The learning curve of electronic prescribing

Introduction: Medication errors are a potentially avoidable source of harm to patients. The authors' hospital has introduced electronic prescribing in an attempt to reduce these errors. A prospective quality improvement project was performed to assess both the impact of this change on prescribing errors and to see if there was a learning curve associated with prescribers using the new system.
Methods: A simple prescribing task was created in which study participants were asked to prescribe a set list of medications for a fictional patient. The participants were timed first using paper drug cards, and then using the prescribing function on iSOFT's iClinical Manager. The prescriptions were also assessed for legibility and errors. This was done within 1 week of the participants starting in the department, and then 2 and 4 months later. A total of 25 junior doctors completed the task. No participant had prior experience of electronic prescribing in a clinical setting.
Results: During week one, the task took a longer average time to complete using electronic prescribing compared to paper (323 seconds *vs* 290 seconds, $P<0.01$). After 2 months the mean time to complete the task was shorter with electronic prescribing compared to paper (261 seconds *vs* 306 seconds, $P<0.01$). There was therefore a significant mean reduction in the time taken to complete the task using electronic prescribing of 62 seconds ($P=0.01$). There were fewer illegible entries or drug errors using electronic prescribing compared to paper prescribing (2.7% *vs* 5.3%, $P=0.68$).
Conclusions: Electronic prescribing appears to reduce prescribing errors. However, there is a learning curve for new doctors using electronic prescribing. Training and support is vital during this period in order to reduce prescribing errors.

There are an estimated 850 000 patient safety incidents per year in the UK (Department of Health, 2000) with 25 000 resulting in deaths (Report of The Bristol Royal Infirmary Enquiry, 2001). Of such incidents, 8.6% are medication related (National Patient Safety Agency, 2005). Medication errors are a potentially avoidable source of harm to patients. The implementation of electronic prescribing has been hailed as one possible way of reducing potential medication errors (Schiff and Rucker, 1998). In 2012, the authors' department implemented electronic prescribing for hospital inpatients with the primary aim of reducing prescribing errors. It was also hoped that the new electronic system would reduce the time it took for junior doctors to prescribe medications, thus allowing them more time to perform other clinical tasks.

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A prospective quality improvement project was undertaken to investigate the impact of this change. The primary aim was to assess if a simple prescribing task took longer to complete with electronic rather than paper prescribing, and the secondary aim was to investigate if doctors became more proficient with electronic prescribing after using it in a clinical setting for some time. The project also assessed whether the introduction of electronic prescribing reduced the number of prescribing errors made compared to those made using traditional paper drug cards.

Methods

A simple prescribing task was created in which study participants were asked to prescribe a set list of medications for a fictional patient. Participants were asked to prescribe paracetamol 1 g four times a day, sodium docusate 200 mg twice a day, senna two tablets at night, tramadol 50–100 mg four times a day, oramorph 5–10 mg every 2 hours as needed for pain. They were also asked to prescribe enoxaparin 40 mg at 6pm, and postoperative prophylactic antibiotics in the form of cefuroxime 1.5 g to be given at induction of anaesthesia, followed by cefuroxime 750 mg at 8 and 16 hours post induction of anaesthesia. Finally, participants were asked to document that the patient had no known drug allergies.

This task represents a fairly standard medication prescription for a patient undergoing elective orthopaedic surgery at the authors' hospital. The participants were timed first using paper drug cards, and then using the prescribing function on iSOFT's iClinical Manager. This was done within 1 week of the participants starting in the department, and then at 2 and 4 months during their attachment. The prescriptions were then reviewed for errors. A total of 25 junior doctors working in orthopaedics, anaesthetics or intensive care completed the task. All participants had at least 1 years' experience of using paper prescribing in a clinical setting. The participants all underwent a short induction lecture in using iClinical Manager, but no participant had prior experience of electronic prescribing in a clinical setting to ensure that all participants started with equal experience of electronic prescribing.

Data were analysed using the Wilcoxon signed rank test and Fisher's exact test. A P value of <0.05 was considered statistically significant.

Results

During week one, the task took a longer average time to complete using electronic prescribing compared to paper (323 seconds *vs* 290 seconds, $P<0.01$). At month two the mean time to complete the task was shorter with electronic prescribing compared to paper (261 seconds *vs* 306 seconds, $P<0.01$). There was therefore a significant mean reduction in the time taken to complete the task using electronic prescribing of 62 seconds. This difference was maintained at 4 months (259 seconds *vs* 308 seconds, $P<0.01$). These results are shown in *Table 1*.

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There were four errors in the paper prescription group: three drug names or doses were illegible, and one drug did not have an administration time documented. Two errors were found in the electronic prescription group; both errors related to an incorrect start date for medications. Overall, there were 50% fewer errors when electronic prescribing were used (2.7% *vs* 5.3%). These results are shown in *Table 2*.

Discussion

Following the implementation of electronic prescribing the authors observed a fall both in prescribing errors and in the time taken to complete the prescribing task compared to using traditional paper drug cards. This study demonstrates that there is an initial 'learning curve' as junior doctors get used to the newly implemented system of electronic prescribing. Initially, the simple prescribing task took a longer average time to complete when compared to the paper task. However, by month two, this difference had reversed and the study participants took less time using the electronic system than the traditional paper drug card. This difference was maintained at the 4-month point in this study, suggesting a sustained benefit from introducing electronic prescribing.

Overall, this study supports the current consensus that electronic prescribing may be a possible way to reduce prescribing errors (Chertow et al, 2001). Donyai et al (2008) found a similar reduction of nearly 50% fewer medication errors following a change from paper to electronic prescribing. They also found a statistically significant reduction in rates of intervention by pharmacists during their study period, demonstrating a potential benefit to the pharmacy service as well. Shulman et al (2005) also noticed fewer overall medication errors, but did find that more 'minor' errors were detected by the electronic system. It is not clear that these errors would have translated to actual patient harm. It is worth noting that in all studies error rates were reduced but not eliminated. Clearly a system change alone is unlikely to achieve this; rather continued education of prescribers and regular audit of departmental practices should be encouraged in addition to the new electronic prescribing system.

It is also worth noting that different types of errors were seen for both methods of prescribing. In the paper group, the main errors involved poor legibility of drug names and doses. Two of these errors related to the prescription of cefuroxime, which may have lead to the patient receiving a delayed or incorrect dose of prophylactic antibiotic. The administration time for enoxaparin was also not completed in one case, again potentially leading to a missed or delayed dose as the nursing staff would have needed to clarify the prescription before the medication could be dispensed. This may be caused by a busy clinician quickly completing a drug card or by the overall legibility of the hand writing of the doctor completing the prescription. Electronic prescribing removes this issue of legibility. However, two new errors occurred that appeared unique to electronic prescribing. Two drug entries were made on a previous patient admission (one prescription for paracetamol and one for oramorph), and so would not appear on the current active list of medications. The nursing staff would therefore be unable to dispense these medications. The errors observed in the electronic prescribing task occurred during week one and month two, while no errors were seen by month four. It is therefore possible that the early errors were the result of an initial lack of familiarity with electronic prescribing, and the errors reduced as the participants gained experience with using the new system.

The authors' department has introduced a regular audit of inpatient prescriptions with the aim of further reducing errors on the new electronic system. In this audit, a representative sample of forty current inpatients is selected and their current prescription charts analysed for errors and accuracy. Identified errors are fed back to the individual prescriber and common or significant errors are discussed in a weekly email to all junior doctors from the lead pharmacist for education and training. The longer term goal of this audit is to further identify errors that persist despite regular training of prescribers, in the hope that such errors may eventually be addressed with changes to the design of the software itself.

Table 1. Mean time taken (in seconds) to complete the prescribing task

	Electronic	Paper	
Week 1	323 (37.1)	290 (34.2)	$P<0.01$
Month 2	261 (20.2)	306 (35.3)	$P<0.01$
Month 4	259 (17.5)	308 (34.8)	$P<0.01$

Figures in brackets are standard deviations from the mean

Table 2. Number of prescription errors at week 1, month 2 and month 4

	Electronic	Paper	
Week 1	2	1	$P=1$
Month 2	0	1	$P=1$
Month 4	0	2	$P=0.48$
Total	2 (2.7%)	4 (5.3%)	$P=0.68$

P value calculated using Fisher's exact test

Limitations

There are some potential limitations to this study. There are other electronic platforms available for electronic prescribing. While it would appear reasonable to assume that these results may be in principle applicable to these other systems, audit of these systems is clearly needed.

Although this study has demonstrated a prolonged benefit of electronic prescribing over the 4-month study period, it remains possible that the observed gains may regress over a longer period of time. Therefore, the authors would recommend that all institutions regularly audit their inpatient prescriptions, regardless of whether they are performed electronically or on paper. The

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relatively small sample size limits the conclusions that can be derived from this study. Further prospective work involving larger numbers of participants would be desirable.

Conclusions

This study has demonstrated that implementing electronic prescribing saves time and may reduce prescribing errors when compared to using traditional paper drug cards. However, the study has also shown that there is a learning curve for new doctors using electronic prescribing. Training and support is vital during this period in order to reduce prescribing errors. BJHM

Statement of contributions: All authors contributed equally to study conceptualization, data collection and article write up.

Conflict of interest: none.

LEARNING POINTS

- There is an initial learning curve to electronic prescribing. This must be taken into account when training new doctors to use these systems.
- While no system can be relied upon to completely eliminate prescribing errors, electronic prescribing may reduce errors relating to the clarity and legibility of prescriptions.
- Regular audit remains vital whenever a new system is introduced to fully assess its impact.

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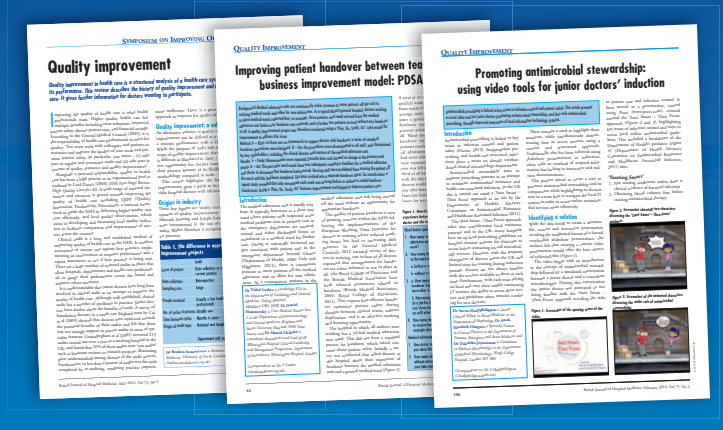
Quality improvement projects



BJHM is encouraging the publication and dissemination of findings from quality improvement projects undertaken in a hospital setting.

These should follow the Squire guidelines (http://squire-statement.org/assets/pdfs/SQUIRE_guidelines_table.pdf). The article should be no longer than 1800 words with up to two figures or tables and a maximum of 10 references. There should be no more than 4 authors and a statement of contribution for each author should accompany the submission. All submissions should also include ethics form A confirming exemption from ethics submission – this form should be obtained locally from the authors' local research and development or audit office.

Full details for submission are available from the BJHM website at www.magonlinelibrary.com/pb/assets/raw/qip_auth.pdf

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