The clinical 'end user' — a neglected resource in patient care

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ABSTRACT — In both medicine and science it is difficult to keep up to date with the large and rapidly increasing literature. Whilst a medical academic is likely to use electronic bibliographic databases for his research, he is less likely to use them in clinical practice. Although the potential advantages of an online search in a clinical situation have been appreciated for some time, in the UK it remains an under-utilised resource. In a pilot end user training project, 9 preclinical and 4 clinical academic staff were taught Data-Star command language together with methods of searching the Medline database. In the 12 weeks follow-up period only 1 of the 4 clinical staff had used online searches to help solve clinical problems. To maximise the use of bibliographic database searches in clinical practice, future end user training projects should aim to overcome the problems of the accessibility of computers and their command languages.

Terminology. A ‘database’ contains bibliographic citations to the published literature whilst a ‘knowledge base’ contains an analysis and synthesis of published information in a given field [Doszkocs, T. E., Rapp, B. A. and Schoolman, H. M. (1980) Automated information retrieval in science and technology. Science, 208, 25-30]. An ‘online’ search is one performed interactively while connected to the computer holding the database (‘computer host’). An ‘end user’ is the person who will use the data abstracted from the computer host.

To deal with a burgeoning literature, many academics now use literature databases (eg Reference Update, Current Contents, Medline or Embase) for their information needs. Whilst a medical academic is likely to use one or more of these systems for his research, he is less likely to use them in clinical practice. A recent survey by the Royal College of Physicians [1] demonstrated considerable reluctance by UK physicians to access currently available electronic database sources. This is in marked contrast to the attitude amongst physicians in the USA [2].

Many hospital or medical school libraries offer a computerised literature search service where requests for information are routinely processed online during office hours by trained librarians or information scientists. This information is later passed on to the clinician, the end user of the information. In the UK to date, few libraries have training programmes to teach health professionals online searching skills [3]. Again this contrasts with the situation in the USA where a recent survey showed that almost 70% of medical school libraries provided an online training programme to staff [4].

Haynes et al. have demonstrated the advantages of online searches over other sources of information [5] and have shown both the variety of sources (computer hosts) and the cost-effectiveness of the technique (in the USA) [6, 7]. Clear advantages can accrue if searches are performed by end users in a hospital environment; for example, the clinical end user knows the subject better than the librarian and can, in urgent cases, obtain information much more quickly (and at all times of the day) with benefit to patient management.

We present here the preliminary results of a pilot end user training project with an example of the use of online searches performed in a clinical environment. We review optical discs and expert systems designed to manipulate the medical literature. The benefits and disadvantages of these systems are considered, and their potential for use by clinical end users is discussed.

Methods and results

An online training programme for end users was established at St George’s Hospital medical school [3]. In the pilot project, 13 members of staff were trained in online searching skills. The group included 9 preclinical academic staff (2 readers, 2 senior lecturers, 1 lecturer, 2 postdoctoral fellows, 2 research fellows) and 4 clinical academic staff (1 senior lecturer, 1 lecturer, 2 research fellows). They were taught Data-Star command language together with methods of searching the Medline database. Access to Data-Star was achieved via the Medical School Local Area Network and JANET (Joint Academic Network). All tutorials included ‘hands-on’ practice, and comprehensive documentation was provided. No attempt was made to suggest possible clinical applications.

The participants were interviewed 12 weeks after training and their usage and search strategies were...
examined by E.L. Only one of the clinicians had spontaneously considered clinical uses of the search facilities; an example of his use of the technique is given below.

Case example

A 41-year-old woman was a ward referral by the gynaecologists for an endocrine assessment of hypernatraemia. She was a schizophrenic (with previous catatonic episodes) who had been admitted 11 days previously for routine colposuspension. Medication on admission was orphenadrine 50 mg qds, lithium carbonate 800 mg daily, fluphenazine 100 mg every 3 weeks; she smoked 15 cigarettes daily. The operation was performed without problem. After the operation she had a chest infection which responded to antibiotics. The daily urine volumes were about 6 litres but serum electrolytes and lithium concentration were normal. On the 7th post-operative day she became increasingly restless, confused and agitated. She was treated with intramuscular chlorpromazine 25 mg and a psychiatric opinion was sought. It was considered that she had an organic psychosis possibly due to an infection; trifluoperazine 10 mg bd was added, with additional chlorpromazine as required. After a total of 3 doses of intramuscular chlorpromazine the patient became pyrexial (39.5°C per axilla), rigid and mute. She was treated with cefotaxime 1 g qds and metronidazole 1 g tds, but the fever continued. Blood cultures, catheter specimens of urine and chest radiology failed to reveal a source of infection. Her daily urine output remained about 5 litres but oral fluid intake decreased as her mental state deteriorated. She became hypernatraemic (serum sodium 153 mmol/litre) and her serum lithium rose to 1.12 mmol/litre. One of us (S.N.) saw her on the 9th post-operative day. The provisional diagnosis was lithium-induced nephrogenic diabetes insipidus and neuroleptic malignant syndrome. This was supported by the measured serum creatine kinase of 1,700 iu/litre (normal for female <200 iu/litre). Appropriate changes to fluid balance, temperature reduction and transfer to ITU were arranged. The temporal relationship to additional parenteral phenothiazines suggested these were the cause of the neuroleptic malignant syndrome but, because of the complicated drug regime and in particular the relationship to lithium, a Medline search was performed (Fig. 1). As a result lithium was also stopped; intravenous dantrolene therapy was started. Discussion with senior neurological and psychiatric colleagues revealed that uncertainty over the role of lithium was not restricted to an endocrinologist with limited experience of this syndrome.

Discussion

Computers have an increasing role in clinical practice in the UK. Their most obvious use is in the handling and management of databases of various sizes (to make appointments or keep data on patients) or in manipulating data output from machines such as CT scanners. Some are used to implement algorithms aiding the diagnosis of specific conditions, eg abdominal pain [8], while others may be used to document and audit clinical activities [9].

The clinical case illustrates the use that a trained clinical end user can make of computers to access suitable databases. The diagnosis of neuroleptic malignant syndrome was made on the basis of the clinical history and examination by a physician inexperienced in its management. A rapid literature search was used to answer the question of whether lithium may have played a role in the aetiology of the syndrome; as a result lithium therapy was stopped. Senior colleagues in the other specialties were unable to answer the specific question raised without themselves having to perform literature searches of some kind.

Currently, few physicians are interested in utilising electronic databases to improve patient care [1]. Physicians in the UK appear to want (third-party) evaluated information in a summarised form with diagrams, pictures and graphic images [1]. Whilst we should not deny that there may be a need for a knowledge base of this type, we consider that if it were restricted to this format it would reduce the quality and amount of information available to the enquiring physician. We believe that this attitude stems, at least in part, from a lack of training in the UK in the principles and practice of database searching. As a result, clinicians perceive computers as unfamiliar tools which are difficult to use. In the USA, where a large number of training schemes are run, various 'user friendly' packages have been developed to encourage the clinical end user. The Paper Chase programs were written to enable clinicians to access Medline more easily [10, 11]; the advent of widespread personal computer use has created a market for similar microcomputer-based 'front end' software such as Grateful Med [12] and Med-Base [13].

The expert system approach has been around for some years [14], and an increasing number of expert systems are being developed for diagnostic and therapeutic applications in medicine [15, 16], although the legal problems of their use remain to be resolved [17]. However, expert systems are being designed to enable clinicians to locate documents in a specific subject area in larger databases. CanSearch helps doctors with no previous training in information retrieval to find cancer therapy related articles stored in the Medline database [18]. The discrete subject 'cancer treatments' was selected to fulfill the requirements of an expert system where general knowledge of clinical cancer therapy, a controlled vocabulary of terms and a set of indexing rules are incorporated into the knowledge base. Terminology is frequently a problem when a naive user such as a clinician uses a complex database like Medline which has its own controlled vocabulary (MeSH: Medical Subject Headings). A solution to this problem is being developed which utilises a menu-based interface called MenUSE [19]. Subject options are chosen from a series of menus which overcome the
problems of terminology. The first expert intermediary for online searching to be marketed in the UK was Tome Searcher, introduced in 1987 for the domain of electrical and electronic engineering; use in other subject areas is currently under investigation.

In this hospital a clinician may access databases through the information scientist (E.L.) who is based in the library; however, a recent alternative is to search Medline himself on a compact disc system (Compact Cambridge) also located in the library. Optical disc technology has provided an interesting alternative to online searching of the Medline database [20, 21] and has helped to popularise computer searches. Medline is now marketed on CD-ROM (Compact Disc-Read Only Memory) by several companies and has been successfully introduced into a number of medical libraries. CD-ROM Medline was available in this institution at a single terminal at the time of the end user course, and all members of the group had previous experience of this system. Several of the participants

Fig. 1. Online search strategy for Medline database used to investigate the case. Annotations appear in italics.

| D-S/MEDL/MEDLINE 1983 - FIRST PART APR.89 |
| COPYRIGHT BY NATIONAL LIBRARY OF MEDICINE |
| D-S - SEARCH MODE - ENTER QUERY |
| 1: neuroleptic-malignant-syndrome# |
| 2: lithium#de. |
| 3: 1 and 2 not xe |
| 4: ..p 3/ti/all |
| Neuroleptic malignant-like syndrome and Lithium (letter). |
| Neuroleptic-induced pyrexia. A benign variant. |
| 'Neuroleptic malignant syndrome' without neuroleptics (letter). |
| Recurrence of neuroleptic malignant syndrome. |
| Neuroleptic malignant syndrome or lithium neurotoxicity? (letter). |
| Reinduction of neuroleptic malignant syndrome by lithium. |
| Amoxapine and neuroleptic malignant syndrome (letter). |
| Neuroleptic malignant syndrome or lithium neurotoxicity (letter). |
| Fever caused by lithium in a patient with neuroleptic malignant syndrome (letter). |
| Neuroleptic malignant syndrome (letter). |
| Symptoms of neuroleptic malignant syndrome in 82 consecutive inpatients. |
| Apparent neuroleptic malignant syndrome with clozapine and lithium. |
| Managing an acutely manic 17-year-old girl with neuroleptic malignant syndrome. |
| Drug treatment of schizophrenia. |
| Resolution of neuroleptic malignant syndrome with dantrolene sodium: case report. |
| 5: ..p 3/short/1,3,4 |
| 1 AN 89070073. |
| AU Koehler-P-J, Mirandolle-J-F. |
| TI Neuroleptic malignant-like syndrome and lithium (letter). |
| SO Lancet 1988 Dec 24-31, VOL: 2 (8626-8627), P: 1499-500, ISSN: 0023-7507. |
| 3 AN 89001771. AU Brennan-D, MacManus-M, Howe-J, Mcloughlin-J. |
| TI 'Neuroleptic malignant syndrome' without neuroleptics (letter). |
| SO Br-J-Psychiatry 1988 Apr, VOL: 152, P: 578-9, ISSN: 0007-1250. |
| 4 AN 88171497. |
| AU Susman-V-L, Addonizio-G. |
| TI Recurrence of neuroleptic malignant syndrome. |
| SO J-Nerv-Ment-Dis 1988 Apr, VOL: 176 (4), P: 234-41, ISSN: 0022-3018 41 Refs. |
| \*confirms possible role for lithium
on the course wished to use online searching since too little time was available on the CD-ROM system. A recent development of this idea has been the production of compact discs of information on specialised topics such as AIDS (Compact AIDS) or intensive care (Micromedex). However, compact discs may not be suited to the clinical situation. They are expensive to rent (approximately £1,300 for the current year and for the preceding five years) and require the purchase of CD-ROM drive. They may not be cost-effective unless frequently used, though discs covering specific subject areas may be a more economical alternative. In contrast, the equipment required for online searches (costing less than £1,000) can easily be used for much of the time for other tasks such as word-processing; it requires no purchase other than a connection to a local area network or modem. The costs of online searches performed via JANET are dictated only by the time used on the computer host and the number of references abstracted from the database; for example, the search illustrated cost approximately £3.

We believe that the systems we have described have potential for a more general use in the clinical situation. While expert systems are still in their infancy, they may provide a means of overcoming the problems of terminology and vocabulary and command languages. Proposals to develop more computer networks within the NHS will provide simpler communication routes for online searching and eliminate the need for modems. However, there is often considerable resistance to the use of computers which may be seen to threaten the ‘expert’ and his or her own personal database of experience [17]. Our results from this pilot study indicate that training of clinicians should be specifically aimed at overcoming both this resistance and the difficulties inherent in searching a database in a ‘foreign’ language.

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