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PERSONAL KNOWLEDGE: A CLINICAL PERSPECTIVE FROM THE VALUE AND EVINCE PROJECTS IN HEALTH LIBRARY AND INFORMATION SERVICES

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The progress of initiatives concerned with implementing evaluated clinical research (such as evidence based medicine and clinical effectiveness) is dependent on the way individual health professionals actually acquire, use and value clinical knowledge in routine practice. The findings of two research projects, the Value and EVINCE projects, are compared with studies of the consolidation and application of clinical knowledge in clinical decision making. The Value project was concerned with the ways in which information from NHS libraries might be used in present and future clinical decision making. EVINCE was a similar impact study for nursing professionals. Both studies confirmed the importance of personal clinical knowledge. Health information services need to use a variety of strategies and knowledge management skills to ensure that the evaluated research evidence is assimilated and implemented into practice.

1. INTRODUCTION

There seem to be varying interpretations of the term ‘knowledge management’ and this section introduces some concepts and definitions which are relevant to the ways health information professionals might support and develop the ‘knowledge base’ of health care. The term knowledge management often seems to be associated with hopes for a more sophisticated use of information systems and technology to serve decision making in organisations, though the knowledge of the business and acquired expertise of staff may be more important to the organisation than the documentation and databases it has about its products and customers. Databases by definition handle data, presumably providing information to those running the organisation. Decisions are made on the basis of knowledge which may require synthesis of many items of information over a period of time. Using the value added framework of Taylor [1] this can be viewed as the increased value provided to data as it is processed through data, to information, to informative knowledge, productive knowledge and from there, through decision processes to action. Taylor distinguishes between the stages of informative knowledge and productive knowledge, and probably the processes involved in bridging those stages of the knowledge generation process are of most interest to those promoting the skills of information professionals in ‘knowledge management’. Of particular concern in health information are methods for filtering the

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vast amount of biomedical literature in the databases, so that users might quickly retrieve, preferably at the point of care, the information they may need to guide a clinical decision.

There is in knowledge management a greater emphasis on working within and for the organisation (rather than acting as a source of information on external sources) in order to capitalise on internal skills and know-how, and that requires excellent communication and information presentation skills [2]. For those information professionals working within the NHS there is a distinction between the 'information manager' who is usually responsible for the patient record type of data and management information, and the librarian who is responsible for text-based sources and therefore more concerned with external sources of information and databases such as MEDLINE. Gaining an organisation-wide perspective is possibly very difficult in the NHS as departmental boundaries militate against the type of collaboration desirable.

Buckland [3] distinguishes between information as 'information as process' as the act of telling and being informed, and 'information as knowledge' as what is perceived in 'information as process'. One view of the key characteristic of 'information as knowledge' is that it is intangible, but that it can be expressed and communicated by 'information as thing' which are representations of knowledge. In the wider sense the latter might viewed as Popper's World 3. World 1 is the world of material things, World 2 represents our thinking, feeling, believing and knowing and World 3 the results of interaction between Worlds 1 and 2. Just how Popper's ideas about World 3 relate to information science activities and the constructs placed on 'knowledge' and the growth of knowledge has been a matter of debate [4, 5, 6], but the differences between informative and productive knowledge, and Popper's Worlds 2 and 3, may underlie many of the problems of deciding on the meaning of relevance in information retrieval. Relevance statements are arguably dynamic rather than static and depend on the mental state and context being considered at that particular time by a user [7]. The interaction between the item retrieved and the user's cognitive state must be considered to understand the nature of relevance to the information seeker. Health information professionals need to be aware of the context of information need and use by the clinician or manager to provide information relevant to the decision process. Whether working as a librarian or as an 'information manager' understanding that context can be very difficult in a large organisation such as the NHS, sometimes justifiably described as a collection of tribes rather than a unified organisation.

For designers of information systems and the information professionals working with those systems there is always a need to consider the informal sources of information as well as the formal, published sources, and the channels of communication used for those sources. Software for group working may formalise and replace, to some extent, existing informal communication channels but it could also build on and reinforce the informal communication channels. For dissemination and implementation of research findings the means of communication and the processes involved in the stages from informative through productive knowledge to action are of particular interest to those funding research which has an immediate application to the health and welfare of the population. As knowledge managers health information professionals may need

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to develop strategies to support the decision processes as research findings are considered for implementation.

Implementing research findings often involves changes in practice and learning for the organisation and individuals. The information space model devised by Boisot [8] provides a framework for considering what Boisot terms the social learning cycle. Many of the activities and necessary skills attributed to knowledge management and information management can be located along the social learning cycle, and the gaps and barriers in the cycle identified [9]. Much of traditional information science and management has dealt with particular types of knowledge – the highly abstract/highly diffused area of scientific knowledge, which is also public knowledge. Information management has been less concerned with personal knowledge and tacit knowledge [10] which can be viewed as the 'intuition' of the decision maker, and, however constructed, cannot be neglected when studying the work of the professional, in particular those practising the art and science of nursing [11] and medicine. The personal knowledge of the health professional, how that personal knowledge is acquired, and how the personal knowledge interacts with the public scientific knowledge concerns many information professionals, educators of health professionals, and managers seeking to provide a more accountable and effective health service.

For large and complex organisations such as the National Health Service the aims of knowledge management are less easy to define than in a smaller organisation. The range of clinical and managerial expertise is much broader, and the informal channels of communication may be intra-disciplinary rather than multidisciplinary. Health information professionals have to be aware that those learning by gaining or using knowledge within a health care organisation may be operating in quite distinctive ways for purposes characterised by their clinical specialty, professional or managerial roles. This paper concentrates on the individual perspective of knowledge management, which does affect the organisational perspective of knowledge management, and associated cultural changes.

2. HEALTH CARE AND KNOWLEDGE MANAGEMENT

Knowledge management can be considered at two levels in health care: organisational and personal. First, the organisational management of knowledge can be considered in the way the system can be encouraged to exploit and make sense of the explicit scientific knowledge base, to make decisions about the purchasing of health care which are as rational and equitable as possible, for example. The rational decision making model does not always explain the apparent behaviour of organisations and the 'knowing cycle' [12] involves individuals making sense of their environment, and creating knowledge, often through the sharing of personal knowledge by informal channels. For health professionals the second level, that of the personal clinical knowledge, interacts with the explicit and public scientific knowledge in the processes of clinical knowledge acquisition, clinical reasoning and the processes associated with intuition. Assessing the full impact of information provision requires an awareness of the personal knowledge processes as well as assessing the apparent relevance and usefulness of the item of information to present and future clinical decisions at the organisational level.

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Progress at the organisational level depends on progress at the personal knowledge level, and vice versa. Health information professionals have traditionally viewed themselves as custodians of the external evidence in the literature (the explicit knowledge), but have had less contact with the processes whereby the personal knowledge of health professionals is developed. There have been trials (largely in North America) of 'clinical librarian' schemes, where the librarian would attend clinical meetings or ward rounds [13]. Such schemes are often costly to run although the users may be very satisfied with the service, and librarians often find the experience valuable.

2.1 Importance of the scientific evidence

In health care the importance of structured knowledge management is acknowledged in the recent rapid growth of interest in 'evidence based medicine' and the support given directly and indirectly by the UK Department of Health to centres such as the NHS Centre for Reviews and Dissemination. Those centres, together with the Cochrane Collaboration, aim to provide health professionals with synoptic views of the effectiveness of various interventions, and such developments provide opportunities for information professionals to exploit their skills [14]. Pressures for greater accountability in clinical decision making have emphasised the importance of basing decision making about treatments on reliable information, based on the best research evidence. There are delays in getting the results of reliable clinical research into practice, one example being the twelve-year delay between the publications indicating the effectiveness of thrombolytic treatment in patients with myocardial infarction and uptake into routine clinical practice [15]. One of the reasons for such delays is undoubtedly the sheer mass of biomedical information produced, at increasing rates, far beyond the ability of the general practitioner to keep up-to-date with advances in medicine. Another reason appears to be apparent conservatism of the health professions to change clinical behaviour. While one would certainly not wish doctors to take up any new treatment without full consideration of the costs and benefits, there does seem to be a reluctance to act on new evidence. Changes in doctors' clinical behaviour may be due to a combination of factors [16], one of which may be formal education or personal reading [17], though reading alone is not generally sufficient [18]. Systematic practice-based interventions appear to be a more effective strategy for continuing medical education to improve professional practice [19], implying that information professionals need to work with other groups and by a combination of methods to ensure that evaluated research is implemented into clinical practice.

2.2 The use of the scientific evidence for future clinical decision making

The ways in which clinical knowledge is confirmed and substantiated have implications for information provision to health professionals and the success of initiatives which aim to support evidence based medicine in the broadest sense. Two research projects provide relevant data to this debate. The first, the Value project [20], funded by the British Library Research and Innovation Centre (formerly the British Library R&D Department) examined the effectiveness of information provision to various categories of medical staff, including a detailed study of the

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patterns of information need and use (including impact on practice). The second, the EVINCE project [21], complemented the Value project in a similar study of nurses, midwives and health visitors. Both projects included examination of the impact of information and the links between information provision, continuing education and changes in professional practice. The research found that these links exist but that the primary impact of information provision is on continuing education (and knowledge). Piecing together the evidence to demonstrate the links between information provision and practice is possible, but more complex than an earlier study of the impact of information on clinical decision making (the Rochester study) appears to suggest [22].

3. CONSOLIDATION OF CLINICAL KNOWLEDGE

For clinicians (doctors and nurses), the term clinical information encompasses not only the information in the biomedical (and social sciences) literature but also the information derived from the patient, whether this is the patient they are treating at the time or a collection of patient records. Gains in clinical knowledge come both from consideration of the literature, and also from personal experience gained in direct clinical care.

For a doctor, the basis on which the knowledge is built will be the physiology and biochemistry and other biomedical knowledge acquired during undergraduate and postgraduate medical education. This type of knowledge has been termed the ‘low-level’ knowledge about the structure and function of the body, and ‘high-level’ knowledge is the knowledge gained from clinical experience [23]. Some of that knowledge will be personal knowledge, some will be gained from a combination of personal knowledge and knowledge gained via other clinicians, in person or through the medium of the journal literature, for example. The ‘low level’ knowledge base of nurses is broader, though shallower, and the recent changes in nursing education require new entrants to the nursing profession to follow a diploma level course which encompasses physiology, psychology and sociology, as well as clinical nursing skills.

The information provider or designer of a clinical information system needs to be aware of the accretion of clinical knowledge and how such knowledge is used in clinical decision making. Of particular interest is the weight placed on personal case-related knowledge and the differences between expert and novice medical decision makers. A study [24] aimed at examining the effect of general and case-related experience on primary care treatment decision making used a series of clinical vignettes or case histories. Between 375 and 380 physicians responded to a series of questions aimed at eliciting how confident they were in implementing therapy without recourse to additional information (from formal or informal sources), and which sources would be used if they did seek further information. Clinical experience was assessed in terms of age, average number of patients seen each week and case related experience assessed by asking how many cases they had seen (similar to the vignette) in the previous year. The study examined ‘willingness to proceed’, ‘information preference’ and ‘continuity of care preference’ (would they prefer to transfer care to a specialist). Physicians’ willingness to proceed with treatment depended on the case content. In two of the vignettes,

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characterised by low willingness to proceed, the level of case-related experience was a significant factor. Surprisingly, in one of the vignettes the younger physicians were more willing to proceed with treatment than the older physicians, a finding attributed to the possibility that younger physicians would perceive themselves as knowledgeable about up-to-date treatments. Physicians showed a generally strong preference for consultations with a specialist if additional information were sought. The notable finding was the apparent confidence and independence acquired after seeing and treating only a couple of cases. In the converse situation of 'unlearning' behaviour, a study of the GPs' reasons for changing prescribing behaviour found that the decision to change behaviour was precarious and depended on the results of the treatment on a few patients [25].

Apparently the effect of case related experience is important for the individual doctor. An early study [26] on the process of clinical problem solving hinted at the importance of case related experience when criterial (expert/opinion leader) physicians could not be distinguished from the non-criterial (less expert) physicians. Problem-solving competence appeared to be related to the case, rather than to general and transferable problem-solving skills. The differences between experts and weaker problem solvers may be related to a greater repertory of experiences, suitably organised in long-term memory. Greater domain knowledge appears to help expert physicians discriminate between, and eliminate, alternative hypotheses in diagnostic reasoning [27]. Case-related experience also appears to dominate how physicians assess new information. Practitioners and opinion leaders compared what they read (in an original research article) with their own experience to assure themselves of the scientific soundness of the information in the article [28].

Basic, pre-registration nursing education in the UK has only recently moved from a largely vocational and hospital based training to an academic education. While awareness among UK nurses of research was scant in the 1970s [29], more recent findings suggest that US and UK nurses frequently seek out research articles [30] and value journals which have clinical articles relevant to direct patient care [31, 32]. Just how research findings are weighed against personal clinical experience is uncertain, but the clinical nursing environment often appears to value completion of the task over questioning of practice [33], while the task-based system of nursing, with an emphasis on the rituals of practice, may serve as a defence against anxiety, to cope with the stress of day-to-day nursing [34]. (In a similar, though more light-hearted vein, it has been pointed out that the neuroses of librarians include the fear of the passive mode and the urge to do something [35].) An organisational model [36] for promoting research-based nursing practice stresses the need to integrate the inductive description of everyday events with later deductive knowledge generation and evaluation of new initiatives.

3.1 Clinical reasoning and intuition

Many studies of doctors' clinical reasoning have attempted to uncover the heuristics involved, the way hypotheses about a patient's condition are generated quickly by experts and decisions reached. One theory [37] of the development of expertise addresses the problem of content specificity, and the differences observed in data gathering techniques between medical students and qualified

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doctors. The theory proposes that clinicians use 'illness scripts' as cognitive structures. Similarly, clinicians were observed to cope with the complexity of medical information by the 'telling of stories'. The familiarity with a case was expressed as 'knowing the patient's story' [38]. A new case may therefore be compared with a memory of a previous patient.

These story schemata are reflected, to some extent, in the way medical knowledge is transmitted. Case presentations could be said to present a story, often a story with a different twist. Case reports are a common feature of many medical journals, flagging up the new story or narrative for a patient with a particular disease or condition and the course of the disease and its treatment. Many peer-reviewed clinical journals contain a mixture of the types of communications between the medical practitioner and the medical researcher. Case reports, which are traditionally considered to be communications between practitioners, sometimes provide misleading evidence of the effectiveness of certain treatments. Hundreds of case reports reported success with extracranial-intracranial bypass for stroke prevention and use of the procedure rose during the eight-year period involved for the proper testing of the procedure in a randomised trial, which found the procedure ineffective [39]. If, however, the case report is the preferred method by which clinicians acquire new information as this mirrors the story schema of clinical knowledge representation, reliance and interest in the case report may continue.

For nurses, there is less emphasis on making the right decision about diagnosis of a condition or selecting the most effective course of treatment. Definitions of nursing, and what nurses do or should do vary. Perhaps one of the most popular is:

> The unique function of the nurse is to assist the individual, sick or well, in the performance of those activities contributing to health or its recovery (or to a peaceful death) that he would perform unaided if he had the necessary strength, will or knowledge. And to do this in such a way as to help him gain independence as rapidly as possible [40].

There is an emphasis of the importance of the relationship between nurse and patient, of holistic care of an individual. Examination of popular nursing journals such as the *Nursing Times* reveals not the case report but care studies, which are detailed personal accounts by practitioners of the conduct of the care of particular patients. A Royal College of Nursing publication [41] reflects the value placed by nursing professionals on the intuition which results from clinical experience and reflection on that experience. To promote health and well being, nurses may need to develop the personal knowledge that comes about through reflective practice [42] (encouraged by clinical 'coaching', rather than formal teaching).

3.2 Application of clinical knowledge in decision making

In a discussion [43] contrasting two theories of intuitive and analytical cognition, Hammond's Cognitive Continuum Theory and the Dreyfus theory of expert cognition, the question posed is the level of thinking (do experts always think intuitively and novices analytically?) or are expert clinicians simply better at making an appropriate choice of mode of enquiry for a particular situation, on a continuum with intuition at one pole and analysis at the other? These differing views

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about the nature of clinical knowledge and its application are relevant to the debate about evidence based medicine and its acceptability to clinicians. The exact definition of evidence based medicine is still being discussed but one definition by some proponents of evidence based medicine is:

> the conscientious, explicit, and judicious use of current best evidence in making decisions abut the care of individual patients. The practice of evidence based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research [44].

Considering the Hammond continuum this would mean that clinicians would have to be able to operate near the analytical pole, to consider evidence carefully and consciously and be able to integrate that mode of thinking with their intuitive judgement at the other pole, a feat that might be considered quite difficult. Between those poles Hammond places system-aided judgement (semi-structured task, medium analytical requirements) and peer-aided judgement (less structured and less analytical than system-aided judgement. Use of clinical practice guidelines (akin to system-aided judgement) and opinion leaders (peer-aided judgement) might therefore be important stages in the continuum linking these polar positions of evidence based medicine.

3.3 Information provision and confirmation of clinical knowledge

How much can the studies and theories of clinical reasoning help to guide provision and evaluation of information services which, after all, contribute to clinical knowledge? To summarise, the following themes appear to recur in several of the studies of clinical reasoning (most of these concern doctors rather than nurses):

- case related experience is important – but the quantity may not be the decisive factor;
- story-making schemata relate to the clinical problem-solving process and also to the way such knowledge may be stored in long-term memory;
- reluctance to use the formal journal literature may be partly due to the dissimilarity between the formal knowledge presentation and the way clinical knowledge is acquired informally;
- novice decision making may be different from expert decision making but experts do not generally agree and appear to develop individual strategies which may be strongly content related.

4. REFLECTIONS ON THE FINDINGS OF THE VALUE PROJECT

If novices and experts approach clinical decision making in different ways, the new doctor or medical student using a more analytical approach than the expert clinician, then it is possible to hypothesise that the more junior doctors will place a different type of value on the cognitive impact of any information supplied.

This hypothesis can be tested against data collected in the Value project. This project included a survey of over 700 requests made by medical staff at eleven sites. These requests included inter-library loan requests, CD-ROM searches (largely MEDLINE) by the clinicians, and mediated searches. The initial sample

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surveyed comprised 337 end-user searches, 307 inter-library loan requests, and eighty-one mediated searches, making an initial total of 725, although only 713 were sent as some of the initial sample could not be traced. No library user was approached more than twice, and preferably only once. Those who had participated in a previous survey for the Value project were eliminated from the pool of requesters/searchers available for survey. The approximate time span covered was an eight to nine week period during April–June 1994, the exact time period depending on the procedures used by the site for handling requests and recording end-user searches. The overall response was 68% (486/713). Most requests or searches originated from senior hospital medical staff or those engaged in scientific research. The most junior doctors surveyed (senior house officers) made comparatively few requests or searches, and the number of requests from GPs was also low. Consultants and academic staff were most prominent among the inter-library loan requesters, while end-user searchers were most likely to be doctors engaged primarily in research, or registrars.

The questionnaire covered reasons for making the request or search, immediate cognitive impact, and the perceived benefits to present and future clinical decision making. Follow-up interviews with a sub-section of those surveyed explored the topics searched and the nature of the benefits of clinical decision making, to provide case study evidence as well as a check on the categories of clinical decision making used in the questionnaire.

The Value project questionnaire was based partly on the questionnaire used in the Rochester study [22], which itself was based on an earlier study in Chicago [45]. The Rochester study appeared to prove that the information provided by the hospital library had a positive impact on clinical decision making and that the information contributed to improved patient outcomes. A study which appeared to demonstrate that the library service was cost-effective in terms of patient care sparked much interest among medical librarians and the study has been replicated elsewhere, with similar, though by no means identical findings. Reasons for the differences are partly attributable to the different methodologies adopted in the studies, and the different cultures involved, but there remain some puzzling differences [46]. Many of the replicated studies do not differentiate between junior and senior doctors, and it is possible that their differing research, and continuing education requirements affect the value estimations.

Some differences were found in the Value project among staff groups in the perceived cognitive impact of information obtained (Table 1). The limitations of course concern the group of senior house officers (SHOs) who made little use of those particular library services, despite making up a sizeable proportion of the medical staff workforce.

There is some evidence to support the different approaches of novices and experts to clinical decision making in the Value project findings. The unsurprising finding is that the SHOs, the novices, were significantly more likely to find that some information was new. However, if confidence in decision making is fairly rapidly acquired on the basis of a few cases, and novices do make early hypotheses in much the same way as the experts [26, pp. 278–279] then it is not surprising that there may be fewer differences among the staff groups on the impact of information on the confirmation and substantiation of knowledge. Development

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Table 1. *Immediate cognitive impact of information: staff group differences (Value project)*

Statement of impact	*SHOs*	*Registrars*	*Senior registrars*	*Consultants*	*Significance*
Some of it was new to me	92% (36/39)	90% (73/81)	92% (57/62)	79% (74/94)	$\chi^2 = 8.61$ ($df = 3$) $p = 0.03$ (significant)
It substantiated what I knew or suspected	61% (23/38)	67% (51/76)	67% (39/58)	78% (69/89)	$\chi^2 = 4.47$ ($df = 3$) $p = 0.22$ (not significant)
Total possible number respondents	40	83	68	105	

Missing values not included in calculation, No and Not applicable values coded as 'No'.

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of clinical expertise may require the encapsulation of biomedical knowledge into clinical knowledge [47], though progress is not necessarily smooth.

The perceived pressures by clinicians to keep up-to-date personally with advances in medical knowledge are explicable if their problem solving skills are integrally linked with the case content. Otherwise one could separate the problem solving skills and assume that these are transferable to different cases. Clinical decision support systems possibly require a subtle mixture of knowledge support and problem solving support – hence the difficulty of constructing systems that will be used by clinicians with widely varying clinical experience. A systematic review of the effects of clinical decision support systems on clinician performance and patient outcome concluded that some, though not all, computer based clinical decision support systems could improve performance or outcomes [48].

In the Value project clinicians were asked about the background to their searches or requests and the personal curiosity or 'need to know' was quite prominent (Table 2).

The only category where there is a statistically significant difference between the novice, more experienced and expert clinicians concerns the prompt of suggestion or advice from a colleague. This fits the picture of a clinical problem solver as an individual expert in his or her own right – and the more senior the more 'rights' they may assume. The other findings appear to demonstrate that the 'need to know' is deemed important by all groups (possibly for different reasons) and that keeping up-to-date via the literature is an important activity.

If information services are to help clinicians consolidate their clinical knowledge the dominance of case-related experience must be taken into consideration. Targeting of services to meet the needs of case presentations may be of more interest to clinicians than attempts to get them to read more journals in general. The SHOs, the novice clinicians, have a different set of clinical knowledge needs from their more expert senior colleagues. As mentioned earlier, supporting the implementation of evidence based medicine may be more difficult than might be assumed and might require a more subtle approach more in tune with clinicians' preferred methods of acquiring knowledge and changing prescribing behaviour.

The other important factor to remember is the individuality of every expert. A service valued by one may not necessarily be used by another individual working in a different specialty, with a different approach to clinical problem solving.

5. REFLECTIONS ON THE FINDINGS OF THE EVINCE PROJECT

The aims of EVINCE were similar, though not identical to the Value project. A similar survey of searches and requests was conducted among a sample of searchers and requesters using eleven different services. The response rate was 40% (311/776), lower than in the Value project. There was considerable variation in the site response rate, and the level of response is attributable to some site specific factors which affected the experimental procedures used (and unfortunately lowered the response). Interviews were arranged with a selection of respondents and non-respondents.

The immediate cognitive impact of information for the nurses differed only slightly to that for the doctors (Table 3).

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Table 2. *Prompts for searches or requests in Value project*

Search or request prompt	*SHOs*	*Registrars*	*Senior registrars*	*Consultants*	*Significance*
Suggestion or advice from colleagues	48% (19/40)	31% (26/83)	16% (11/68)	11% (11/103)	$\chi^2 = 27.7$ (3 *df*) $p < 0.01$ (highly significant)
Reading of personal journals and books	35% (14/40)	36% (30/83)	46% (31/68)	45% (46/103)	$\chi^2 = 2.54$ (3 *df*) $p = 0.47$ (not significant)
Personal curiosity or the 'need to know'	60% (24/40)	54% (45/83)	50% (34/68)	43% (44/103)	$\chi^2 = 4.4$ (3 *df*) $p = 0.22$ (not significant)

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Table 3. *Immediate impact of information on doctors and nurses*

Impact	*EVINCE project (nursing professionals)*	*Value Project (medical staff)*
Some of it was new to me	90%	88%
It substantiated what I knew or suspected	75%	66%
It refreshed my memory of details or facts	61%	57%
Total number of possible responses for each category	307	486

Note: % response is calculated on response for each category

There were few detectable differences in information behaviour among staff groups in EVINCE. It was extremely difficult from the job titles and brief descriptions to make sensible groupings. Various divisions were attempted, for example between acute and community staff, staff nurses and midwives but there were few statistically significant differences in the patterns of information need and use among groups. Role differences may be less well defined, and differences in information need and use may be at the individual, rather than the group level, for nursing and midwifery staff. Those 'upwardly mobile' and active information seekers may be more easily identified by their interest in post-registration education (number of courses attended) than by the job title, grade or years in post [49].

6. USING INFORMATION IN CLINICAL PRACTICE: RESULTS FROM VALUE AND EVINCE

For the EVINCE project the impact of the information obtained was assessed in a similar manner to the Value project. The Value project defined the value of information to medical staff in terms of benefits of clinical decision making. The link to benefits in terms of health service outcomes could be delineated in terms of clinical decision making, as the decisions of doctors make a difference to the costs and benefits of health care. Nurses, midwives and health visitors have a different set of professional responsibilities for care and the clinical decision making categories that were appropriate for clinicians would not be entirely suitable. For the nursing professionals, the factor that influences patient outcome is the quality of nursing care. Better care is almost by definition more competent care, and EVINCE thus considered the value of information to nurses, midwives and health visitors in terms of the contribution to improved competencies.

Various frameworks [50, 51] of competencies and skills were used to derive a set of categories for the possible impact of information on nursing competencies (and hence future nursing practice). While the Value project dealt with general clinical decision making categories for diagnosis, therapy and management of the quality of care, the EVINCE categories (Table 4) broadly concerned patient/client assessment, monitoring and quality management of care. The latter group of categories (quality management of care) were the same as those used in the Value

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Table 4. *The impact of information on nursing practice (EVINCE)*

The information would or did help in …	*Positive response*
Evaluation of practice outcomes	70%
Improved quality of life for patient and/or family	68%
Interpersonal relations with clients/patients	61%
Audit or standards of care	57%
Monitoring of care	56%
Legal or ethical issues	51%
Initial assessment of a patient/client	45%
Interpersonal relations with colleagues	37%
Practical nursing techniques (e.g. lifting/IV lines)	29%
Care administration (e.g. planning rotas)	25%

Total number of responses = 307. Percentage who indicated that at least one category would be affected = 96%. Percentage response is calculated by response for each category.

Table 5. *Impact of information on clinical decision making (Value/medical staff)*

The information would or did help in …	*Positive response*
Recognition of abnormal or normal condition	36%
Identification /evaluation of alternative therapies	35%
Improved quality of life for patient and/or family	33%
Confirmation of proposed therapy	32%
Differential diagnosis	31%
Minimisation of risks of treatment	27%
Audit or standards of care	26%
Revision of treatment plan	25%
Choice of diagnostic test	22%
Legal or ethical issues	16%

79% (383/486) of all respondents indicated that at least one category of clinical decision making would be affected. (Group included staff who were entirely concerned with research.) 89% (321/361) of clinician respondents indicated that at least one category of clinical decision making would be affected. Total number of responses = 486 (of which 361 were clinicians). Percentage response is calculated on the response for the category.

project (Table 5). There are parallels between diagnosis (Value) and assessment (EVINCE), and between choosing therapy (Value) and monitoring/evaluation of care (EVINCE). For both groups of health professionals there is a cycle of assessment of care needs, provision of care and audit of care provided.

There are differences in the way the impact of information on future practice may be quantified among medical staff and nursing staff. The generally higher percentages for the nursing staff signify that nurses were far more likely to tick more than one category of impact. For the doctors, the impact was often quite specific, but nurses had often requested a general article or review which covered several aspects of the topic and nurses found it difficult to be specific about the future impact on their practice. Information useful to nurses may often be general but, equally, nursing care is holistic and requires the integration of physiological

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Table 6. *Which clinical decisions are of most interest – and to whom?*

Staff group	*Rank (% frequency for group) 1st*	*Rank (% frequency for group) 2nd*	*Rank (% frequency for group) 3rd*
SHOs Number in group = 40	Recognition of normal/abnormal condition (54%)	Revision of treatment plan (54%) (tied)	Identification or evaluation of alternative therapies (51%)
Consultants Number in group = 105	Confirmation of proposed therapy (49%)	Identification or evaluation of alternative therapies (48%)	Minimisation of risks of treatment (39%)

Notes: percentage response calculated on response to the category

and psychosocial knowledge with clinical experience. Assessment of the impact of an item of information on knowledge requires consideration, therefore, of the specificity of information required, the level of knowledge (specialist/general), and the breadth of aspects of the subject of interest to be considered.

Those with less knowledge – the novices – are thus more likely to value information on a broader set of categories than the experts with more knowledge. The impact of clinical decision making differed qualitatively and quantitatively between groups (Table 6) though the findings are based on relatively small group sizes (particularly the SHOs, who made relatively little use of those library services studied). For the junior doctors the impact of information is greater in the sense of being broader. The order of priorities reflects the greater concern among junior doctors that the choice of treatment is right for the condition and a greater concern among the senior doctors that the choice is the best and safest possible.

Evidence based health care requires the systematic use of the evidence in the literature to help in decisions made about the care of individual patients or groups of patients. For all groups of clinicians (SHOs, registrars, senior registrars and consultants) ‘identification and evaluation of alternative therapies’ appeared in the top three categories of impact. For the nurses ‘evaluation of practice outcomes’ was the most important category, closely followed by considerations about the quality of care (quality of life and the nurse-patient relationship).

Nursing roles and responsibilities are increasingly varied and changing rapidly. It was perhaps not too surprising that it was difficult to identify statistically significant differences between the pattern of impact for acute and community nurses, or between staff nurses and midwives. For nurses the differences in subjective valuations of the impact of information appear to be at the individual level and may not be influenced by the role implied by the current job title and grade, but more by individual interest in continuing education. The UKCC (United Kingdom Central Council for Nursing Midwifery and Health Visiting) envisages post-registration and practice developing along three stages, the final stage being ‘advanced practice’.

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Table 7. *The impact of information on practice for nurses doing courses*

Category of impact	*Positive response*	*(Total group)*
Evaluation of practice outcomes	75%	70%
Improved quality of life for patient and/or family	66%	68%
Interpersonal relations with clients/patients	65%	61%
Monitoring of care	62%	56%
Audit or standards of care	57%	57%
Legal or ethical issues	55%	51%
Initial assessment of a patient/client	48%	45%
Interpersonal relations with colleagues	42%	37%
Practical nursing techniques (e.g. lifting/IV lines)	34%	29%
Care administration (e.g. planning rotas)	28%	25%

Total number of responses (course work group) = 181. Percentage response is calculated by response for each category. Total number in whole group = 307.

Formal post-basic education will contribute to the development of the advanced practitioner but experiential knowledge will also be required. Interestingly, the impacts on future practice were generally rated higher for nurses obtaining information for course work in EVINCE (Table 7). The educational setting provided a halo effect, possibly allowing the full impact of the information provided to be assessed.

Follow-up interviews of the nursing and midwifery professionals suggested that for many nurses the evidence from the research literature is important; they also value the personal knowledge that might come from seeing, or experiencing a way of caring or the experience gained from one patient. Information gained from other nursing professionals is valued and that type of tacit knowledge is not likely to be documented in the literature. It is of course easier, and more acceptable for many nurses, to pick up the phone in the ward and ask the local expert than to leave the ward to visit the library. Many of the interviewees opted for a combination of asking the expert, backed up with a literature review and library-based search. For most of the interviewees the expert they might approach would preferably be known to them. Their reasons for this approach could not be explored in the interview, but their perceptions of the local expert would give them a gauge to assess the reliability of the information obtained.

7. THE ROLE OF THE HEALTH INFORMATION SERVICES

In both projects the health professionals acknowledged the importance to their present and future professional practice of access to the knowledge base of health care. Both nurses and doctors were in sympathy with the aims of evidence based practice, with differences reflecting their responsibilities in patient care, and the extent to which the evidence or knowledge base is made explicit in their particular research literature. Clinical experience and ‘tacit knowledge’ are an important part of personal knowledge for all health professionals and affect how they value the explicit research evidence in the literature and in databases such as the

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Cochrane database of systematic reviews (Cochrane Library). The practice of evidence based health care, when it points to the need for a change in practice, will also require organisational change. Implementation of properly evaluated findings in the health service may need an integrated approach to change management [52], one which considers all the processes of implementation of innovations. The barriers are both cultural and structural. Education is partly the answer, but given that there is a cultural divide between the researcher, practitioner and educator [53] how should library and information services proceed to support evidence based practice? What therefore might be the role of the information professional in the exploitation of the knowledge base of health care?

The Value and EVINCE project findings, along with other studies, indicate what information professionals need to consider. For doctors it is possible to distinguish between the information seeking patterns and knowledge acquisition of novice and expert clinicians. To some extent services to support critical appraisal and skills in retrieving the evaluated evidence can be tailored to the career stage of the doctor, and his or her area of practice (primary care with generalist needs or acute care with specialist needs). For nurses the identification of particular groups to serve such as a group of expert 'advanced practitioners' seems much more difficult. They exist, but cannot easily be identified by title of role or length of nursing experience in the more generalist areas. There are 'clinical nursing specialists' but the scope of the designation varies. Local knowledge will be particularly important for any information professional wishing to contact the formal and informal information 'gatekeepers' among the nursing staff.

For nurses, the informal processes of nursing knowledge acquisition ('seeing is believing') appear very important, but nurses are less likely than doctors to have tried to make their tacit knowledge at least partially explicit through publication in a journal. For some health professionals support for publication might be useful for the individual concerned and valuable to other health care organisations with an interest in the area of the study. Information professionals have promoted skills of information retrieval but have been less ready in the health sector to encourage those engaged in local research projects to publish. Much of the nursing research literature may languish in the grey literature of internal reports and dissertations, which makes systematic review of the nursing literature extremely difficult and time-consuming.

Health information professionals have promoted the teaching of information retrieval skills in continuing education programmes and improved appraisal of the research literature will help the selection of appropriate items of information, but that is only part of the learning cycle. Both the Value [54] and EVINCE projects included quality assurance guidelines which focused on the enhancement of the value of the information services through a better understanding of the context of information need and use. Evidence based practice should be seen as relevant to the individual practitioner and should relate to his or her individual professional development. The factors which affect the quality of the clinical learning environment for nurses [55] include the acknowledgement of nursing expertise and the opportunities for learning both formally and informally. The library and information services are almost certainly allied with formal education in some way, and strategies for supporting evidence based practice may be rooted in the

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formal education process. The extent of integration of the library into the post-graduate and continuing medical education programmes varies considerably but it is fair to say that the library support provided – and requested by the trainers – is generally passive rather than active. To act as change agents the health information professionals may need to work more actively with educationalists and those involved in commissioning post-registration education. Opportunities for informal learning might also be supported through identification of important opinion leaders and discussion with them.

At the individual level 'taking evidence on board' might be viewed as a series of stages:

Stage 1 Acknowledgement of a possible problem (reflection *in* practice)
Stage 2 Reflection *on* practice
Stage 3 Using information to consider options for change
Stage 4 Investigation of implementation needs
Stage 5 Implementation
Stage 6 Evaluation

Information and library services certainly play a direct part in Stage 3, by providing and encouraging access to relevant research and evidence on practice, protocols and guidelines, and also in Stage 6 where evaluation will require review of practices and procedures in comparison to other published (and unpublished) studies. Provision of access to the resources is only one aspect of the process of getting research into practice, and education in using the resources is equally important. The library and information services are already supporting critical appraisal programmes and promoting the use of the Cochrane Library database for access to evaluated research. Health professionals need to be able to locate, obtain and appraise the evidence available to them to assess the need for change or review of clinical practice. For many of them, formal education courses provide an environment where such questioning of practice is actively encouraged. This, for many, is a process of discovery which should be supported by information service staff, whether or not information skills are formally integrated into the curriculum. One approach to such integration of information skills into the curriculum notes the need to support tutorial staff as well as students [56]. Integration of information skills into the curriculum has been the aim of many librarians serving nursing students for some years, but much depends on the support of the academic teaching staff, not only for involvement in the initial curriculum development but also in the evaluation of the teaching and learning methods used. The effectiveness of one formal North American programme 'Pathways to Information Literacy' [57] was evaluated using a variety of methods including formal feedback (grades), informal questioning, self-reported attitude changes and comparisons with other student groups. Results of the graduate survey indicated that students who completed the Pathways programme did read a wider selection of professional journals, and were more likely than previous cohorts of students to be engaged in research activities. Gaining such evidence in the UK would be difficult at present as the structural changes in information and library provision for nursing staff that accompanied the move of nursing education into higher education have focused more on rights of access rather than types of service offered. More cross-sector co-operation

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between the NHS and HE libraries is necessary, as the EVINCE report concluded, but there is a lack of understanding and communication between the two cultures [58]. The problem is particularly acute for nursing staff but better communication between the two sectors might benefit all health professionals, particularly those working in primary care.

Current research projects are exploring how health information professionals could increase their role in knowledge management in the health service. The AuRACLE project [59] at Sheffield University (Department of Information Studies in conjunction with ScHARR (Sheffield Centre for Health and Related Research)) [60] is seeking to develop computer-based support for evidence based information seeking, trying to improve on the traditional reference interview to ensure that health professionals can structure their clinical problems into a search strategy that will be more successful in retrieving useful references. GIVTS (Getting Information to Vocational Trainees – an evaluative study) [61] (Department of Information and Library Studies, University of Wales Aberystwyth) is examining the effectiveness of targeted information services for trainees enrolled on the three-year GP vocational training programme, of which two years are spent working in hospital as an SHO (senior house officer) and one year as a GP registrar in a practice. Various aspects of the knowledge cycle are covered in both projects but they share an interest in improved diffusion and exploitation of knowledge by working more closely with the clinical information needs of the health professionals, bridging the gap between informative and productive knowledge.

The health information professional may increasingly have to work with those involved in continuing education at all levels, formal and informal, to ensure that information services support continuing professional development of health professionals and managers. Study days, journal clubs and team meetings are all situations which potentially promote reflective practice and the eventual implementation of research into practice. Health librarians should be involved in the planning, implementation and follow-up of the continuing education programme and should watch for the ‘teachable moment’ [62], to take advantage of opportunities to integrate information skills into the educational process. Ultimately that process encompasses all aspects of health information work, from consumer health information through abstracting and indexing of the biomedical literature to helping health professionals retrieve that information and relate it to their practice for the benefit of the patient. Boisot’s concept of the social learning cycle reminds us that merely making one part of the cycle easier is only part of the solution. The entire cycle of knowledge creation and exploitation and the processes involved should eventually be considered.

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