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Paper-based versus computer-based records in the emergency department: Staff preferences, expectations, and concerns

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Although the potential benefits of computer-based records have been identified in different areas of the healthcare environment, in many settings paper-based records and computer-based records are still used in parallel. In this article, emergency department (ED) staff perspectives about the use of paper- or computer-based records are presented. This was a qualitative study in which data were collected using in-depth semi-structured interviews with the ED staff. The interviews were transcribed verbatim and data were analysed using framework analysis. In total, 34 interviews were undertaken. The study identified a number of factors which might encourage or discourage the use of paper-based and computer-based records in the ED. Users also expressed their concerns and expectations. Although there is a tendency towards computerizing healthcare settings, user acceptance of technology should not be underestimated. To improve user acceptance, users' concerns should be investigated and addressed appropriately.

Keywords

computer-based records, emergency department, paper-based records, user acceptance

Introduction

Nowadays, using information systems in the healthcare environment seems to be inevitable, since there are many potential benefits [1, 2]. These benefits include improving the quality of care, reducing medical errors, and improving communication between healthcare professionals [1], as well as enhancing the readability, availability, and accessibility of information, and improving data quality [2]. To achieve these benefits, various types of

computerized information systems have been designed and implemented to date, and this process will continue as technology develops and improves. However, the potential benefits have not always been fully realized [3–5] due to technical or non-technical barriers or both.

One of the major non-technical challenges in developing and implementing a successful information system is user acceptance, since users will have to face a change in their work habits [2]. User acceptance is 'a multifactor construction based on an affective and cognitive evaluation of all components surrounding and influencing the interaction process between a user and an information system' [6, p. 247]. For example, users need to change their documentation habits and will have to change from using paper to using a computer. Although healthcare professionals and administrative staff are usually aware of the weaknesses of paper-based records (e.g. illegibility of handwriting, incompleteness of data, and inaccessibility of information [2]), the main advantages of paper-based records (e.g. portability and ease of use) are still valued. In addition, paper-based records are stable (they do not need electricity or backing up) and flexible [3]. Paper-based records are also compatible with the daily tasks of healthcare professionals, and they have been accepted as part of the job for a considerable time. However, there are different factors which might influence the acceptance of computer-based records in healthcare settings. For example, there may be increased time and effort required for entering patient data (although duplication of information collection should be reduced), decreased interaction with patients, and a lack of integration between the capabilities of an information system and the clinicians' workflow [7, 8]. In this article, the theories and models of user acceptance [9] are not discussed, but they are presented elsewhere [10]. Here, we focus on the studies undertaken to evaluate user acceptance of clinical information systems [11–17] and those which have identified the various factors that might influence the use of information systems in different clinical settings. Some studies [2, 18, 19] have compared the content [18, 19] or the capabilities of a computerized system against paper records [2], and a few studies have investigated users' perspectives on paper-based records and computer-based records. Lium et al. [4] conducted a study to explore changes of clinicians' work after the implementation of an electronic medical records (EMRs) system. In their study, some of the participants compared using EMRs with paper records in their work practice. Similarly, in Ilie et al.'s study [20], physicians' attitudes towards and usage behaviours of EMRs were investigated and compared with their attitudes towards paper-based records. However, in both studies [4, 20] only physicians in different professional grades were chosen to be the subjects of the studies.

Emergency departments (EDs) have particular characteristics that make them different from other clinical departments, e.g. providing urgent care for life-threatening conditions, and this is likely to affect the way that staff use medical records and information. Given the special characteristics of the emergency departments (EDs) in terms of the patients, who may be in a critical condition, and clinicians, who are responsible for providing high-quality and rapid emergency services for patients [21], it is important to know the factors that may influence the use of information systems. As emergency medicine is one field in which guidance regarding applying information technology is scarce [22], understanding the perspectives of ED staff about using computerized systems may help in designing better systems in the future. Although many information systems have been developed and implemented in EDs to date, the number of studies focused on investigating users' perceptions of emergency department information systems is limited. The main aim of

this research was to investigate users' perceptions of, and interactions with, emergency department information systems (EDIS). In this article, we report issues that might influence the use of EDIS, and compare users' perspectives about paper-based and computer-based records in the ED.

Methods

This was an exploratory study which was conducted in March–April 2007. In this study, in order to gain a better and in-depth understanding of the context, and factors, which might influence the use of information systems in the ED, a qualitative approach was used. Qualitative research methods, such as interviews, can encourage interaction with real users to explore their perspectives about an information system. This, in turn, can help to improve the design and usability of the system [7].

The research setting

The research setting was an ED located in a large urban teaching hospital in northern England. The hospital has more than 1100 beds and over 5500 staff. The ED is particularly busy as it is the only major one in the city responsible for caring for adult patients suffering from a wide range of emergency conditions. Typically, the ED team treat more than 250–300 patients per day. In this department, paper-based records are used as the main source of information (e.g. medical records, patient notes, ED cards). The ED also has three main information systems: a patient focus information system (PFIS), a patient tracking system and a radiology information system called E-film; however, these systems are not integrated. The PFIS is the main information system in the hospital and its ED module is used in this department. This system is mainly used for ordering blood tests, viewing blood test results, and patient registration. The level of access to different parts of the information systems is different for different groups of staff.

Data collection and analysis

Before conducting the research, a favourable ethics opinion was sought and obtained from one of the local research ethics committees (LRECs) in the UK National Health Service (NHS).

In order to collect data, semi-structured interview was chosen as the most appropriate method, as the study was exploratory and the aim of the study was to investigate users' perceptions. According to Thomas [23], in order to collect information about people's knowledge and opinions, an interview is more efficient than direct observation. Similarly, Punch [24] and Denscombe [25] explained that the interview is one of the main tools for collecting data to understand people's perceptions, emotions, experiences and feelings and their definitions of different situations. This helps to gather more in-depth data. In this study, convenience sampling was used to recruit the participants. However, in order to have a broader picture of users' perceptions, all groups of staff who used the information systems were interviewed.

Before interviews were undertaken, an information sheet was given to the interviewees to inform them about the study and the process of the interview. The interviewees were also asked to sign a consent form to indicate that they agreed to be interviewed. The

interviews were digitally recorded (with the participants' consent) and were then transcribed verbatim.

To analyse the interview data, the method of framework analysis was used. This method has been developed for use in applied qualitative research [26]. In applied research, objectives are clearly set and the results of the research should answer the objectives of the study appropriately. In this study, data were analysed by one of the researchers (HA) and discussed with the other researchers (PB, SG). To facilitate coding data, the computer software NVivo 7 was used.

Results

Participants' characteristics

Thirty-four members of ED staff were interviewed in total. The mean length of interviews was 43 minutes. The participants were the ED staff who used at least one of the information systems in the emergency department and included 11 doctors (different levels), 12 nurses (various grades), two patient flow champions, one service manager, two secretaries, five receptionists and one doctor's support worker. In order to maintain the confidentiality of the participants' information during data analysis and in reporting the findings, the identities of the participants were anonymized, and they were described as being in one of three main groups: doctors, nurses and administrative staff. Nine participants were male and 25 were female. The age range was 25 to 57 years. Their work experience in emergency medicine and the period of time that they had worked in that particular emergency department were similar, ranging from less than 1 year to more than 10 years.

Interview results

The ED staff used both paper-based records and computer-based records in their workplace. The interviewees discussed both sources of information and explained why they preferred each of these to be used in the ED.

Using computer-based records: reasons why and why not

Following data analysis, it was evident that some clinicians preferred using computer-based records and some preferred using paper-based records. However, most of the administrative staff preferred using a computer in their work. Some people also preferred a combination of paper and computer, and some explained that they were not able to compare these two, as they had never used fully computer-based records.

The interviewees explained why they preferred using computer-based records. In their opinion, the advantages of using a computer included avoiding duplication, increasing the speed of processes, facilitating work, improving access to patients' notes, improving clinical decision-making, improving the legibility of writing, reducing clinical errors, and providing accurate data. In reference to this, a doctor noted:

> You'll get more accurate data, so you are not having to guess, or take risks on minimum information. So you have much more comprehensive information, it is up to date, your

> communication with other agencies is current, you can communicate well with others, and it makes the patient's care pathway much more safe probably. (Doctor 8)

Improving the accessibility of information was mentioned as another advantage of using computer-based records. Some of the clinicians mentioned that using computer-based records could save time and could make their jobs easier by improving the accessibility of information:

> … it takes a lot less time to just click on the screen which obviously means we would have more time with the patient. (Nurse 3)

The comments by this nurse and the doctor above suggest that the overall effect of improving patient care, in terms of making it safer and freeing up time, was an important aspect of using computers.

Reducing the chances of error was another benefit of using computerized systems that might encourage staff to use them. Some of the ED staff mentioned that using computer-based records could also improve communication in the department. For example, a nurse suggested:

> It is good, because the department is busy. You can't always find who you need to talk to in a certain amount of time. They might be busy assessing or whatever they might be doing, so I mean having that system to put information on does help. (Nurse 8)

Some of the interviewees noted that they were able to do their jobs easier and quicker using a computer, and this could be critical in an ED, in which patients' lives can be dependent on high-quality care being given immediately. A member of the administrative staff said:

> … I found it three times quicker on a computer. It is a lot quicker and everything is just so tidy. (Administrative staff 10)

The system's features, in terms of ease of use and usefulness, were other factors which might influence the use of the system by the ED staff, for example:

> If it is not too time-consuming and it has got the value, value for time, if it is going to positively contribute to the patient care, if it is easier, much easier than to actually write in the classical fashion on notes, then I prefer it to the notes. (Doctor 6)

Although this interviewee indicated a preference for using computers, it was also clear that the preference was provisional on the potential benefits being realized. Despite the advantages of computer-based records, some of the ED staff thought that even if they were not interested in using such a system personally, they should respect the organizational rules and policies:

> If [there is] … a computerized system … then you can't do anything … there is not something to encourage me, if you have to use it, you have to use it. (Doctor 4)

Interviewees also expressed their concerns about using computer-based records. For example, implementing a change in the ED would be a major concern for the ED staff, as these doctors indicated:

> I think people, initially; when you're introducing the change it is quite hard for people to get used to it. (Doctor 4)

> It is just the human nature. I think a lot of people don't like change, do they? It means you have to engage your brain a little bit more than you normally do and I just think people find that quite hard really, when they have got lots of things going on at the same time. (Doctor 11)

From the users' point of view, not only implementing a system, but also users' work habits and computer skills should be taken into account, as noted by a doctor:

> I can't use a computer, I was trained on paper. (Doctor 1)

Some of the staff were concerned about the feasibility of all members of staff using computer-based records. In their opinion, entering data into a computer and searching for patients' data were part of clerical jobs for which the administrative staff were responsible, not the clinicians. One of the nurses mentioned:

> Everyone just assumes that we'll just get the receptionists to do it. I don't think it would be feasible for all members of staff to be trained and use that, I mean obviously that is a different job, that is their jobs and we have to know the reason for these all to be able to do what they do. (Nurse 7)

Other concerns of the staff were mainly related to the completeness and accuracy of data, and intrusion on the doctor–patient interaction due to using a computer. The interviewees were also concerned about the technical problems of a computer, such as system downtime and a system crashing. An administrative staff member suggested:

> You can't just trust the computer, can you? If it is crashing, then you have lost everything, at least we have got the paper work to back up as well. (Administrative staff 9)

Typing speed was another issue. However, some of the clinicians, particularly the doctors, indicated that typing information into a computer could be similar to writing on paper and that speed could be increased by practice and training. However, a lack of adequate equipment and PCs could be a barrier to the effective use of computers in the ED.

ED characteristics and the use of computers

When interviewees were asked about using computer-based records in the ED, some of them focused on the nature and characteristics of the ED. In their opinion, the speed of work, patients' conditions and the departmental workload were some of the factors which might influence using computer-based records. Some interviewees noted that entering data into the computer as well as writing the notes on paper could be time-consuming. This was important because the ED was a high-workload department.

> No time to do all of that, it takes far too long, I don't know who would [do], there are far too many patients in the department, many notes too, we certainly wouldn't be doing [them] ourselves, because there wouldn't be any time. (Nurse 7)

A patient's condition was also important, as the ED clinicians were responsible for treating patients who might be in a critical condition. An interviewee suggested:

> I think in a lot of ways it is the computer systems that get forgotten. If the patient is quite ill, they get the priority. Some of staff will look after the patient and the computer is the secondary thing. (Administrative staff 3)

Another issue mentioned by some of the interviewees was related to the environment of the ED and safety. They thought that computers could be damaged by violent patients and their relatives who may attend the ED. In this case, using computerized systems in the department could be risky and costly:

> I don't think you could physically have one in each cubicle … they get vandalized with patients and things, if they get really in a temper or they get annoyed … you get drunk people and they can't be very pleasant or you can get people that they have been involved in accidents, they have got head injuries and that can make them violent. (Administrative staff 4)

These comments highlighted the importance of the work environment and its possible influences on the use of IT in the ED.

Using paper-based records: reasons why and why not

The interviewees also explained why they preferred using paper-based records. In their opinion, a large amount of information could be available in a paper-based format. An interviewee stated:

> The paper information gives you more depth. It gives you a greater feeling and it will give you little personalized comments that somebody might have made about the patient's feelings, fears, worries, the carers and details on medical histories that we don't have online in this hospital. (Administrative staff 1)

Some of the ED staff thought that using paper-based records would be easier and quicker. In addition, as the number of computers was limited in the ED, they preferred using paper-based records rather than wasting time finding a free PC:

> Just fill the card in and walk with them round would be quicker … it can sometimes be quicker and easier than finding a spare computer and inputting information. (Nurse 7)

Although using paper-based records had some advantages for the ED staff, some of them complained about the disadvantages of paper-based records. They thought that searching for information in paper-based records was time-consuming, mainly because of the volume of information:

> Patients have lots of medical notes, then you spend hours touring throughout some basics, some information that you might not need. (Doctor 5)

In terms of the quality of information written on an ED card, some of the staff complained about the incompleteness of information. In addition, the legibility of handwriting was another problem mentioned by the interviewees:

> My handwriting can deteriorate. If I am writing very fast, my words can just merge into a line … some people might not interpret that. (Doctor 9)

> Everybody's handwriting is completely different, we often have a problem because we can't read what the doctors have written, read again, finally we prescribe things as we scan, let you read what they have got. (Nurse 3)

Moreover, as a nurse explained, a lot of information could be repeated in paper-based records, leading to a large volume of paper which was difficult to manage and store. The inaccessibility of paper-based records was another issue mentioned by the interviewees.

A member of the administrative staff said, 'nine times out of ten we spend a lot of time looking for missing records' (Administrative staff 2). This could be time-consuming and, if it was not urgent, staff did not spend time looking for them. In fact, using paper in the department could be a 'challenge', as mentioned by a member of the administrative staff.

A summary of the concerns of users about using computer-based records and paper-based records is presented in Table 1.

User expectations

The ED staff also discussed their expectations of a computerized information system. These expectations could be categorized as non-technical and technical issues. Among the non-technical expectations, organizational issues, such as user involvement, change management and training, were of great importance. The interviewees expected to obtain a better understanding of the change and the system that might be implemented in the future. The need for communication with system developers and user involvement in the design and implementation process were also mentioned by some staff.

Although some of the interviewees were positive about the application of IT in the ED, their main concern was the transition from where they were to where they needed to be, as a nurse mentioned. In terms of the initial stage of introducing the change, the interviewees had different opinions. Some of the respondents agreed on introducing the change bit by bit. In their opinion, this way of introducing the change allowed users to become familiar with the system gradually, 'whereas a whole big system sometimes is a step too far for people', as a doctor mentioned. However, some of the staff preferred to become familiar with different aspects of a new system all at once rather than to experience a series of changes that were central to their working practices. In explaining why, an interviewee said:

> Every time you change something, change itself is a new thing … [and] during the process of change, there is a lot of pain. (Doctor 8)

Table 1 Users' concerns about using computer-based records and paper-based records

Concerns about using computer-based records in the ED	Implementing change in the ED
	Users' computer knowledge and skills
	Feasibility of using computer-based records by all members of staff
	Completeness and accuracy of data
	Intrusion on the doctor–patient interaction
	Technical problems of a computer
	Shortage of equipment and PCs
	Nature and characteristics of the ED
	Using computer-based records and paper-based records at the same time with the same information
Concerns about using paper-based records in the ED	Difficulty in searching information
	Incompleteness of information
	Illegibility of handwriting
	Difficulty in management and storage
	Inaccessibility of paper-based records

After implementing the system, some of the interviewees expected to have enough time to learn and to get used to using it. Training was another important issue mentioned by the interviewees. They thought that training should be adequately funded for all of the staff in the department. As a nurse mentioned, the more training that people had for using a system, the more confidence they felt about using it. Apart from basic computer training courses, some of the respondents indicated that it was also important if somebody could take responsibility and lead the process of change in the actual workplace.

A number of technical issues were also highlighted by the interviewees. These were mainly related to systems integration, interface design, ease of use, usefulness, and system functions.

The interviewees expected to have an integrated system in their hospital, which was also linked to other information systems at a local level. For such an integrated system, the interviewees also expected to have 'just one password'. Obviously, memorizing one password would be much easier than memorizing various passwords for different systems.

In terms of interface design, most of the interviewees expected to have a system which was 'user-friendly' (Administrative staff 3) and 'as simple as possible' (Doctor 11). Some of the interviewees indicated that using a flexible system was of great importance in the ED. In fact, the clinicians expected to have a system which could be customized to their needs. This system should be able to provide them with structured data, such as tick boxes, as well as free text. The location of a workstation was also important, as doctors and nurses had to move around the department. For example, some of the interviewees preferred to have an access point in each cubicle and some others preferred to have handheld devices.

> You need to have things that you can use when you are with the patient, not actually have to go away and do it as a separate thing. I think that is something that we really need to change, we need to integrate it into practice, not have it as well as [other things]. (Nurse 4)

Given the characteristics of the ED, such as the speed of work, it was important for the staff to have an easy-to-use system. The usefulness of an information system was also important for the interviewees. However, they had different perceptions of usefulness. For example, some of the interviewees indicated that monitoring staff performance and having access to patient information could illustrate the usefulness of a system. For some other interviewees, a system would be useful if it was 'at least as good as the current system' (Doctor 6), which was paper-based records.

In terms of the functions of the system, some of the staff expected to have a system that was fitted to their tasks, otherwise it could be 'time-consuming' (Nurse 10). Other staff hoped to have automated systems. For instance, instead of clicking on the patient tracking system, this should be done automatically using advanced technology, as a doctor said.

Discussion

Recent work has suggested that in the majority of healthcare settings, paper-based records are still used in parallel with computer-based records, and the use of paper has not been completely eliminated [4]. The disadvantages of using paper and computer-based records

simultaneously could be duplication, data fragmentation, and inconsistency in the availability of data, which can influence healthcare delivery [18]. To avoid this, before designing such a system, it is important to understand to what extent implementing a new information system in a setting is necessary and how such a system can help to improve organizational functions [27].

The results of this study showed that most of the ED staff were aware of the benefits of computer-based records. This is important because, if users realize that using computerized information systems could have benefits for them, they might be encouraged to use them. According to the results, while the interviewees agreed with the benefits of using computer-based records, they were concerned about how these benefits could be realized in practice. This could have resulted from the limited use of computers in the department, even though there had been computerized systems in place for some time. In fact, the current systems provided the clinicians with limited functions and paper-based records were the main source of information. It seemed that staff who had more computer experience in their job were more positive about, and more interested in, using computer-based records than staff who had limited experience.

Although the main aim of implementing information systems in the ED is to increase efficiency and to contribute to improvements in patient care, staff needed to see some of the actual benefits of a system to be encouraged to use it [11]. As Taylor [28, p. 251] indicated, 'gaining early efficiencies is crucial to EDIS acceptance'. This could be achieved, for example, by using an automated tracking system in the ED.

The results also showed that some of the interviewees were concerned about using computer-based records in the ED environment. For example, some of them were worried about using a computer in a high-workload ED. The results are consistent with the findings of Jones's study [29], which showed that clinicians who worked in low-workload departments were more positive about using an information system than clinicians who worked in high-workload departments. In fact, the second group of clinicians were concerned about the time that they should spend on using a computer rather than on clinical practice. Moreover, as van der Meijden et al. [11] highlighted, the workflow of the ED, particularly when the department is busy, does not allow, for example, waiting for logging on and starting up a system. This may result in a system not being used or limited use of the system by staff and they may look for easier ways, such as using the telephone for communication or repeating clinical tests, because the required information is not available. Therefore, in order to design an acceptable system, usability issues should be taken into account [7]. In particular, it is important to understand how an information system can help the clinicians' workflow in a busy environment, such as the ED. Otherwise, technical issues and users' expectations that are left unmet may cause user resistance.

In terms of the non-technical issues, the results showed that transition from using paper to using a computer was one of the main concerns of the ED staff, and they expected to be informed about future systems. This is supported by van der Meijden et al. [11], who suggested that if the process of change is accompanied by user involvement in designing and implementing an information system, user resistance can be reduced. Similarly, Taylor [28] indicated that user involvement is essential for a system to be accepted by its users.

Training on the use of computers was also found to be an influencing factor on the use of information systems in the ED. According to the interviewees, some of the ED staff did

not even know how to use a computer. Therefore, more investment on computer training courses is required, particularly in an environment in which the use of the computer is limited, and users are relatively inexperienced.

Overall, the findings of this study revealed that the ED staff had positive attitudes towards the use of information systems in their department. However, their attitudes were mainly associated with the current systems that they used. Their attitudes might change, for instance by using a new system and by the way that system was introduced. As Heeks [27, p. 133] indicated, 'neither design nor reality should be seen as static, they are dynamic'. Therefore, it is important to investigate users' perspectives about an information system at different stages to identify the strengths and weaknesses of the information system. This can help to design better systems in the future.

Limitations of the study

It is important to note that as the current study was undertaken in one setting, i.e. a UK emergency department which was using specific information systems, the results may not be fully transferable to all healthcare settings. However, the study has proved useful in identifying issues that are of importance in this type of department, and could be useful for planning and developing information systems in other emergency departments. In this study we also used convenience rather than purposive sampling. However, a diverse range of staff were interviewed to reflect a full range of opinions.

Conclusion

In this article we have reported users' perspectives about paper-based and computer-based records in the ED and discussed how these might influence the use of EDIS. Despite an extensive effort to implement information systems, healthcare staff were still concerned about the use of technology in the ED, though some of them had positive attitudes towards developments. Their concerns were related to a number of factors, such as their computer knowledge and skills, the technical aspects of a system, and the organizational and environmental factors which might influence the use of information systems in the ED. To meet users' expectations, these factors need to be taken into account during system design and implementation. Our findings also showed differences in clinicians' and non-clinicians' attitudes towards using IT in the ED. While the administrative staff had positive attitudes, clinicians were concerned about using IT in the ED, particularly when they were busy treating patients. Therefore, in designing information systems for the ED, the characteristics of the clinicians' work and the nature of the department should particularly be considered. Underestimating these factors may negatively influence the use of information systems in the ED.

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