retrieved for the year 2005 (Table 3).

ISI WoS. All the MeSH terms and subheadings listed in Table 1 were used as entry terms (topics). The singular form instead of the plural obtained more results,

TABLE 2 Comparison of results of the final field-specific queries using PubMed and ISI WoS (accessed June 2008; duplicates are included in the number of results due to the search with single MeSH terms/topics)

PubMed ('MeSH')		ISI WoS ('Topic')	
'Family Practice' [MeSH]		TS=('Family Practice' OR 'Family Practices' OR 'General Practice' OR 'General Practices')	
AND 2005 :2005 [dp]	2193	AND PY=(2005)	1427
'Physicians, Family'[MeSH]		TS=('Family Physician' OR 'Family Physicians' OR 'General Practitioners' OR 'General Practitioner' OR 'Primary Care Physicians' OR 'Primary Care Physician')	
AND 2005 :2005 [dp]	659	AND PY=(2005)	1935
'Primary Health Care'[MeSH]		TS= ('Primary Health Care' OR 'Primary Healthcare' OR 'Primary Care')	
AND 2005 :2005 [dp]	3386	AND PY=(2005)	4022
'Rural Health'[MeSH]		TS=('Rural Health')	
AND 2005 :2005 [dp]	576	AND PY=(2005)	82
'Rural Health Services'[MeSH]		TS= ('Rural Health Services' OR 'Rural Health Service' OR 'Rural Health Center' OR 'Rural Health Centers')	
AND 2005 :2005 [dp]	629	AND PY=(2005)	9
'Comprehensive Health Care'[MeSH]		TS= ('Comprehensive Health Care' OR 'Comprehensive Healthcare')	
AND 2005 :2005 [dp]	8326	AND PY=(2005)	11
'Community Health Services'[MeSH]		TS= ('Community Health Services' OR 'Community Health Service' OR 'Community Health Care' OR 'Community Healthcare' OR 'Community Healthcares')	
AND 2005 :2005 [dp]	17 074	AND PY=(2005)	47
'Family Medicine'		TS=('family medicine')	
AND 2005 :2005 [dp]	1319	AND PY=(2005)	236
All 'MeSH' terms	27 077	All 'Topic' terms	5938
All 'MeSH' terms without 'Community Health Services'[MeSH] and 'Comprehensive Health Care'[MeSH]	7604	All 'Topic' terms without 'Community Health Services' and 'Comprehensive Health Care'	5896

while the inversion of the words in a phrase—for example from 'General Practices' to 'Practices, General'—retrieved identical results. Furthermore, the terms 'Generalist' and 'Generalists' retrieved >85% of results in non-medical fields (e.g. from the field of ecology, entomology, zoology). Therefore, from all entry terms listed in Table 1, Generalist was not included in the final query.

In contrast to PubMed, inclusion of the two search terms, Community Health Services and Comprehensive Health Care, did not result in major changes in the number of articles found. For the year 2005, only 47 publications for the term Community Health Services and 11 for the term Comprehensive Health Care could be retrieved (Table 2). Eleven articles out of 47 and five articles, respectively, were retrieved also in the general search query without using these two terms.

Using the final query, 73 out of 100 abstracts, checked during our validation process, were directly associated with the field of FM. The others were linked to areas such as nursing, holistic medicine, herbal or traditional medicine, screening, emergency medicine, paediatrics, dermatology, military medicine and public health.

Finally, the following search term was used covering the topics field: TS = ('Family Practice' OR 'Family

Practices' OR 'Family medicine' OR 'General Practice' OR 'General Practices' OR 'Primary Health Care' OR 'Primary Healthcare' OR 'Primary Care' OR 'Family Physician' OR 'Family Physicians' OR 'GPs' OR 'GP' OR 'Primary Care Physicians' OR 'Primary Care Physician' OR 'Rural Health' OR 'Rural Health Services' OR 'Rural Health Service' OR 'Rural Health Center' OR 'Rural Health Centers' OR 'Comprehensive Health Care' OR 'Comprehensive Healthcare' OR 'Community Health Services' OR 'Community Health Service' OR 'Community Health Care' OR 'Community Healthcare' OR 'Community Healthcares') AND PY = (2005).

With this query, 5938 publications in the field of general practice/FM for the year 2005 could be retrieved (Table 2). When the entry terms Comprehensive Health Care and Community Health Services were omitted, 5896 results could be retrieved.

The full query for the author's affiliation disclosed a vast spectrum of different research interests of primary care investigators: from environmental and occupational health and forensic topics to cellular and molecular biology. Based on a detailed list of information about each co-author provided by the database, national and international cooperations and university

TABLE 3 Comparison of results for the two databases (PubMed and ISI WoS) when searching for publications by GPs or GP institutions

PubMed [affiliation]	ISI Web (author's address / organisation, incl. abbreviations)	
<ul style="list-style-type: none"> ○ General practice [ad] OR ○ Family practice[ad] OR ○ Family medicine [ad] OR ○ primary health care [ad] OR ○ community medicine [ad] OR ○ community health care [ad] OR ○ primary care [ad] OR ○ Rural Health [ad] OR ○ Rural Health Services [ad] 	(AD= <ul style="list-style-type: none"> ○ General practice OR ○ Gen practice OR ○ Gen Pract OR ○ Family practice OR ○ Family medicine OR ○ Family Med OR ○ Fam Med OR ○ primary health care OR ○ Prim Care OR ○ community medicine OR ○ community health care OR ○ Community Hlth OR ○ Comm Hlth OR ○ Rural Hlth) OR (OG= <ul style="list-style-type: none"> ○ General practice OR ○ Gen practice OR ○ Gen Pract OR ○ Family practice OR ○ Family medicine OR ○ Family Med OR ○ Fam Med OR ○ primary health care OR ○ primary care OR ○ Prim Care OR ○ community medicine OR ○ community health care OR ○ Community Hlth OR ○ Comm Hlth OR ○ Rural Hlth) 	
AND 2005:2005 [dp]	3399 AND PY=(2005)	5943

associated research networks or independent research institutions could be identified.

Since in this database abbreviations used by the authors for affiliations/addresses are not expanded to the full terms, they have to be separately included in the search to increase sensitivity.

Among the 100 articles analysed in detail, there were 14 with international collaborations, 18 originated from non-university departments and 42 showed a GP as first author. In the other 58 publications a GP was positioned as co-author; those could not be found in PubMed.

As outlined in the Methods section, the list of entry terms and their respective abbreviations is shown in Table 3.

Finally, the following search term for author's 'address/organization' were used: (AD = (General practice OR Gen practice OR Gen Pract OR Family practice OR Family medicine OR Family Med OR Fam Med OR Primary health care OR Primary care OR Prim Care OR Community medicine OR Community health care OR Community Hlth OR Comm Hlth OR Rural Hlth)) OR (OG = (general practice OR Gen practice OR Gen Pract OR Family practice OR Family medicine OR Family Med OR Fam Med OR Primary health care OR Primary care OR Prim Care OR Community medicine OR Community health care OR Community Hlth OR Comm Hlth OR Rural Hlth)) AND PY = (2005). Using this final query, 5943 publications by GPs or general practice institutions could be identified for the year 2005 (Table 3).

Results for field-specific journals

Family Practice (Oxford University Press). Using the complete query (including Comprehensive Health Care and Community Health Services and FM) limited to the year 2005 and to the journal *Family Practice*, which contains 115 contributions in the list of contents (issues 1–6), 92 articles could be retrieved in PubMed and 93 in ISI WoS including all original articles.

In the ISI WoS database, the exact entry term (as contained in title, abstract or keywords) was required for identification of the articles. Contributions using abbreviations or document types such as letters to the editor, correspondences, editorials etc. could not be found. In contrast, when searching in PubMed, some additional publications such as 'correspondences' and articles concerning wider public health themes could be found.

Overall, 14 contributions out of 115 with the characteristics described above could not be found in both queries; likewise, contributions from a supplement issue of the journal were not retrieved.

FM (Society of Teachers of Family Medicine). From a total of 196 contributions (issues 1–10), 155 could be retrieved in PubMed and 74 in ISI WoS. A detailed analysis of the results obtained by searching ISI WoS showed that most of the contributions in this journal deal with educational subjects and that the required exact ISI WoS topic/entry term was not always used in the title or abstract. Contributions listed under literature, letters to the editor or book reviews could not be found.

Using PubMed, the same publications as in ISI WoS could be retrieved; in addition, 86 contributions of a different publication type including three articles from the section 'International FM Education' could be identified.

In summary, all original articles could be identified using both queries; however, a total of 40 contributions of a different type out of 196 could not be retrieved at all.

Results of the two databases when searching for publications by GPs or general practice institutions (author's affiliation)

Table 3 summarizes the two different search queries as they were applied in the corresponding boxes of the entry masks in the databases. It is evident that the respective abbreviations of the entry terms are relevant. Compared to the complete entry term, approximately three times more relevant articles can be found in ISI WoS if appropriate abbreviations are used.

As can be seen, 3399 articles from PubMed and 5943 from ISI WoS could be found for the year 2005. In the ISI WoS, the address/organization is documented for all authors; in contrast, in PubMed, only the affiliation of the first author is provided. As a consequence, co-authorship of GPs/general practice institutions is likely to be missed.⁷

Considering the increasing importance of practice-based research networks, the term 'research network' was separately used during our validation process as a possible affiliation/address of authors. This search did not match any results in ISI WoS, while in PubMed, 32 results could be retrieved. However, a detailed analysis of the matched affiliations showed that a vast majority of articles was not related to GPs/general practice institutions but to some other medical or non-medical institutions.²⁷ Since only the first author is provided in PubMed contributions from GPs/general practice institutions and their resulting co-authorship could not be completely identified. In contrast, all articles could be identified in ISI WoS by using the preselected entry terms only. Therefore, the entry term "research network" was not added to the final query in both databases.

Based on our analyses, Table 4 summarizes the characteristics of the two selected databases when searching for articles published by GPs/general practice institutions as well as for those published in the field of general practice/FM.

Discussion

To our knowledge, this study identifies the most sensitive search strategy so far to retrieve publications in the field of general practice/FM and by GPs or general practice institutions. Based on our results using two common databases, PubMed should be the preferred choice for quantitative assessment of publication output in the field of FM and ISI WoS should be the preferred choice for quantitative assessment of publication output by GPs or general practice institutions.

When searching about publications in the field of FM, it is evident (Table 2) that the results obtained from the two databases used differ markedly. A detailed analysis of the results differentiated by the MeSH term or topic used shows discrepancies for each individual entry term. This is due to the fact that the

two databases apply different criteria for the inclusion of scientific journals;^{19,28} in addition, the allocation of publications to the entry terms (MeSH or topic) is differently handled by the two databases.^{7,29} In other words, the results obtained by using corresponding entry terms in the two databases comprise not necessarily identical publications, even if the number of retrieved results might be the same. This is most evident for the entry terms Comprehensive Health Care and Community Health Services as shown in Table 2. Due to their low specificity, the use of these two entry terms when searching about the field of FM cannot be recommended. However, they might be useful if a specific question has to be addressed or when combined with appropriate limits.

In addition to the existing MeSH terms and their different subheadings, inclusion of the search term FM proved to be important (Table 2), as it has been shown before.⁷ Furthermore, the plural form of the entry terms contained among the subheadings of a given MeSH term (Table 1) is important when searching in the ISI WoS. However, the quantitative results obtained using a single MeSH term or topic have to be seen with caution because a single publication could be listed under multiple MeSH terms.²⁹ Only in combination with all other MeSH terms or topics as applied in our final query duplicates are automatically excluded.

To further validate our methodology, two journals relevant for FM²⁶ were selected. Using both queries, original articles could be identified completely in both databases; however, publications that do not meet the criteria of an original article could be found more likely in PubMed.

Searching for research articles published by GPs or members of institutions of general practice/FM again reveals major differences between the two databases. The most significant relates to the fact that in PubMed, only the affiliation of the first author is provided,⁷ while in the ISI WoS, the affiliations of all authors are provided (if documented by the authors). As a consequence and in contrast to the search about the field of FM, more articles can be found in the ISI WoS than in PubMed (Table 3). Equally important national or international collaborations within or outside the field of general practice/FM can be identified.²⁷

Furthermore, the results of our validation process showed that abbreviations of author affiliations used are not automatically identified in the ISI WoS and have, therefore, to be separately included as entry terms (Table 3). The ISI abbreviation system helps to overcome various barriers regarding incomplete publication records/affiliations or affiliations provided in other languages than English.

When searching for field-specific publications by a selected GP-author, no major quantitative differences could be found between the two databases

TABLE 4 Comparison of the two databases (PubMed and ISI WoS) used to assess publication output in the field of FM/general practice or by GPs/general practice institutions

Parameters	PubMed	ISI WoS
Access to database	Free	Subscription required
Indexed journals	Broad spectrum (not only biomedical)	Impact factor rated only
Document types	Different types	Focus on original articles
Languages	Various languages	Focus on English
Allocation of articles by	Team of experts (MeSH)	Author (Topics and keywords)
Affiliations provided for	First author	All authors
Identification of collaborations	Very difficult	Easy
Search sensitivity	Additional search terms required	Abbreviations and plural forms required
Additional tools provided	My NCBI	My cited articles list and analyse results

NCBI, National Center for Biotechnology Information.

(results not shown). The search for an author with a more common name or for authors with the same initials might identify unrelated publications by various other authors. In this case, inclusion of the author's affiliation in the query term (ISI WoS) helps to specifically select the publications by the author in question.

The following limitations of our study have to be considered. First, since different search terms and strategies have to be applied to meet the differences of the two databases, the publications retrieved are not necessarily identical. Second, additional general practice/FM-related search terms may exist, which could improve the results of the literature search. Third, the results obtained describe the situation in the field of general practice and FM. In another discipline, comparison of these two databases may yield different results. Fourth, we compared only two selected databases, which might not be the best options for every purpose;^{30,31} as a consequence, articles not included in either database but listed in another electronic archive cannot be found. Fifth, publications with incorrect listed authors or affiliations/addresses cannot be identified.⁶ Finally, our results obtained from the year 2005 may not fully be applicable to other time periods because of changes in listed journals or indexing conditions.⁷ The number of retrieved publications may change due to journals subsequently indexed or withdrawn even for a preceding year.

Conclusions

We aimed to develop a sensitive search strategy to assess publication output in the field of FM and by GPs/general practice institutions using two selected electronic databases. To quantitatively assess publication output in the field of FM, we identified PubMed as the preferable database and defined a comprehensive list of combined entry terms, which should be

applied. We anticipate that the strategy accomplished will help to ease assessment of publication output in FM and comparison with other disciplines.

To quantitatively assess publication output by GPs/general practice institutions, we recommend ISI WoS as the preferable database and have defined a comprehensive list of search terms, which should be applied.

Consequently, the ISI WoS is more suitable to compare the research productivity of different countries, authors or institutions. In addition, there are also some pragmatic aspects, which differentiate the two databases used (Table 4) such as access or languages covered.

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