

Minimising Prescribing Errors in Paediatrics - Clinical Audit

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ABSTRACT

Background: Thousands of medicines are prescribed in the UK every day without any problem, but medication errors occur with potential for serious impact on patient safety.

Objectives: This study had three core objectives: **1)** To measure the incidence and nature of prescribing errors in a children's teaching hospital. **2)** To explore the factors contributing to them. **3)** Use clinician feedback to design an intervention to help reduce errors according to local needs and resources.

Methods: A prospective review of in-patient medication charts, out-patient prescriptions and electronic discharge summaries was carried out for two consecutive weeks to identify the incidence and types of prescribing errors. An online survey and questionnaire was sent amongst doctors, pharmacists and nurses to explore the perceived causes of prescribing errors. Suggested strategies from healthcare professionals in the online survey and questionnaire were used to devise a paediatric prescribing pocket guide that was given out to all prescribers.

Results: Prescribing mean error rates varied between written in-patient drug charts (56.8%), out-patient prescriptions (46.8%), and electronic discharge medication orders (19.0%). The three most common types of errors were *unit dose missing* (29.4%), *valid period missing* (23.4%) and *administration times missing or incorrect* (9.4%). Potentially serious errors were less common (6.4%) and almost all were intercepted before they could affect patients. The three most frequently suggested causes of errors were *being busy/rushing* (73.9%), *being tired/not concentrating* (47.8%) and *not checking* (45.7%). Errors were mostly thought to arise *when starting a new post* (56.5%), *when on-call* (47.8%), and *at the end of a working day* (39.1%). After review, a majority of positive views were collected regarding the design, content and usefulness of the paediatric prescribing pocket guide. This intervention would be subject to review and audit in due course.

Conclusions: This study reinforces the message that prescribing errors are common in secondary care paediatrics and more needs to be done to reduce such errors impacting patient care. Prescribing errors are often multifactorial and efforts to reduce them need to address multiple causes to be of some benefit. Future research will investigate the impact of the devised educational intervention in reducing local prescribing errors and improving clinical practice.

Key Words: patient safety; safe prescribing; pharmacy; paediatrics

Introduction

Thousands of medicines are prescribed in the UK every day without any problem, but medication errors occur with potential for serious impact on patient safety. In 2007, the overall NHS expenditure on medicines in England was £11.2 billion with hospital prescriptions accounting for 25.7% of the total cost¹. During this year, over 72,000 incident reports involving medicines were received by the National Patient Safety Agency (NPSA) in England and Wales². Over 11,000 of these involved prescription errors. However, underreporting is common within the NHS, and therefore the true incidence of medication errors is unknown¹⁻². In children, the risk of medication errors is often exacerbated by the need of calculations to determine the dose. Prescribing errors are particularly important in this age group as they can lead to significant morbidity and mortality. A study suggested that the potential adverse drug reaction rate was 3 times higher than in adults³. A recent review found prescribing errors in 13.2% of paediatric medication orders⁴. Prescription error rates, however, vary widely according to published studies which might be due to differences in the definition of prescribing error and methods used to identify them.

Causes of prescribing errors

The work of Reason⁵ provides a good understanding of how errors are made in a healthcare setting. One of the greatest contributors to accidents is *human error*⁵. Reason⁵ distinguishes between active and latent errors. *Active failures* are the unsafe acts committed by people who are in direct contact with patients, and their effects are felt almost immediately. *Latent factors* are system/institution failures. *Error-producing factors* are conditions related to the task and the environment at the time when the error occurs; they do not directly cause errors, but errors are more likely to occur in their presence. Studies identify multiple factors contributing to errors and include active and latent errors⁶⁻⁷. Figure 1 highlights some of the reported causes of prescribing errors in the 'Swiss Cheese Model'. This model proposes that if errors are made at each stage, and are not identified, there is a chance that a serious error may occur.

Interventions for reducing prescribing errors

The Department of Health has suggested that action to reduce the risks of prescribing in paediatrics should focus on training and competence assessment in drug dose and infusion rate calculations in addition to improved availability of aides-memoire where validated computer software is not available⁸. Furthermore, the importance of having the child's age, weight and intended dose (mg/kg) on all prescriptions is of vital importance⁸. Currently three broad approaches have been used to reduce prescribing errors in the literature:

- 1) Provision of training to develop competence⁸⁻⁹
- 2) Expansion of professional roles, such as having pharmacists reviewing in-patient drug charts to identify and rectify errors⁸⁻⁹
- 3) Development of tools/equipment, such as electronic prescribing and computerised support systems, to improve prescribing processes (eg gentamicin dosing programs)⁸⁻⁹

Key objectives

With the majority of errors being potentially avoidable¹⁻⁸, it is therefore plausible that the impact of errors can be reduced through improvements in prescribing. This project aimed to:

- 1) Measure the incidence and nature of prescribing errors in our paediatric teaching hospital
- 2) Identify the perceived causes of and factors contributing to errors
- 3) Design an intervention to help reduce errors according to local needs and resources. Feedback on the developed resource would be obtained by questionnaire. Evaluation of improvements in prescribing a result of this intervention was beyond the scope of the study and will be the basis for follow-up review.

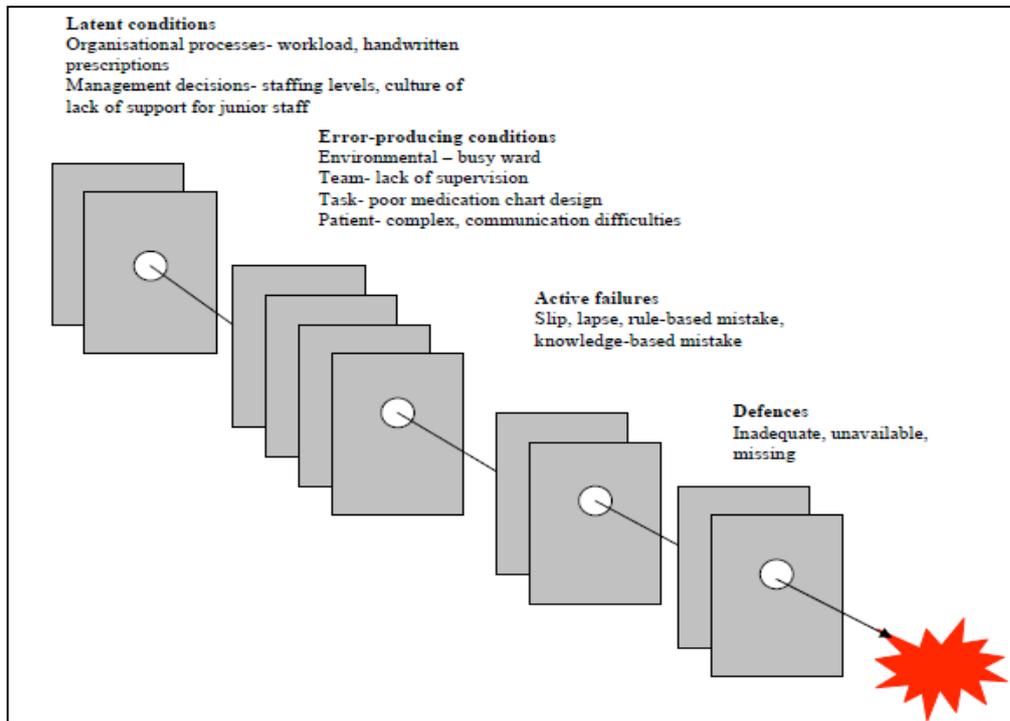


Figure 1. Reason's model of accident causation adapted from Dornan *et al*⁶.

Methods

This study was conducted at the Royal Alexandra Children's Hospital in Brighton. Ethical approval was not required as local clearance was granted.

1) Assessing the incidence and type of prescribing errors

A definition of a 'clinically meaningful prescribing error' proposed by Dean *et al*¹⁰ was adopted for this study.

"A clinically meaningful prescribing error occurs when, as a result of a prescribing decision or prescription writing process, there is an unintentional significant (1) reduction in the probability of treatment being timely and effective or (2) increase in the risk of harm when compared with generally accepted practice".

A prospective review of all in-patient drugs charts was conducted on a daily basis for two consecutive weeks in October 2011 from surgical and medical wards, and the high-dependency unit (HDU). Errors were also identified from electronic discharge summaries, also known as TTOs ("to take home") and handwritten out-patient prescriptions dispensed by pharmacy during this period. The first-author (a pharmacist) was the sole data collector. Ward pharmacists helped to identify prescribing errors during their ward visits. Data were collected about the type of error, medication, drug category according to systems of the body (e.g. cardiovascular and respiratory systems), grade of the prescriber (e.g. senior house officer, consultant, etc) and when the error was made. Prescribing errors were classified into three main error categories: legal requirements, drug details and safety issues.

2) Understanding the causes of prescribing errors

An online anonymous survey was designed to explore local causes of prescribing errors. All doctors, pharmacists and nurse prescribers working in the hospital at the time of the study were asked to participate in the survey.

Table 1. Prescribing error rates

	In-patients Medical ward	In-patients Surgical ward	In-patients HDU	Out- patients	TTOs
Total N ^o of prescriptions with at least one error	272	287	179	58	34
Total N ^o of prescriptions checked	461	510	332	124	179
Mean error rate	59.0%	56.3%	53.9%	46.8%	19.0%

TTOs ('to take home'): Electronic discharge summaries

HDU: High-dependency unit

Table 2. Type of prescribing errors detected

Error type	Errors N ^o	Errors %
LEGAL REQUIREMENTS		
Date missing	31	2.4
Illegible writing	4	0.3
Signature missing	34	2.6
DRUG DETAILS		
Administration times incorrect/missing	123	9.4
Brand prescribed	73	5.6
Drug prescription in wrong section	1	0.1
Frequency missing	40	3.0
Incorrect date	4	0.3
Incorrect device	1	0.1
Incorrect drug name	9	0.7
Incorrect drug spelling	15	1.1
Incorrect formulation	3	0.2
Incorrect frequency	18	1.4
Incorrect route	2	0.1
Incorrect strength	4	0.3
Multiple formulations	4	0.3
Multiple frequencies	1	0.1
Product/formulation/device not specified	17	1.3
Rate not specified	7	0.5
Route missing	7	0.5
Strength of suspension not specified	17	1.3
Strength/dose missing	25	1.9
Volume not specified	8	0.6
SAFETY ISSUES		
Allergy missing	38	2.9
Drug not prescribed but indicated	6	0.4
Inadequate drug choice	1	0.1
Incorrect duration	2	0.1
Incorrect rate	4	0.3
Incorrect unit dose	1	0.1
No indication	86	6.5
Overdose	21	1.6
Underdose	11	0.8
Unit dose missing	386	29.4
Valid period missing	307	23.4
Total	1311	100.0

A large number of medication orders contained more than one prescribing error, giving a total number of 1311 errors. As shown in table 2, the three most common types of errors were *unit dose missing* (29.4%), *valid period missing* (23.4%) and *administration times missing or incorrect* (9.4%). These errors were generated by not filling in drug charts correctly. Potentially serious errors were less common (6.4%). The three most common errors were *allergy missing*, *overdose* and *under-dose*. Almost all serious errors were intercepted by pharmacists and nurses before they could affect patients.

The three drug categories with the highest number of prescribing errors were analgesics (22.8%), antimicrobials (16.8%) and gastro-intestinal system drugs (15.5%). As shown in figure 3, when analysed according to the type of drug category, the distribution of the type of errors was significantly different ($p < 0.0001$; χ^2 test). The two most common errors for analgesics and gastro-intestinal drugs were *unit dose missing* and *valid period missing*. For antimicrobials, the most frequent error was *not writing an indication*.

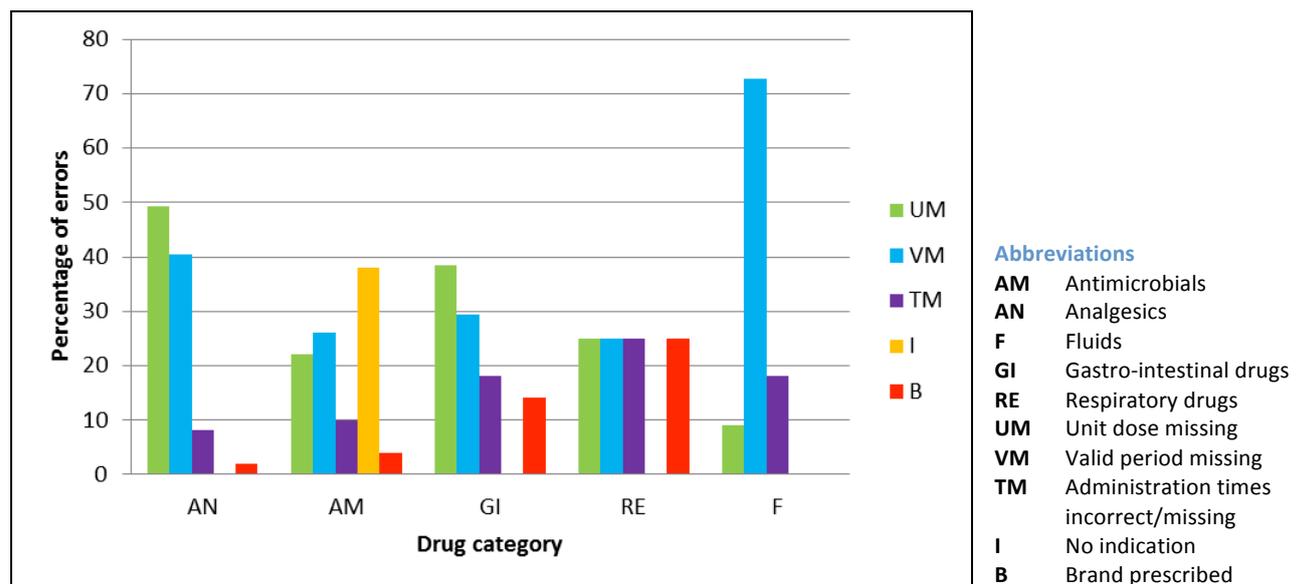


Figure 3. Type of prescribing errors by drug category.

All grade of doctors made prescribing errors, but senior house officers made the highest number of mistakes (29.2%). Prescribing errors were more likely on admission to hospital (52.6%).

2) Causes associated with prescribing errors

A total of 46 healthcare professionals participated in the online survey; most of participants were doctors. All respondents felt that prescribing errors should be shared with colleagues. Participants thought that the most common causes of errors were *being busy/rushing* (73.9%), *being tired/not concentrating* (47.8%), and *not checking* (45.7%) (figure 5). Errors were most thought to arise *when starting a new post* (56.5%), *when on-call* (47.8%), and *at the end of a working day* (39.1%).

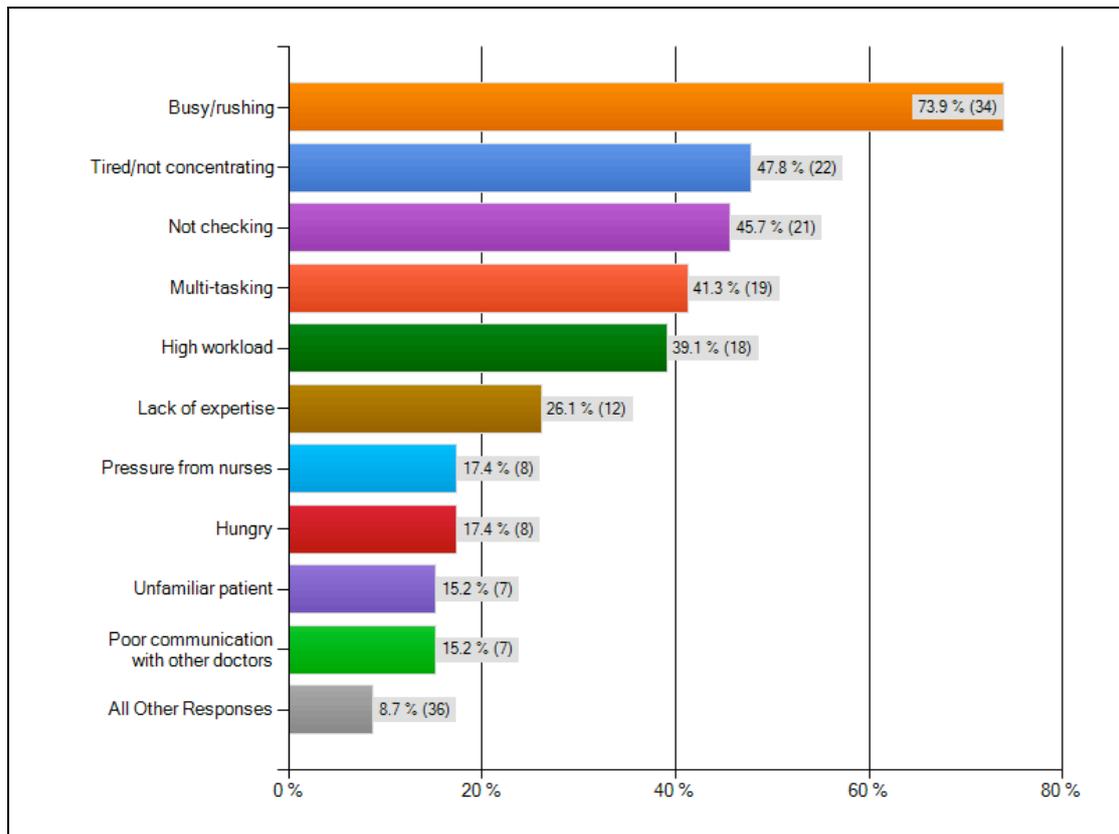


Figure 4. Clinician perceived causes of prescribing errors.

3) Paediatric prescribing pocket guide

All participants liked the layout and format of the pocket guide. The majority of respondents felt it was very easy (70%) or extremely easy to read (23.3%). All participants rated the guide as a useful intervention and felt that they were likely to use the prescribing guide in the future. This will be reviewed in a future study in conjunction with other paediatric prescribing education sessions.

Discussion

1) Incidence of prescribing errors

Our results are higher than previously reported prescribing error rates and this may be explained by variations in the definition of prescribing error and disparity of data collection methods used. The mean error rates for in-patients and out-patients were higher than for TTOs. This may be because TTOs were computer generated. Evidence suggests that electronic prescribing system can help improve safety and efficiency of prescribing¹¹.

Most serious errors were intercepted by pharmacists and nurses before they could affect patients. This finding, together with the fact that prescribing errors were more likely on admission to hospital, supports the presence of pharmacists on the wards as a safety net. Involvement of pharmacists in medicines reconciliation has been found to improve not only medicines reconciliation but also prevent medication errors¹². Analgesics, antimicrobials and gastrointestinal system drugs were the most frequently prescribed medications and this had important implications when designing an intervention to help reduce prescribing errors.

2) Causes of prescribing errors

Being busy and rushing whilst prescribing may be a consequence of other error-producing conditions, such as a high workload, lack of sufficient numbers of medical staff or working

without support from senior colleagues. Rushing can lead to *multitasking, feeling tired and not concentrating or not checking* prescriptions which may contain errors.

In hospital, junior doctors who have the least experience do most prescribing¹³⁻¹⁴. *Lack of expertise* was an important highlighted factor contributing to prescribing errors, which is also noted in the literature¹³⁻¹⁵. In addition, feeling under *pressure by nursing staff* and *assuming that someone else would check* their prescriptions and flag up any potential errors were other important factors reported. Nurses and pharmacists are regarded as experienced professionals able to point out errors and provide advice about prescribing. Although they are an important part of the safety net in prescribing, doctors may rely on them too much to pick up their errors.

Other reported problems related to the hierarchical culture in the medical profession were *poor communication between doctors* and *following orders* given to them. Being rushed and busy can lead to doctors' not double-checking information given to them by other members of staff or not questioning senior orders. Junior doctors should not work in isolation when prescribing; senior staff should provide adequate support and prompt junior prescribers to review prescriptions. As per previous research, our study suggests that interventions to improve prescribing are needed to improve training, control the environment and change organisational cultures.² It is likely that the best strategies are multifaceted, combining more than one intervention.²

3) Paediatric prescribing pocket guide

Trainee doctors had suggested that having a drug handbook would help minimise errors. Therefore, a paediatric prescribing pocket guide was designed including the most frequently prescribed medications. All participants rated the guide as a useful intervention and felt that they were likely to use it in the future. Our results were encouraging as the majority of respondents did not want to return the draft prescribing pocket guide at the end of the study. The team wishes to carry out a study looking at the rates of drug errors after this intervention in conjunction with paediatric prescribing educational sessions.

Limitations

There are several limitations to our study. Firstly, a large number of prescriptions contained more than one prescribing error. Therefore, it is not possible to compare prescription error rates by different prescribers. Secondly, we relied on one sole data collector in the identification of prescribing errors. Therefore, we cannot exclude the possibility of undetected medication errors, and hence underestimating the incidence of prescribing errors. Furthermore, there was no test of observer reliability. Thirdly, we selected a comprehensive definition of prescribing errors to be recorded, which differs from other studies and therefore inter-study comparisons may be challenging. Finally, the study did not assess the efficacy of the prescribing pocket guide. Re-auditing prescriptions after the introduction of the pursued intervention would have produced more robust results.

Conclusions

While recognising these limitations, we feel that we have been able to show just how common paediatric prescribing errors are and have good data on the perceived reasons for these errors. As multiple factors are contributing to prescribing errors, it is likely that the best strategies are multifaceted, combining more than one intervention. However, strategies should be prioritised according to local needs and resources. Future research should investigate the impact of the devised prescribing pocket guide in reducing local prescribing errors.

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