The clinical impact of pharmacist interventions in an emergency unit

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OVER the past 40 years there has been significant development in clinical pharmacy in UK hospitals and the Government has published a number of documents supporting the pharmacist’s clinical role.1–3 The recognition of the importance of the clinical pharmacist has assumed that the pharmaceutical care provided during patient hospital stays helps reduce risk and costs associated with errors and improves outcomes, particularly those associated with medication-related issues.4

However, although many hospital pharmacists undertake a significant amount of practice research that shows the impact of the clinical pharmacy service on the quality of patient care, much of it is unpublished and retained locally, therefore, the evidence in the UK continues to be relatively weak.

Prescribing errors pose a threat to hospital inpatients, leading to increased morbidity, mortality and an increased economic burden to health services.5 In the UK the rate of prescribing errors varies widely, ranging from 0.3 per cent to 39.1 per cent of medication orders written for hospital inpatients and from 1 per cent to 100 per cent of hospital admissions.6

Pharmacy research has shown that prescribing on admission to hospital often contains inaccuracies that can result in patient harm, with potentially serious effects and increased risk of illness.7–9 Medication errors range from those with serious consequences to those that have a relatively minor impact on the patient. Therefore, the severity as well as the frequency of errors needs to be assessed.

The Nuffield Trust, an independent health charity, recently published figures showing that admissions to hospitals have risen by almost 12 per cent over the past five years, with emergency admissions now making up 35 per cent of all hospital admissions in England.10 This situation has led to the redesign of the emergency portal in many hospitals as a single emergency assessment unit (EAU) for all medical and surgical patients.

At the Royal Wolverhampton Hospital NHS Trust there is a single EAU, but it excludes children, orthopaedics and head injuries.

Winter pressures and a continuous need for beds at the trust mean that our EAU has a fast turnover, with 75 per cent of patients being assessed, transferred to a ward or discharged home within 24 hours.

With the staff working under such constant pressure it is not surprising that there is an increased risk of prescribing errors.7 Thus the emergency assessment unit is one of the main areas within the hospital where pharmacists can contribute to patient care.11

The impact of pharmacist involvement on prescribing and management of prescribed medicines on admissions units has been shown in a number of studies.11–13 However, there has been criticism that although studies have attempted to measure the benefits of pharmacist input on the emergency assessment unit, they have been few and limited in scope, and conclusions were more often drawn in terms of pharmaceutical input than in benefit to patient care.6

This study sets out to evaluate how pharmacist involvement enhances patient care by reducing potential risk in relation to medication-related issues. The objectives of the study were to determine:

ABSTRACT

Aim

To evaluate the clinical impact, quantity and quality of pharmacist interventions in potential patients’ outcomes in a high risk area, in this case an emergency assessment unit. These interventions were related to identifying, preventing and resolving drug-related problems.

Design

A pharmaceutical care plan form was issued for every patient entering the study, where the investigator pharmacist would record any possible drug-related issue and the way a solution had been attempted. Each drug-related issue was blinded and assessed by two experienced healthcare professionals according to its potential to cause medical harm using the trust categorisation matrix.

Subjects and setting

190 patients admitted to the emergency assessment unit at New Cross hospital, a 700-bed general hospital in Wolverhampton, West Midlands, over a period of four months.

Main outcome measures

The assessment of drug-related issues by two healthcare professionals using the trust categorisation matrix.

Results

The pharmacist intervened in 159 of a total of 190 patients (83.7%) giving rise to a total of 360 interventions with the mean number of interventions being 1.9 per patient. According to the external assessor doctor there were 54 red alerts before intervention by the clinical pharmacist and all of them were converted to green after intervention by the pharmacist. According to the assessor doctor there were 134 red alerts before intervention by the pharmacist of which 126 (94%) were interventions with the mean number of interventions being 1.9 per patient. According to the assessor doctor there were 54 red alerts before intervention by the clinical pharmacist and all of them were converted to green after intervention by the pharmacist.

Conclusion

Pharmacist interventions were common and most of them related to preventable prescribing errors. The intervention of the clinical pharmacist significantly improved the predicted patient outcome by reducing the risk of harm in most cases.
The number of pharmacist interventions made in a representative sample of patients seen in the EAU
The number of pharmacist interventions per hospital admission
The main therapeutic groups of medicines requiring pharmacist interventions

Method
On a normal day at the trust, the admitting doctor sees patients who arrive at the EAU after referral by the walk-in centre, the accident and emergency department or a GP. The admitting doctor, after the initial assessment, takes a drug history from the patient normally based on either patient recall or the medicines that the patient has brought in. It is rare for GPs to write a referral letter that includes medication details and when they do, these are often inaccurate.

The admitting doctor then writes a drug chart for each patient and, after this, the pharmacist examines the chart to ensure the medicines it outlines are safe, appropriate and cost-effective and to initiate the supply of any medicines not stocked on the ward.

In order to evaluate the quantity, quality and clinical impact of pharmacist interventions, a pharmaceutical care plan form was developed and completed for each patient entering the study, whether or not the pharmacist had intervened (see Appendix I-IA). This plan contained all relevant clinical information and was not recorded by the pharmacist. Each medication issue was risk rated according to its potential to cause medical harm using the trust categorisation matrix, which assesses the likelihood of recurrence and the potential consequences if it was not corrected (Appendix II). This risk rating was carried out before and after the pharmacist had intervened.

The trust categorisation matrix is a validated method adapted from the one used by the National Patient Safety Agency to assess critical incidents. It produces a colour-coded, traffic-light alert system for each issue depending on the risk of harm.

The colours resulting from the assessment range from green (low), yellow (moderate), amber (high) or red (serious). Using this method the investigator was able to compare the risks for each medicine-related issue before and after intervention.

A problem coding form with a list of possible issues with potential to cause medical harm was developed to facilitate the analysis of the types of interventions (Appendix III).

To prevent operator bias the lead consultant for the unit and a senior pharmacist with a high level of clinical experience assessed the pharmacist’s interventions independently. The assessing pharmacist and doctor undertook their assessments using the same risk categorisation matrix independently and each was blinded to the other’s assessment.

The impact of pharmacist intervention was assessed by calculating the intervention rate, or number of interventions made per individual hospital admission, and whether the assessors considered the intervention to be necessary.

If the assessors considered the intervention to be unnecessary it was recorded as having no potential for medical impact.

Minor interventions (such as prescribing medicines by brand rather than generic name), failure to adhere to standards (such as prescribing guidelines) or clarification of additional instructions (such as before meals) were not recorded by the pharmacist.

Inclusion criteria
Any medical or surgical patient admitted to the emergency assessment unit could be recruited for the study provided he or she had been seen post-take by a consultant so that the consultant had an opportunity to review the admission notes (usually from the A&E department, where medicines reconciliation is not a priority) and could amend or clarify drug charts if necessary before they were added to the study.

Exclusion criteria
No patient was excluded from the study other than those not already seen post-take by a consultant. Ethical approval was not needed because patients and staff were not subjected to any additional action taken or proposed.

Each medication issue was risk rated accordingly. Inaccurate or incorrect taking of a patient’s drug history was the most common reason for intervention by the pharmacist. Of these 62 related to unintentional omission, with 34 considered to have a major potential for medical harm (amber and red alerts). These concerned the omission of antidepressants, benzodiazepines, antibiotics (including muscle relaxants in patients with multiple sclerosis, and cardiac drugs.

A further 43 related to wrong dose, of which, seven were graded as having a major potential for medical harm. One example was the prescribing of phenobarbital at a strength 100 times higher than the patient’s usual dose; 16 related to incomplete prescriptions, of which two were rated as having major potential for medical harm and involved no dose for enoxaparin in patients diagnosed with acute coronary syndrome.

Allergies
In 62 instances it was thought there was a major potential for medical harm if allergies were left unresolved.

Thromboprophylaxis
All medication issues related to thromboprophylaxis were considered to have major potential for medical harm if the pharmacist had not intervened.

Discrepancy
There were discrepancies between what was written on the patient record and what was prescribed on the treatment chart. Four discrepancies were considered to have major potential for medical harm. They included failure to initiate nitrates in a patient who came with unstable angina and failure to stop methionine in a patient admitted with acute left ventricular failure.

Side effects
Four side effect issues were considered to have major potential for medical harm and were the cause of admission. Examples included the continuation of two
unjustified duration of treatment

sleeping tablets.

antihypertensive agents, antidepressants and

major potential for medical harm, an example

polypharmacy were considered to have a

polypharmacy

collapse and low pulse.

of atenolol in an elderly patient admitted with

bleeding and the continuation of a high dose

non-steroidal anti-inflammatory medicines in

a patient admitted with gastrointestinal

bleeding and the continuation of a high dose of

atenolol in an elderly patient admitted with

collapse and low pulse.

Polypharmacy Four instances of polypharmacy were considered to have a

major potential for medical harm, an example

being the continuation of treatment on

admission of an elderly patient after a fall who

was taking 23 tablets a day, including

antihypertensive agents, antidepressants and

sleeping tablets.

Unjustified duration of treatment Long courses of antibiotics were inappropriate in

seven instances and were stopped as a result of

pharmacist action, but were rated as having

little potential for medical harm.

Interactions All drug interactions were

considered to have a major potential for

medical harm. An example was the

prescribing of clarithromycin to an elderly

patient on aminophylline without previously

halving the dose or determining levels, or the

prescribing of clarithromycin without taking renal

function into consideration.

Discussion

The pharmacist made 360 interventions on a

total of 190 admissions. In 330 cases (91.7 per

cent) the pharmacist’s intervention was

accepted. In 30, the recommendation was not

accepted or was not productive. In most cases

the risk alert was reduced after intervention by

the pharmacist; in 91 per cent when assessed by

the external pharmacist and in 95 per cent

when assessed by the doctor. In no case was

the risk of harm increased after pharmacist

intervention.

There was agreement on coding in 54.2 per

cent of interventions; in general the assessing

pharmacist rated the interventions as having

greater impact on potential patient outcome

than the doctor. There

have been some similar

studies in the literature

that have shown that

different healthcare

professionals’

assessment of the impact

of medication errors

differs and often

depends on personal

experiences.13,14

In this study there was

only one member of
each discipline and

therefore it is difficult to

know if the differences

were due to individual

assessors or to their

clinical profession. Perhaps this could be

investigated further, with

two members of each

discipline assessing each intervention instead

of one. The agreement on coding could

therefore be explored both intra- and inter-

professionally.

Some 83.7 per cent of patients in the study

were found to have at least one drug-related

issue that needed pharmacist intervention. Although

this figure may look higher than the figures

quoted by other workers, it is important to

bear in mind that in this study the

denominator is hospital admissions while most

of the studies done in the UK, such as the one

carried out by Dean et al are based on the

total number of medicine orders written and,

therefore, their figures will appear smaller.8

This study also differs from many other

published studies in that it attempted to

measure the potential medical impact of the

pharmacist’s interventions with regard to

drug- and pharmaceutical care-related issues

and not solely those generated by prescribing

errors.

In this study the pharmacist interventions

relating to prescribing errors accounted for

91.1 per cent of the total, whereas in another

recently published study only 52 per cent of

pharmacist interventions related to a

prescribing error.13 This difference could be

because the latter study was conducted in a

28-bed general surgery ward, whereas this

study was conducted in an emergency

assessment unit.

Thus the patient population in this study

was different, being primarily medical patients

(177 medical versus 13 surgical) who usually

present with multiple co-morbidities and

would probably be on more regular and varied

medication than the surgical patients.

Furthermore, the turnover of patients in the

EAU is faster than in a surgical ward thus

increasing the risk of prescribing errors.

Another published study carried out in a

similar environment to ours identified 740

prescribing errors in a total of 235 acutely ill

medical patients with the mean number of

prescribing errors being 3.06 per patient,13 which is

higher than our intervention rate of 1.9 per patient.

However, the proportion of pharmacist

interventions relating to prescribing errors in

TABLE 1: BEFORE INTERVENTION

Risk rating of medication issue before pharmacist intervention

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Red</th>
<th>Yellow</th>
<th>Amber</th>
<th>Green</th>
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</thead>
<tbody>
<tr>
<td>Consultant</td>
<td>54</td>
<td>124</td>
<td>146</td>
<td>36</td>
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<tr>
<td>External pharmacist</td>
<td>134</td>
<td>177</td>
<td>46</td>
<td>3</td>
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</table>

TABLE 2: AFTER INTERVENTION

Risk rating of medication issue after pharmacist intervention

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Red</th>
<th>Amber</th>
<th>Yellow</th>
<th>Green</th>
</tr>
</thead>
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<tr>
<td>Consultant</td>
<td>0</td>
<td>4</td>
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<tr>
<td>External pharmacist</td>
<td>7</td>
<td>13</td>
<td>3</td>
<td>337</td>
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TABLE 3: TYPES OF INTERVENTIONS

<table>
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<tr>
<th>Type of Intervention</th>
<th>Number</th>
<th>Percentage</th>
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<tbody>
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<td>Omission</td>
<td>82</td>
<td>22.8</td>
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<tr>
<td>No need for drug</td>
<td>15</td>
<td>4.2</td>
</tr>
<tr>
<td>Abx stopped</td>
<td>7</td>
<td>1.9</td>
</tr>
<tr>
<td>Duration</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>Wrong dose</td>
<td>43</td>
<td>11.9</td>
</tr>
<tr>
<td>Side effect</td>
<td>7</td>
<td>1.9</td>
</tr>
<tr>
<td>Interaction</td>
<td>9</td>
<td>2.5</td>
</tr>
<tr>
<td>Discrepancies</td>
<td>19</td>
<td>5.3</td>
</tr>
<tr>
<td>Incomplete</td>
<td>16</td>
<td>4.4</td>
</tr>
<tr>
<td>Allergies</td>
<td>65</td>
<td>18</td>
</tr>
<tr>
<td>Duplication</td>
<td>5</td>
<td>1.4</td>
</tr>
<tr>
<td>Route change</td>
<td>3</td>
<td>0.8</td>
</tr>
<tr>
<td>Thromboprophly</td>
<td>25</td>
<td>6.9</td>
</tr>
<tr>
<td>Other</td>
<td>59</td>
<td>16.4</td>
</tr>
</tbody>
</table>

Percentages do not total 100 due to rounding.
study (91.1 per cent) is similar to that in a published study in a psychiatric hospital (93.4 per cent). Although the setting where the study was conducted was different, the definitions of prescribing error used by the authors were the same as ours, meaning that the potential errors would have been measured in the same way.

The results from this study showed that most of the care issues identified related to prescribing errors originating in the process of writing the prescription rather than in the prescribing decision: 228 versus 100 (69.5 per cent versus 30.5 per cent). These results are similar to those reported in other studies. In this study, the highest error rate related to poor medication history-taking and prescribing. The medication history taken by the doctor during the initial clerking was compared with that taken by the pharmacist on review.

Some 48.4 per cent of patients admitted to the EAU had at least one error in their medication histories, giving an average of 1.5 errors per patient. These figures are lower than in other studies, such as the one carried out by McFadzean et al., where 65 per cent of the patients admitted to the admission unit had errors in their drug history.

However, in the McFadzean study the definition of a prescribing error was different from ours. It included actions such as the use of lower case letters when writing the prescription, abbreviations of micrograms or units and omission of the prescriber’s signature as prescribing errors, whereas we did not record these as errors.

Inaccuracies were more often seen with certain medicines: inhalers were most likely to be omitted or incorrectly prescribed (16.3 per cent), calcium supplements (9.2 per cent), heparin for thromboprophylaxis, which was the next most frequent error type. This finding concurs with the analysis of all the Royal Wolverhampton Hospital NHS Trust pharmacists’ interventions where medicines reconciliation accounted for 910 out of a total of 2,010 pharmacist interventions in the quarter.

The study agrees with others in that pharmacists have been shown to be better than doctors in taking accurate drug histories and, although it could be argued that patients may give more accurate information once they are questioned for the second time after the initial assessment by the doctor, pharmacists may still be the ideal people to undertake this task as they have a broad pharmacological knowledge, and this can help when discussing drug treatment and over-the-counter medicines with patients.

This study showed that in many cases (37 per cent) obtaining an accurate drug history was due to using at least two sources of information rather than one. Unfortunately, doctors in the EAU work under pressure and may not always take the time to look for a second source of information. The results of this study would support the case for an independent pharmacist pharmacist as an improvement in patient safety has been shown and an approach would free doctors’ time for other tasks.

As well as errors in medication histories this study shows that a limited number of errors involving certain drugs occur repeatedly, such as the interaction between statins and macrolides. Targeted educational measures, such as monthly prescribers newsletters, have been implemented in some hospitals with success, and in our hospital feedback to groups of prescribers on common errors is being introduced.

After this study was completed, and in line with the medicines reconciliation guidelines (from the National Institute for Health and Care Excellence and the NPSA), the Royal Wolverhampton Hospital NHS Trust developed a new treatment chart with an additional box for pharmacy documentation such as medication history so that accurate information is transferred from one ward to another. An additional box for the recording of thromboprophylaxis only has also been added. In addition to this, the pharmacist writes the medication history, together with any changes, omissions or discrepancies.

The trust went live with electronic prescribing early in 2012. A recent study showed that electronic prescribing improved the quality of prescribing by reducing both prescribing errors and the need for pharmacists’ clinical interventions. However, some new types of errors were introduced, such as selection of the incorrect product dose or frequency from a menu, and inappropriate use or selection of default doses. It would be interesting to repeat this study once electronic prescribing is fully established in the trust and to compare the number of interventions made before and after, but this is outside the scope of this study.

Limitations Our study has a number of limitations: first, it was conducted only in the EAU at one teaching hospital. However, studies carried out in other hospitals in the same kind of setting have produced similar results.

Secondly, the prescribing error rate may be underestimated, since it is impossible to be sure that the pharmacist identified all of them. Conversely, the pharmacist in the EAU (the author) was aware of the study and may have acted differently from normal (the Hawthorne effect). However, the time spent by the pharmacist on the unit was no longer than usual and interventions were accepted in 91.7 per cent of the cases, indicating they were not unreasonable.

Finally, the consultant assessor was aware of the study and was actively involved in the unit, and this could have introduced bias.

Conclusions The pharmacist in the EAU routinely made interventions on prescriptions over the course of the study and most of them related to preventable prescribing errors. A high proportion of interventions related to errors in medication histories and further work to improve medication history-taking on admission is needed.

The intervention of the clinical pharmacist significantly improved the predicted patient outcome by reducing the risk of harm in most cases.

There have been few studies that have attempted to assess the clinical impact of pharmacist interventions, so further work is needed in this area to build on the findings here.

Within the Royal Wolverhampton Hospital NHS Trust, a routine monitoring and feedback system to groups of doctors has been introduced as a learning tool, by highlighting common errors. The impact of this approach warrants further investigation.

References


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14 Dean BS, Barber ND. A validated, reliable method of scoring the severity of medication errors, American Journal of Health-System Pharmacy 1999;56:57–62.


18 Prescribing test to be introduced for new doctors. Pharmaceutical Journal 2009;283:672.


20 Last quarterly medicines management report Q1 2011/12. The Royal Wolverhampton Hospital NHS Trust.

## Appendix I: Pharmaceutical care plan form

<table>
<thead>
<tr>
<th>Pharmaceutical care plan form</th>
<th>Time/day of admission</th>
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<tbody>
<tr>
<td>Patient identity number:</td>
<td>Time/day seen by pharmacist:</td>
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<tr>
<td>Date of birth:</td>
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<tr>
<td>Sex:</td>
<td>Hospital number:</td>
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</tbody>
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Drug history
From: GP________ patient_______ POD________ care home_______ other (please specify)_______

<table>
<thead>
<tr>
<th>Name/dose/frequency</th>
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PC: Diagnosis: Labs:

OBS:
Appendix IA: Pharmaceutical care plan form (reverse side)

<table>
<thead>
<tr>
<th>IN</th>
<th>Issues</th>
<th>Likelihood</th>
<th>Conseq (potential harm)</th>
<th>Action taken by pharmacist</th>
<th>Likelihood</th>
<th>Conseq (potential harm)</th>
<th>Alert</th>
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Appendix II: Risk categorisation matrix

Likelihood scores:
E Rare: do not think that this will happen again
D Unlikely: not expected to happen again but it is possible
C Possible: may recur occasionally
B Likely: will probably recur but it is not a persistent issue
A Almost certain: will undoubtedly occur

Consequence scores (potential for medical harm):
1 None: no harm
2 Minor: low harm
3 Appreciable: moderate harm
4 Major: severe harm
5 Catastrophic: death or permanent injury

Royal Wolverhampton Hospital NHS Trust categorization matrix

Appendix III: Type of problem coding

Omission
No need for the drug therapy/polypharmacy
Antibiotic course stopped
Treatment duration
Wrong dose
Side effect
Compliance
Drug Interaction
Discrepancies
Incomplete (no dose, frequency, route, strength)
Allergies not recorded
Duplication
Route change
Thromboprophylaxis
Other