

# LITERATURE SEARCHES IN MEDICINE: A COMPARATIVE EVALUATION OF MANUAL AND CD- ROM SEARCH MODES\*

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**Abstract:** In the present study, manual and CD-ROM search modes are compared in terms of quality and time, based on the medical searches conducted from Index Medicus and Comprehensive Medline CD-ROM (Ebsco). The more effective search mode is determined with respect to certain quality criteria (Relevance, Coverage, Novelty). The faster mode in terms of response time is revealed, concerning the rate of the speed. The medical doctors of Hacettepe University Medical Center (Ankara, Turkey), who refer to the Center Library in 1991, are represented by 50 samples. Each of the 50 request topics is searched by the researcher, both manually and by computer. Equivalent periods of coverage are used (1988-1991). Precision and Recall, being the measures of relevancy, and Novelty ratios are found for both modes. The source, representing the current medical literature faster, is determined as well. Coverages of both search sources, for an equivalent period, are compared. The faster mode is found by measuring the response times. Results indicate that the CD-ROM mode is more effective than the manual one, in terms of relevance, coverage, novelty and response time. However, manual searches have revealed higher Precision and the time devoted to manual search strategies is shorter. Since the two modes have complementary features, co-existence of both is suggested.

## Introduction

Let it be admitted that there is always a need for high quality medical search results in every country in the world, because these results have significant effects on human health. A weighty portion of literature searches performed by several institutions in this country are on medicine. The aim of the present study is to determine the more effective medical search mode in an objective manner, since

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there is a strong subjective tendency towards computerized literature searches in Turkey. CD-ROM mode, in particular, attract the attention of most of the librarians and users. Manual searches seem to be entirely abandoned.

In the present study, manual and CD-ROM search modes are compared in terms of quality and time, based on the medical searches conducted from Index Medicus (IM) and Ebsco Comprehensive Medline CD-ROM respectively. The more effective search mode was determined with respect to certain quality criteria such as relevance, coverage and novelty. The faster mode in terms of response time was revealed, concerning the rate of the speed.

## **Methodology**

The medical doctors of Hacettepe University Medical Center (Ankara, Turkey), who refer to the Center library in 1991 (821) were represented by 50 samples (n=50). Following the search interviews, an effort was spent to arrange search strategies equally. As a principle MeSH terms were selected for both modes. However, in preparing CD-ROM search strategies natural language terms were used, where needed, in combination with MeSH terms. In particular, when a specific MeSH term did not exist at all, depending on the features of the request topic, either broader MeSH terms were coordinated with natural language terms or only natural language terms were used. Each of the 50 request topics was searched both manually and by computer, by the researcher. Equivalent periods of coverage were used (1988-1991). As far as 1991 searches were concerned, equivalent months of the year were determined. However, there was a 6-month delay in receiving 1991 IM issues while the CD-ROM disks were usually available within the existing month. The problem was solved by installing the back month's disk each time, instead of waiting for the coming IM issue.

Each CD-ROM search output was compared with the equivalent manual search result list to find out the unique and common citations. As a result, citations were categorized in three groups:

1. Unique citations retrieved from the manual search,
2. Unique citations retrieved from the CD-ROM search,
3. Common/matched citations retrieved from both search modes.

Single literature lists, categorized in these three groups, were submitted to the requesters. The requesters were asked for making relevance judgements regarding their search topics. Two relevance assessments, relevant and nonrelevant, were used, simply just to avoid confusions and uncertainties of multi-category relevance assessments. The requesters were not informed about which group indicated

which search mode. The advantage of producing a single list is to avoid the risk of judging the same citation several times.

Abstracts were provided for each citation to ensure healthy judgements. Original article abstract photocopies were attached to the first group citations which were uniquely retrieved from the manual searches. Since CD-ROM produced the abstracted outputs, there was no problem for the groups 2 and 3. A questionnaire was attached to each abstracted list. This questionnaire was prepared for additional relevance and novelty assessments.

Each judged literature list was reassessed on its return, to estimate Precision (P)-Recall (R) pairs for two modes. P and R, being the measures of relevance, are the two well-known performance criteria. P is defined as the proportion of retrieved citations that are relevant, while R is the proportion of relevant citations that are retrieved. These two ratios are defined as:

$$P: \frac{\text{Number of relevant citations retrieved}}{\text{Total number of citations retrieved}} \times 100,$$

$$R: \frac{\text{Number of relevant citations retrieved}}{\text{Total number of relevant citations in the collection}} \times 100.$$

It was necessary to obtain the number of citations retrieved (for P), number of relevant citations retrieved (for P and R) and total number of relevant citations in the collection (for R).

Estimation of P ratios caused no problem for both modes:

$$P \text{ (Manual): } \frac{\text{Group 1+3 (relevant citations retrieved)}}{\text{Group 1+3 (relevant, nonrelevant citations retrieved)}} \times 100$$

$$P \text{ (CD-ROM): } \frac{\text{Group 2+3 (relevant citations retrieved)}}{\text{Group 2+3 (relevant, nonrelevant citation retrieved)}} \times 100$$

In estimating the R ratio it was necessary to get the total number of relevant citations in the collection. This is completely impractical in any system of a normal size. As an alternative, "Relative Recall" (RR) is used commonly, to calculate R ratios. In the current study, RR estimations were based on the relevant citations retrieved. The total number of relevant citations in the collection was accepted as the sum of the relevant citations retrieved in the groups 1, 2 and 3. Thus the R ratios for search modes estimated as follows:

$$R \text{ (Manual): } \frac{\text{Group 1+3 (relevant citations retrieved)}}{\text{Group 1+2+3 (relevant citations retrieved)}} \times 100$$

$$R \text{ (CD-ROM): } \frac{\text{Group 2+3 (relevant citations retrieved)}}{\text{Group 1+2+3 (relevant citations retrieved)}} \times 100$$

After the calculation of individual P-R pairs, average P and R ratios were estimated for both modes (50 searches) as follows:

$$\text{Average P (Manual): } \frac{\text{Group 1+3 (relevant citations retrieved by 50 manual searches)}}{\text{Group 1+3 (relevant and nonrelevant citations retrieved by 50 manual searches)}} \times 100$$

$$\text{Average P (CD-ROM): } \frac{\text{Group 2+3 (relevant citations retrieved by 50 CD-ROM searches)}}{\text{Group 2+3 (relevant and nonrelevant citations retrieved by 50 CD-ROM searches)}} \times 100$$

$$\text{Average R (Manual): } \frac{\text{Group 1+3 (relevant citations retrieved by 50 manual searches)}}{\text{Group 1+2+3 (Total relevant citations retrieved by 50 manual and 50 CD-ROM searches)}} \times 100$$

$$\text{Average R (CD-ROM): } \frac{\text{Group 2+3 (relevant citations retrieved by 50 CD-ROM searches)}}{\text{Group 1+2+3 (Total relevant citations retrieved by 50 manual and 50 CD-ROM searches)}} \times 100$$

Coverage, being another performance measure, can be described in terms of how much coverage of the literature on a specific subject is provided by a particular data base. IM and Medline CD-ROM were not evaluated in this particular sense. But the coverage of these two sources of 1991 were compared. Coverage evaluation was performed in two stages:

1. The lists of journals indexed by IM<sup>1</sup> and Medline CD-ROM<sup>2</sup>, were compared with the medical journal list prepared by Brandon and Hill<sup>3</sup> successively.

<sup>1</sup> The National Library of Medicine, List of Journals Indexed in Index Medicus (Bethesda, Md.: The National Library of Medicine, 1991)

<sup>2</sup> A List/output of journals indexed by Ebsco Medline CD-ROM in 1991.

<sup>3</sup> A.N. Brandon and D.R. Hill, "Selected List of Books and Journals in Allied Health," Bulletin of the Medical Library Association 80 (3 1992): 238-239.

2. The lists of journals indexed by IM and Medline CD-ROM), were compared with each other in details.

Evaluation studies regarding novelty were performed in two stages as well:

1. Novelty ratios were determined for both modes and compared.
2. The source, included the current citations in its coverage earlier, is determined.

Novelty Ratio (NR), being one of the important quality criteria in evaluating the literature searches, can be described as, the proportion of relevant items retrieved in a search that are new to and unknown by the requester. The ratio is defined as:

$$\text{NR: } \frac{\text{Number of new (unknown) relevant citations retrieved}}{\text{Number of relevant citations retrieved.}} \times 100$$

The requesters were asked to mark the relevant citations that were new to them. So individual and average NRs for both modes were estimated in our study, by means of the assessments of the questionnaires and the lists judged by the requesters.

Estimation of NRs for both modes:

$$\text{NR (manual): } \frac{\text{Group 1+3 (new / unknown relevant citations retrieved)}}{\text{Group 1+3 (relevant citations retrieved)}} \times 100$$

$$\text{NR (CD-ROM): } \frac{\text{Group 2+3 (new / unknown relevant citations retrieved)}}{\text{Group 2+3 (relevant citations retrieved)}} \times 100$$

Averages NRs were estimated for both modes (50 searches) as follows

$$\text{Average NR (Manual): } \frac{\text{Group 1+3 (new / unknown relevant citations retrieved by 50 manual searches)}}{\text{Group 1+3 (relevant citations retrieved by 50 manual searches)}} \times 100$$

$$\text{Average NR (CD-ROM): } \frac{\text{Group 2+3 (new / unknown relevant citations retrieved by 50 CD-ROM searches)}}{\text{Group 2+3 (relevant citations retrieved by 50 CD-ROM searches)}} \times 100$$

Novelty has another aspect, in terms of adding the current citations as soon as possible into the coverage of the data base. This has a primary importance in medicine. Thus, the second stage of the comparative evaluation study regarding novelty was performed to determine the search source which included the current citations into its coverage earlier. This study was based on the common citations retrieved, in group 3. To give an example for this stage, search number 10, retrieved 14 common citations. 8 of them appeared in IM and in Ebsco Comprehensive Medline CD-ROM in the same year, 6 of them appeared in CD-ROM a year earlier than IM. The sum of such citations, revealed the total numbers regarding this aspect.

Response Time (RT), being the basic time measure, consists of the time devoted to strategy preparation and actual search time. The faster mode was found in this study, by measuring both strategy and actual search times for each search in the two modes. After determining the individual RTs, total and mean RTs were estimated for both modes, regarding 50 searches.

## **Results and discussion**

Relevance:

The average P ratios of searches were as follows: Manual 84.2%, CD-ROM 75.1%. The average R ratios of searches revealed were: Manual 53.1%, CD-ROM 84%. The manual searches yielded a higher P ratio while CD-ROM searches revealed a higher R ratio.

The average P ratio of CD-ROM searches was lower than the manual ones. One of the reasons of this result might be the usage of natural language terms in the CD-ROM strategies. It is well known that there are some disadvantages of using such terms which result in retrieving those citations which are nonrelevant. For example, if a certain term has several meanings, it is possible to retrieve a nonrelevant item, containing the nonrelevant meaning. The success of manual searches in P ratios is due to some features of human brain including deciding, understanding, conceiving, perceiving, avoiding and coordinating. Besides, manual search strategies based on MeSH terms eliminate the disadvantages of natural language terms. Even if a term or a synonym is missed in the strategy, it is possible to retrieve a relevant citation.

On the other hand, manual searches yielded a lower R ratio. One of the reasons of this result might be the advantage of natural language terms. These terms, allow to retrieve more citations which enhance the R ratio. Besides in IM searches, if no specific MeSH terms are available, the words or terms related to the topic, are searched under some broader MeSH terms; in such cases some significant relevant

citations are likely to be missed. In addition, some terms might be hidden under a MeSH term that probably does not exist in the strategy.

It should be mentioned that the success of CD-ROM searches in P ratio (75.1%) was higher than the success of manual searches in R ratio (53.1%). In conclusion, it should be emphasized that CD-ROM searches were more successful than the manual ones in terms of relevance. But it should be kept in mind that in P ratio, manual searches were more successful.

#### Coverage:

Results of the coverage evaluation study is as follows:

1. 29.8% of the journals indexed by Medline CD-ROM existed in Brandon and Hill's list. On the other hand, 23.3 % of the journals indexed by IM existed in this list. CD-ROM was more successful in terms of coverage. However, the outcome of this study revealed the fact that none of the sources were sufficient in their coverage, in accordance with Brandon and Hill's list.
2. IM indexed 2.960 journals, Medline CD-ROM indexed 3.435 journals. 2.768 journals were indexed commonly by both sources, 667 journals were uniquely indexed by CD-ROM, while 192 journals were uniquely indexed by IM. Thus, CD-ROM indexed 475 more unique journals than IM.

It is well known that besides IM, Index to Dental Literature and International Nursing Index are among the sources which are covered by Medline. This detailed coverage study revealed the fact that 667 uniquely indexed journals by the mentioned CD-ROM product of Medline, were not totally dental and nursing journals. Only 326 out of 667 were such journals. 341 were mainly medical and related area sources. On the other hand, IM indexed 192 unique journals. It was surprising to see that few of them were on dentistry and nursing. As far as the year 1991 was concerned the two sources did not index an amount of medical journals in common. Medline CD-ROM was found to be more comprehensive in its coverage, since it indexed 341 medical and related area journals uniquely, that were neither dental nor nursing, which were apparently more in number than the 192 journals uniquely indexed by IM.

#### Novelty:

1. The average of the NR results for manual was 7.47%, while it was 11% for CD-ROM. Thus, Ebsco Comprehensive Medline CD-ROM was more successful in bringing the relevant citations to the requesters' attention for the first time.
2. It was also found that Medline added the current literature into its coverage earlier than IM. 68.9 % of the common citations retrieved by both modes,

represented by group 3, appeared in Medline CD-ROM and in IM in the same year. 30.7% of them appeared in Medline a year earlier than IM. There were no citations appeared in IM earlier than Medline CD-ROM. Thus, once more, CD-ROM was found to be more successful.

#### Response Time:

The present study revealed that CD-ROM searches were faster than the manual ones, as commonly accepted undoubtedly. The RT for CD-ROM searches was 50 hours 35 minutes in total. The mean CD-ROM search RT was 1 hour 42 seconds. The total RT devoted to manual ones was 149 hours 10 minutes. The mean manual search RT was 2 hours 59 minutes. Approximately, within almost a 3 hour's time, 3 CD-ROM searches were completed, while a single manual search was performed.

One of the most significant results of the present research was that the time spent for CD-ROM strategies was longer than the manual ones. The time devoted to manual strategies was 4 hours 10 minutes in total. The mean manual search strategy time was only 5 minutes. On the other hand, CD-ROM strategies took 9 hours 35 minutes in total and the mean strategy time was 11.5 minutes.

### Conclusion

Results indicate that the CD-ROM mode is more effective than the manual one, in terms of relevance, coverage, novelty and response time. However, it should be kept in mind that manual searches have revealed higher P, IM indexes unique journals which do not exist in Medline CD-ROM (as far as 1991 is concerned), most of the common citations retrieved by both modes appear in IM and Medline CD-ROM within the same year, and the time devoted to manual search strategies is shorter.

Considering the results of this study, it is concluded that the two search modes have complementary features which suggest the co-existence of both, where possible and needed. If, IM already exists in the library, searchers should decide, in an objective manner, when to search IM and when to search Medline CD-ROM, depending on the features of the request topic.

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