Chapter 4.13
Evaluation of a
Fuzzy Ontology–Based
Medical Information System

David Parry
Auckland University of Technology, New Zealand

ABSTRACT

Evidence-based medicine (EBM) requires appropriate information to be available to clinicians at the point of care. Electronic sources of information may fulfill this need but require a high level of skill to use successfully. This paper describes the rationale and initial testing of a system to allow collaborative search and ontology construction for professional groups in the health sector. The approach is based around the use of a browser using a fuzzy ontology based on the National Library of Medicine (NLM) Unified Medical Language System (UMLS). This approach may provide high quality information for professionals in the future.

INTRODUCTION

Evidence-based medicine (EBM) (Sackett, Richardson, Rosenberg, & Haynes, 1997) has become increasingly important in the modern healthcare industry. Indeed, the concept of basing practice on evidence is even extending to the software engineering domain (Kitchenham, Dyba, & Jorgensen, 2004). Care that is not based on evidence has become increasingly indefensible from professional, safety, and economic points of view. Electronic access to high quality information can improve the professional knowledge of clinicians (Leung et al., 2003), and is very popular (Westbrook, Gosling, & Coiera, 2004). However, there are a number of difficulties associated with providing high-quality information to support EBM.

Assessing and finding appropriate information is difficult and can be time-consuming. This is partly due to the continuing difficulty users have in navigating the interfaces used by various systems and also because of the lack of training available. Indeed, if the concept of just-in-time information retrieval, as an aid to clinical decision-making at the point of care is to be realised (Gardner, 1997), then complex time-consuming

Table 1. Information quality

Aspect	Comments
Peer-review	World Wide Web (WWW) sites as well as journals may now have peer-review in place.
Randomised Controlled Trial (RCT)	This is the gold standard for clinical interventions although many interventions have not been subjected to this process. There are also issues of the quality and power of a trial. In some cases, meta-analysis can cause smaller trials to lose credibility.
High citation number	This is more of a rule of thumb than an absolute factor. If the source is frequently cited, then it indicates that large numbers of authors have found it relevant. It is perfectly possible that a particularly bad study may have a high citation index, or that the index may be inflated for other reasons such as age of the reference. It is possible to infer that references cited in "good" documents are more likely to be good themselves but this is dangerous to extend too far.
Recent	This depends on the rate of change of the field. Documents in very active research areas are likely to have a shorter useful life than those in inactive areas.
Significant result	A document containing information that a treatment or diagnostic method is effective, and that this effect is large, is likely to be more useful than one that does not. If there is a traditional treatment that is shown to be ineffective then this also is significant.
Authoritative source	For electronic sources of information the Health on the Net Code of Conduct can give some guidance — otherwise, inclusion by indexes or directories, for example, MEDLINE or Cochrane, can lend authority. The author affiliation can be an important issue here. An automated system for "authoritativeness" is described by Farahat, Nunberg, Chen, and Heylighen (2002).
Usability	Traditional Web usability, for example, Neilson's heuristics (Neilson, 2000), and also in terms of technical issues such as plug-ins, media, and so forth.

strategies performed by trained users are not possible. Recent work, looking at the usage of the Clinical Information Access programme (CIAP) in New South Wales (Gosling, Westbrook, & Coiera, 2003) has emphasised cultural barriers to using online sources of information in a clinical setting, and this includes a perceived lack of skill in information retrieval by clinicians.

In assessing the usefulness of information sources, a framework to identify the aspects that are important needs to be established. Three dimensions have been identified, including information quality, clinical relevance, and clinical usefulness, based partly on the work of Sackett et al. (1997), and some of the limits used in PubMed and other information sources. The aspects of each dimension are outlined in Tables 1 to 3.

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