Proximate Positioning of Nurses to the Hospital Information System as a Determinant of Use

Ms N Mbananga, M.A.
&
Ms R Madala, B.A.
Burden of Disease Research Unit
Medical Research Council
Pretoria

ABSTRACT
The Northern Province started to implement an integrated computerised Hospital Information System (HIS) in its 42 hospitals. The evaluation process of the HIS was seen as an integral part of its implementation. During the planning stage of the HIS an evaluation team was established to plan, design and conduct an evaluation of the system.

Part of the overall aim of the qualitative component of the study was to assess HIS effectiveness in meeting health workers' information needs. The objectives of the study amongst others were to assess Hospital Information System’s effectiveness in providing information for supervision, planning and clinical care amongst nurses and to evaluate HIS in patient administration and admission. The evaluation was designed as a Randomised Control Trial (RCT). Circumstances dictated that the analysis be conducted as a Before and After Control study. The qualitative methods were one of the methods chosen to conduct an evaluation.

Nurses reported using the system often, particularly those who had user-names and passwords. The same was not true for those nurses without user IDs. It is clear that those nurses with passwords were 'positioned' nearer the computer and thus were better able to use it. Those nurses without passwords did not use the computers because of their distal positioning.

The hypothesis that can be generated from the data is that distal or proximal positioning of nurses influences the effectiveness and efficiency of HIS. This also suggests that information for hospital management and clinical care management is available to managers and nurses in relation to their position to the system. Another important finding was the reality that HIS implementation is doomed if no fertile and receptive ground is prepared before implementation particularly training of nurses who appear to be the primary drivers of HIS.

BACKGROUND
In 1995 the National Department of Health (NDoH) established a National Committee to develop a strategy towards a National Health Information System for South Africa (NHIS/SA). The committee was made up of members from each of the nine provinces. The aim of this committee was to develop and monitor national health information system strategies which would guide the development of a national health information system countrywide. The objective of the NHIS/SA was to provide management information for health managers and health workers. The committee identified patient care and financial information systems as crucial for health care management in the country.

As a response to national strategy and in recognition of provincial need, in 1998 the Northern Province started to implement an integrated computerised Hospital Information System (HIS) in its 42 hospitals. The decision to implement PCIS in this province coincided with the provincial need to restructure services, which involved shifting resources from tertiary and secondary care levels to the primary care level. Hospital Information System (HIS) was one of the restructuring strategies in the Northern Province.
The two main objectives of the HIS were as follows:

**Improve patient care by providing patient information within and between hospitals.** The provincial accessibility of such information would improve the internal and spatial integration within and between hospitals. This integration is particularly important in the light of the referral system between hospitals and ward transfers within hospitals. Internal and spatial integration of patient information was observed by health care professionals as the best method of improving information accessibility through easy handling of medical records via the computers and network. The process of handling medical records through a computer network promises to result in the timely provision of information for diagnosis; access to lab results; easier patient administration and improved overall hospital management.

**Improve health system management in general, beyond patient care.** HIS is expected to improve revenue collection, aid management decision-making by identifying primary cost-drivers at hospital level and provide accessible information for management at all levels of the health system.

The evaluation process of the HIS was seen as an integral part of its implementation. During the planning stage of the HIS an evaluation team was established to plan, design and conduct an evaluation of the system. The qualitative study was one of the methods chosen to conduct an evaluation.

**LITERATURE REVIEW**

Qualitative data are used to gain critical insight into motivations and interactions within an organisation. Detailed qualitative data that is collected from individuals about their actual processes within the organisation and its setting can be used to interpret the findings and explain how and why information systems bring about change. Tripodi (1983) suggests four criteria which can be applied to both formative and summative evaluation. These are effort, effectiveness, efficiency and unanticipated consequences. Effort includes staff time, activity and commitment. Effectiveness refers to the extent to which the practice objectives have been achieved, while efficiency concerns the relationship of effectiveness to effort and reflects practice relative to the extent of achieved desirable change. Practice effectiveness refers to the extent to which planned objectives are achieved by users of the system or programme. Practice efficiency is the relationship of effectiveness to effort and can be easily assessed by considering changes per worker’s activity (Tripodi 1983). Qualitative research methods have been used in evaluation studies of computerised systems such as laboratory information systems. (Friedman and Wyatt 1994; Kaplan 1991 and Anderson et al. 1994).

While evaluation research and scientific inquiry differ, both use the same logic of inquiry in their procedures. Scientific study focuses primarily on meeting specific standards, regardless of the organisational interest in the study. Despite the scientific rigour which is crucial in evaluation research, it must take cognisance of the interest of the organisation and stake holders. Thus, evaluation research must be conducted in such a way that it will provide information that is useful for the managers of the organisation.

Within models of change are theoretical perspectives, which are based on different conceptions of what is believed to cause change and which explain how information systems affect organisational change (Kaplan 1991). These perspectives are:

- The computer system is an external force.
- The computer system design is determined by user information needs.
- Complex social interactions determine system use.

These three perspectives form a comprehensive framework within which a hospital information system can be evaluated. They also help system evaluators recognise the inadequacies of using only one perspective and encourages them to consider additional areas in the evaluation study together with research strategies involved (Anderson et al. 1994). The evaluation of the Northern province hospital information system was approached within the framework of these perspectives in order to provide a comprehensive report for managers and other stakeholders. At the same time the Efforts/Efficiency/Effectiveness Model (EEEM) (Tripodi 1983) was employed to guide the study design.

New information systems have a powerful potential to improve the functioning of health care institutions (Neuman, et al., 1996). However, this benefit can only be realised if health care information systems can be successfully developed, implemented and managed. Literature reveals a gloomy picture with regard to Health Care Information Systems’ success from many countries. There is evidence that a majority of information systems initiatives are failures in both private and public sector (Heeks and Davis, 1999; James, 1997). Research shows that many health care organisations have used huge amounts of money and frustrated a group of people by imposing these systems and wasted efforts in implementing information systems (Heeks, et al., 1999). According to (Heeks, et al., 1999) there are four main forms of failure:

- The total failure of systems never implemented or in which a new system is implemented and abandoned.
- The partial failure of an initiative in which main goals/objects are not obtained with undesirable consequences.
- The sustainability failure of an initiative that succeeds initially and fails after twelve months.
- The replication failure of an initiative which succeeds in its pilot location but cannot be implemented in other health centres.

The four failures highlighted by Heeks et al., (1999) are irrefutable and have been observed in many countries. However, there are also a few points to be taken into account in reporting about these failures. It is useful to identify clearly where the nodes of failures are and how these can be remedied. Health Information Science is a relatively new science and consequently it cannot provide a theoretical framework to guide development and implementation of Health Care Information Systems. The failures of these systems indicate the immaturity and a lack of a strong scientific background to support them. Information systems have worked well in business and corporate environments. In these organisations there is one central manager who defines both rules and behaviour and in large businesses accountability is rigid. In these types of organisations the relationship of the end user with the manager is clear and streamlined. Users of systems in such organisations are not empowered to make decisions without invitation.

In professional organisations the situation is totally different. Professionals at every level have to make decisions guided by their professional knowledge and are accountable. The situation becomes even more difficult in health organisations with various professionals with powers to make decisions. Health professional organisations are complex systems and that is the reason that they have complex systems which are difficult to develop, implement and realise benefits with ease and sometimes fail (Simpson, et al., 1998; Beaumont, 1999). Nevertheless, health care information systems do have a potential to improve health care management and the challenge is to make them work.

**PURPOSE OF THE STUDY**

The overall aim of the qualitative component of the study was to assess HIS effectiveness in meeting health workers information needs. HIS successes and failures were to be assessed by considering the objectives set prior to imple-
mentation, which are listed below.

Objectives of the study
Assessment of HIS in providing information for supervision, planning and clinical care collect qualitative data on computer processes that deal with general nursing care and supervisory role of matrons.
Evaluation of HIS in patient administration: gather qualitative data on patient administration and admission.

RESEARCH DESIGN
The evaluation was designed as a Randomised Control Trial (RCT). Circumstances dictated that the analysis be conducted as a Before and After Control study. This occurred because the order in which hospitals received information system did not meet the match of the RCT schedules for reasons beyond the control of the evaluators. This does not in any way affect the qualitative results, although it has an impact on the rigour of the quantitative study which is still in process.

According to the RCT design 24 district hospitals were selected and divided into an experimental group and a control group. Each group consisted of a dozen hospitals. The implementation of the information system took place in the experimental hospitals before the control hospitals, thereby providing a period of comparison. Qualitative research was conducted in a subset of 7 hospitals chosen from the original 24. This type of research was used for evaluation because it provides an understanding of the system from the viewpoints of the users as well as the processes leading to outcome indicators. It also helps to determine the influence of the social organisational context on system use, which is significant because computer systems do not and cannot exist in a vacuum. The implementation and use of a computer system occurs in a social and organisational context that shapes what happens at the contact stage. Although experimental inter-ventions can illustrate the existence of the causal relationship they are not competent in revealing how causal processes work (Tripodi, 1983). Qualitative methods provide an opportunity to examine the actual processes involved and to form explanations for the events and processes that lead to specific outcomes.

The evaluation programme asked two questions:

1. Does HIS improve the quality of decisions by making information readily available to nurses and health matrons?
2. Is the information being utilised to improve the efficiency and effectiveness of services?

These questions, focussed on the effectiveness and efficiency of HIS, formed the basis upon which an evaluation method for HIS was developed and designed.

Methods of data collection
The 7 hospitals selected for the qualitative component of the study were chosen according to size, which was important in order to investigate how HIS is evaluated in big and small hospitals respectively. Of the 7, HIS was implemented in four experimental hospitals while the remaining three (control hospitals) were not computerised. The Effort/Effectiveness/Efficiency Model (Tripodi, 1983) was used to guide the qualitative methods used to collect data from these hospitals. An interview schedule (see appendix) was designed within this model and used to interview key informants and guide focus group discussions. Matrons, Six focus group discussions were conducted with ward nurses in each of the hospitals visited. The questions, which were asked in both in-depth interviews and focus group discussions, related to time efforts in performing daily functions and effectiveness of the system in providing information needs. Data were collected using tape recorders and by taking notes. Most participants in the study signed consent forms. In some cases the consent was verbal because the study was well-known as it was advocated by the provincial office prior to implementation. Participants in hospitals expressed willingness to take part.

Data Analysis
Two types of analysis were conducted: content analysis and inductive analysis.

Content Analysis
Information maps were developed manually from the notes to identify clear themes and topics. The content analysis method was conducted. The data were also recorded into a computer programme, which generated transcripts that were then systematically searched for words, phrases and concepts, which were developed into themes. Recurring themes were identified. Categories of identified themes were then grouped according to similarities and differences between the data collected from focus group discussions and data collected from key informants or individuals in hospitals. The themes were cross-analysed to check the difference between those in early and those in late in terms of effort, effectiveness and efficiency of HIS. An Effort/Effectiveness/Efficiency Model was used to analyse data (see appendix).

Inductive Analysis

Africa Journal of Nursing and Midwifery, November 2002 - Vol 4 No 2 [22]
ward. In this regard efforts in checking and retrieving information were reduced by 20%. The matrons were concerned about the accuracy of the information that they obtained from the system. Periodically, they conducted information audits by checking the records and registers used in the ward for admission and discharges against the electronic reports from the system. In some instances discrepancies were identified.

Matrons were generally of the opinion that the system was too demanding and wasted too much of nurses’ time. One matron remarked that the system increased nurses’ workloads: “Nurses have to write in the patients’ paper record and sit in front of the computer to capture the same information.” Ward nurses appeared to take more time on recording information than on patient care. One matron said “computing information is a non-nursing duty, it takes up a lot of patient care time.” Despite the positive functions that the system could perform, matrons had conflicting perceptions about the system, pointing out the negative aspects of minimising patient care time and duplicating recording activities. One matron suggested, in direct contradiction with the opinion that the system would make the nurses workloads lighter and do away with the need for ward clerks, that ward clerks were more necessary than ever in order to reduce the duplication in the wards. “They said that the system was going to make our work easier and we need to do away with the ward clerks, no the system makes our work difficult it is now that we need ward clerks” one matron remarked. Another matron expressed dissatisfaction that the system could not provide a matron’s report. As far as the matrons were concerned the system only increased efforts around patient records. It appears, from the matrons statements, that their expectations were high with regard to the system’s potential, and that they were in general, disillusioned and disappointed by it. The system’s only effective aspect was that it allowed them to check admissions and discharges in each ward. However, even though the system was generally considered problematic and information needs were not met, matrons were against the idea of totally removing it away from the hospital.

The Role of HIS in improving Patient Care Management by Nurses

The nurses listed the following socio-demographic data as necessary to the execution of their duties: the personal particulars of the patient (name, ID number, address, next of kin, age, occupation, sex); health related information (medical/health history, diagnosis, lab results, treatment); whether the patient was a private patient or not and information about the medical condition of the patient (vital signs or biological indicators, temperature, pulse, blood sugar levels, blood pressure). In order to nurse a patient according to the diagnosis, information related to the nursing care plan is needed.

When discussing how well the system provided for their information needs, the nurses made it clear that the system successfully provided socio-demographic data. Nurses were encouraged to rate the quality of information provision. On a scale of 1-10 the system scored 7-8 points. The nurses explained that demographic data improved because the system compelled OPD clerks to fill in all information fields. “Before the system,” one nurse reported, “clerks would fill in the ID, the name and the address of the patient only, leaving the rest up to us.” Like the OPD clerks, nurses reported that the system was functioning well in the admission and registration of patients.

The system was not well аппарат with regard to carrying out functions related to health/clinical data and patient management. The system did not provide codes for all diseases, conditions or procedures, such as burns, termination of pregnancy or classification of fractures. We sometimes look for a diagnosis and we do not find it” one nurse remarked. When the diagnosis or code cannot be found they left it blank. Sometimes the machine does not allow you to pass the code field, you give up and use paper system only” one nurse stated. This suggests that the information in the system is incomplete and may lead to inaccuracies if nurses are forced to fill in any code so as to proceed to the next step. This suggests that not all information captured in the system is accurate. It appears that with this prevalence of inaccuracy in data an intensive audit is necessary before the computerised information can be considered reliable. Another complaint was that some of the modules were not in the system. We shuffle between computer and paper records for instance you look for the patients card in the computer you find it but you do not get information on X-ray and laboratory and you need to go for the paper system” one nurse complained. She continued sometimes this waste your time. The delay in the development of the remaining modules of the system appeared to frustrate nurses.

Another problematic area for nurses was discharging patients from the computerised system. Like the revenue clerks, nurses reported that sometimes the system did not discharge patients. One nurse reported, Sometimes you admit the patient into the computer the machine refuses and tells you that the ward is full but the ward is not full”. The discontinuity between physical and system-recorded space was directly linked to the system going off-line for two to six weeks at a time as reported earlier. The nurses complained that it was not easy to update the backlog caused by the system a problem also highlighted by the matrons. This reveals that the system is poorly updated about developments in the ward, which further reflects the inaccuracy of data.

The nurses raised one issue, which they considered quite problematic. The system uses a concise definition of a child: a person under the age of thirteen. The system automatically calculates the age of the patient based on the date of birth which is entered. If a patient who is thirteen years and a few months old is admitted, the system classifies him or her not as a child, but as an adult. The nurses were concerned about this, because the system defined older children as adults when they were clearly not as socially mature as adults. This concern can be associated with the impacts of imposing a structured, rational information system on social/health practice and behavioural realities. It remains to be seen whether this problem can be solved by readjusting the system itself to give nurses greater leeway in the definition of a child, or whether nurses themselves will have to accept the system’s rigidity.

The definition of a child was related to the system’s pre-allocation of beds in the wards according to medical categories and gender. This was problematic, especially in small hospitals where there was no clear bed earmarking based on medical categories or gender. “When there are no beds in the male ward we sometimes admit an emergency in the female ward, but the machine refuses to accept a male patient in a female ward” one nurse reported. She continued, For instance one day there was a male patient who was very sick there was no male or female bed we had to admit him in a maternity ward the computer refused to take a man in a maternity ward but we ignored it and we used manual system”.

Nurses were particularly incensed about the thorny issue of user IDs and passwords. Not all nurses were issued with user IDs and those that were not, found themselves in disadvantaged positions, as other nurses refused to allow them to use theirs. Further, if the nurse with the password was not on duty, nurses had to go to other wards to ‘borrow’ passwords. This appeared to generate animosity and conflict, as those without passwords felt that they had an inferior status to those with passwords. Some nurses who lacked user IDs developed negative attitudes toward the computer system, such as the nurse who complained that she did not have anything to contribute to the debate be-
cause I do not have a password what can I say? Ask those who can use the system, I do not know why the system administrator has not given me a password, it is not nice to go around and ask 'lend me your password' like a beggar”.

Nursing Informatics Coordinators (NIC) is a cadre of nurses which has developed with the implementation of the hospital information system. NICs reported that they felt responsible for the nurses without passwords as all staff needed access to the system in order to do their work. "I feel bad because people say why so and so and not me, it is like I pick and choose" she reported. One NIC reported that she had to persuade nurses to use the system, because it would not work if people refused to use it. Hopes were high that staff would get used to the system and learn how to use it. "I had to persuade them to use the system especially the old ones because this system has to work and if people do not use it, it will not work. I also did not know much about computers but I tried it was not easy it needs patience" one NIC reported.

**DISCUSSION**

Nurses reported using the system often, particularly those who had user-names and passwords. The same was not true for those nurses without user IDs. It is clear that those nurses with passwords were 'positioned' nearer the computer and thus were better able to use it. Those nurses without passwords did not use the computers because of their distal positioning. The hypothesis that can be generated from this data is that distal or proximal positioning influences the effectiveness and efficiency of HIS amongst nurses. This also suggests that information for hospital management and clinical care management is available to managers and nurses in relation to their position to the system.

The matrons and nurses reported that since the data revealed that nurses in general and matrons in particular were able to access information if they had the competent skills to drive the system. This is reinforced by the fact that those nurses with some form of computer skills were able to use the system to get the limited information. Matrons and nurses reported that all they could obtain were daily reports and could not get higher level reports, which means that computing skills are crucial for higher level reports, including hospital outcome indicators. Another important point that emerged from the data is that practice assistants nurses and NICs to master the system.

Another important fact that emerged from the data is that practice assists nurses and NICs to master the system. This instance demonstrates that staff need to be educated regarding how these systems function in order to reduce these complaints.

The power gained by nurses with passwords was a source of resentment to the non priviledged. This threatens the use of the new system in the future. Some nurses did not give chances to others to learn to use the computers. This monopoly is an unexpected and undesired consequence of the system, which can be associated with novelty of the system and may lessen with time as staff get used to it. One possible solution would be to provide computer laboratories for block training in hospitals where staff can have unlimited time to learn. Despite these problems enthusiasm generally prevailed amongst nurses.

**CONCLUSION**

In conclusion it is clear from this study that nurses as drivers of Hospital Information Systems need to be positioned nearer the system by equipping them with the necessary knowledge and skills if the effectiveness and efficiency of these systems are to be realised. Another important point is the realisation that junior staff in a hospital environment are the ones that drive the system and should get prime attention and involvement in the development of these systems as this has also been highlighted by Simpson and Beaumont (1998) that management information system are doomed without a strong clinical system.

The research suggests that training should be continuous so as to take nurses through the adaptation and assimilation stages and up to the blending stage.

**REFERENCES**


