Perceptions of Prescribers towards Electronic Prescription: A Pre-Implementation Evaluation

Dhanya S Palappallil[1]*, Carol Pinheiro[2]
[1]Assistant Professor, Department of Pharmacology, Govt Medical College, Kottayam, Kerala, INDIA.
[2]Assistant Professor, Department of Community Medicine, Govt TDMC, Alappuzha, Kerala, INDIA.

ABSTRACT

Objective: Electronic (e) prescribing is computerised prescribing. The Government of Kerala has started the e-health initiative. The objective of this study was to obtain the perceptions of prescribing doctors on e-prescription before its implementation. **Method:** This was a questionnaire based cross sectional study conducted for a period of six months in a Government tertiary care teaching hospital of Kerala. The prescribing doctors of the institution formed the sample population. The response to the structured questionnaire was measured on Likert scale. Data were analysed using SPSS 16. Domain scores of perceived usefulness, ease of use and fitness to the Institution were calculated by averaging the response. Chi square test was done to find the association of score of each domain with independent variables. **Results:** Two hundred and fifty seven prescribing doctors of age range 22-60 years participated of which 49% were females and 51% males. Response rate was 73% (257/350). Although 70.5% have heard of e-prescriptions only 14% participants had hands on exposure. The mean perceived usefulness, perceived ease of use and fitness were 3.5±0.47, 3.35± 0.49 and 2.95 ± 0.44. **Conclusion:** Dislike for paper prescriptions was the single most important factor associated with perceived usefulness, perceived ease of use and perceived fitness of e-prescription in the institution. Information technology training and infrastructure development should go hand in hand with implementation of e-prescribing.

Key words: Electronic prescribing, Electronic prescription, Medication error, Health Information Technology.

Key Messages: For successful implementation of electronic prescriptions, training and technologically developed settings is a must. Educating the prescribers on preventable medication errors associated with paper prescriptions can lead to the acceptance of e-prescribing.

INTRODUCTION

Prescription is a written order by the doctor to the pharmacist. It has the status of a legal document. Re-dispensing with repeated use of same prescription is illegal. The common problems faced with handwritten prescriptions are poor legibility, incomplete writing or insufficient information, use of non-standard abbreviation, unintended omissions, failure to stop a drug timely, dose errors, dosage form errors and rarely inaccuracy in writing.[1]

Electronic (e) prescribing is the evolution of traditional methods to a technological advancement. It is an integral component of the health information technology (IT) system, an inter-operational platform, bridging communication gaps among doctors, patients, nurses and pharmacists. It has the potential to enhance the safety of pharmacological treatment by reducing the morbidity associated with medication errors by eliminating illegible hand writing, providing alerts on drug-drug interaction and drug allergy.[2] By offering access to medication history, including prescriptions issued by other prescribers it helps to identify "doctor shoppers". The time spend handling the prescription renewal requests are considerably reduced.[3] Electronic prescribing for controlled substances curbs the abuse and diversion of prescription drugs. This is by substantially reducing prescription fraud associated with paper prescriptions like falsifying prescriptions, prescription pad theft and forgery.[4]

Errors with e-prescribing is seen to be on the rise soon after its implementation.[5] It may be attributed to technology factors like poor user interface design like auto-populate features and dropdown menus, end user factors like poor knowledge of the e-prescribing platform or inadvertently entering incorrect information and environmental factors such as lack of time or poor location of the computer.[6] The effect of e-prescription on the pharmaceutical market is towards a negative side as physicians will prescribe the cheaper generic drugs as opposed to the expensive branded ones.

The Government of Kerala launched the e-health initiative in 2014.[7] The objective of this study was to obtain the perceptions of the prescribers on perceived usefulness, ease of use and fitness of e-prescribing system before its implementation. The positive predictors favouring its adoption in the institution were also studied.

METHODS

This was a cross sectional, questionnaire based study done amongst the prescribing doctors of a Government teaching hospital in Kerala. The study period was six months from July to December 2016. Sample size was computed as 257 at 95% confidence level allowing 5% margin of error. Stratified sampling was done and 92 Permanent doctors, 67 Residents and 98 Interns formed the sample.

The study was initiated after getting the Institutional Review Board and Ethics Committee Approval (EC/13/2015 dated 15/12/2015 of the institution). Practising doctors were invited to participate in the study by distributing a structured questionnaire. Two reminders encouraging the completion of instrument were given personally and mobile messaging or email. Three hundred and fifty questionnaires were distributed to achieve the target sample size.

The questionnaire was partially adopted from Agency for Healthcare Research and Quality.[8] The instrument was modified based on previous survey instruments which assessed the extent of use of computers amongst health professionals, Roger's innovation diffusion theory, Davis's Technology Acceptance Model and Dixon's IT Adoption Model.[9-12] The questionnaire consisted of 6 parts –Demography, Current prescribing activities, Computer Usage, Perceived usefulness, Perceived ease of use and Perceived fitness of e-prescriptions. The response was measured on Likert scale 1(Strongly disagree) to 5 (Strongly agree).

Statistical Analysis-The data were analysed using SPSS 16 for windows (SPSS Inc, Chicago, USA). Prior to conducting the analysis the internal consistency of instrument was assessed for reliability using Cronbach's coefficient alpha (≥0.8). The response to each question was presumed to be the score of that question. The scores were reversed for negative questions and mean domain scores were calculated. Responses were dichotomized (1-3 as bad and 3.1-5 as good) for further analysis. Chi square test was done to find the association of score of each domain with independent variables. Using binary logistic regression model predictors of perceived usefulness, ease of use and fitness of e-prescribing in the institution were evaluated.

RESULTS

Three hundred and fifty questionnaires were distributed of which 257 were returned, response rate being 73%. There were 126 females and 131 males with a mean age 31± 8.59 years (range 22-60). About 24.1% (62) were from medical specialty, 37.7% (97) from surgical and the rest were interns who had prescribing experience of less than one year. Around 33.9% had prescribing experience of more than five years. More than fifty percent participants claimed that they had high volume load of patients. The current prescribing activities of the participants are summarized in Table 1. Even though 70% claimed their prescriptions to be legible and 60.7% liked paper prescriptions, only 40% were able to track the continuity of their prescription as shown in Table 1.

Around 70.8% had computer usage experience for more than 5 years, 23.7% for 1-5 years and the rest less than one year. As shown in Table 2, 79% were comfortable with use of computers, and only 57.6% had self-assessed good knowledge of computers. Of the 70.5% (181) who have heard of e-prescriptions only 14% (37) had hands on exposure in generating it.

The mean perceived usefulness, ease of use and fitness were 3.5±0.47, 3.35± 0.49 and 2.95 ± 0.44 respectively. As shown in Figure 1, majority of the participants thought that ability to send e-prescription will be good (65%) and would lead to safer prescribing (63%) with less medication errors. A vast majority liked getting notified when there was potential chance of drug-drug interactions (80.5%), whether the patients received the prescribed medication from the pharmacies (67.3%) and what other doctors prescribed for co-existing illness (73.2%). Only 30.4% were afraid that their work would be controlled while sending e-prescriptions. Even though almost equal number of participants agreed and disagreed on the fact that storage of personal healthcare information in database would be unethical and would lead to data abuse, 79.4% agreed that this data could be used for research purpose. More than 50% of the participants disagreed to the statement that e-prescribing would decrease the economic burden of healthcare system.

As shown in Figure 2, about 45% agreed that using e-prescription means faster or easier prescribing. Even though only 35.8% felt that it would affect the work flow around 60% opined that it would cause technical problems, require regular technical assistance, patients might think that doctors were referring to the internet for prescribing and unauthorized e-prescriptions might be send by hacking and logging into their user interface. Despite thinking that prescribing through software would be

Table 1: Current prescribing activities of the participants (n=257).

Variables	Disagree (1+2) %	Neutral (3) %	Agree (4+5) %
Have legible handwriting	7.8	22.2	70.0
Like paper prescription	17.1	22.2	60.7
Able to track continuity	32.3	23.7	44.0
Refill demand for lost prescription	58.8	20.6	20.6
Prescriptions were altered by patients	56.8	23.3	19.8
Prescription pads were stolen	70.0	34.0	16.7
Pharmacists called back to clear doubts	38.9	31.9	29.2
Incorrect drug was filled from pharmacy	54.1	21.8	20.6

Table 2: Current computer usage profile of the participants (n=257).

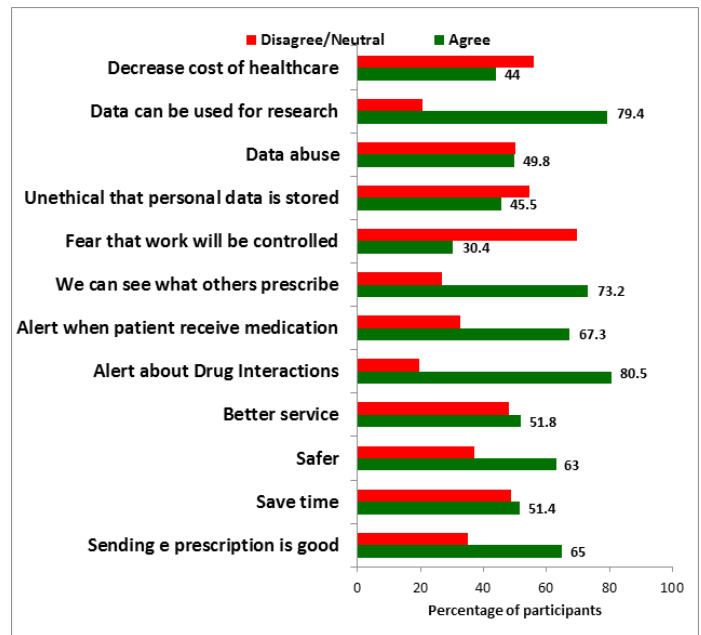| Variables	Disagree (1+2) %	Neutral (3) %	Agree (4+5) %
Comfort with computer use	6.2	14	79.8
Computer use for personal/professional purposes	4.7	9.3	86
Use computer at home	13.2	15.2	71.6
Use computer in hospital	41.6	28.8	29.6
Good knowledge on computer	13.6	28.8	57.6

Figure 1: Perceived usefulness of e prescriptions.

complicated (32.7%) or it would be difficult to change e-prescription (42.8%), 77.8 % thought it was easier to renew prescriptions electronically. However, 82.9% doctors claimed that they would like to meet the patients in person than give automatic refills. Only a small minority thought that e-prescriptions would improve the patient satisfaction. 79.4% opined that the pharmacies need to be well equipped to fit into the e-prescribing network. More than fifty percentage thought that e-prescribing would help in detecting medication misuse and diversion.
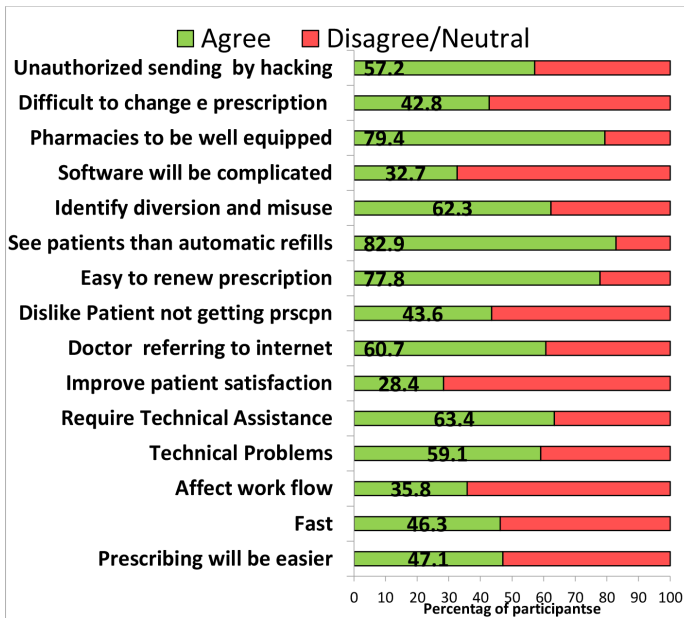
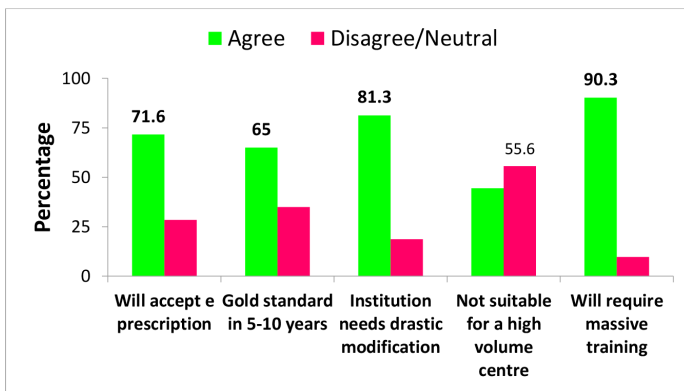**Figure 2:** Perceived ease of use of e prescriptions.

Figure 3: Perceived fitness of e prescription.

Figure 3 depicts the perceived fitness of e-prescription in the institution. Even though majority of the participants agreed to accept e-prescription once it was adopted in the institution, 55.6% felt that it was not suitable for a high volume centre like ours. There was a compelling demand for infrastructure development and massive training in the Institution. Almost two third of the participants felt that e-prescribing would be the gold standard in next five to ten years in India.

Table 3 summarises the factors associated with perceived usefulness, ease of use and fitness of e-prescription after performing univariate analysis. Binary logistic regression was performed with significant factors of univariate analysis as summarized in Table 4. Good computer knowledge and dislike for paper prescriptions were found to be predictors of positive attitude to usefulness of e-prescription. Knowledge about e-prescription and dislike for paper prescriptions were positive predictors of perceived ease of use and fitness of e-prescription.

DISCUSSION

Electronic prescription is a long overdue alternative to the five thousand year old prescription using pen and paper. About three billion paper prescriptions are written every year in India.[13] Electronic prescribing and

Table 3: Univariate analysis of factors associated with perceived usefulness, ease of use and fitness of e prescription.

Factors	Chi²	p value	Odds Ratio	95% Confidence Interval
Perceived Usefulness				
Medical specialty	3.8	0.05	2.58	1.1-6.9
Good computer Knowledge	18.9	<0.001	4.7	2.2-9.9
Computer use in hospital	5.2	0.022	2.79	1.1-6.9
Comfort with computer use	10.7	0.001	3.2	1.5-6.6
Dislike paper prescriptions	6.2	0.013	2.64	1.2-5.8
Knowledge of e prescription	4.8	0.028	2.13	1.1-4.2
Perceived Ease of use				
Comfort with computer use	4.9	0.027	2.09	1.1-4.0
>5 years Work Experience	4.4	0.036	1.79	1.0-3.1
Knowledge of e prescription	5.2	0.023	1.91	1.1-3.4
Send e prescription	5.1	0.023	2.24	1.1-4.6
Dislike paper prescriptions	4.5	0.035	1.72	1.1-2.9
Perceived fitness				
Medical Specialty	4.9	0.026	2.18	1.1-4.4
Computer use in hospital	3.9	0.05	1.8	1.1-3.4
Dislike paper prescriptions	9.4	0.013	2.46	1.4-4.4
Knowledge of e prescription	8.2	0.004	2.25	1.3-4.0

Table 4: Positive predictors of usefulness, ease of use and fitness of e prescription by binary logistic regression.

Independent predictors	Wald	p value	Adjusted Odds Ratio	Confidence Interval
Perceived usefulness				
Good computer knowledge	16.6	0.001	4.79	2.3-10.1
Dislike for paper prescription	5.73	0.017	2.69	1.2-6.1
Perceived ease of use				
Knowledge of e prescription	5.38	0.02	1.97	1.1-3.5
Dislike paper prescriptions	4.7	0.03	1.77	1.1-2.9
Perceived fitness				
Knowledge of e prescription	8.62	0.003	2.38	1.3-4.3
Dislike paper prescriptions	9.68	0.002	2.59	1.4-4.7

dispensing processes of drugs whether in medical practice, follow up or research has become an integral part of pharmacoinformatics.[14] Studies on barriers and facilitators to implementation of electronic prescription have been done amongst physicians, pharmacists, staff of physicians as well as IT staff.[15] This study was done amongst the prescribing doctors of a rural tertiary care institution with more than 50% of participants taking care of high patient load.

Incentivizing electronic prescribers, data on reduction in prescription errors and its impact on health outcomes, online real time verifications by pharmacists, formulary adherence, reduction in adverse drug reactions and timely drug-drug interaction alerts have paved to the slow but successful adoption of e-prescribing in the developed nations.[16] Technology acceptance model (TAM) research among physicians have revealed contrasting results between the pre and post implementation phases.[17-18]

A study done in the pre-implementation phase of primary care centres revealed that the median perceived usefulness and ease of use were respectively 4.1 and 3.2 in one centre and it was 4.2 and 3.5 in another.[19] This is comparable to our study where the mean perceived usefulness and ease of use was 3.5±0.47 and 3.35± 0.49 respectively. Around 71.6% opined that they were willing to adopt e-prescribing in the future and 65% felt that it would be the gold standard for prescribing in the coming years. There was a demand for infrastructure development, computer skills training as well as development of drug equipped internal pharmacies which can meet the demands of prescriptions generated electronically.

Electronic health records (EHR) have existed in the developed nations since 1970s.[20] Early adoption have slowed and soured because of resistance to accept computerised protocols and clinical information systems.[16] A review by Jeetu and Girish found that e-prescriptions were less variable and generated mostly default medication instructions with signatured messages, which automatically appear within the text box in the EHR.[21] By providing flexibility through doctor directed prescribing, provision of personal digital assistants with preferred drugs/personal drugs (P drugs) has paved way to acceptance of e-prescribing.[16]

Dislike for paper prescriptions was the single common factor associated with participants positive attitude towards perceived usefulness, ease of use and fitness to adopt technology in this institution. Prescribing errors in terms of medication, direction, length of treatment, dose, dosage form, amount to be dispensed, poor legibility and use of inappropriate abbreviations are one of the largest preventable errors in the hospitals.[2,16] Kaushal *et al.* found that e-prescribing adopters had significantly lower rates of prescribing errors (6.6 versus 38.4) and near misses (1.3 versus 2.7) than non-adopters at one year.[2] Yugandhar *et al.* opined that electronic prescribing system reduced 75% of prescribing errors with error rate being 8.4% compared to 33% of handwritten prescriptions.[22] The dispensing errors due to inadequate deciphering of "doctor scribble" can be eliminated. Handwritten prescriptions had 5.5 higher odds of having prescribing errors (OR 5.5, 95% CI 4.6-6.1).[22] Panchbhai *et al.* stated that pre-printed prescriptions and electronic entry devices can reduce illegibility and hence medication errors.[23] The drug-drug interaction alerts, knowledge about past history of drug allergies and adverse drug reactions, suggestion of right dosage will make e-prescriptions prone for less prescribing errors. Patients have picked up and taken drugs with perseverance with e-prescriptions than those with paper prescriptions leading to better compliance.[16]

Good computer knowledge was found to be predictors of positive attitude towards usefulness of e-prescription. Electronic prescribing system is a complex system necessitating finesse in operating computers or digital assistants who are experts. Physicians require additional training in utilizing e-prescribing technology efficiently and effectively. To facilitate the usefulness of e-prescriptions the software must be user friendly, easily operable, customized and updated in terms of local requirements and prescribing trends. A predefined notion that use of technology is expensive, hard to learn, time consuming and error prone is a major barrier in adoption of computerized prescriptions. The positive influence of previous computer knowledge has been demonstrated in previous studies.[17,24] Previous knowledge about e-prescriptions was associated with perceived ease of use and perceived fitness of e-prescription in this institution. Even with previous knowledge and hands on experience many e-prescribers have quit the same owing to technical problems with network connectivity, lack of patient identifiers, time pressure, uncertainty on receipt, processing and dispensing of drugs for e-prescriptions from pharmacies.[25] Lack of incentives, suspicion on encroachment of professional autonomy by higher authorities, loss of patient's privacy by hacking, stealing computers or access to database are other concerns which can demotivate the prescribers in using e-prescriptions. This research summarizes the perceptions of prescribers in pre-implementation period of a single tertiary care institution. Even though the study population corresponds to usual proportion of prescribers in the institution a larger sample size would have yielded better results.

CONCLUSION

Electronic prescribing is a long term investment to reap benefits in terms of ensuring patient safety, increasing quality healthcare and tuning hospitals in right stride towards "Digital India". Dislike for paper prescriptions was the single most important factor associated with perceived usefulness, perceived ease of use and perceived fitness of e-prescription in the institution. Dislike for paper prescriptions by educating the prescribers on preventable medication errors associated with it can lead to the acceptance of e-prescribing. There needs to be extensive training of stakeholders especially prescribers and infrastructure development before its adoption to make it successful and fruitful.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVIATIONS

CI: Confidence Interval; **EHR:** Electronic Health Record; **e-prescription:** Electronic prescription; **e-prescribing:** Electronic prescribing; **IT:** information technology, **OR:** Odds ratio; **P drugs:** Personal drugs; **prscpn:** Prescription; **SPSS:** Statistical Package for Social Sciences; **TAM:** Technology Acceptance Model

SUMMARY

Electronic prescriptions are computerised prescriptions.This study aimed at determining the perceptions of prescribing doctors of a tertiary care centre about electronic prescription in three domains namely perceived usefulness, perceived ease of use and fitness of institution for the adoption of e- prescribing system .Dislike for paper prescription was found to be the most important factor associated with the three domains. Proper training of faculty in information technology with infrastructure development will envisage e-prescriptions as the gold standard for prescribing in India in the coming years.

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