

An Inventory of Publications on Computer-Based Medical Records: An Update

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Summary

Objectives: In 1998, we reported a steady increase in the number of publications indexed in MedLine with the MeSH term 'Medical Records Systems, Computerized'. No signs indicating an increasing interest of high-impact medical journals to publish on the computer-based patient record could be determined. In this review we provide an update.

Methods: We retrieved and analyzed all English publications indexed before Feb 22 2002 in PubMed with the MeSH term 'Medical Records Systems, Computerized'.

Results: We retrieved a total of 5856 publications, of which 1824 (31%) appeared in a journal with an impact factor in the year of publication. The total impact-score shows an upward trend.

Conclusions: The results show that the earlier observed increase in number of publications did not persist in the second half of the nineteen-nineties. Since the mid-nineties, there has been a steady yearly production of publications indexed with the MeSH term, reflecting a sustained interest in the domain. However, the volume of publications appearing in journals with higher impact factors is increasing. Furthermore, high-impact journals, such as the "British Medical Journal", the "Lancet" and "Annals of Internal Medicine" regularly publish on the subject, reflecting an interest well beyond the medical informatics community.

Keywords

Medical Records Systems, Computerized, MedLine

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Introduction

In scientific medical literature, researchers have already debated the development of computerized alternatives to the paper-based medical record since the 1960's (1, 2). In subsequent years, increasing emphasis was placed on the computer-based medical record. In 1991, for example, the Institute of Medicine stressed the importance of these developments by stating that the computer-based record is essential for the maturation of the scientific basis of health care (3). Increased recognition of the importance of the computer-based record, however, does not necessarily lead to additional research activities. In 1998, we therefore analyzed the medical literature to determine whether the increased recognition of the importance of computer-based records was reflected in the volume of scientific publications (4). In that study, we reported an increase in the number of publications on computer-based records. Due to the limited number of computer-based records publications in high-impact journals, we failed to determine whether major medical journals were also giving more attention to the topic.

Since our previous study, new publications have appeared, more publications became available through PubMed, and new MeSH terms emerged (5, 6). In this brief review we revisit the issues that we addressed four years ago. First, has the increase we observed in 1998 continued in subsequent years? Second, are the high-impact journals carrying an increased number of publications on computer-based medical records?

Methods

On February 22, 2002, we retrieved the publications indexed in PubMed (7) with the MeSH term 'Medical Records Systems, Computerized' (MRSC); This term, introduced in MeSH in 1991, is defined as 'Computer-based systems for input, storage, display, retrieval, and printing of information contained in a patient's medical record'. For comparability to the 1998 search, we limited the search to English publications.

For each publication, we determined the year of publication, the journal in which the publication appeared, the impact factor according to the Science Citation Index (8) of that journal in the year of publication (for publications prior to 1996, we used the impact factor of 1996), the country of the first author of the publication (from the 'affiliation' field), and the MeSH-terms (other than MRSC) by which the publication was indexed.

We subsequently counted the number of publications per year, the number of publications per journal, and the number of publications per country. To uniquely distinguish journals, we used the ISBN as an identifier. From the MeSH term lists per journal, we compiled a list containing all MeSH terms used, and counted the number of publications for each term.

Not all journals have an impact factor. For each year, we counted the publications that appeared in a journal with an impact factor and we calculated for each year a total impact-score for each year by adding up the individual impact factors of publications in that year.

Over the years, the use of MeSH terms to index publications may change. New terms (e.g., Internet) are being added.

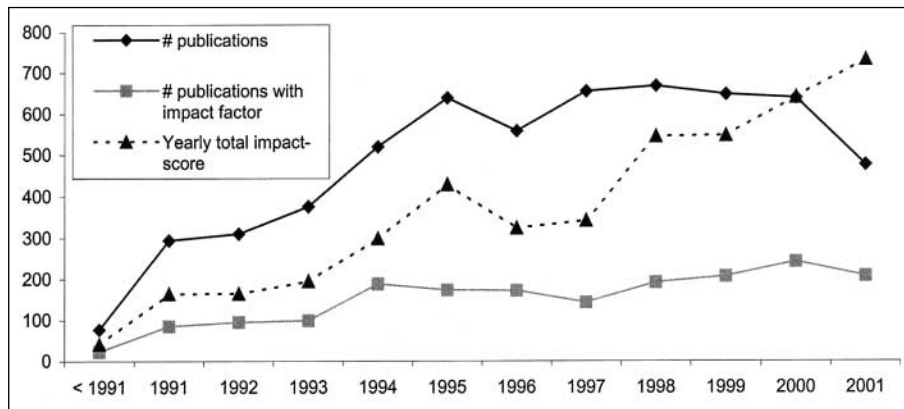


Fig. 1 The yearly number of publications in English, indexed in PubMed with the MeSH term 'Medical Records Systems, Computerized'. The figure furthermore shows the number of publications that appeared in journals with an impact factor in the year of publication, and the total impact-score of these publications in that year. For publications appearing before 1996, we used the impact factors of journals in 1996.

Based on the MeSH terms by which publications were indexed in a given year, we counted the frequency of the MeSH terms for each year.

Results

We retrieved a total of 5856 publications indexed in PubMed with the MeSH-term 'Medical Records Systems, Computerized' (MRSC). Of these 5856 publications, 1824 (31%) appeared in a journal with an impact

factor in the year of publication. Figure 1 shows per year, the total number of publications, the number of publications in a journal with an impact factor, and the total impact-score per year.

The 5856 publications appeared in 812 different journals. Of these 812 journals, however, 374 journals (46%) carried only a single publication indexed with MRSC. For the journals that carried 20 or more publications indexed with MRSC, Table 1 shows the number of publications.

Of the 5856 publications, 3742 (63.9%) contained information about the first authors' affiliation. From the affiliation descriptions, we were able to determine the country in 3669 cases. These 3669 publications originated from 57 different countries. Table 2 lists the ten most frequently contributing countries, together with the number of publications.

The 5856 publications were indexed with in total 2290 different MeSH-terms. Table 3 lists the twenty most often used MeSH terms, supplemented with the terms that were among the ten most used terms in one or more of the years.

Table 1 The journals with 20 or more publications indexed in PubMed with the MeSH term 'Medical Records Systems, Computerized', ranked by number of publications.

Rank	Journal	# of publ.	Rank <cont>	Journal	# of publ.
1	J AHIMA	317	22	Health Serv J	45
2	Stud Health Technol Inform	298	23	Med Inform (Lond)	44
3	Healthc Inform	275	24	Mod Healthc	43
4	Proc Annu Symp Comput Appl Med Care*	268	25	Comput Healthc	36
5	Medinfo	232		Hosp Health Netw	36
6	Health Data Manag	226	27	Healthc Financ Manage	30
7	Health Manag Technol	155		J Healthc Inf Manag	30
8	Proc AMIA Symp*	145	29	Physician Exec	29
9	Methods Inf Med	141		Health Inf Manag	29
10	Int J Med Inf	128	31	JAMA	26
11	MD Comput	120		Lancet	26
12	J Am Med Inform Assoc	108		Nurs Manage	26
13	Int J Biomed Comput	101	34	Int J Clin Monit Comput	25
14	Proc AMIA Annu Fall Symp*	99	35	Med J Aust	24
15	Top Health Inf Manage	86	36	Aust Fam Physician	21
16	BMJ	73		Med Econ	21
17	Comput Methods Programs Biomed	64		Acad Med	21
18	Comput Nurs	50		Med Group Manage J	21
	J Med Syst	50	40	Br J Gen Pract	20
20	J Digit Imaging	46		J Ambulatory Care Manage	20
	Healthc Inf Manage	46		Ann Intern Med	20

* These three journals actually refer to the same yearly conference proceedings, but are indexed using different ISBN numbers.

Discussion

In this paper we provided an update on an inventory (4) of English publications indexed in PubMed with the MeSH-term 'Medical Records Systems, Computerized' (MRSC). In our previous study (on publications before 1998), we reported an increase of publications in the early nineties. The data in this paper, however, suggest that this increase did not continue; after 1995 there seems to be a steady yearly production of about 600 MRSC publications. The lower number of publications for the year 2001 should be attributed to an indexing-lag: not all publications of 2001 had been indexed on the day of retrieval (February 22nd 2002).

The publications have appeared in a wide range of journals. About one third of publications appeared in a journal with an impact factor. Of the high-impact journals, the British Medical Journal, the Journal of the American Medical Association, the

Lancet and Annals of Internal Medicine publish regularly on the subject.

The total yearly impact-score shows an upward trend. This increase is more prominent than the slight increase in the number of publications in journals with an impact factor. Furthermore, the average impact factor of all journals increased only marginally: from an average impact factor per journal of 1.32 in 1996 to 1.40 in 2000. We, therefore, believe that the increasing total yearly impact-score reflects an increase in the volume of publications on the com-

Table 2

The ten countries with most publications in the 3669 publications from which the country of origin could be determined.

Country	# of publications	Percentage
USA	2212	60.5
UK	312	8.5
Germany	154	4.2
The Netherlands	136	3.7
Canada	105	2.9
Australia	82	2.2
Italy	82	2.2
Japan	76	2.0
France	71	1.9
Sweden	51	1.4

Table 3 The twenty most frequently used MeSH terms, supplemented with the MeSH terms that were in the yearly list of ten most often used terms.

Rank	MeSH Term	# of publ	Rank in year										
			<92	92	93	94	95	96	97	98	99	00	01
1	Hospital Information Systems.	952	1	1	1	2	2	4	6	4	4	4	6
2	Computer Communication Networks.	914	5	3	2	1	1	3	1	2	7	7	7
3	Computer Security.	875	10	10	3	6	6	2	2	1	1	3	5
4	Software.	866	2	2	6	3	3	5	4	3	3	2	3
5	Confidentiality.	771	6	9	4	5	7	1	3	5	6	5	2
6	User Computer Interface.	622	7	4	24	4	5	8	5	6	5	6	9
7	Systems Integration.	457				11	4	6	8	7	8	8	8
8	Data Collection.	451	20	7	5	10	8	7	7	12	9	10	11
9	Computer Systems.	405	9	50	7	7	11	10	11	10	10	12	24
10	Internet.	366							860	9	2	1	1
11	Information Systems.	348	16	29	31	8	10	9	9	11	23	37	43
12	Information Storage and Retrieval.	331	44	39	26	14	9	11	14	13	11	16	17
13	Database Management Systems.	326	8	25	16	9	12	26	17	19	15	13	25
14	Databases, Factual.	297	4	8	22	15	23	76	25	26	12	18	16
15	Medical Record Linkage.	264	53	123	54	41	28	45	10	8	14	24	12
16	Attitude to Computers.	261	24	28	17	21	16	24	27	15	13	20	37
17	Family Practice.	247	23	41	14	35	13	21	20	38	16	17	33
18	Microcomputers.	239	3	5	11	16	34	41	107	53	52	46	39
19	Documentation.	234	13	27	15	24	32	22	33	41	22	19	21
20	Forms and Records Control.	234	17	16	32	12	21	27	36	33	31	25	18
23	Medical Records.	212	45	15	10	23	40	14	43	23	47	34	48
25	Automatic Data Processing.	194	19	21	9	61	45	23	13	76	38	47	83
30	Planning Techniques.	182	34	14	8	20	26	48	76	45	58	66	72
43	Practice Management, Medical.	146	51	330	63	99	75	82	42	137	45	29	10
52	Health Insurance Portability and Accountability Act.	132							856	176	44	9	4
53	Medical Records Department, Hospital.	128	35	6	19	185	42	62	199	101	282	58	104

puter-based record in journals with higher impact factors.

As illustrated by Table 3, the use of MeSH terms changes over the years. The terms 'Internet', and 'Practice Management, Medical', for example, have been introduced as MeSH-terms in 1999 and were increasingly used to index publications in subsequent years. Not only are new terms introduced, shifts in indexing of long-existing terms also reflect the relative importance of certain topics. The increase of the term 'Internet', for example, seems to coincide with a decrease in the use of the term 'Computer Communication Networks', and the increase in the use of the term 'Health Insurance Portability and Accountability Act' possibly reflects changes in legislation. Moreover, a trend from more technical terms such as 'Hospital Information Systems', 'Software' and 'Computer Systems' to more functional terms such as 'Confidentiality' and 'Health Insurance

Portability and Accountability Act', which was already noticeable in our 1998 search, seems to have continued.

Regarding the countries from which publications originated, we conclude the publications originated from more countries (in 1998 from 43 countries (4) compared to 57 countries in this overview). Like in 1998 (4), however, the same ten countries account for almost 90% of all publications.

In summary, in the early nineties we observe an increase in the number of publications in the area of computer-based patient records. Since the mid-nineties, we observe a steady production of publications reflecting a sustained interest in the domain. These publications, however, increasingly appear in journals with higher impact factors. Moreover, many medical journals publish on the topic, reflecting an interest well beyond the medical informatics community.

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