Using Patient Data to Rank Records of Literature Retrieval

Eneida A. Mendonça, M.D., James J. Cimino, M.D., Stephen B. Johnson, Ph.D.
Department of Medical Informatics, Columbia University, New York, NY, USA

Introduction. Several studies have assessed the needs of clinicians for access to information pertinent to clinical practice.[1][2] Increasing importance is being given to the use of the best current evidence in clinical practice and health services. Special attention has also been given to the assessment of medical errors and other adverse events in health care. Studying the incidence of medical errors and other adverse events, researchers have shown that most of the failures can be related to impaired access to information.[3] Our goal is to improve the way retrieved medical literature is presented by identifying critical information in the individual medical record that is useful for determining the relevance of literature data.

Research question. "What is the effect of using the automated knowledge based approach compared to a physician's selection of articles when using a traditional information retrieval system?"

Methods. We describe the use of clinical data present in the medical record to determine the relevance of research evidence from literature databases. We studied the effect of using automated knowledge approaches as compared to physician's selection of articles. We used indexing techniques such as term frequency (TF), inverse document frequency (IDF), and TF*IDF. A detailed description of these scores can be found in a previous publication.[4]

We performed a study to assess the effect of using the automated knowledge approach compared to a physicians' selection using traditional retrieval systems. Three patients consented to the use of anonymized versions of the data stored in their electronic medical records. For each case, four clinical questions were selected from a database of generic questions. A health science librarian generated the search strategy for each question. Two information retrieval systems were searched: PubMED and OVID (Evidence-Based Medicine Reviews). All search strategies were keyword based with Boolean connectors. Subjects were recruited as follows. Three board-certified internists, one board-certified family physician, and one research physician were selected as experts. All physicians, except one, actively practice medicine in their fields. Participants were given instructions that included the case descriptions and the questions assigned to each case along to the citations retrieved by the two searches. They were asked to score each citation according to the relevance of the article (citation) to the question asked and to the patient the case referred to. Each participant analyzed all citations. The automated method scored each citation retrieved, based on how well the abstract and title in the citation matched the case's summary. The main outcome measure in our study was the distance of averaged correlation coefficients between subjects and the average of the raters.

Results. The 3 clinical cases and 12 questions generated a set of 219 citations: 111 from PubMED and 108 from EBM reviews. The number of citations per question varied from 1 to 28. The four questions that retrieved only one citation were removed from the statistical analysis. Thus, the total number of citations analyzed was 215. The correlation coefficient between subjects and the average of the raters varied from 0.04 to 0.52. TF*IDF correlated significant with the average of physicians' when judging the relevant of citations to the care of an individual patient. No physicians differed significantly from other physicians. The automated methods did differ from physicians with significant p values.

Conclusions. The application of an indexing measure (TF*IDF) correlated significantly with the average of physicians when judging the relevance of citations to the care of an individual patient. Additional studies are needed in order to understand if this performance is acceptable in a clinical environment.

References

1. Covell DG, Uman GC, Manning PR. Information needs in office practice: are they being met? Annals of Internal Medicine 1985; 103(4):596-9.
2. Timpka T, Ekstrom M, Bjurulf P. Information needs and information seeking behavior in primary health care. Scandinavian Journal of Primary Health Care 1989; 7(2):105-9.
3. Leape LL, Bates DW, Cullen DJ *et al*. Systems analysis of adverse drug events. ADE Prevention Study Group. JAMA 1995; 274(1):35-43.
4. Mendonça EA, Cimino JJ, Johnson SB. Using narrative reports to support a digital library. Proc AMIA Symp 2001; 458-62.