

Digital libraries in a clinical setting: friend or foe?

Anne Adams, and Ann Blandford

Middlesex University, Computer Science Dept, Bounds Green Road, London, N11
2NQ, U.K.

{A. Adams, A.Blandford}@mdx.ac.uk

Abstract. Clinical requirements for quick accessibility to reputable, up-to-date information have increased the importance of web accessible digital libraries for this user community. To understand the social and organisational impacts of ward-accessible digital libraries (DLs) for clinicians, we conducted a study of clinicians' perceptions of electronic information resources within a large London based hospital. The results highlight that although these resources appear to be a relatively innocuous means of information provision (i.e. no sensitive data) social and organisational issues can impede effective technology deployment. Clinical social structures, which produce information - and technology - hoarding behaviours can result from poor training, support and DL usability.

1 Introduction

The increased importance of evidenced based medicine for healthcare professionals necessitates the use of current best evidence in clinical decision-making. Within the clinical community there is, therefore, an escalating need to improve the accessibility of reputable information sources. Web accessible information resources present the potential to greatly advance learning capabilities regardless of users' location and time restrictions. In comparison with traditional libraries, digital libraries can provide specialized information in a format that is easily updated, with speedy searching and access facilities.

Wyatt [28] argues that poor use of computer databases and the Internet by clinicians to answer clinical questions is due to slow, inconvenient access to computer-based clinical knowledge resources. Digital Libraries offer the potential, as flexible information resources, to address these demands [19, 28, 15]. The National electronic Library for Health (NeLH) project is a proposed solution to resource problems within the UK. Wyatt [28] suggests that a predictor of the resource's success can be seen in the achievements of its pre-cursor, the Australian Clinical Information Access Project (CIAP). Since the launch of CIAP in 1997 [6] there has been a substantial increase in its use, as well as the development of a culture that is open to the sharing of clinical information within the New South Wales health system.

1.1 Background

Digital libraries (DLs) are major advances in information technology that frequently fall short of expectations [7, 28]. Covi & Kling [7] argue that understanding the wider context of technology use is essential to understanding digital library use and its implementation in different social worlds. Recent health informatics research also argues that social and organisational factors can determine the success or failure of health-care IT developments [8, 11, 12]. Heathfield [11] suggests that this is due to the complex, autonomous nature of the medical discipline and the specialized (clinician or software engineer) approach to system development. Negative reactions to these systems is often due to inappropriate system design and poor implementation. However, there may be other less obvious social and political repercussions of information system design and deployment. Symon et al [26] have identified, within a hospital scenario, how social structures and work practices can be disrupted by technology implementation. Although these systems often deal with sensitive, personal information, other system design research has found that apparently innocuous data can be perceived as a threat to social and political stability [1,2,3]. To understand the impact of DLs within the medical profession, an in-depth evaluation is required of the introduction and later development of these applications within their specific social and organisational settings. However, as Covi & Kling [7] have highlighted, there are few high-level theories that aid designers in understanding the implication of these issues for DL design and implementation.

This 3 year project within a large London based hospital is evaluating the introduction of Internet and Intranet ward-accessible DLs (not containing any personal information) for all health care practitioners (from student nurses to surgeons). The research aims to identify current informal work practices, social structures (i.e. perceived roles and status) and technology perceptions, so as to inform system design, development and implementation. This study will therefore not be task and technology specific [26] or review patient / organisational interactions but assess psychosocial elements of clinicians' organization, information and technology perceptions. The work reported here focuses on the results of the first phase of the study – establishing a baseline from which to assess developments over time.

1.2 Hospital Library Scenario

Initially the hospital staff used a library within the hospital grounds. More recently, the library was positioned across the road from the hospital. The library re-positioning meant that staff wishing to use the library and meet their own tight schedules found it increasingly difficult to get the information they required. The increased importance of up-to-date, relevant information on which to base clinical decisions and current practice necessitated a quick solution to this problem. To resolve this, computers were placed on the wards with access via the web to clinical digital libraries (e.g. Medline, Cochrane, NeLH).

1.3 Context of Use

DL Research increasingly focuses on the importance of directing DL design towards the work practices and communities they support [14, 7]. However, it is important to establish the differences between formal and informal work practices and the impact of social structures within those communities.

Formal procedures relay the correct way to conduct the work but do not allow for organisational dynamics, changing situations, evolution of task definitions, or social and political aspects (e.g. staff motivation, hierarchies) [9]. The distinction between formal and informal work practices can be even more important for health care systems. Symon et al [26] found that high status clinicians frequently deviated from formal procedures when a low value was placed on the work activity. Systems designed to support only formal work practices can be too inflexible. Adams & Sasse [4] found that systems which do not take into account informal work practices and are perceived to restrict these practices will be circumvented. DL designers must therefore design their systems around both formal and informal procedures, understanding both social and organisational norms.

An organisation's culture has a direct impact on informal practices that can develop into social and organisational norms [22]. When hospital information systems were first introduced, it was found that the greatest difficulties in the system's deployment lay not with technical issues but with the users, their reactions to its introduction and the acquisition of new skills [10]. Many of these issues related directly to social and organisational norms with regard to social structures.

The diverse organisational culture of hospital structures, made up of many different professions with their own specific social identifiers, can often produce conflicts between those professions [17, 27, 18]. Symon et al [26] identified conflicts within a clinical setting relating to social status and information procedures. Higher status professionals were identified as being more concerned with keeping their status as an expert than adhering to formal organisational norms. Schneider and Wagner [21] also highlighted the increased importance, within a clinical setting, of local knowledge, informal collaborative contexts and technology to support the sharing of information. However, the electronic dissemination of information within a clinical setting can be used and interpreted in politically sensitive ways. Digital libraries, in particular, can change the context of people's work-practices and can therefore restructure their relationships with both each other and the task in hand [26, 23]. The restructuring of these professional relationships can have far-reaching social and political consequences. Ultimately, system designers should be aware of social and political motivations within an organisation in order to develop and implement more sensitive design strategies.

2 Research Method

Focus groups and in-depth interview were used to gather data from 73 hospital clinicians. 50% of the respondents were nurses while the other 50% were senior and junior

doctors, consultants, surgeons, Professions Allied to Medicine (PAMs) such as occupational therapists, managers and IT department members.

Four issues guided the focus of questions:

- Perceptions of what clinical information is currently required, available, and used to complete their job effectively.
- Perceptions of how this information is currently accessed, and how these processes accommodate current working practices
- The impact of organisational social structures on information perceptions, information accessibility and acceptability
- Technology perceptions (specifically of DLs) and how these affect other issues already identified.

An in-depth analysis of respondents' information and technology perceptions was conducted using the Grounded Theory method. A pre-defined concept for a 'Digital Library' was not employed so that users were allowed to explore what they perceived comprises a digital library. Respondents, however, also discussed specific digital libraries that they had used (e.g. Medline, Cochrane, NeLH).

Grounded Theory [25] is a social-science approach to data collection and analysis that combines systematic levels of abstraction into a framework about a phenomenon which is verified and expanded throughout the study. Once the data is collected it is analysed in a standard Grounded Theory format (i.e. open, axial and selective coding and identification of process effects). Unlike other social science methodologies, Grounded Theory provides a more focused, structured approach to research (closer in some ways to quantitative methods) [24]. The methodology's flexibility can cope with complex data and its continual cross-referencing allows for grounding of theory in the data thus uncovering previously unknown issues

3 Results

Users' current information needs, dissemination processes and the impact of newly introduced technology were identified in relation to organisational, social and political structures. It was found that perceptual problems associated with organisational hierarchies, technology misconceptions, the accessibility of the technology and its information impeded the introduction of digital library access via the Internet. These problems produced increased user resentment, decreasing the effectiveness of everyday working practices. Further analysis of data from high status users within the community found that reduced effectiveness of technology integration within the user community was directly related to poor usability, inadequate training and inappropriate task applicability. The main finding can be classified in terms of; 1 the perceived effectiveness of digital and traditional libraries as a clinical resource. 2 the relationships between control over, and access to, information according to perceived status of the clinician, 3 perceptions of the technology as tool or plaything, and 4 the different ways that various classes of clinicians access information.

3.1 Clinical Libraries (Traditional vs. Digital Libraries)

All the respondents noted that traditional libraries were perceived to have limited accessibility due to the physical location of the libraries. The poor usability of current library systems made it difficult to access specialized information and limited the use of information sources. Journal access, for example, was kept within the library with time-consuming, poor quality photocopying facilities limiting effective access to within the library confines. This meant that clinical users requiring high quality journal images to compare with samples under their microscope were unable to complete these tasks. These users proposed that digital libraries accessible from the laboratory, with reasonable multimedia representations and search facilities would be a major advance in library usability. Limited supply of source materials was also considered a major problem with traditional libraries, which the users perceived could be quickly and effectively solved via electronic supply of documents. However, many users noted that digital libraries were only now becoming useful because they now adequately covered their area of expertise.

3.2 Status Impacts on Current Information Dissemination Procedures

To fulfill nurses' and PAMs' information requirements two distribution procedures were identified: hard copy and verbal dissemination. Hard copy (e.g. paper guidelines, books) and verbal dissemination is hampered by poor accessibility due to priority access for those of a higher status. Verbal dissemination, due to the time restrictions and the status structure, was dealt with via a crisis management approach (i.e. information is released and passed onto the nurses as and when a crisis occurs or is imminent). Many nurses and PAMs perceived that accessibility problems were associated with senior staff's information hoarding behaviours. It was suggested that these procedures could be used to obscure senior staff's lack of up to date knowledge. These behaviours produced resentment in the nurses and feelings of social restricting pressures (i.e. putting them in their place, shutting them out). All the junior staff members (i.e. nurses, PAMs and doctors) considered digital libraries an essential tool in completing their jobs effectively. Nursing staff (especially student nurses) and PAMs perceived them as an 'empowering tool' providing them with the information and knowledge that they required.

All the senior staff members confirmed the current dissemination processes detailed above. However, senior staff members noted that status directed current information dissemination because:

- Higher status staff required more theoretical knowledge
- Lower status staff required more practical knowledge

Some senior staff expressed a concern that junior staff would not be able to interpret or fully understand some information sources. For example:

"... you find that people will just go off and they will misunderstand the national guidelines because they come out in long documents"

which interpretation requires further study. So I think for junior doctors they can be misleading, harmful, damaging.” (consultant)

Senior staff, therefore, do not perceive that digital libraries are required, or even desirable, for lower status staff.

3.3 Status Impacts on Technology Perceptions

The hospital’s current information hierarchy (i.e. theoretical information only for those of a higher status) was identified as affects technology perceptions. Computers on the wards were identified as a threat to existing information dissemination procedures. Web-accessible digital libraries, in particular, disrupt these processes by increasing knowledge for those of lower status:

“they’re going to be quoting text books at us and quoting policy notes but they need to go out there nursing patients.” (Nursing manager)

Some senior staff confirmed that they saw technology and specifically digital libraries as a benefit of status:

People lower down. Well they would resort to the actual standard text.’ (nursing manager)

Nurses and PAMs noted that information hoarding procedures by some senior staff also produced technology hoarding. Senior staff members often sought to retain their expert status by continuing to control information dissemination procedures via restricted access rights. Nurses’ and PAMs’ access to current technology within the hospital, is limited by either physical OR social restrictions (e.g. passwords, computer locks, location of computers). The hospital’s current information hierarchy was also found to limit perceptions of future technology uses and locations for access. Access to digital libraries from the wards was particularly sensitive since higher status staff regarded this location as requiring practical rather than theoretical knowledge. Often the location of the computers on the wards within a specific territorial boundary caused friction between different user groups (e.g. doctors and nurses, senior and junior staff) who felt social pressure restricting their access.

Some senior staff argued that they would happily access information via the technology on behalf of junior staff. However, junior staff argued that security protocols would preclude a third party performing some information retrieval tasks.

Many senior staff members perceived digital libraries stored on an intranet and accessed by junior staff as less politically sensitive than web-accessible digital libraries. The Internet was seen as a threat to their status by providing open access to information sources while providing the potential for abuse (i.e. access for non-professional purposes). Intranet information provision, in contrast, was perceived as controlled by higher status staff members. Locally based DLs were also seen as advantageous for provision and effective updating of trust specific policies, protocols and standards. These were seen as not only increasing local accessibility to relevant documentation but also awareness.

3.4 DL Usability and Users' Perceptions of Technology

Many senior staff noted that poor usability meant that information access via computers was time-consuming. Computers were thought of as supporting research and not, therefore, necessary on the wards. Some senior staff added that serious time constraints meant that clinicians sitting at computers on the wards would be viewed as a wasting valuable time. Task specific libraries, however, were perceived far more as a tool than a plaything:

"I mean there are sort of Journals and manuals but they haven't got time to sit down and actually play per se." (nursing manager)

"I'd like to think that as things are in the NHS with everybody so busy all day that there isn't a lot of time for all this sort of 'lets go and look at the computer screen and see what we can latch onto'." (consultant)

The usability of current medical digital libraries (e.g. Medline, Cochrane, NeLH), in particular, was frequently noted as being so poor that clinicians would rather search the Internet for the information they required. Using the Internet as one big digital library was reported as quicker for picking up technology skills (e.g. browser usage) than using specific DLs that employ varied and often complex searching mechanisms – a finding that echoes those of a parallel study working with non-clinical users [5]. For a skilled clinician, the Internet was believed to be an important aid in accessing reputable up-to-date information sources (e.g. academic sites, professional colleges).

Different routes for accessing digital libraries were noted as a key issue in the perceived usability of the system. Once the technology became less intrusive and more familiar, the users' confidence in information retrieval greatly increased. Portals are therefore an attractive proposition as long as they are appropriately designed to provide access to the right information.

Many senior clinicians, although able to navigate the web, did not perceive themselves as computer literate especially with regard to digital library usage. Recently qualified staff members, in contrast, were perceived by their superiors as far more computer literate. Of particular importance to all user groups was the subsequent friction developing between recently qualified members of staff and those classed as 'old school professionals' who, in many cases, were techno-phobic.

"the problem is that there is no formal help plan here and a lot of people feel 'well I should know about it but I don't and I feel silly going to somebody that is much younger than I am saying explain it to me'." (surgeon)

"because there are a lot of people in the department who haven't had any experience at all. You know who haven't been on training sessions and they're frightened of it." (PAM)

This generation gap was identified as a key factor in producing senior staff's perceptions of computers as a threat to their status as experts.

All the respondents noted the lack of support and training available with digital libraries. Effective on-line support was proposed as a major factor in changing negative

DL perceptions. However, some senior staff noted that current online training and support facilities were not given at the right level for many clinicians needs.

“Things either seem to be at the ‘this is how you turn the computer on’ level or very advanced and there doesn’t seem to be much in between.” (surgeon)

3.5 DL Usability and Users’ Perceptions of Technology

An important element of digital library perceptions is related to users’ information management strategies. Digital libraries, while enabling users to develop some quicker, less stressful strategies, were restricted by the physicality of the medium and concepts of interaction styles.

Many of the clinicians proposed that digital libraries were a key element in enabling them to develop effective information management strategies. Previous hard copy management strategies required the user to frequently identify their current, imminent and future information needs for each journal they subscribed to. This meant frequent reading and re-reading of journals, sorting, cutting out and filing relevant sources. Electronic libraries enabled these users to dramatically simplify this process by speeding up the search, selection and filing procedures. However, many of the clinicians also noted that although DL mechanisms have speeded up these processes they do not support serendipitous skimming of information sources. Most senior clinicians, therefore, stated that they interwove their use of DLs with hard copy sources. Initially these users skim-read journals to identify potential articles of interest. This also supported their need for serendipitous interactions with articles not directly related to their area of expertise. These interactions were conducted with off-line sources because such resources are portable and staff are working to tight time constraints (e.g. they will read printed documents on their coffee break or while walking between meetings). Printed documents were also noted as being easier to interact with, digest and use as an interaction point with colleagues. Digital libraries were then used for later retrieval of previously identified articles or for directed searches to answer a current clinical query. Once these articles were found, however, the full documents (and frequently abridged versions) were always printed and read off-line. All the user groups, therefore, repeatedly noted the importance of adequate printing facilities. Key usability problems were also noted as relating to problems downloading and printing these documents.

Journals were noted as the major form of digital library information. International journals were highlighted as particularly important for obtaining up-to-date information on specialist areas of research.

“At a consultant level one tends to go less to text books and more and more to Journals.” (consultant)

However it was recognized that, because digital libraries were primarily used to store journals and related summaries, this constrained interpretations of future digital library uses. Restricted awareness of what digital libraries could store curbed perceptions of

potential users (e.g. researchers, students, senior staff) and their tasks (e.g. research purposes, continued professional development and new developments).

Users' perceptions of the future relevance of digital libraries within a clinical setting related primarily to its interactivity. For example, current digital libraries simply represent mailed 'letters to the editor' electronically; this could be extended to online debates or reviews of articles. Similarly, the immediate benefits of updated, locally relevant day-to-day clinical information (e.g. policies, procedures, induction data, guidelines, and protocols), electronically stored and quickly retrievable, were recognized. Clinicians, however, require more than simple electronic representations of documents. These information sources would be invaluable if, subject to appropriate authentication, they could fulfill specific user needs, provide local knowledge and prompt updating requirements.

"... how to care for a wound point 6 ohhh yes I have to use this type of dressing and where are they kept ohhhh right they're kept under there" (nursing manager)

Users also detailed the need for flexible libraries of organisational information (e.g. job title, role, contact details, schedules and diaries) that would then link into communication media such as email and ultimately the electronic patient record.

The IT department agreed that training was an issue within the organisation and that there was a need for more collaboration / communication with academic sites. However, the major problem identified with these developments was rapid organisational change with no apparent organisational body dealing with how these changes should occur.

The successful future deployment of this technology depends on collaboration and open mindedness towards technology uses as opposed to current information hoarding and technology misconceptions. Effective digital library design and use also depend on the provision of adequate digital library peripherals, usability and training with resources that meet research, practical and up-to-date information needs.

4 Discussion

The launch of CIAP (web-accessible DL) in Australia was accompanied by many stories of lives saved by clinicians who could quickly access relevant, specialised, up-to-date information. The publicity suggested that DLs were an instant success. However, as shown in this study, information is socially interpreted, and digital libraries can have significant effects on social relationships [23]. Within a clinical setting, information is negotiated and reinterpreted relative to experience and personal relationships [26]. This is especially relevant for those who regarded their status as an expert as being of paramount importance.

The findings detailed in this paper have also identified the importance of social structure and status in information dissemination processes. The majority of conflicts related to high status clinicians' information hoarding behaviours that led, in many cases, to technology hoarding. Increased information accessibility can provide users

with knowledge which was previously inaccessible to them. Speedy, extensive information provision, as provided by digital libraries, was identified as a cause of conflicts and resentment within the organisational structure. However, the causes of information, and thus technology, hoarding can reveal potential solutions to these problems.

The main source of these behaviours was senior staffs' perception of their own inadequate technical abilities. With improved quality in IT training for subordinates there was a perceived increase in the gap between the knowledge acquisition abilities of junior and senior staff. Senior staff viewed the increased ability for junior staff to access information as a threat to perceptions of them as experts. As one participant noted:

"It's like being given a Rolls Royce and only knowing how to sound the horn." (surgeon)

As noted by Levy et al [13], technology within the health profession is slowly eroding senior clinicians' sense of power. 'Smart' decision support tools and telehealth facilities are seen as re-directing the information power to lesser-trained providers or to the patients themselves. However, in reality, the nursing profession argue that technology is used to strengthen existing organisational cultures and status norms [20]. These findings identified, however, that nurses (specifically student nurses) were still very positive about digital libraries. Many nurses perceived DLs as not only an important information tool but also a device to liberate and empower them to complete their jobs more effectively.

Comparing the perceived success of CIAP [6] to our findings of conflicts from DL introduction, there are 3 main factors which have been suggested as being significant in the project's success [16]. Firstly CIAP was developed, deployed and managed by stakeholders in the system (i.e. all levels of clinicians and senior management): one of the major champions behind the system was a senior nurse. Secondly, usability was of primary importance in the system development and, finally, the system was deployed within a knowledge friendly culture where information sharing is encouraged.

The introduction of CIAP was hampered, however, by problems with access to PCs in clinical areas and resistance from IT managers who felt that their control on information and Internet access was being eroded. It was feared that clinicians would waste time 'playing' on the Internet. It is interesting to note that the IT department, within this study, were positive about computerised clinical information although they expressed a cautious approach to developments to ensure system usability while understanding the political sensitivity of any decisions they made.

5 Conclusion

Although DLs appear to be a relatively innocuous development in information provision (i.e. no sensitive data provision such as medical records), this research has highlighted how related social and organisational issues can impede effective technology deployment. To counteract these problems DL designers and implementers must first identify the social context prior to technology deployment. There is a need within this

context to reduce perceived threats of DL technology amongst senior staff members by strongly supporting training. With increased usability and adequate technical support for senior clinicians, DLs would be perceived as support, rather than replacement, for their clinical expertise. Finally, to decrease the perception of DLs as irrelevant playthings (but work tools), increased general usability of the tools and task directed applicability are required. DLs must also be integrated appropriately into the workplace so that they aid all user groups in their work practices without being perceived as a tool to undermine senior clinicians' power. Increasing DL interactivity by blurring the divisions between supporting information, knowledge and communication tasks is a key issue in the development of applicable systems acceptable across the social structures.

Ultimately to design effective Digital Libraries we need to identify more than just effective mechanisms for storing and retrieving documents. There are further questions that should be asked with regard to the social repercussions of what is being stored, who will access it and for what purposes.

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