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ACCEPTABILITY OF MEDICAL DIGITAL LIBRARIES

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ABSTRACT

Evidenced-based medicine has increased the importance of quick accessibility to reputable, up-to-date information. Web accessible digital libraries (DLs) on the wards can address the demand for such information. The use and acceptability of these resources has, however, been lower than expected due to a poor understanding of the context of use. To appreciate the social and organisational impacts of ward-accessible DLs for clinicians results of a study within a large London-based hospital are presented. In-depth interviews and focus groups with 73 clinicians (from pre-registration nurses to surgeons) were conducted, and the data analysed using the grounded theory method. It was found that clinical social structures interact with inadequate training provision (for senior clinicians), technical support and DL usability to produce a knowledge gap between junior and senior staff, resulting in information – and technology – hoarding behaviours. Findings also detail the perceived effectiveness of traditional and digital libraries and the impact of clinician status on information control and access. One important conclusion is that increased DL usability and adequate support and training for senior clinicians would increase perceptions of DLs as support for, rather than replacement of, their clinical expertise.

KEYWORDS

Digital libraries, user communities, social structures, usability, grounded theory.

INTRODUCTION

One recent development within the UK health service has been a growing focus on clinical governance, which demands an improved application of existing knowledge through the use of current best evidence in clinical decision-making. Web accessible digital libraries present the potential to greatly increase access to reputable information sources regardless of users' location and time restrictions. In comparison with traditional libraries, digital libraries can provide specialised information in a format that is easily updated, with speedy searching and access facilities.

Wyatt [1] 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 [1, 2, 3]. The National electronic Library for Health (NeLH) project is a proposed solution to clinical resource problems within the UK [4]. Wyatt [1] 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 [5] in 1997 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.

The focus of this paper is on the introduction of web-accessible information resources – in particular, Digital Libraries (DLs) – within the UK health service. The study reported here explores the attitudes and experiences of clinical staff within a large London teaching hospital, and draws inferences on how DLs can be introduced and used effectively by the range of users for whom they are intended.

BACKGROUND

Digital libraries are major advances in information technology that frequently fall short of expectations [6,1]. Covi & Kling [6] argue that appreciation of the wider context of technology application 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 healthcare IT developments [7, 8, 9]. Heathfield et al [9] suggests that this is due to the complex, autonomous nature of the medical discipline and the specialized (e.g. clinician or software engineer) approach to system development. Negative reactions to these systems are often due to inappropriate system design and poor implementation. There are, however, less obvious social and political repercussions of information system design and deployment. Symon et al [10] have identified, within a hospital scenario, how social structures and work practices can be disrupted by technology implementation. Although hospital systems often deal with sensitive, personal information, for which such disruption might be anticipated, other system design research has established that apparently innocuous data can be perceived as a threat to social and political stability [11,12,13]. Digital libraries may be viewed as containing such innocuous data.

When hospital information systems were first introduced, it was found that the greatest difficulties in system deployment lay not with technical issues but with the users, their reactions to systems introduction and the need to acquire new skills [14]. Many of these issues related directly to social and organisational norms with regard to social structures. To evaluate the impact of social structures on users' perceptions, it is important to establish the difference between formal and informal work practices. 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) [15]. The distinction between formal and informal work practices can be particularly important for health care systems. Symon et al [10] 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 and Sasse [16] found that systems which do not take into account informal work practices, and are perceived as restricting these practices, will be circumvented. DL designers must therefore design their systems around both formal and informal procedures, understanding both social and organisational norms. The work reported here identifies some of these norms within a particular hospital setting.

An organisation's culture has a direct impact on informal practices that can develop into social and organisational norms [17]. 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 [18, 19, 20]. Symon et al [10] 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 experts than with adhering to formal organisational norms. Schneider and Wagner [21] also highlighted the importance, within a clinical setting, of local knowledge, informal collaborative contexts and technology to support the sharing of information. It must be realised, however, that the electronic dissemination of information within a clinical setting can be used and interpreted in politically sensitive ways. DLs, 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 [10, 22]. 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.

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. Covi & Kling [6], however, have highlighted the fact that there are few high-level theories that aid designers in understanding the implication of these issues for DL design and implementation. The work reported here has been conducted within a project 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 is therefore not task and technology specific [10], and

does not review patient / organisational interactions, but is assessing psychosocial elements of clinicians' organization, information and technology perceptions.

RESEARCH METHOD

As noted above, the research has been conducted in a large London hospital. Hospital staff had historically 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).

The study is based on qualitative data gathered from a broad spectrum of clinical staff. Focus groups and in-depth interviews 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 jobd 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 Digital Libraries) and how these affect other issues already identified.

A pre-defined concept for a 'Digital Library' was not employed so that users were allowed to explore their own interpretations of what comprises a digital library.

Respondents, however, also discussed specific digital libraries that they had used (e.g. Medline, Cochrane, NeLH).

An in-depth analysis of respondents' information and technology perceptions was conducted using the Grounded Theory method. Grounded Theory [23] 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). Compared to other social science methodologies, Grounded Theory provides a focused, structured approach to research [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.

Using the grounded theory method, transcribed interview and focus group data was initially classified (open coding) to identify numerous concepts pertaining to similar phenomena (categories) along with identifying the properties and dimensions of the said categories. The next stage of analysis (axial coding) identified high level phenomena (e.g. central ideas, events) along with the conditions and users' strategies

pertaining to those phenomena (e.g. causal conditions, intervening conditions). This initial analysis was then elaborated (selective coding) and interpreted to identify the core category (the central phenomenon around which all the other categories are integrated). A conceptualisation (storyline) of the descriptive narrative, set around the core category, was then exposed. This whole process is iterative so that it is validated by continual comparisons with the raw data to confirm or refute conclusions. Finally the analysis integrated identified instances of process effects (e.g. factors changing over time) so that changing factors within the theory can be identified. It is important to note that as concept relationships are grounded in the data, quotations can easily be used to illustrate these relationships but are not the only justification for these concepts. Such quotations are used in this paper to illustrate key points that emerged from the analysis.

RESULTS

Users' current information needs, dissemination processes and the impact of newly introduced technology were evaluated 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 the information stored therein impeded the introduction of digital library access via the Internet. These problems produced increased user resentment, decreasing the effectiveness of everyday working practices. The final analysis identified two main themes in the findings:

1. the perceived effectiveness of traditional and digital libraries as a clinical resource, and
2. the impact of clinician status on control over, and access to information.

Clinical libraries (traditional and digital)

All the respondents perceived traditional libraries to have limited accessibility due to the physical location of the libraries to which they had access (including, but not limited to, the main hospital library). 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. Digital libraries, accessible from the laboratory, with reasonable multimedia representations and search facilities, would provide these users with a major advance in library usability. Limited supply of source materials was also considered a major problem with traditional libraries, which users believed could be quickly and effectively solved via electronic supply of documents.

The effectiveness of digital libraries was inhibited by the poor usability of the technology. Many senior staff noted that poor usability meant that information access via computers was time-consuming. It was argued that computers are ‘playthings’ used for research purposes and should not, therefore, be on the wards.

“I mean there are sort of journals and manuals but they haven’t got time to sit down and actually play per se.” (nursing management)

*“Everyone is so busy there is simply never a moment in the day when you think –
ahhhh what should I do now.”* (surgeon)

This perception was identified as particularly damaging when it led to the supposition that those using computers on the wards were traitors to the time and cost limitations of the modern health system.

“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 ‘let’s go and look at the computer screen and see what we can latch onto’.” (consultant)

Digital libraries on the whole were not perceived as a tool to aid and support current clinical decision-making. 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 to be 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 [25]. 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). It is important to add, however, that once the digital library technology became more familiar (e.g. familiar language, information groupings), the users’ confidence in information retrieval greatly increased.

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. 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 by skim-reading hard copy journals to identify articles of potential interest. This approach 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 these resources are portable, thus conforming to users' 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

repeatedly noted the importance of adequate printing facilities. Key usability problems were also reported concerning downloading and printing 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)

It was recognised by respondents that, because digital libraries were primarily used to store journals and related summaries, this initially constrained interpretations of future digital library uses. Restricted awareness of what digital libraries could store curbed perceptions of who were potential users (e.g. researchers, students, senior staff) and what their tasks might be (e.g. research purposes, continued professional development and new developments). Further discussion often brought out new possibilities – most notably, of the provision of local (hospital-specific) information.

Users’ perceptions of the future relevance of digital libraries within a clinical setting related primarily to their interactivity. 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 fulfil 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.

Status and information dissemination

To fulfil clinical information requirements two current 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 also inhibited by a crisis management approach (i.e. information is released and passed on to the nurses as and when a crisis occurs or is imminent).

“the supervisors they don't have time to tell you this is the policy for here”

(pre-registration nurse)

“you're just sort of thrown in at the deep end and when you do it wrong they do sort of pull you up about it.” (pre-registration nurse)

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 because they required unnecessarily time consuming means of finding information (taking them away from

their patients) and also induced feelings of social restricting pressure (i.e. putting them in their place, shutting them out).

“Why shouldn't we have anything that they are hiding from us?” (post-registration nurse)

“We should be given the opportunity to learn as much as we can, be as much, be as effective as we can be for the sake of the patients” (pre-registration nurse)

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

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

Written policies and guidelines were noted as being of limited use for those whose main objective is hands-on 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)

Status and technology

The hospital's current information hierarchy (i.e. information only for those of a higher status) was found to limit perceptions of who should be using the technology,

what it is used for and general computer awareness. The approach by some senior staff of information hoarding was identified as being associated with that of technology hoarding. Nurses' and PAMs' access to current technology within the hospital was limited by either physical or social restrictions (e.g. passwords, computer locks, location of computers).

"... But they put a block down on that because they've said 'well if one student nurse gets to use it then all the student nurses will want to use it'." (pre-registration nurse)

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)

Many senior staff members expressed a desire to retain their expert status by continuing to control information dissemination procedures. Some senior staff argued that they would rather access digital libraries on behalf of junior staff.

"... if they want something on this or that then I'm around to do it for them." (nursing manager)

Junior staff argued, however, that apart from this wasting valuable time for senior staff, security protocols could preclude a third party performing some information retrieval tasks. All the junior staff members (i.e. nurses, PAMs and doctors) considered digital libraries as essential tools. Nursing staff (especially student nurses) and PAMs perceived them as an 'empowering tool' providing them with the information and knowledge they require to complete their jobs effectively.

Computers on the wards, in particular, were identified as a threat to existing information dissemination procedures since higher status staff regarded this location as requiring practical rather than theoretical knowledge. 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)

Computers on the wards also increased friction between different user groups (e.g. doctors and nurses, senior and junior staff) trying to access them.

“I know there is some friction between the junior doctors and the nurses about who the computers are there for ... sometimes the computer has been put in a place where it is very obviously in one territory” (doctor)

“I know that there is one computer on the ward which is supposed to be for everyone to use it but because it’s in the doctors office they don’t want people in there in a certain time because they could be putting something on tape, doing their notes. So it ain’t for everyone, is it?” (post-registration nurse)

The distinction between information available on the Internet and on an intranet was of particular importance. 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 because it provides open access to information sources while providing the potential for abuse (i.e. access for non-professional purposes). Senior clinicians also noted that junior staff members would not be able to interpret the quality of all the information potentially available to them on the Internet.

“... there may be stuff in this country that is of a reasonable quality but it requires some skill to some extent to be able to discriminate. I don't have difficulty with this; I don't know how much the nurses or the junior doctors would be able to discriminate.” (consultant)

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 increasing not only local accessibility to relevant documentation but also awareness.

Status and training

Many senior clinicians, although able to navigate the web, did not perceive themselves as computer literate, especially with regard to digital library usage. In contrast, those same senior clinicians perceived recently qualified staff members as far more computer literate. The poor usability of digital libraries was identified as a crucial factor in the difficulties senior clinicians encountered.

“So there ought to be something user friendly – especially for older consultants – so that they didn't feel too silly about it, but really showed them how useful it could be for them to have access for these things.” (surgeon)

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)

A 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. 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)

The IT department agreed that training was an issue within the organisation and that there was a need for more collaboration and communication with academic sites. The major problem identified with these developments was rapid organisational change, with no apparent organisational body dealing with how these changes should occur. The requirement for different approaches to training for different groups of staff – in particular, for individual training for senior staff – was recognised as part of a total strategy of improving acceptability and use of DLs.

DISCUSSION

The introduction of web-accessible DLs has enabled speedy access to reputable sources of up-to-date information. The launch of CIAP (a web-accessible DL) in Australia was accompanied by many stories of lives saved by clinicians who could quickly access relevant, specialised information. The publicity suggested that DLs were an instant success. As shown in this study, however, information is socially interpreted and digital libraries can have significant effects on social relationships [22]. Within a clinical setting, information is negotiated and reinterpreted relative to experience and personal relationships [10].

The findings detailed in this paper have identified the importance of social structure and status in information dissemination processes. Increased information accessibility can provide users with knowledge which was previously unavailable to them. Speedy, extensive information provision, as made possible by digital libraries, was identified as a cause of conflicts and resentment within the organisational structure.

Senior clinicians identified various problems that could be encountered by juniors staff's increased access to information:-

- Junior staff would not be able to decipher the information.
- Increased time spent seeking information would take their time away from the patients.
- Junior staff require more practical experience, rather than theoretical knowledge.

Junior staff responded to restrictions in information accessibility with these arguments:

- Junior staff are trained within higher education to analyse and interpret complex information sources.
- DL provision (depending on the variety of information provided) can dramatically decrease the time spend obtaining this information through other sources (e.g. by telephone, fax or on foot), so that they can spend more time with the patients.
- These information sources are regarded as a supplement to, not replacement for, practical experience.

Ultimately, as this research points out, digital libraries (even if they contain only non-personal information) can have dramatic social and political repercussions. The causes of information, and thus technology, hoarding, however, can reveal potential solutions to these problems. Our findings have identified three reasons why technology supported information dissemination triggers information and technology hoarding behaviours in senior staff.

- 1) Some senior staff have experienced heightened levels of perceived expertise by controlling information sources. This position is threatened with the advent of increased information access.
- 2) Junior staff noted that some senior staff used the lack of information accessibility as a bureaucratic barrier to hide their lack of up to date knowledge. Technology supported information dissemination is perceived as a threat because it highlights these inadequacies.

- 3) Many senior staff members perceived themselves as technically under-qualified. With improved quality in IT training for subordinates, there is a perceived increase in the gap between the knowledge acquisition abilities of junior and senior staff. Senior staff noted the increased ability of junior staff to access information as a threat to perceptions of them as experts.

For the majority of respondents, the third factor (i.e. the lack of technology expertise and training) was viewed as the source of most information and technology hoarding behaviours. 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 [26], technology within the health profession is slowly eroding senior clinicians’ sense of power. ‘Smart’ decision support tools and tele-health facilities are seen as re-directing the information power to lesser-trained providers or to the patients themselves. The nursing profession, however, argue that technology is being used to strengthen existing organisational cultures and status norms [2]. Our study found that nurses (specifically student nurses) were still very positive about DLs. 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 [5] to our findings of conflicts from DL introduction, there are three main factors that have been suggested as being significant in the project’s success [27]. 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 of information and Internet access was being eroded. It was feared that clinicians would waste time ‘playing’ on the Internet. In contrast, 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.

CONCLUSIONS

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 introduction. Identifying where these problems are likely to occur can help in the effective development and deployment of these technologies [22, 28].

Our findings, in summary, have identified that digital libraries can greatly increase information accessibility. Inadequate training provision (for senior clinicians) and poor computer usability, however, produces a knowledge gap between junior and

senior staff that reverses organisational norms. Junior staff having recently¹ left university were found to have acquired a reasonable degree of confidence and competency with both general and specific computer applications. These abilities allowed them to overcome, to some extent, significant usability issues identified with the technology (specifically digital libraries). Senior staff who lacked recent computer training were not able to overcome these problems so easily. This knowledge gap sometimes resulted in a rejection of the technology (either for themselves or restricting access to senior staff only) as a threat to their expert status. Consequent resentment was found amongst junior staff. Inadequate training, poor DL usability and support for priority tasks was also found to produce a negative perception (by those in senior roles) of computers as play things rather than time-saving tools for specific tasks or knowledge building assets. Specifically within a clinical setting, the use of computers at the point of care is considered by many as a betrayal of the sorely needed time and resources essential to our health service.

To counteract these problems, DL designers and implementers must 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, increased general usability of the tools and task directed applicability are required. DLs must also be integrated appropriately into the workplace so that they

¹ Although there are some variations this is a norm for the majority of staff who left academia within the past 5 years.

aid all user groups in their work practices without being perceived as a tool to undermine senior clinicians' power. A recent project conducted by Barnet Community Healthcare trust [29], seeks to do this by taking librarians into the field to identify information needs and provide them within convenient settings. Increasing DL interactivity by blurring the divisions between supporting information, knowledge and communication tasks is also 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. This is the subject of ongoing research.

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