What do critical care nurses want from Clinical Information Systems?

Peer reviewed research paper

Peter Norrie, PhD, MSc, ENB100, RGN, PGCE, MIBiol, HND, Senior Lecturer in Nursing, De Montfort University, Leicester

Introduction

Many claims have been made for the introduction of information technology (IT), computers and computerised systems within the acute care setting. However, closer examination of these claims can lead to the conclusion that they are based upon optimism, rather than evidence (Norrie 2000). Within the last ten to fifteen years, computerised systems have been developed which have the potential to change radically the way that critical care nurses work. These have largely been referred to as Clinical Information Systems (CIS) and Patient Data Management Systems. Although the terms are essentially synonymous, CIS will be used in this work as it is more commonly reported within the recent literature. Perhaps the single criterion which defines CIS is the ability to integrate all of the disparate IT sources found within the critical care environment together, so that instead of there being a number of stand-alone pieces of equipment, the acquisition, handling and recording of data can become unified.

One issue that becomes evident when exploring the potential impact of computerised systems upon nurses, is that the majority of published work has been undertaken by medical staff. This produces a significant limitation to the credibility of this work, principally in the limited understanding of what nursing is and what nurses do. This is not simply a theoretical limitation. For example, the quantitative studies which have been produced by authors such as Bradshaw et al (1989), Hendrickson et al (1990) and Lutheran Hospital (1991) into the impact of these systems have all imposed arbitrary systems of classification upon nurses' working practices prior to CIS implementation, and then compared time spent in undertaking these activities prior to and post CIS implementation. However, unless the definition of nursing activities has validity, then the tools which were devised will similarly be invalid, as will the research findings (Norrie 2000).

The study

The research took place within a teaching hospital in the Midlands of England and was undertaken as a collaborative project, between hospital and university staff.

Within the adult critical care unit a pilot CIS implementation was undertaken, and this formed the research opportunity for the project. By the time of the fieldwork, staff therefore had gained some experience of the capabilities of using these systems. In addition, a senior nurse was involved with the implementation process and had already disseminated information about the system, through both formal and informal teaching sessions. Thus the nurses were primed: they had been exposed to the CIS, their awareness of it had been raised and they had knowledge of its capabilities.

Methods

In order to generate theory that could be applicable in a number of settings, an inductive approach was chosen (May 1997). Similarly, because there was a dearth of published research exploring the aspirations and concerns of nurses with regards to computerised systems, an approach influenced by grounded theory was used. However, in order to produce focussed research, semi-structured interviews were used, which arguably deviates from the grounded theory approach of Glaser and Strauss (Glaser and Strauss 1967, Smith and Biley 1997).

Sampling

Stratified sampling was chosen because three main groups of nurses who would use a CIS were identified, in order to obtain a greater degree of representation than straightforward randomisation (Polit et al 2001). These were described by their clinical grading, denoted as grades D,E and F. It was identified that nurses within each of these categories may have different and valuable perspectives on the use of CIS. The nurses who worked at grade 'G' were not included because the largest proportion of their work is managerial and therefore they would not be major users of a bedside system. Four nurses from each stratum were randomly obtained because it was felt that a

total of twelve interviews was the largest sample that could realistically be dealt with in terms of the resources of the project.

All but one of the staff gave permission to proceed, and a replacement was obtained by a further random selection.

Measures

A schedule of questions was compiled by negotiation between the authors and is given in table 1.

Table 1: Schedule of questions
Tell me about yourself and your career
One of the obvious features about the Critical Care environment is the amount of technology involved in patient care – how do you feel about this?
What do you understand by the term information technology/computerisation?
How do you feel about the traditional method of patient data collection, documentation & charting system?
What do you perceive are the advantages with using the current methods of documentation?
Can you list up 3 main advantages and which of these is the main one?
What do you perceive are the disadvantages with using the current methods of documentation?
Can you list up 3 main advantages and which of these is the main one?
What do you know or understand about the CIS implementation in the ITU here?
Do you have an understanding what the capabilities of CIS are, if so what are they?
What are your expectations of CIS?
At this point in time, do you perceive any advantages with using the CIS?
At this point in time, do you perceive any disadvantages with using the CIS?
How do you think that the current use of IT/ computerisation within the unit affects your role as a nurse?

The questions were generated from four main sources. Firstly there was an element of benchmarking, illustrated by the questions concerning sources of satisfaction, dissatisfaction and general attitudes. Secondly, two overarching research questions were identified. These can be summarised as, firstly, what do critical care nurses want from a CIS and secondly can CIS support nurses within critical care?'. Their constituent components were then isolated. For example, the

latter produced the questions concerned with the perceived advantages and disadvantages of the current methods of documentation, as these would be areas of nursing activity which would be significantly changed by the CIS implementation.

Thirdly a number of the questions were influenced by the available literature. For example, there are reports of nurses being intimidated by computerisation which has been seen as giving orders to the staff (Large 1994). Issues such as these would be picked up in the questions which addressed expectations and perceived disadvantages. The final source of questions derived from the clinical service evaluation of the system. This accounts for some of the more closed questions used latterly in the questionnaire.

Procedure

An informal atmosphere was fostered and the interviews took place in a quiet room adjacent to the clinical area. A tape recorder was used and this was clearly visible to the interviewees. Approximately half the interviews were undertaken by the researcher alone and half were undertaken in conjunction with the senior nurse involved in the CIS pilot. The majority of the interviews took between 20 and 30 minutes.

Results

Transcription of the tapes was made by an experienced audio typist. Transcription symbols were not used. However, in order to support accuracy, the transcripts were all reviewed and compared with the tapes. Amendments and corrections were made by the researcher to support quality, following the recommendations of Gillham (2000).

Analysis

Analysis of the interviews was undertaken using a simplified grounded theory approach, based upon Strauss and Corbin's (1990) and Smith and Biley's (1997) description of methods. To promote validity, an independent co-reviewer was employed to parallel the coding and generation of categories.

Discussion

The analysis will follow the interview scheme previously described, with some exceptions which will be discussed as they occur. The first item to consider is the demographic nature of the sample.

All three of the clinical grade groups were made up of three females and one male. Within the D grade nurses, the time spent within nursing ranged from two months to four years, the time spent within critical care was between two months and two years. Within the E grade nurses, the time reported as spent in nursing was between eight and eleven years, whilst the time spent within critical care units (not necessarily the research site) was between two and nine years. Three of the sample reported a specialist qualification in critical care nursing. Amongst the F grade nurses, the time spent within nursing was reported as being between six and eight years, with a minimum of six years being spent within the speciality. All had specialist critical care qualifications.

Technology in the clinical area: positive attitudes

The nurses appeared to use the term 'technology' to include two sets of equipment. Firstly, they identified a group of medical devices such as ventilators and syringe drivers as 'technological' in nature. In addition they identified the IT aspects of the patient monitoring or laboratory reporting systems as fitting within the term. Therefore, any distinction between the two was not really made, suggesting that the nurses adopted a pragmatic analysis, being willing to adopt any piece of technology that could help them to deliver their patient care, regardless of its provenance. For example modern ventilators and other devices are also driven by embedded microprocessors and provide extensive patient information displays, so really the term technology can be applied quite widely to encompass both aspects of 'technology' (i.e. machines which do things for patients) and 'information technology' (i.e. machines which deliver patient data). As a general statement, the staff were positive about the potential of technology to support patient care within the critical care area, albeit with some important limitations. A large proportion of the sample (two at F, all the E and three of the D grade nurses) reported that they felt technology was a useful tool which helped them look after their patients. They identified patient monitoring systems, ventilators and fluid administration devices as supportive technology. For example, the ways in which modern ventilators have made it easier to ventilate and promote patient comfort was noted by Sister A:

'Ventilation modes have changed and make it a lot more easy to ventilate a patient and they require less sedation and it is more comfortable for them.'

Similarly, Sister B summarised a theme raised by a number of the staff:

'Yes it is a lot of technology, but at the end of the day it is a necessity … the patient needs it and the patient comes first and the technology supports the patient.'

Three nurses reported that they had been attracted into the clinical area by the presence of technology. Technology therefore was largely seen as a positive and supportive feature of the environment, as long as it was used with discretion and did not dictate the course of the nursing. As Nurse G said

'I think that's where technology and experience should work together, I don't think it should be all technology. I think your experience is really important.'

Technology in the clinical area: negative attitudes

Some similar themes emerged when considering the hazards of working in such a technological environment. The staff worked every day with technology, and so were aware of some potential pitfalls of this alliance. It was identified that it was possible to become too focused on the technology to the detriment of nursing care, there was a possibility of a 'Frankenstein effect', where the technology became the master rather than the servant. For example, Staff Nurse H said:

'well I think sometimes we have to stop and think what we are doing. Sometimes I think we use too much technology on patients that probably don't want it.'

To support this she cited the case of an 87 year old patient with dementia who was ventilated post operatively. As she concluded:

'I think we should have, I don't know, a conscience I suppose.'

Similarly, Staff Nurse G identified that:

'I think that a nurse's clinical observation is more important than technology, but I think that you have to use them both in this area to be safe with your patient.'

Amongst the D grade nurses, it was identified that initially the amount of technology had caused some anxiety. However, it was also mentioned that because they were relatively young, they had been brought up with computers and so, it was reported, assimilated it easily.

Amongst the broader cohort, poorly implemented technology was identified as being especially undesirable. Within the unit, blood results were accessible through an antiquated computer link with the pathology laboratories. As Staff Nurse I put it:

'Nine times out of ten you can't actually get into the computer screen, it sort of comes up with a different starting message and you can't actually get it into the directory that you need it to be in to get your results back…. it's a pain in the bum because then you have to spend twice as much time chasing it up anyway.'

The frustration of this flawed communication medium was evident. This was reinforced by Sister F who remarked that:

'we have that computer that we have for the lab results which nobody seems to be able to function and if that is anything to go by then we are going to be in big trouble!'

Definitions of IT within the clinical area
The application of the term 'information technology' was defined in three ways. Firstly, staff across all three grades identified IT as being able to provide important data which could be used to support patient care. The way in which these data could be brought together was also noted, as Staff Nurse F said:

'for me computerisation is trying to bring everything together on … a screen in front of you, without having to go into the into the corners of the unit to find that information, or to go to numerous different people to try and find that information.'

This idea of increasing the accessibility as well as the improved quality of the information was also noted by Charge Nurse C who identified that a lot of nursing time was spent in documentation and this time could be freed up by using IT systems to record data, again with the understanding that this extra time could be used to deliver more care:

'Presumably it is going to free up our time because we spend a lot of time every hour charting and documenting things, so hopefully it is going to free up our time to actually give care as opposed to doing some paperwork.'

The second definition equated IT specifically to the use of computers within the clinical area, and again it was identified by two nurses that the majority of hardware within the environment could already be described as 'computerised', that is it utilised embedded microprocessor control.

It was also reiterated that despite the provision of IT, human skills must remain central to the care of patients within this environment.

'I see it as an instrument to help me care for my patients. At the end of the day they are paramount and it is tools really that help make your work easier.'

What staff hoped to gain from using CIS
A number of responses from questions 5-11 (table 1) were combined to produce a conceptually linked account.

Perceived advantages of using a CIS
The interviewees identified improved documentation and accessibility of information as desirable goals. It was widely identified that the majority of the patient data would be stored within CIS. It was thought that this central store of information would allow ready access to important information by nurses, medical staff and other members of the multidisciplinary team. The nurses were very positive about the quality of the information that would be available, noting that the accurate recording of data would support legality and safety issues and would be able to speed up and make more efficient the discharge and admission of patients to and from the unit. For example Sister B noted that:

'if it works well, ….., we can do audits from it, we can get all the information that we need from it and get rid of all the numerous pieces of paper that are duplicated ten times over on the unit that all say the same thing.'

As well as data management issues, across all the grades of nurses, there was a consensus that CIS could save time for the nurses and this time could be translated into improved patient care. This was

---

reported across all three grades and was mentioned serially by a number of interviewees.

For example Staff Nurse F felt it could make discussion concerning patient management more efficient:

'so I am hoping that it will be time saving and just easier to view if somebody comes along and asks you for information that you would be able to press a few buttons and show, if say the surgeon comes along and asks you for information, then you would be able to show him relevant information.'

More widely, it was hoped that the system could cut down on repetitive paperwork and by centralising information would make it more readily available. In addition to these workload issues, staff felt that CIS could have a direct impact on patient care. It was thought that assessment of patients could become more continuous, rather than an activity which occurred once every hour, when the twenty four hour chart was filled in.

Perceived disadvantages of using a CIS

A large proportion of the staff were concerned about reliability, more specifically that the system would 'crash.' This was again reported across all three grades. The reliability of the recorded data were also mentioned as being uncertain. As Staff Nurse I put it:

'you only get out of the computer what you put into it, so obviously you might get one person that uses it really well, but then somebody else who doesn't put the information in... it depends on the people that are using it as to how well it will actually work back for us.'

Three members of staff were concerned that by using CIS, an important step in data management might be omitted. With manual data recording, the staff were actively required to note and interpret the data before recording it. There was concern that in contrast, with the automatic acquisition and recording of data, that this cognitive step would be lost, and so 'contact' with the data would be reduced. For example one Staff Nurse identified that

'it would be that people wouldn't maybe monitor the trends so well as if they were writing it themselves every hour'

Finally, the possibility of a Frankenstein effect was again identified, more specifically that the system might be too directive.

*'it will come up on the screen and it will tell you when to give you Cefuroxime (*an antibiotic*), I don't want a machine to tell me when to give my Cefuroxime!'*

Conclusion

Within the fieldwork, a number of questions were put to the interviewees which aimed to focus consideration on their use of the complex machinery, technology and sources of information used within the clinical area. In their replies, the nurses did not appear to differentiate between the different equipment which was predominately characterised by IT, such as the monitoring systems in place, nor that which was predominantly characterised by mechanical functionality such as the ventilators or syringe drivers. Therefore the terminology referring to 'IT' or other forms of 'technology' presents a limitation to discussion, as the equipment referred to by the nurses contained, to some extent, both of these elements. In other words, to produce unambiguous theory, equally unambiguous terminology is a prerequisite. However, commonalities between both ends of the spectrum can be identified. The principal feature identified by the nurses was not primarily related to the physical or specificational nature of the equipment, rather that it was capable of being applied within the clinical area to support patient care. The technology was reported as *'a necessity'* , the *'patient needed it'* and it was *'a partner in crime.'* However, having introduced this perspective, a distinction would then have to be made between a secondary set of features, so that for example bed linen or other resources relevant to patient care were not included. These considerations were that the equipment was technological in nature and included elements of IT. In order to clarify the discussion all these aspects of the supportive technology will be subsumed within the term 'Client Applied Information Technology' or CAIT. It is suggested that this term may be useful in exploring the needs of critical care nurses in future research.

Similarly, it can be identified that it is the ability of the critical care environment to allow nurses to focus on specific aspects of care which is the single most satisfying element of their work. This

includes communication with patients and their relatives, helping their colleagues and being in a position to care for all the patients physical and psychological needs. Indeed this delivery of quality direct patient care can be described as the nurses' primary aim and this is the second piece of novel terminology to be introduced.

These two constructs work coherently. The critical care nurses can be predicted to respond positively to any aspect of CAIT which can further these primary aims

Although these findings seem anodyne, in comparison to the established literature, they are quite innovative and reveal a gulf between the medically dominated research surrounding CIS, with its insistence upon time management and measurement, and the emphasis in this work upon quality of nursing care and nursing experience.

Finally, the cognitive step is an interesting concept. It suggests that for a system to support patient care optimally, there must be occasion for the nurses to actively validate or otherwise engage with the data. Without this, the nurse will lose contact with changes in their patients' status, so that despite the CIS being able to obtain large volumes of data, the transmission of this data to the human element which can effect changes in management, i.e. the nurses, will be impaired. This would represent a significant limitation in practice to the use of these systems and would potentially result in large volumes of redundant data and poor patient management decisions.

References

Bradshaw, K.E. Sittig, D.F. Gardner, M. Pryor, T.A. Budd, M. (1989) Computer based entry for nurses in the ICU, MD Computing 5(5): 274-280.
Gillham, B. (2000) The Research Interview. London: Continuum.
Glaser, B.G. Strauss, A.L. (1967) The Discovery of Grounded Theory: Strategies for Qualitative Research. Chicago: Aldine.
Hendrickson, G. Doddato, T. Kovner, C. (1990) How do nurses use their time? Journal of Nursing Administration 20(3)31-37.
Large, W. (1994) Nurses attitudes towards computerisation in intensive care. British Journal of Nursing, 3(11): 558-564.
Lutheran Hospital (1991) CIS Impact study- unpublished report. Lutheran Hospital 1910, South Avenue, La Crosse, Wisconsin.

May, T. (1997) Social Research: Issues, Methods and Processes. 2nd edition. Open university press: Oxford.
Norrie, P. (2000) Brahms but not necessarily Liszt: the impact of computerised systems on nursing within intensive care. Chapter in Making a Difference. D. Freshwater (editor), University of Nottingham: Nursing Praxis International: 65-76.
Polit, D.E. Beck, C.T. Hungler, B.P. (2001) Essentials of Nursing Research. 5th edition. Philadelphia: Lippincott.
Smith, K. and Biley, F. (1997) Understanding grounded theory: principles and evaluation. Nurse Researcher, 4 (3): 17-30.
Strauss, A. Corbin, J. (1990) Basics of Qualitative Research: Grounded Theory Procedures and Techniques. Newbury Park CA: Sage.