

# Multiple perspectives on the impact of electronic ordering on hospital organisational and communication processes

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## Abstract

Electronic ordering systems provide many potential benefits for improving the efficiency and effectiveness of healthcare delivery. They also have major implications for organisational and communication processes within hospitals. We undertook a qualitative study using focus groups and interviews with doctors, nurses, IT managers, and pathology laboratory managers to investigate the impact of the system on their work processes and relations within a major teaching hospital. This study revealed that the new electronic ordering system involved major alterations to the information management processes within the hospital, which in turn affected communication processes and work relations.

**Keywords:** *Evaluation studies; communication; hospital information systems; hospital administration*

There is a high level of interest, both across Australia and internationally, in the application of Electronic Ordering Systems (EOS) (First Consulting Group 2003; Victorian Government Department of Human Resources 2003; Humber 2004; Oacis Programme 2005). These systems provide healthcare professionals with the ability to enter orders directly into a computer and receive results back electronically (Lee et al. 1996; Doolan & Bates 2002; Kuperman & Gibson 2003; Ash, Gorman et al. 2004). The potential benefits of EOS include increased compliance with guidelines, optimisation of clinical time and enhanced communication processes (Sittig & Stead 1994; Lee et al. 1996; Overhage et al. 1997; Weiner et al. 1999; Murff & Kannry 2001; Doolan & Bates 2002; Hwang, Park & Bakken 2002; Mekhjian et al. 2002; Geiger & Derman 2003; Berger & Kichak 2004). These systems are core components of electronic health records, which, when linked with other systems, allow clinicians greater accessibility to information sources along with the provision of decision-support that can improve healthcare (Ash & Bates 2005).

Despite the numerous potential advantages of electronic ordering systems, they are costly and difficult to implement (Institute for Clinical Systems Improvement 2004), and can change the way organisations function with significant other unpredicted consequences (Kaplan 1997a). Indeed, it is these difficulties that have contributed to tempering some of the initial enthusiasm for EOS (Ash et al. 2000; Ash, Sittig et al. 2004; Hendy et al. 2005). Healthcare is complex and the problems encountered with IT systems like EOS are not just technical but are often related to the combined social and technical dimensions involved in implementation (Wears & Berg 2005). This is particularly the case with EOS where the changeover to clinicians placing electronic orders significantly alters the order management procedure and impacts on the work flow of physicians, nurses and others in the hospital (Stablein et al. 2003), affecting many work processes across departments and hospitals.

## Theoretical considerations

There has been much research and commentary on the difficulties and sometimes failures associated with large scale IT implementations, but as Lorenzi & Riley (1995) point out, the organisational impacts are often ignored and not well understood by health informatics professionals. Many of the early studies into this field tended to regard technology as an objective, external force and failed to comprehend that technology in organisations both shapes and is shaped by human action (Orlikowski 1992; Jones, Orlikowski & Munir 2004). Evaluation studies often explore the impact of new systems on measures of employee acceptance and system efficiency, ignoring the organisational and inter-departmental implications of systems (Aydin & Rice 1992).

More recently, there has been an expansion in the number of studies of organisational issues (Massaro 1993a, 1993b; Kaplan 1997a, 1997b; Davidson & Chismar 1999; Dykstra 2002; Cheng et al. 2003; Callen & Creswick 2004). A cross-site qualitative study of an EOS system in the US by Ash and colleagues used observations, focus groups and interviews with clinical, administrative, and information technology staff. Among the major themes identified were organisational issues such as collaboration, culture and power (Ash et al. 2003). Other studies have emphasised the dynamic and fluid character of organisational issues (Berg 1999) that are often not easily understood nor immediately quantifiable (Lorenzi & Riley 1995). Taken as a whole, these studies point to tension between the isolating capacity of computer systems (e.g., fewer interpersonal interactions) on the one hand, and the potential to integrate the organisation through shared access to information on the other hand (Aydin & Rice 1992). These approaches to the evaluation of IT systems have demonstrated the value of interpretive methods aimed at understanding the context and processes of IT system implementation as a socio-technical construction of organisational practice (Walsham 1993; Kouroubali 2002; Iedema et al. 2004; Braithwaite et al. 2005). Utilising such tech-

niques can contribute to methods such as clinical trials that are designed to determine causal relationships between IT interventions and specific changes in clinical relationships (Georgiou et al. 2005; Westbrook et al. 2005).

This paper reports on the results of a qualitative case study which investigated the perspectives and experiences of healthcare professionals (doctors, nurses, pathology laboratory personnel and IT managers) of the impact of EOS on hospital organisational and communication processes.

## Methods

### Design

Qualitative interviews and focus groups were used to increase our understanding of the processes and phenomena involved in the electronic system; and in the case of focus groups, to utilise group dynamics to stimulate discussion and provide insight into our research question (Bowling 1997; Krueger 2000). The comparison of different perspectives was aimed at broadening the description of the system's effects on areas of organisation as well as enhancing the validity of the findings (Denzin 1978; Murphy et al. 1998; Murphy 2001). The research and its design were approved by the University of New South Wales Human Research Ethics Committee and the relevant Area Health Service Human Ethics Committee.

### Setting

The study was carried out at a major Sydney teaching hospital that has a large pathology test processing facility. The EOS system was rolled out in the hospital over the period of a year beginning in November 2003 to include diagnostic test orders (linked to the existing test reporting system) along with medical imaging, diet and orders for porter services.

### Participants

Opportunistic sampling techniques, motivated by constraints of time and accessibility (Quine 1998), were used to obtain a sample comprising doctors, nurses and laboratory personnel for interviews and participation in focus groups. All interviews and focus groups were carried out in a semi-structured format that asked participants to describe their expectations and experiences of the new EOS.

### Data collection

Sixteen interviews (11 involving doctors, two with pathology managers/scientists and three with nurse unit managers) were conducted separately by two researchers. Interviews generally lasted between 15 and 30 minutes. In addition, three focus groups were held with separate groups of nurse unit managers (four participants), information service personnel (four par-

ticipants), and pathology laboratory managers and hospital scientists (six participants). One researcher facilitated the focus groups that lasted between 40 and 70 minutes. These sessions were carried out during the period August–September 2004, nine months after the implementation of the EOS system. All sessions were taped. This resulted in nine hours of taped recordings each transcribed by a person experienced in the task, amounting to 118 pages of text.

### Analysis

We adopted concurrent analysis techniques, including regular field notes and memos kept by our two field researchers to record reflections about the meaning of the data, to help identify emerging themes, categories and possible relationships or patterns (Gifford 1998). These reflections assisted in the content analysis of the recorded interviews and focus group sessions (Glaser & Strauss 1967; Bowling 1997). Themes were then reported and discussed during the course of four formal sessions with six other members of the research team. Qualitative data analysis software, NVivo 2.0, was used to assist our analysis (Bazeley & Richards 2000).

## Results

### Impact of the electronic ordering system on the ordering process

Under the old system, doctors were required to fill in a hand written request form for a pathology laboratory test which accompanied a patient specimen delivered to the laboratory for analysis. The role of the laboratory staff was to receive the specimen, check that the information matched the specimen and contained the relevant patient and doctor identifiers (including doctor's signature). This information was then entered into a hospital laboratory information system which generated a laboratory identification number for the specimen. The specimen then proceeded through the laboratory analysis stage before a test result was reported back to the clinician.

The EOS replaced several steps in the old hand written process. Clinicians were now able to place an electronic test order directly from a computer (on the ward or elsewhere) which generated its own laboratory identification number. After an order was generated, clinicians printed a paper copy of it which then accompanied the specimen to the laboratory. When specimens were received in the laboratory it was no longer necessary to enter information into the pathology information system as it was already present. Laboratory staff were now only required to match the specimen identification to the information available in their system before they proceeded with the analysis.

From the doctor's perspective this new process proved to be more efficient, but with scope for greater improvement. As one doctor explained:

We didn't think [that it was more efficient] initially, but that was part of the initial learning curve I think. But that has settled down now, so that the ordering process is more efficient, although there are some areas where it is still quite difficult. There are quite a number of steps to go through, which hopefully will be improved in the future. But now everybody knows the process to place these electronic orders.

Many doctors remarked that the actual physical component of typing in an order can be more time consuming and 'clunky' because of the multiple screens that sometimes need to be accessed. Most doctors commented that the new system is more reliable because it required less human involvement, and hence decreased the potential for error:

When we had hand written forms for the next day, you're hand writing the form and then you've got a courier who has to pick up the form from everybody, then it has to be delivered to the department, then someone has to pick up the form and type in the right test off your handwriting. So there are a few things there, which have been cut out, where you just go online, you order what you want and if you're thorough with what you want to order, usually there is not a problem.

Nurses also remarked on the efficiency benefits of the new system, noting that once a record of an intervention has been made, it becomes immediately accessible across the hospital. One nurse noted how the new system provided ancillary healthcare professionals, such as physiotherapists and social workers, with an instant case history with requisite patient identifiers and results.

### Impact on work processes

Doctors reported that the new system made them more accountable for the test ordering process because there was now a clear audit trail which identified exactly when a test was ordered, collected, processed and test results issued. According to one doctor, it allowed them to clearly ascertain where the responsibility for follow-up lay at any particular time.

A number of doctors and nurses reported that the new system had a positive impact on communication channels within the hospital. This is because more professionals are able to access the system electronically making exchange of information easier and faster. One nurse unit manager commented that:

We're better informed to give information to other clinical people. With patients, if people are enquiring about people, you can find them if they're not on your ward. That's quite good in tracking their history. That's improved.

A doctor described how the introduction has forced a change in work processes:

An especially good thing was that we used that as an opportunity to change other things, like the blood collection policy. It had been a long standing policy in this unit that one member of the team, usually a junior doctor, collected all of the blood at night and that had multiple issues for us, which we wanted to fix, such as one staff going from patient to patient and touching devices with the infection risk that goes with that . . . So along with the implementation of the electronic ordering, we've successfully been able to shepherd through a change in the collection policy, so that by and large each patient's nurse collects blood from their patient at night, and the ordering now is electronic and online and done by the night doctor.

### Impact on organisational processes

While many clinicians spoke highly of the benefits of the new system, pathology laboratory managers and scientists expressed concerns about the changes in responsibility. They reported that the implementation process was badly coordinated and paid insufficient attention to their needs and expectations. In the past, the pathology laboratory performed data quality checks on incoming hand written requests. They were required to identify and rectify any inconsistencies in the request particularly on occasions when the request form and the specimen did not match, or did not arrive together. Often this involved providing physicians with advice about the tests ordered. The new system may have streamlined the laboratory test reception process, but it had also reduced some aspects of their monitoring role and caused some initial confusion about how to follow up any potential discrepancies. As one senior pathology manager suggested:

There's no interpretation from the staff, that's what it comes down to. So we're not interpreting what tests have been requested and what the clinical significance is. All the staff are doing now is bringing in orders into the laboratory.

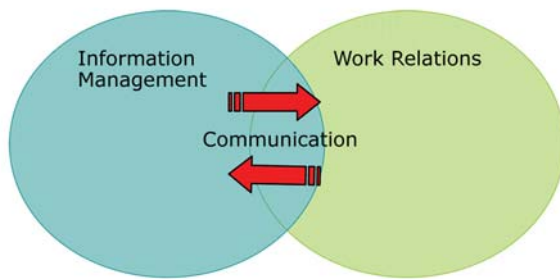
The issue of inter-departmental functioning also featured in discussions with clinicians. One doctor noted that a possible downside of the new system was that it has reduced inter-departmental communication:

There's less need for different departments to talk to each other, which has never been an official sort of thing. If you know the person at the other end that you're dealing with, there's much less capacity for irritation. So I think it probably has reinforced people working in . . . I think silos is a pretty common buzz-word for it.

### Discussion

The results of this study point to three distinct areas where the new EOS affected organisational processes and relationships: (i) information management; (ii)

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communication and (iii) work relations (see Box 1). Within this framework 'information management' refers to the actual performance and management of the ordering process; 'communication' refers to areas such as interaction among staff and issues of responsibility and accountability involved in the actual fulfilment of the ordering process; and 'work relations' includes issues of inter-department relationships, and the roles of healthcare professionals.

The Box presents the themes as an interlinked diagram implying that the relationship between the three categories is strongly interconnected and reflexive rather than linear. Hence the implementation of new information management systems has the potential to both affect and be affected by existing communication processes and work relationships (Orlikowski 1992; Berg, Aarts & van der Lei 2003; Jones, Orlikowski & Munir 2004; Wears & Berg 2005). This point is exemplified by the descriptions offered by pathology scientists and managers. They felt that their previously existing work relationships and communication channels had not been taken into account by the information management processes introduced by the new system. Conversely, doctors and hospital information service staff explained that the new system had contributed to greater levels of accountability and reliability and provided them with the opportunity to re-engineer and improve some of their work processes.

Our data also describe the potential of the new system to impose changes in the organisational relationships both within and between departments. Doctors and nurses described the change in their workflows and how this had affected communication with other departments. As one doctor noted it had the potential to lead to 'silos'. This finding is consistent with other research in this area, which has pointed to the potential of electronic ordering to cause shifts in the power distributions between staff and departments (Ash et al. 2003) or even to foster an us versus them approach (Ash & Bates 2005), particularly among departments which lose ownership of data entry functions as a consequence of new order entry systems (Aydin 1994).

The interviews and focus groups in this study were carried out nine months after the implementation of the new electronic ordering system began. Although

this retrospective approach encouraged participants in the study to reflect on their experiences and views about the new system, its disadvantage is that it can mean that some factors seen as important in the formative period of the implementation are now overlooked or dismissed through hindsight. This study has incorporated multiple perspectives about the new system, and sought wherever possible to present differing views. The generalisability of its findings are restricted by the limited size of the sample and the circumstances peculiar to the hospital studied. Nevertheless, the findings do have a level of transferability to other settings and provide a useful overview of the potential organisational and communication issues that hospitals are likely to confront with electronic ordering.

### Conclusion

The participants in this study pointed to a number of factors which had shaped the impact of the new system. These included: (i) the increased monitoring capacity and accountability created by the new system, allowing clinicians to monitor and better communicate with each other; (ii) flexibility of the system that made it easier for clinicians to enter and transfer information; and (iii) preparedness and collaboration between and within departments that played a key part in how staff perceived the system, with pathology laboratory staff reporting levels of disenfranchisement and clinical staff welcoming the chance to re-engineer some work processes. These findings can be used to help healthcare managers anticipate and deal with the complex variety of issues they are likely to confront. They also point to the importance of ensuring a robust inter-departmental collaboration in the planning and implementation process.

This research shows that qualitative study designs can play a useful role in identifying factors that may trigger change in organisational and communication processes (Georgiou et al. 2005). They also have the potential to supplement and inform findings derived from other studies employing other methods (Westbrook et al. 2005) as part of multi-method approaches to ICT research (Mingers 2004).

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