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Electronic Prescribing System in a Teaching Hospital – User Satisfaction and Factors Affecting Successful Implementation

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ABSTRACT

Background: Despite the increasing global trend towards e-prescribing, its impact in India is uncertain. Therefore the factors towards successful implementation of e-prescribing system are worth exploring.

Objectives: To assess physicians and pharmacists' satisfaction, the factors that determine their satisfaction and perceptions about the advantages and disadvantages of e-prescribing system.

Method: A cross-sectional, anonymous questionnaire survey was administered to physicians and pharmacists. Factors pertaining to reliability, speed, ease of use, adequacy of training and impact on productivity and patient care of the system were determined. Two-tailed t tests were used to find the differences in satisfaction level. Simple correlation analysis was used to find the relation between factors and satisfaction level.

Results: 389 (57%) physicians and pharmacists responded, of which 323 questionnaires that met inclusion criteria were included for analysis. The users were generally satisfied with e-prescribing system (mean=4.75 on a 7 point scale). The pharmacists were more satisfied than the physicians (95% *vs.* 75%; $p<0.001$) and the medical physicians more than surgeons (80% *vs.* 71%; $p=0.055$). Relatively, many physicians (25%) than pharmacists (5%) were dissatisfied. The user satisfaction was positively correlated with majority of factors ($p<0.01$; $r \geq 0.3$) defined pre-hoc that included time saving, productivity, safety, system response time and reliability. However, none of the factors had significant negative correlation with dissatisfaction.

Conclusion: Overall the users were satisfied with e-prescribing system; however, senior physicians were more dissatisfied than others. The findings have implications for strategic training, development of additional features and optimize use among dissatisfied users.

Keywords: Electronic prescribing, Physicians, Pharmacists, Factors, Perceptions.

INTRODUCTION

It has been estimated that medication errors cause deaths in one out of 131 outpatients and one out of 854 inpatients [1]. An important step proposed by the Institute of Medicine to reduce the occurrence of medication errors is to make greater use of information technology in prescribing and dispensing medications [2]. Electronic prescribing (e-prescribing) is a promising technology which involves writing prescriptions electronically by which doctors and pharmacists can possibly avoid many of the errors that accompany handwritten prescriptions, as the technology ensures that all the necessary information is filled out and legible [3]. Research done to study the impact of electronic prescribing has proved that this technology has the potential to improve the quality of care and patient safety [4,5]. Despite its proven efficiency, the implementation of electronic prescribing has failed in many settings [6-9]. One of the main reasons was that the designers and implementers failed to recognize the various features, implementation strategies and other factors that can increase user satisfaction [10]. A study [11] has shown that the successful implementation of electronic prescribing is possible, but only if the complexity is recognized and skillfully managed. Another study [12] concluded that implementers should frequently monitor areas of satisfaction and dissatisfaction among users.

Previous studies have examined the satisfaction and impact of electronic prescribing implementation on end users, but primarily on doctors [5,13,14] and sometimes on nurses [6,15,16]. This corresponds to the fact that most studies on medication errors focus on prescribing errors and administration errors but rarely on dispensing errors even though dispensing errors can cause patient harm [17]. Very few studies have compared the impact of electronic prescribing on physicians and pharmacists. For example, Tan et al. [18] evaluated the satisfaction between doctors and pharmacy staff and found that doctors were more satisfied than pharmacy staff.

In India, the government has recently launched e-prescribing system in government hospitals in a phased way, whereas few private hospitals have already implemented the system. In settings where the system has already been implemented, the observed acceptance rate among users is low. Over the last few years, the country has seen an expeditious growth of technology, communication and information. Simultaneously, the government prompts all sectors including healthcare to go electronic to promote transparency as well as quick and errorless prescriptions. E-prescribing system is believed to improve the efficiency of patient care *via* ensuring safe prescribing and dispensing by losing shortcomings of conventional paper prescriptions. The system is also believed to reduce the actual time spent on individual patients collecting accurate medication history which is otherwise laborious with conventional prescriptions and is a crucial factor to be considered in a highly populated country like India with high disease burden. Conceptually, the country with huge population and healthcare need would benefit from the perceived potentials of e-prescribing system. However, the virtual impact of e-prescribing system in the country is yet to be elucidated. Furthermore, the factors affecting successful implementation of e-prescribing system in this country need to be determined.

OBJECTIVES

The primary objectives of this study were to evaluate the overall satisfaction level with the newly implemented e-prescribing system among physicians and pharmacists and to identify the factors towards satisfaction and dissatisfaction with the system. The secondary objective was to find user perceptions about the advantages and disadvantages of e-prescribing system.

METHODS

Design

The study was a cross-sectional, anonymous questionnaire survey with three phases of data collection. Provider Order Entry User Satisfaction and Usage Survey (POESUS) questionnaire was used for data collection. POESUS is a valid and reliable questionnaire developed by Lee et.al, 1996 [6]. The initial part of the questionnaire asked users to indicate their gender, age, service area (medical/surgical), position (Intern, non-PG registrar, PG student, junior consultant/senior resident, senior consultant, pharmacist or assistant pharmacist), attendance of training sessions, prior experience with e-prescribing system and personal computers. This study adopted only part 1 of the original questionnaire, as the other parts were not relevant to the e-prescribing system under study. The questionnaire included 16 items covering five concepts (reliability, speed, ease of use, adequacy of training, impact on productivity, and patient care). Item numbers 14 and 15 were modified from the original questionnaire in order to conform to the context of this study. Item number seven was only for physicians, as pharmacists were not involved in prescribing. Each item was ranked on a scale from 1 (definitely no) to 7 (definitely yes). Also, the questionnaire included two open ended questions about user perceptions on advantages and disadvantages of the e-prescribing system under study.

Surveys were anonymous but were marked so that the survey questionnaire could be sent to the non-respondents one month after the initial/previous questionnaire distribution. Completed questionnaires with more than 25% non-response rates were excluded and not considered for analysis [19].

Setting

The study was conducted in a 2400 bed tertiary care teaching hospital in India. The e-prescribing system under study was developed by the institution and implemented at least 10 years prior to this study. Though e-prescribing was not made mandatory at the time of this study, prescribers were encouraged and constantly urged to prescribe electronically.

The e-prescribing system under study was developed by the institution and was implemented at least 10 years prior to the start of this study. The e-prescribing system interface is organized in a way that the prescriber can select any particular brand with specified strength and form of a generic drug of prescriber's choice available in the pharmacy. The system prompts the prescriber to choose an appropriate dispensing unit of patient convenience or where all the prescribed drugs are available (target pharmacy). The prescriber has the option of creating and saving any number of drug regimen templates (e.g. Anti-tubercular regimen, *H. pylori* regimen) under the section 'favorites' for quick prescribing. Also, the prescriber is able to repeat old prescriptions or adjust its dosages in few clicks without having to essentially re-enter all drugs again. The system allows the prescriber to record details including allergies and adverse events which is always displayed to the prescriber and helps in decision making while prescribing subsequently. The system also provides information on currently available drug strength, form, dosage and cost and display the

list of brands available when a drug is selected by its generic name. The system pops up alerts for potential drug-drug interactions and allergies while prescribing. The system also enables prescribers to record, display and sort current and past medications, record and display patient identifying information, access product information, access BMI/BSA calculator. However, free-text option was not available at the time of this study. Prescribers were allowed to prescribe all drugs using e-prescribing system except controlled medications for which a paper prescription was mandatory.

The e-prescribing system was integrated with the clinical workstation so that the prescribers were able to view patient results, medication history, current medications and other particulars of the patient while prescribing. The purpose of using the system did not vary across different physician cadres.

Sample

Practicing medical physicians and surgeons of all departments including broad and higher specialties and pharmacists available at the time of study were included. Medical personnel included interns, postgraduate (PG) and non-PG registrars, residents in higher specialty/fellowship, junior consultants and senior consultants. Pharmacists who were authorized to handle e-prescriptions were identified and invited to participate in the study. We compared the satisfaction level between physicians and pharmacists, and between physicians of medical and surgical stream. Physicians, surgeons or pharmacists who had not used the system were excluded from the study.

Data collection

Data pertaining both primary and secondary outcomes were collected using POESUS questionnaire. Researchers distributed the questionnaires to physicians and pharmacists of all departments with the assistance of department secretaries except a few (all intensive care units and high dependency units) where e-prescribing system has not been used to prescribe medicines. Among 194 pharmacists, 115 pharmacists who were authorized to handle the e-prescribing system were identified and invited to participate in the study. The questionnaires were distributed to the non-respondents three times over a period of one month. Participation was purely voluntary, and the participants were asked to fill the questionnaire anonymously. The study was approved by the institutional review board (IRB).

Data analysis

We estimated that a sample of 174 respondents would provide the study with 80% power to detect the difference in satisfaction level between physician and pharmacists. The overall satisfaction level (item 16) of the respondents was estimated by creating a binary dissatisfaction score. Respondents who rated the satisfaction below the midpoint were marked as dissatisfied and above which were marked satisfied (0=dissatisfied, satisfaction rating 1 to 3; 1=satisfied, satisfaction rating 4 to 7). Two tailed t-tests were used to find the differences in satisfaction level between physicians and pharmacists, between physicians in medical and surgical stream. The association of factors (Items 1 to 15 on the survey questionnaire) pertaining to system characteristics including efficiency, quality, adequacy of training and reliability indicated on the seven-point Likert scale were explored by correlating the mean score of individual factors with the overall satisfaction level. Responses to open-ended

questions were listed and categorized based on the frequency of occurrence. The relationship between factors and overall satisfaction level were estimated by using Pearson correlation analyses. All data were analyzed using SPSS 16.0 software.

RESULTS

Overall profile of participants

Of the 683 physicians and pharmacists were approached at the end of three phases of questionnaire distribution, 389 (57%) of the total sample responded, 66 (10%) of the returned questionnaire were with more than 25% non-response rate and hence were excluded. The remaining 47% (n=323) were included for analysis resulting in a completion rate of 83%.

Among the total of 568 physicians who were asked to complete the questionnaire, 311 (55%) of the physician sample completed, 260 (46%) of the sample which met the inclusion criteria were included for analysis. Of the 260 completed questionnaires, 66% were male, 59% were medical physicians and 41% were surgeons, 4% were interns, 5% were non-PG registrars, 34% were PG students, 30% were junior consultants or senior residents and 27% were senior consultants. Only 14% of the physicians indicated that they had attended a training session. 52% of the physicians had less than 1 year of experience and 11% had more than 3 years of experience with e-prescribing system.

Overall, 69% of 115 eligible pharmacists completed the questionnaire. After excluding completed questionnaires with more than 25% non-response rate, 63 (55%) were considered for analysis. Of the 63 pharmacist respondents, male and female were 50% each, 87% were pharmacists and 13% were assistant pharmacists. Only 10% had attended a training session. Just above 50% had more than 3 years of experience with e-prescribing system.

Overall user satisfaction

The overall satisfaction with the e-prescribing system was determined by using the questionnaire item 16 "Overall, I am satisfied with the electronic prescribing system". Overall, the users were satisfied with the e-prescribing system (mean=4.75 on a seven point scale). When physicians and pharmacists were separately considered, the mean scores were above mid-point for both the groups. In general, pharmacists were more satisfied (mean=6.43 (± 1.434)) than the physicians (mean=4.34 (± 1.58)), $p<0.001$. In the positional hierarchy of physicians, it was noted that there was a decreasing trend of satisfaction as the hierarchy increased (i.e. 2% of interns and none of the non-PG registrars were dissatisfied with the e-prescribing system whereas, 37% of the senior residents and 28% of senior consultants were dissatisfied). Overall satisfaction level and e-prescribing system characteristics are presented in Table 1.

Table 1: Respondent characteristics by group and their overall satisfaction level.

Group	**Satisfied**	**Dissatisfied**	**Significance**
	n (%)	**n (%)**	
Gender			
Male (n=203)	160 (78.8)	43 (21.2)	P=0.89

Female (n=118)	92 (78)	26 (22)	
Age			
Age<30 years (n=124)	101 (81.5)	23 (18.5)	P=0.51
Age 31-40 years (n=130)	98 (75.4)	32 (24.6)	
Age 41-50 years (n=52)	40 (76.9)	12 (23.1)	
Age 51+ years (n=17)	15 (88.2)	2 (11.8)	
User groups			
Pharmacists (n=63)	60 (95.2)	3 (4.8)	P=0.0001
Physicians (n=260)	194 (74.6)	66 (25.4)	
Area			
Medical physicians (n=104)	116 (79.5)	30 (20.5)	P=0.06
Surgeons (n=146)	71 (68.3)	33 (31.7)	
Position			
Interns (n=11)	9 (81.8)	2 (18.2)	P=0.005
Non-PG registrars (n=12)	12 (100)	0 (0)	
PG students (n=89)	67 (75.3)	22 (24.7)	
Junior consultants/senior residents (n=76)	57 (75)	19 (25)	
Senior consultants (n=70)	48 (68.6)	22 (31.4)	
Pharmacists (n=55)	53 (96.4)	2 (3.6)	
Assistant pharmacists (n=8)	7 (87.5)	1 (12.5)	
Training session			
Attended training session (n=42)	32 (76.2)	10 (23.8)	P=0.84
Not attended training session (n=267)	209 (78.3)	58 (21.7)	
Experience with EPS			
<1 year experience (n=144)	116 (80.6)	28 (19.4)	P=0.34
1-3 years experience (n=103)	76 (73.8)	27 (26.2)	
3+ years experience (n=51)	42 (82.4)	9 (17.6)	
Experience with personal computers			
Never use personal computers (n=9)	7 (77.8)	2 (22.2)	P=0.08
Occasional users of personal computers (n=123)	105 (85.4)	18 (14.6)	

Regular and expert users of personal computers (n=183)	134 (73.2)	49 (26.8)	
Overall satisfaction level			
Overall (n=323)	254 (78.6)	69 (21.4)	

Factors towards satisfaction

Overall, majority of users belonging to both the user groups were satisfied with the e-prescribing system. Among the 15 factors studied (Table 2), all factors were found to be significantly correlated with satisfaction except the factor 'easy to use' (r= -0.02; p=0.171). Few factors including impact on patient care (r=0.67), reliable (r=0.62), productivity (r=0.55) and response time (r=0.52) were strongly correlated ($r \geq 5$; $P<0.001$) with satisfaction. Though significant, other factors including time saving (r=0.47), training (r=0.42), speed (r=0.31), quality of care (r=0.35) and safety (r=0.30) were less strongly correlated (r=3-5; $P<0.001$). Rest of the factors had no meaningful relationship with satisfaction ($r<3$; $P<0.001$).

Factors towards dissatisfaction

Relatively, only a small proportion (21%) of users were dissatisfied with the e-prescribing system. However, none of the factors were found to have significant negative correlation with dissatisfaction. Few factors including productivity (r=0.31), reliability (r=0.31), training (r=0.21) and positive impact on patient care (r=0.30) p=0.003, showed positive correlation with dissatisfaction but were found to have the opposite effect to what was expected. Although, the predictor 'can get help from someone when needed' was negatively correlated with dissatisfaction, the association was not statistically significant. Table 2 shows the list and factors and their correlation coefficients.

Table 2: Correlates of satisfaction and dissatisfaction.

Factors	**Satisfaction**	**Dissatisfaction**
	Pearson's correlation coefficient	**Pearson's correlation coefficient**
Saves me time	0.47**	0.14
Improves my productivity	0.55**	0.31*
Easy to use	-0.02	0.17
Improves safety of care	0.30**	0.03
Is reliable	0.62**	0.31*
Improves patient care quality	0.35**	0.13
Gives information I need	0.29**	0.2
Speeds me up	0.31**	0.02
I had adequate training	0.42**	0.21*
I ask someone for help when needed	0.25**	-0.09
Reduces error	0.23**	0.18

I was able to find help when needed	0.19**	0.19
I can benefit from refresher classes	0.21**	0.03
Response time is fast	0.52**	0.13
Has positive impact on patient care	0.67**	0.30*
**p<0.001; *P<0.01		

Perceptions

The respondents were asked to indicate their perceptions on advantages/disadvantages and satisfaction/dissatisfaction of specific features of e-prescribing system *via* two open-ended questions. The most common and common responses to the question "What is the one thing you like most about e-prescribing system?" are listed in Table 3. For 36% of physicians the e-prescribing system was easy and reliable, 20% of physicians liked e-prescribing system because it gave information on product availability, stock and cost. 17% physicians believed e-prescribing system prevents medication errors and 12% perceived that the system saves time. The responses from pharmacists differed from those of physicians. Majority of pharmacists (49%) perceived that the e-prescribing system saves time and 20% said, it increases income to the institution and 14% believed that the system prevents medication errors.

Responses to the second open-ended question "What is the one thing you would like to change/add/modify/remove from e-prescribing system to make it better?" are listed in Table 4. The most common responses from physicians included, they dislike the e-prescribing system in its current format, and instead they needed a much reliable modified programme (26%). 14% of physicians perceived that the e-prescribing system was not user friendly and time consuming. The pharmacists differed from physicians in their perceptions about the downsides of e-prescribing system. Majority of them (40%) said that they weren't able to interpret directions and instructions on tapering dose, inhalers, syrups and injections all the time. Many pharmacists (11%) suggested that prescribers should check target pharmacy stock before prescribing.

Table 3: Responses to open ended question: "What is the one thing you like most about electronic prescribing system?"

Physicians
Most common responses**
Easy and reliable (36%) Giving information on product availability, stock, and cost (20%) Prevents medication errors (17%) Time saving (12%)
Common responses*

Drug interaction alert (6%) Provision for creating templates, favorites and packages (4%) Patients buy medicines in-house that may benefit the institution (3%) Prevents misuse that otherwise can occur with paper prescriptions (2%)
Pharmacists
Most common responses**
Time saving (49%) Patients buy medicines in-house that may benefit the institution (20%) Prevent medication errors (14%)
Common responses*
Easy and reliable (6%) Prescriber identity is clear (4%) Reduces workload (3%)
**Most common responses = if cited by more than 10% of the respondents *Common responses = if cited by more than 2% and less than 10% of the respondents

Table 4: Responses to the open ended question: "What is the one thing you would like to change/add/modify/remove from electronic prescribing system to make it better?"

Physicians
Most common responses**
Don't like the current format/need modified system (26%) Not user friendly and time consuming (14%)
Common responses*
Need training sessions (9%)
If less/no stock in target pharmacy, it should reflect (8%)

System response time is slow, the system often hangs (8%)
My favorites, templates and packages should be easily modifiable (5%)
Patient information cannot be efficiently provided (6%)
Drug information for all drugs need to be included (5%)
Instructions on tapering dose, inhalers, syrup and injections cannot be prescribed properly (5%)
Free text option is needed (3%)
Add dose calculator (2%)
Pharmacists
Most common responses**
Patient directions and instructions on tapering dose, inhalers, syrups and injections are not interpretable (40%) Prescribers should check target pharmacy stock before prescribing (11%)
Common responses*
Dangerous drugs should not be allowed in e-prescribing (7%)
Pending prescriptions should not appear while dispensing (7%)
Need training sessions (7%)
After e-prescribing there should be a cross checking step (7%)
Different color codes should be given for different pharmacies (4%)
Don't like the current format/need modified system (4%)

DISCUSSION

E-prescribing system allows prescribers to send prescriptions electronically to a pharmacy of patient's convenience. This makes the prescribing and dispensing process more efficient and convenient for prescribers, pharmacists and patients. In spite of prescribers being constantly urged to use e-prescribing system, a major proportion of prescriptions the hospital pharmacies received were conventional rather than e-prescriptions. This tendency is an indication that the e-prescribing system was not as successful as anticipated. This study was conducted with the intention of finding whether the users were satisfied or dissatisfied, factors towards satisfaction and dissatisfaction and their perceptions on the advantages and disadvantages of e-prescribing system.

From the results of this study it was found that generally the users were satisfied with e-prescribing system. As predicted based on opinions and few previous findings [20,21], pharmacists were more satisfied than physicians and so the medical physicians than surgeons [6]. Even though, the respondents differed with respect to their experience with e-prescribing system or personal computers, no significant difference was found in their overall satisfaction level between those with less or more experience. Attending or not attending a training session also didn't make significant difference in the satisfaction level. In the current setting, a team of staff from the hospital computer section provided training sessions on need basis and participation was voluntary. A study [22] conducted in the UK interviewed members involved in the training of prescribers and found that the educational background of trainers and method of training could probably create an impact on successful implementation of e-prescribing system. In one setting, providing ward based support to prescribers and conducting training sessions by the hospital informatics team were largely unsuccessful due to lack of staff engagement. Few other settings have employed trainers with clinical background and experience in education, members of the prescribing and pharmacy management directorate and designated team of trainers with clinical and technical background. The later group of trainers have used different methods of training prescribers including work-flow based training, e-learning based approach with multiple modules covering all aspects of different patient scenarios, specialist training e.g. for a specialist clinical area such as pediatrics and training based on clinical scenarios and exercises. Hospitals using the later training approaches had successful implementation of e-prescribing system.

Similarly, difference in neither age nor gender was found to contribute to significant difference in satisfaction level. Other settings also failed to prove an association between age and gender with satisfaction level but, one study [23] which surveyed Swedish patients found that the age groups of patients had a significant influence on attitudes towards e-prescription. No previous studies reported an association between physicians or pharmacists' positional hierarchy with satisfaction level, however we noticed in our study that, among physicians there was an increasing trend of dissatisfaction with e-prescribing system as the positional hierarchy increased (i.e. more senior consultants and senior residents were dissatisfied than interns or non-PG registrars). The reason for this increasing trend of dissatisfaction with increasing positional level is not known and further study will be required to elucidate this relationship. One possible reason would be the resistance to shift to a new system. As the system is in place for more than 10 years, majority of the prescribers at the junior level might have started using e-prescribing system right from the initial stage of their careers. For prescribers at the senior level, they would have had to shift from an older system that that they were comfortable with. According to one of the practice enhancement facilitators with TransforMED, a subsidiary of the American Academy of Family Physicians, frequent and effective communication at strategic, operational and individual levels is especially important for successfully implementing a change and it has to start at the top level [24]. Other possible reasons why senior consultants were dissatisfied with the e-prescribing system might be attributed to medication errors specific to the system such as those due to drop-down menus and inadvertent entering of incorrect information which were commonly observed with electronic prescriptions. Though alerts are useful to prevent medication errors, in some cases alerts can be annoying e.g. aspirin and clopidogrel combination therapy is recommended in selected patients, but while prescribing these two drugs, the system pops up a drug interaction alert which is contextually inappropriate, possibly leading prescribers to ignore the alerts.

Like other comparable studies [25,26], the physicians in our study were relatively less satisfied with the e-prescribing system compared to pharmacists. This may be explained by multiple factors including the finding that e-prescribing system consumed more time than conventional prescription writing for many physicians. One study [26] which looked exclusively at the

factors influencing the time doctors take to prescribe, reinforced the need for appropriate alerts to be presented to individuals at an appropriate place in the workflow, in order to improve prescribing efficiency. On the contrary, for pharmacists the e-prescribing system saved time in our study. Our finding is corroborated by a recent study [27] which estimated that 1.33% of handwritten prescriptions required clarification compared with 0.66% of e-prescribing system generated prescriptions.

Overall, user dissatisfaction was high among physicians. Beyond 'time' as a single factor, there might be other factors too that had contributed to user dissatisfaction. For instance, because of the absence of mandatory training on e-prescribing system, certain users may be unaware of the features available in the system. Trouble using the system arises when an inappropriate target pharmacy is chosen, or when an obsolete generic or brand name is chosen or when the prescriber is unaware of the existence of aforesaid features which helps prescribing using the system. This predictor could probably have contributed to user dissatisfaction because many physicians in our setting expressed the need for training sessions on e-prescribing system when asked for their perceptions. Another possible reason would be that, although there is some evidence that e-prescribing system reduces some types of medication errors, it has also created new types of medication errors [28]. In this study, pharmacists indicated few instances where the e-prescribing system could potentially yield medication errors, for example, they complained that the e-prescribing system was unable to efficiently transcribe patient instructions on tapering dosages that could potentially result in dispensing error or wrong dose error.

The correlation analysis showed that certain factors were strongly correlated with satisfaction and others less strongly correlated, although they were all significant. The ratings of efficiency factors including productivity and response time; quality related factors including reliability and impact on patient care were strongly correlated with user satisfaction. However, factors including time saving, quality of patient care, speeds me up, improves safety of care, and training were less strongly correlated with satisfaction. The remaining factors, easy to use, gives information, could get help from someone, reduces error, ability to find help, and refresher classes had no meaningful association with satisfaction. Some of the factors which failed to have meaningful association with satisfaction were corroborated in the open-ended questions which imply a strong recommendation to the implementers to improve those factors to gain a successful implementation of the system. User friendly, increased time consumption and need for training sessions were amongst those factors expressed under both closed and open questions which need immediate attention to increase user satisfaction and usage of system.

A miniscule number of pharmacists and a sizeable proportion of physicians were found to be dissatisfied with the e-prescribing system. Among dissatisfied users, unlike as anticipated, none of the factors were negatively correlated with user dissatisfaction in our study, suggesting none of the factors could be specifically attributed for users' dissatisfaction. Also, no factors had significant positive association with dissatisfaction except a few which were less strongly associated but had the opposite effect to what was expected. The lack of negative association with dissatisfaction can be interpreted as users not being completely dissatisfied with the factors studied but there might be also other factors which contributed to dissatisfaction, some of which were explored using the open-ended questions. This observation was contrary to Lee et al. [6] who was able to find a clear negative association with few factors that contributed to dissatisfaction.

Altogether, these correlates provide implications to best improve the e-prescribing system, with a special focus on those factors which were less strongly correlated and not meaningfully associated with user satisfaction. In countries such as India with

an extremely huge population and the hospitals being often crowded, the context greatly differs from many other countries where a majority of the studies on e-prescribing system have been carried out. In India, clinicians and pharmacists are expected to care for more patients in limited time but error free (for example, in the current study setting, more than 8000 out-patient prescriptions are being processed everyday which is significantly a large number). Successful implementation of e-prescribing system in similar setting requires special attention to the factors of user satisfaction and dissatisfaction. A secondary analysis [10] on computer based prescribing concluded that if system designers fail to recognize that various electronic prescribing system's features and implementation strategies that can increase clinicians' negative emotions, then this may increase the likelihood that the system implementation will fail or that the system will never be routinely used by clinicians.

We introduced two open-ended questions at the end of the study questionnaire with an intention to identify issues that might complement closed questions and to reassure that all relevant issues regarding e-prescribing system have been covered. The open-ended questions captured specific and unique factors about advantages, disadvantages, satisfaction and dissatisfaction of e-prescribing system. Though the predictor "time saving" was found positively correlated with user satisfaction *via* closed question, responses to open-ended questions revealed that for a significant proportion of physicians, the system was not actually saving time while for majority of pharmacists the system always saved time. Few physicians expressed the usefulness of providing "free-text option" if available with the system to provide clear patient information and maintain orderliness of tapering doses which they felt difficult with the current system. Pharmacists also reported difficulty in interpreting patient information and tapering doses with the current system. However, a recent research published in JAMA Internal Medicine [29] found free-text option in e-prescribing system distracting for pharmacists and could be severely harmful for patients. The study found that 66% of free-text notes were inappropriate, in which most of these contained conflicting medication directions. Pharmacists in our study said that, with e-prescribing system it was easy to clarify prescription doubts as the system always provided prescriber identity, which may not be always possible with conventional paper prescribing. Some physicians considered the e-prescribing system as not user-friendly and have suggested that the system to be re-formatted. Target pharmacy selection by the prescribers was often inappropriate as said by a significant number of pharmacists. Usually when the target pharmacy selection goes wrong, the pharmacist should either arrange for the prescribed drugs from a different pharmacy or from pharmacy stores both of which will bother both the pharmacist and patient. Thus, on a broader scale, physicians and pharmacists had different opinions, perceptions and preferences and hence represent two different user groups, implying that both these groups can contribute separately to the enhancement of e-prescribing system. For any system to be successfully implemented, it is essential that the views of different user groups should be determined to identify areas of concern and to maximize the utility of that system [30].

Our descriptive study could be limited by the following factors. It was conducted in a single multispecialty tertiary care teaching hospital using a specific e-prescribing system. The response rate in this study was far below than anticipated. Only 47% of the study population responded to the survey, and the perception of remaining 53% non-respondents was not known, and this might affect the strength of the results. However, to minimize selection bias, every physician and eligible pharmacist available at the time of this study were invited to participate. Being a cross-sectional study, the perceptions of users over time is not known. Conducting a longitudinal study or series of cross-sectional studies can address this issue. Although this study has a few limitations, the findings provided valuable recommendations for a future roll out of enhanced e-prescribing system with successful implementation.

CONCLUSION

The study findings indicate that the users are generally satisfied with the e-prescribing system even though it was not as successful as anticipated. Further, the findings imply recommendations for the enhancement of e-prescribing system which is important for increasing acceptability among users. The respondents recommended that the e-prescribing system should be user friendly, faster, clear instructions for patients and free from target pharmacy confusion. We conclude that responding to the recommendations from both the user groups may facilitate its successful implementation.

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