

Evaluating User Satisfaction with an Electronic Prescription System in a Primary Care Group

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Abstract

Introduction: Electronic prescribing has been proposed as an important strategy to reduce medication errors, improve the quality of patient care and create savings in health care costs. Despite these potential advantages, user satisfaction plays a significant role in the success of its implementation. Hence, this study aims to examine users' satisfaction and factors associated with satisfaction regarding an electronic prescription system implemented in the National Healthcare Group Polyclinics in Singapore. **Materials and Methods:** An anonymous survey was administered in October 2007 to all physicians, pharmacists and pharmacy technicians working in the 9 National Healthcare Group Polyclinics. **Results:** Respondents included 118 doctors and 61 pharmacy staff. The overall level of satisfaction with electronic prescribing was high. Doctors and pharmacists reported a high degree of agreement that electronic prescribing reduces prescribing errors and interventions, and they did not want to go back to the paper-based system. Users were generally satisfied with the functionality of the system but there was some degree of workflow interference particularly for the pharmacy staff. Only 56.9% of the pharmacy respondents expressed satisfaction with the review function of the electronic prescription system and only 51.8% and 60% were satisfied when processing prescriptions that included items to be purchased from an external pharmacy or prescriptions with amendments. The results also revealed that satisfaction with the system was more associated with users' perceptions about the electronic prescription system's impact on productivity than quality of care. **Conclusion:** The survey results indicate that the implementation of the electronic prescription system has gone reasonably well. The survey findings provide opportunities for system and workflow enhancement, which is important as these issues could affect the acceptability of a new technology and the speed of diffusion within an organisation.

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Introduction

Electronic prescribing has been proposed as an important strategy to reduce medication errors,¹ improve the quality of patient care² and create savings in healthcare costs.³ Electronic prescription systems allow the prescribing clinician to electronically send an accurate, error-free and understandable prescription directly to the pharmacy. The basic documentation functions of electronic prescribing systems have the potential to increase patient safety and reduce costs through improved legibility since the misinterpretation of poorly handwritten prescriptions is the most frequently identified causes of medication errors.⁴ Clinical decision-support tools can assist prescribers at the

point of care by suggesting appropriate doses and frequencies and by including alerts and reminders. It may also incorporate patient-specific medical information such as patients' medication allergies. Together, these advanced features have the potential to further improve patient safety and reduce costs by assisting doctors and pharmacists in identifying potential therapeutic conflicts.

Supporting the theoretical benefits of electronic prescribing, a recent systematic review conducted by Ammenwerth et al⁵ found that Computerised Physician Order Entry (CPOE) systems significantly reduced the relative risk in medication error rate by between 13% and 99%. Studies that examined the impact on CPOEs on

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potential and actual adverse drug events found a significant reduction in relative risk of between 35% and 98% and between 30% and 84% respectively. Despite the potential advantages of electronic prescribing, human factors could play a significant role in the viability and success of the new technology^{6,7} and user satisfaction is one of them.⁸ From the view of physicians and pharmacists, changes to workflow, familiarisation with the technology, and time commitment may overshadow the potential benefits of electronic prescribing.⁶ Therefore, to ensure successful implementation of the system, implementers should frequently monitor areas of satisfaction and dissatisfaction among users.⁹

In Singapore, the government has made health information technology (IT) a cornerstone to deliver personalised health care services to achieve high quality and cost-effective clinical care.¹⁰ Up to \$200 million has been committed to developing an electronic health records system accessible by authorised medical practitioners at hospitals and polyclinics over the next 2 years.¹¹ Electronic prescribing has already been implemented in the 9 National Healthcare Group polyclinics. In the development of information systems, a necessary but challenging part is evaluation. Despite the intense interest in the implementation of health IT, no local studies have been published to assess user satisfaction with these systems. In addition, much of the international research literature has focused on the inpatient, rather than ambulatory setting.¹² To address the gap in literature, this study has been designed to assess users' satisfaction with the system's functionality, its impact on productivity and the perceived impact of the electronic prescription system on prescribing errors and interventions in an outpatient setting.

Materials and Methods

Setting

This study was conducted at the 9 National Healthcare Group polyclinics. The implementation of the CPOE system for prescriptions began in 2006. In June 2007, this system was subsequently integrated with the pharmacy system to enable a seamless electronic transfer of the prescription information between doctors and pharmacies. The electronic prescription system maintains a complete medication list and a recent medication history for each patient; clinical decision-support tools, including alerts and reminders, which incorporates patient-specific medical information such as patients' chronic conditions or medication allergies; and capacity for two-way electronic communication between the doctors and the pharmacy.

Survey Development

We developed the survey questionnaire after reviewing

the literature^{6,7,13-15} and interviewing key members of the project management group. Survey questions addressed demographic information, experience in healthcare, experience with computers, and experience using the electronic prescription system. In addition to collecting information about the respondents, the survey covered functionality, user training and support, and overall satisfaction. A draft survey was tested for face validity with several individuals thought to be representative of the survey population. The survey questionnaire was subsequently pilot-tested at one of the polyclinics to identify any additional design issues. The final questionnaire consisted of 4 sections and 40 questions. In this study, electronic prescription referred to paperless prescribing, processing and dispensing of medication.

The functionality section of the survey contained 23 questions eliciting user satisfaction with a variety of electronic prescription functions based on the list of tasks carried out by the physicians, pharmacists and pharmacy technicians in the workflow. As the introduction of the new system necessitated changes in workflow, the questions were also structured to draw out user satisfaction with the ease of working paperless. Respondents were asked to rate each level of satisfaction as *Very satisfied*, *Satisfied*, *Neutral*, *Dissatisfied* or *Very dissatisfied*. The survey also asked respondents to indicate their agreement or disagreement with statements regarding the adequacy of training and ongoing support as well as their perception regarding the impact of the use of electronic prescription on prescription errors and interventions. The response categories for these questions include *Strongly agree*, *Agree*, *Unsure*, *Disagree*, and *Strongly disagree*.

Survey Implementation

A cross-sectional survey was conducted at each polyclinic in October 2007. A hardcopy self-administered anonymous questionnaire was given out to doctors, pharmacists, pharmacy technicians and assistants present at the time of survey administration. The completed form was collected by hand.

Statistical Analysis

An optical mark reader (OMR) was used for data input. The survey responses were dichotomised for the analyses. Descriptive analyses consisted of frequency distributions and 2X2 tables. Differences in respondent profile and level of satisfaction or agreement were tested for significance using chi-square test. Statistical significance was determined by $P < 0.05$. Data analysis was performed using Statistical Package for the Social Sciences (SPSS) version 15.

Results

Respondents included 118 doctors and 61 pharmacy staff with a mean of 5.2 and 4.1 years in practice respectively.

Table 1. Characteristics of Respondents

Characteristics	Respondents (%)
Doctors	118 (100.0)
Consultant/Senior Family Physician	5 (4.2)
Family Physician	22 (18.6)
Family Doctor	35 (29.7)
Medical Doctor	55 (46.6)
Locum	1 (0.8)
Pharmacy staff	61 (100.0)
Senior Pharmacist/Pharmacist	46 (75.4)
Pharmacy Technician	10 (16.4)
Others	5 (8.2)
Ownership of computers	156 (90.2)
Mean years in practice	
Doctors	5.2
Pharmacy Staff	4.1
Have been using e-prescription for	
Less than 1 month	13 (7.3)
1 to 3 months	42 (23.6)
3 to 6 months	50 (28.1)
More than 6 months	73 (41.0)

At the point of the administration of the survey, 69.1% of the respondents have used the electronic prescription system for at least 3 months (Table 1).

Computer Literacy

To assess respondents' computer literacy, they were asked about their computer ownership, typewriting ability, and self-rated computing skills. Only 10.7% and 3.4% of the respondents rated their computer skills and ability to use the electronic prescription system to be below average. Almost all the respondents (96.6%) reported that they are motivated to learn new skills to use the system effectively (Table 2).

Respondents' self-rating of computer skills was significantly associated with their ability to use the electronic prescription system ($P < 0.001$) and level of motivation to pick up new skills to use the system effectively ($P < 0.001$).

Table 2. Self-reported Computing Ability and Motivation to Learn New Skills

	Very poor	Poor	Average	Good	Excellent
How would you rate your computer skills in general?	5.1%	5.6%	62.4%	22.5%	4.5%
How would you rate your ability to use the electronic prescription system?	1.7%	1.7%	35.2%	50.9%	10.6%
How would you rate your motivation to pick up new skills to use this system effectively?	3.4%	0.0%	27.8%	58.5%	10.2%

Functionality of the Electronic Prescription System

Respondents were asked to comment on how satisfied they are with the electronic prescription system compared to the previous environment with a paper-based system. From Table 3, the majority of doctors who responded were either satisfied or very satisfied with the way that the electronic prescription system allowed them to create prescriptions, review patients' prescription history and amend prescriptions. Over 85% of doctors were satisfied with the detection of prescribing errors and the ability to receive alerts for drug-interaction and drug-allergy.

The majority of pharmacy staff were satisfied or very satisfied with how the new prescriptions were downloaded onto the pharmacy computer. Over 70% of the respondents were also satisfied with recalling of previously dispensed prescriptions and processing of standard prescriptions using the new system. However, only 56.9% of the respondents expressed satisfaction with the review function of the electronic prescription system. The system was also not perceived to be more satisfactory than the paper-based system when processing prescriptions that include items to be purchased from an external pharmacy or prescriptions with amendments.

Processing and System Speed

Only 1 in 10 doctors expressed neutrality or dissatisfaction with the time spent for entering prescription or patient information into the system. A smaller share of pharmacy respondents expressed satisfaction with the time spent on processing prescriptions when using the new system (Table 3). A higher share of doctors (87%) expressed satisfaction with the speed of the electronic prescription system compared with pharmacy staff (50%). Pharmacy staff's satisfaction with the time spent on processing standard purchases was found to be associated with their rating of their ability to use the electronic prescription system ($P = 0.014$).

User Training and Ongoing Support

More than 70% of the respondents agreed or strongly agreed that sufficient training was conducted before the launch of the system and that they know what to do when the system is down (Table 4). There was no correlation between self-reported computer skills and perception of

Table 3. User Satisfaction with System Functionality and Speed

	Neutral /Dissatisfied / Very Dissatisfied	Very satisfied / Satisfied
(A) Respondents – Doctors		
Create new prescription	15.2%	84.7%
Detect prescribing errors	13.6%	86.5%
Receive drug-interaction alerts	12.9%	87.0%
Receive drug-allergy alerts	10.1%	89.9%
Review prescription history	12.8%	87.2%
Track health maintenance items	23.0%	76.9%
Amend processed or dispensed prescriptions	21.4%	78.6%
System speed	27.3%	72.6%
Time spent to enter prescription or patient information	13.0%	86.9%
(B) Respondents – Pharmacy Staff		
Obtain/download new prescriptions onto pharmacy computer	28.8%	71.2%
Read and understand contents of prescriptions	46.6%	53.4%
Recall previously dispensed prescriptions	25.3%	74.6%
Review current prescription and refills against previously dispensed prescriptions	43.0%	56.9%
Document prescription interventions	37.9%	62.1%
Process standard purchases	26.8%	73.2%
Process prescriptions that include drug items to be purchased externally	48.3%	51.8%
Process prescriptions with amendments	40.0%	60.0%
Time spent to process standard purchases	37.5%	62.5%
Time spent to process prescriptions that include drug items to be purchased externally	40.7%	59.3%
Time spent to process prescriptions with amendments	46.8%	53.2%
System speed	50.0%	50.0%

training adequacy. However, respondents who agreed to the above 2 statements also reported significantly greater ability in using the electronic system ($P=0.010$; $P=0.016$).

Reduction of Prescription Errors and Interventions

Over 70% of doctors and pharmacy staff either agreed or strongly agreed that with electronic prescriptions, the number of prescription errors and interventions were reduced (Table 5).

Overall Satisfaction

The survey asked respondents to indicate their agreement or disagreement with the statement, "If I could go back to paper-based records with no penalties, I would do so." 78.8% and 72.1% of doctors and pharmacy staff either disagreed or strongly disagree with the statement, indicating strong support for the use of the electronic prescription system. Overall satisfaction was not significantly related to the level of agreement that prescription errors ($P = 0.727$)

and prescription interventions ($P = 0.266$) were reduced.

To get another perspective on satisfaction, the survey asked respondents to indicate their agreement or disagreement with the statement recommending the electronic prescription system they use to any physician or pharmacy staff. The doctors agreed or strongly agreed with the statement comprise 84.7% whereas 76.7% of the pharmacy staff gave similar responses (Table 5). Overall satisfaction for doctors was found to be significantly associated with the satisfaction with the way the electronic prescription system allows the user to create new ($P = 0.002$) or amend processed prescriptions ($P = 0.047$) and the amount of time taken to enter prescription information ($P = 0.043$). Whereas pharmacy staff's overall satisfaction was significantly associated with their satisfaction with the amount of time spent on processing standard purchases ($P = 0.047$). Overall satisfaction was not significantly related to self-reported computing skills ($P = 0.191$).

Table 4. User Satisfaction with Training and Support

	Neutral /Dissatisfied / Very Dissatisfied	Very satisfied / Satisfied
Sufficient training was conducted before launch of the system in your clinic.	29.6%	70.4%
I know what to do during downtime.	26.5%	73.5%

Table 5. Overall Satisfaction

	Unsure/Disagree/ Strongly disagree	Strongly agree / Agree
(A) Respondents - Doctors		
E-prescription has reduced the number of prescription errors.	21.7%	78.3%
E-prescription has reduced the number of prescription interventions.	27.1%	72.9%
If I could go back to paper-based records with no penalties, I would do so.	78.8%	21.2%
I would recommend this e-prescription to any physician/pharmacy staff.	15.3%	84.7%
(B) Respondents – Pharmacy Staff		
E-prescription has reduced the number of prescription errors.	21.3%	78.7%
E-prescription has reduced the number of prescription interventions.	28.3%	71.7%
If I could go back to paper-based records with no penalties, I would do so.	72.1%	27.9%
I would recommend this e-prescription to any physician/pharmacy staff.	23.3%	76.7%

Discussion

The overall level of satisfaction to electronic prescribing was positive. Respondents reported a high degree of agreement that electronic prescribing reduces prescribing errors and interventions, and they did not want to go back to the paper-based system. A higher proportion of doctors were more satisfied than the pharmacy staff. However, this was not a surprising finding as electronic prescribing by doctors was put into practice several months before it was integrated with the pharmacy to allow paperless prescribing. In addition, this survey showed that 87% of the doctors were satisfied with the amount of time spent creating new prescription orders, which has been cited in many studies^{16,17} to hamper the physician order entry system adoption. Our results also revealed that similar to other studies;^{18,19} prior computing knowledge was not significantly associated with overall satisfaction.

The survey results also showed a greater degree of workflow interference for the pharmacy staff. Only 56.9% of the respondents expressed satisfaction with the review function of the electronic prescription system and only 51.8% and 60% perceived the new system to be more satisfactory than the paper-based system when processing prescriptions that included items to be purchased from an external pharmacy or prescriptions with amendments. Based on the workflow at the point of survey administration, the pharmacists would still need to inform the prescribing

doctor via telephone to amend the prescription order if the patient decides at the point of dispense that certain medication items will be purchased from an external pharmacy or requests for amendments to be made. Pharmacy staff will only process the amended prescription when the electronic amendments have been made and received by the pharmacy electronically. Although only 53% to 63% of the pharmacy staff reported satisfaction with the amount of time taken to process the different types of prescription orders, more than 70% agreed that safety is improved. The results indicated a general agreement that electronic prescribing is beneficial but there is scope to improve the turnaround time of these transactions by reducing doctors' response time and improving the usability of the system. One example could be to reduce the number of steps required to amend a prescription.

Most respondents were positive regarding the system's functional features including receiving alerts on drug-drug interaction or drug allergy. However, the results also revealed that satisfaction with the system was more associated with users' perceptions about the electronic prescription system's effect on productivity than its effect on quality of care. Doctors' and pharmacy staff's perceptions appeared to be influenced by the amount of time spent on entering prescriptions and processing standard purchases respectively. This finding was similarly reported by Lee.²⁰ One plausible explanation is that factors such as ease of use and speed are immediately apparent and influences the

user's perception or satisfaction with the system directly. Conversely, reductions in prescription errors or interventions are facilitated by improved legibility of prescriptions, implementation of drug-drug and drug-allergy alerts, which may be perceived by users as crucial but non-negotiable factors for going electronic and are therefore not directly associated with their levels of satisfaction. The results suggest that while quality improvement benefits are important, administrators need to focus on ensuring efficiency to enhance users' acceptance of electronic systems.

The results also showed that respondents with higher self-rating of computer skills tend to rate their ability to use the electronic prescription system and level of motivation to pick up new skills more positively. Prescribers' lack of computer skills has been cited to be a key barrier to increased use of computerised prescription order.²¹ Although most respondents thought that adequate training was provided, more focused educational programmes can be tailored for staff with lower computing literacy to reinforce user confidence and facilitate future implementation of electronic systems.

In addition, whether advanced electronic prescription features can shape prescribing behaviour and reduce adverse drug events in primary care will depend largely on whether doctors adhere to the system alerts. Although satisfaction with this functionality could imply greater adherence to such decision aids, other studies²³ have reported a high percentage of overridden alerts. Further work is necessary to examine whether respondents' self-reported satisfaction match actual adherence to drug interaction and drug allergy alerts.

The survey was administered 3-months after electronic interfacing of the prescription order messages to the pharmacy system and asked respondents to compare the new paperless prescription system to their memory of the previous paper-based system. As such, our study captured respondents' perceptions during a transitional phase and may reflect the impressions of users who are still beginning to learn the system. With time and experience, users' perceptions of the system may change. Hence, the results should be seen in this context. Another limitation of our study was that the survey was not designed to assess whether external factors such as implementation, customisation, and institutional readiness could influence user satisfaction. Other studies have found that system implementation can have a major role on how users view the system.^{24,25}

In conclusion, the survey results indicate that the implementation of the electronic prescription system has gone reasonably well. This augurs well for the adoption of electronic systems and other features of CPOE in the

primary healthcare sector. The survey findings also provided opportunities for system and workflow enhancement, which is important as these issues could affect the acceptability of a new technology and the speed of diffusion within an organisation.

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