An observational study of medication administration errors in old-age psychiatric inpatients

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Abstract

Background. Relatively little is known about medication administration errors in mental health settings.

Objective. To investigate the frequency and nature of medication administration errors in old-age psychiatry. To assess the acceptability of the observational technique to nurse participants.

Method. Cross-sectional study technique using (i) direct observation, (ii) medication chart review and (iii) incident reports.

Setting. Two elderly long-stay wards in an independent UK psychiatric hospital.

Participants. Nine nurses administering medication at routine medication rounds.

Main outcome measures. Frequency, type and severity of directly observed medication administration errors compared with errors detected by retrospective chart review and incident reports.

Results. Using direct observation 369 errors in 1423 opportunities for errors (25.9%) were detected vs. chart review detected 148 errors and incident reports none. Most errors were of doubtful or minor severity. The pharmacist intervened on four occasions to prevent an error causing patient harm. The commonest errors observed were unauthorized tablet crushing or capsule opening (111/369, 30.1%), omission without a valid reason (100/369, 27.1%) and failure to record administration (87/369, 23.6%). Among the nurses observed, the error rate varied widely from no errors to one error in every two doses administered. Of the seven nurses who completed the post-observation questionnaire, all said they would be willing to be observed again.

Conclusion. Medication administration errors are common and mostly minor. Direct observation is a useful, sensitive method for detecting medication administration errors in psychiatry and detects many more errors than chart review or incident reports. The technique appeared to be acceptable to most of the nursing staff that were observed.

Keywords: administration, adverse drug events, elderly, medication errors, mental health, observation, psychiatry

Medication errors (prescribing, transcribing, dispensing and administration errors) are an important cause of patient morbidity and mortality [1]. Medication administration errors are a common sub-type of medication errors and accounted for 34% of errors in one large USA study conducted in medical and surgical units [2]. Observational studies in general hospitals have yielded error rates varying between 3.5 and 27% of doses [3–8]. Direct observation detects medication administration errors at a much higher rate than chart review or incident report review [9]. The observational method has been demonstrated to be valid and reliable [10].

Less research on medication errors has been conducted in mental health settings, and little is known about the incidence of medication administration errors in psychiatry [11]. Medication administration to psychiatric inpatients presents different challenges from that to patients in general hospitals. Psychiatric settings might be expected to pose fewer risks to patients, as parenteral drug administration is uncommon and mainly limited to depot antipsychotics used to treat schizophrenia, intravenous vitamin B for patients with alcohol dependence and intra-muscular antipsychotics and benzodiazepines for rapid tranquillization. Intravenous fluids and blood products are not administered. On the other hand, many psychiatric patients are extremely vulnerable. They may lack mental capacity to give informed consent to medication, may be non-compliant and even violent. The elderly mentally ill are particularly vulnerable as they may be confused, resist

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medication administration, be physically frail and require complex medication regimes.

Review of the literature (by searching Medline, PsycINFO, CINAHL, BNID and AMED from 1966 onwards) revealed only a handful of studies on medication administration errors in psychiatry, with most based on retrospective chart review or official incident reports [12–14]. We were unable to identify any reports of observational studies in psychiatry, apart from a very small study conducted in a learning disability group home [15], a study of tablet crushing in residential homes for the elderly [16] and an observational study of medication administration to psychiatric inpatients but this did not report on the frequency of errors [17]. Concerning studies of older persons conducted in general hospitals, we identified an observational study partly conducted in a geriatric unit [6] and another conducted in an elderly female ward with acute admissions [4].

The aims of the current study were to use the observational technique in two long-stay old-age psychiatry wards to determine the frequency and nature of medication administration errors, to study factors associated with errors and to compare observed errors with those detected by chart review and incident report. We also wanted to assess if the observational technique was acceptable to participating nurses.

Methods

Study setting

The study was approved by the Local Research Ethics Committee. It was conducted at St. Andrew's Hospital, Northampton, a 450-bedded independent charitable hospital providing psychiatric care for patients with a wide range of mental health problems. We studied medication administration on two long-stay wards for elderly mentally ill patients, a 13-bedded unit for patients with dementia and challenging behaviour (Ward A) and a 21-bedded unit for frail elderly patients with dementia (some patients also had schizophrenia) offering nursing home type care (Ward B). We carried out a semi-structured interview with each patient's consultant psychiatrist to obtain an ICD-10 clinical diagnosis [18] and details of the patient's disabilities.

Prescriptions are written on a paper medication chart. It is hospital policy that each time a medication is administered the administering nurse signs the medication chart. If the nurse is not able to administer the medication, they should record an omission code e.g. 'A' if the patient is absent, 'R' if the patient refuses the medication. Medication administration on Wards A and B is undertaken by one nurse, with the assistance of 'runners' who may be nurses or healthcare assistants. The runners take medication to patients who are unable to walk to the medicines trolley. Runners are required to ensure that medication is taken by the patient, i.e. tablets are swallowed.

Details of how participants were recruited

Nursing staff were given information about the aims of the study and invited to participate. Participants were required to give written consent. At the end of the study, participants were invited to complete a questionnaire on how acceptable or otherwise they had found the experience of being observed.

Definition and classification of medication administration errors

We defined a medication administration error as ‘a deviation from a prescriber’s valid prescription or the hospital’s policy in relation to drug administration, including failure to correctly record the administration of a medication’. This definition was derived and adapted from the literature [7, 19, 20] and is one that we have used previously [14]. Omission of a drug for valid clinical reason was not counted as an administration error, provided the nurse recorded an appropriate code on the medication chart indicating that the drug was not given.

Administration errors were categorized using the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) taxonomy [21]. Errors were categorized at consensus meetings attended by all three researchers.

Severity of errors

Error severity was rated on the following five-point scale that two of the researchers had previously used in medication error research [22]:

Grade 1—errors or omissions of doubtful or negligible importance.
Grade 2—errors or omissions likely to result in minor adverse effects or worsening condition.
Grade 3—errors or omissions likely to result in serious effects or relapse.
Grade 4—errors or omissions likely to result in fatality.
Grade X—unratable (due to lack of clinical and other information).

Error severity was agreed by the three researchers at consensus meetings.

Method of observing medication administration

J.S. (Head Pharmacist) observed medication administration of regular and as required (prn) drugs given at each of the four routine daily drug rounds. Administration of ‘prn’ drugs and depot preparations given at other times of the day or night was not observed. Details of medications that were administered were recorded on a standard pro-forma data collection sheet. It was agreed beforehand that if the observer witnessed a ‘near miss’ incident whereby an error was about to be made that was likely to cause patient harm, then she would intervene prior to the medication being administered. For the purposes of the study, such ‘near miss’ events were counted as errors. After the medication round, J.S. examined each patient’s medication chart to check that the correct medication had been
given, to see if any medication had been omitted in error and if any clerical errors had been made.

**Administration errors detected by chart review**

A second pharmacist (see Acknowledgement) blind to the results of the observational study carried out a retrospective chart review of the recording of medication administration for those drug rounds that were included in the observational study. She recorded the number and type of errors that she was able to detect by chart review.

**Administration errors reported using the Hospital’s medication error reporting system**

The Hospital policy is that all medication errors should be reported on an incident form that is sent to and collated by the responsible senior nurse manager. We requested details of the number of administration errors reported for Wards A and B for the 3 months before and the 3 months after the study as well as for the study period.

**Statistical analysis**

Data were analysed using SPSS version 14.0 [23]. The \( \chi^2 \) test was used to compare differences between variables and whether or not an error had occurred.

**Results**

**Patient details**

Medication administration to 32 patients was observed. Of these, 20 (63%) had organic brain disease and 12 (38%) schizophrenia. Nineteen (59%) patients had more than one diagnosis. Twenty-one (66%) were unable to give informed consent with respect to medication. Thirteen (41%) had swallowing difficulties, 13 (41%) sometimes refused or spat out medication and 15 (47%) had a history of aggression towards nursing staff.

**Participants and details of medication rounds observed**

Nine out of 12 (75%) nurses approached consented to take part in the study. Observations were conducted over a 2-week period in March 2006 on Ward A and in June and July 2006 on the Ward B. On Ward A five medication rounds at 08.00, 12.00, 18.00 and 22.00 h were observed, giving a total of 20 rounds observed, whereas on Ward B, four rounds each at these times were observed, giving a total of 16 rounds.

**Details of medication administered**

A total of 1423 opportunities for error were studied (1313 doses were administered, 10 doses were not/could not be administered for valid clinical reasons and there were 100 omission errors). Most doses were oral (1306; 91.8%). The rest were: topical 59 (4.1%), inhaled 47 (3.3%), ophthalmic 9 (0.6%) and subcutaneous 2 (0.1%).

**Details of error numbers, types and severity detected by direct observation**

A total of 369 errors were made out of 1423 doses (25.9%). For 20 (1.4%) doses, two errors were made. The types of error observed are given in Table 1. The commonest error types encountered were crushing tablets without the authorization of the prescriber (28.7%), omission without a valid clinical reason (27.1%), failing to sign the medication chart to record that a drug had been administered (23.6%) and wrong quantity (8.7%). Other types of error were comparatively rare. Concerning the 111 instances where tablets were crushed or capsules opened without authorization, this was specifically contra-indicated by the drugs’ manufacturers in seven instances (esomeprazole three doses, digoxin two doses, aminophylline modified release one dose and lansoprazole orodispersible one dose).

<table>
<thead>
<tr>
<th>Error type</th>
<th>Frequency</th>
<th>Percent of total number of errors</th>
<th>Percent of total number of doses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crushing tablets without authorization</td>
<td>106</td>
<td>28.7</td>
<td>7.4</td>
</tr>
<tr>
<td>Omission without valid reason</td>
<td>100</td>
<td>27.1</td>
<td>7.0</td>
</tr>
<tr>
<td>Not signing for an administered medication</td>
<td>87</td>
<td>23.6</td>
<td>6.1</td>
</tr>
<tr>
<td>Wrong quantity</td>
<td>32</td>
<td>8.7</td>
<td>2.2</td>
</tr>
<tr>
<td>Wrong formulation</td>
<td>14</td>
<td>3.8</td>
<td>1.0</td>
</tr>
<tr>
<td>Administration of a prescribing error</td>
<td>9</td>
<td>2.4</td>
<td>0.6</td>
</tr>
<tr>
<td>Wrong time</td>
<td>7</td>
<td>1.9</td>
<td>0.5</td>
</tr>
<tr>
<td>Wrong drug</td>
<td>6</td>
<td>1.6</td>
<td>0.4</td>
</tr>
<tr>
<td>Opening capsules without authorization</td>
<td>5</td>
<td>1.4</td>
<td>0.4</td>
</tr>
<tr>
<td>Mixing drug with food without authorization</td>
<td>2</td>
<td>0.5</td>
<td>0.1</td>
</tr>
<tr>
<td>Unauthorized extra dose</td>
<td>1</td>
<td>0.3</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>369</td>
<td>100</td>
<td>25.9</td>
</tr>
</tbody>
</table>
The severity ratings of the errors detected are given in Table 2. More than two-thirds of errors were of doubtful or negligible importance (Grade 1). Only one error was rated as likely to result in serious effects or relapse. For nearly a quarter of errors, potential severity could not be rated. This was mainly because a nurse had been observed to have correctly administered a dose of medication but had then failed to sign the medication chart. It was therefore possible, but not certain, that another nurse might then have administered a duplicate dose. The pharmacist observer intervened on four occasions to prevent patient harm (two wrong drug errors, one wrong dose error and one omission error).

Analysis of the more severe errors (Grade 2 and 3) showed the commonest error types were omission (N = 13) (e.g. insulin, sodium valproate and carbamazepine), wrong drug (N = 6) (e.g. propranolol given instead of trazodone, quetiapine given instead of olanzapine) and unauthorized crushing (N = 5) (e.g. aminophylline modified-release).

### Factors associated with errors

Proportionally fewer errors were made at the 22.00 h medication round than at other rounds (08.00 h 215 errors out of 694 doses, 31.0%; 12.00 h 50/157, 31.8%; 18.00 h 81/345, 23.5%; 22.00 h 23/227, 10.1%, P < 0.0001).

A greater proportion of errors involved non-psychotropic drugs (non-psychotropic errors 258 out of 893 doses (28.9%) vs. psychotropics 111 errors out of 530 doses (20.9%), P = 0.001). A greater proportion of errors involved drugs administered by non-oral routes (non-oral routes, 70 errors in 118 doses (59.3%) vs. oral route, 299 errors in 1305 doses (22.9%), P < 0.0001). Of the 59 doses of topical preparations prescribed, there were 58 errors. In 57 instances, the error involved was omission of a topical preparation without a valid clinical reason. When topical creams and lotions were excluded from the analysis, the difference between errors involving the oral and non-oral routes disappeared.

Errors were more often associated with patients with a diagnosis of organic brain disease than those with functional mental illnesses (253/829, 30.5% vs. 116/594, 19.5%, P < 0.0001) and with those who lacked capacity to consent to medication administration than those with capacity (272/913, 29.8% vs. 97/510, 19.0%, P < 0.0001). Medication errors were also more often associated with patients with swallowing difficulties than those without (179/480, 37.3% vs. 190/943, 20.1%, P < 0.0001) and with those who were known to regularly spit out or refuse medication than with those who did not (169/540, 31.3% vs. 200/883, 22.7%, P < 0.0001). After excluding those doses of medication where tablets were crushed or capsules opened, errors were still more often associated with patients with swallowing difficulties (110/377, 29.2% vs. 117/780, 15%, P < 0.0001) but not with the other patient characteristics.

Among the nurses observed, the error ratio (number of errors made per total doses observed) varied widely from no errors made to one error in every 2.0 doses administered (P < 0.0001). The median error rate was one error in every 6.4 doses administered.

### Errors detected by chart review

The independent pharmacist who reviewed the medication charts detected 148 administration errors. The types of errors detected were as follows: 133 omissions, 9 unauthorized extra doses, 5 wrong times and 1 administration of a discontinued item. All errors detected by chart review were detected by direct observation but of the 133 omissions detected by chart review, direct observation demonstrated...
that 33 of the 133 omissions were in fact clerical errors (the nurse had correctly administered the medication but then failed to record administration on the medication chart).

Errors reported using the Hospital's medication error reporting system

During the period of the observational study no administration errors on Wards A or B were reported using the Hospital's medication error reporting system. No errors were reported in the 3 months before and only one error in the 3 months after the study.

Acceptability of the observational technique reported by participants

Seven (78%) of the nine participants completed the post-observation questionnaire. Five out of seven (71%) thought the observational procedure was well explained prior to commencement. None rated the experience of being observed as unpleasant. Two (29%) reported that they felt being observed made it more likely for them to make an error. All seven said they would be willing to be observed while administering medication in the future.

Discussion

In this observational study of medication administration to elderly long-stay psychiatric inpatients, errors were very common, occurring in one in four doses. Most errors were not serious and no patient suffered observable harm as a result of errors, although the pharmacist intervened on four occasions to prevent patient harm. The commonest types of error were unauthorized crushing of tablets or opening capsules, omission of medication and failing to sign for medication. More errors were associated with patients with swallowing difficulties, even after crushed doses of medication were excluded from the analysis. The reason for this association is not clear. The error rate varied widely between the nine nurse participants. The observational study detected two and a half times the number of errors than did retrospective review of the medication charts, whereas none of the errors detected during the observational study were reported using the hospital's incident report system. In addition, some errors misclassified as unauthorized omissions by chart review were shown by the observational study to be failures to sign for administered doses.

The observational technique appeared acceptable to most of the participating nurses. All who completed the post-observation questionnaire stated they would be willing to be observed administering medication in the future, although two reported they felt that being observed made them more prone to make errors. The pharmacist observer had to stand very close to the administering nurse in order to accurately record medicines administration and some nurses commented that this was intrusive. However, an observational study conducted in a general hospital reported no evidence that the technique made nurses more or less likely to make errors [10]. The participating nurses were aware of the aims of the study and it is possible that this knowledge may have affected their behaviour. The fact that observation was not disguised could have resulted in greater vigilance. Equally, it could have made some nurses anxious and inattentive and thus more prone to make errors.

Compared with observational studies conducted in general hospital settings, our study detected a similar proportion of errors but fewer potentially serious errors [6, 7]. In psychiatry, few drugs are administered parenterally. However, many of the patients in our study were physically frail requiring medication for physical conditions and all were elderly. Serious and fatal medication administration errors are more common in elderly patients [1]. Medicines administration to our patients was particularly difficult as some were confused and uncooperative, could be aggressive and had swallowing difficulties. On the other hand, the patients in our study were long stay and there was a low turnover of nursing staff. Patients' medication change little during the study period and yet despite this errors were very common. It would be expected that the error rate on a psychiatric admission ward would be much higher because of the greater turnover of patients and nursing staff and frequent changes to prescriptions. There are a number of possible reasons for the large number of process errors detected in our study. The pharmacist observer noted that medication administration frequently occurred at patients' meal times in noisy and sometimes cramped conditions. Thus, the administering nurse had to contend with many potential distractions as well as being under pressure to complete the medication round as swiftly as possible. The ward atmosphere during the nighttime medication round was, by contrast, much quieter and less pressured. At the time the study was conducted, there was no standardized refresher training in safe medication practice for nursing staff.

In our study, the commonest error type was the unauthorized crushing of tablets (and a few instances of opening capsules). Although beyond the scope of this researcher study, the pharmacist observer found no evidence that unauthorized tablet crushing was being used to covertly administer medication to patients. In some instances, the crushed medication was then mixed with food. However, we could not find reports of this type of error in other observational studies, apart from one conducted in two units in France, one of which was a geriatric unit [6] and another conducted in an elderly acute admission ward [4]. Tablet crushing and capsule opening were observed to be common in an Australian study of units for the elderly [16]. In our study, crushing was done for two main reasons: for patients with swallowing difficulties and for uncooperative patients, but there were also instances of tablets being crushed for no obvious reason. Surveys of nursing and care staff have reported that tablet crushing is common in residential and nursing homes [24], as is the practice of concealing drugs in food and beverages [25]. Crushing tablets alters the bioavailability of some drugs and may have serious consequences for the patient. It may be appropriate but should be
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authorized by the prescriber. A pharmacist may be able to recommend a more appropriate dosage form. Since this study was conducted, staff on one of the wards concerned have set up a multidisciplinary medication administration group to review all patients’ medication regarding administration problems such as swallowing difficulties. The team includes a pharmacist and a speech and language therapist and aims to ensure medicines are administered in a safe and effective way.

The other common error types we encountered were omission of a medication without a valid clinical reason and failing to sign the medication chart after a medication had been administered. In our study, most of the prescriptions for topical preparations were not being administered. Omission errors have been reported as the most common type of administration error in observational studies conducted in general hospitals [3–5].

Six wrong drug errors were detected in our study, all rated as being grade 2 severity (likely to result in minor adverse effects or worsening of the condition). None of these errors involved drugs of similar sounding names or similar packaging. One wrong dose error concerned confusion between two liquid preparations held in bottles of approximately the same size though with different coloured labels. Thus, given that no clear cause for these wrong drug errors was evident, it was not possible to develop strategies to prevent their re-occurrence. Wrong drug errors are an important cause of morbidity and mortality in general hospitals, and in one large USA study, they were the second most common cause of fatal medication errors [1].

Our study has a number of limitations. It took place on two wards of an independent sector hospital, and thus the findings may not apply to the National Health Service or community settings. However, the patients studied were not atypical of those found in nursing homes for the elderly mentally ill, although some exhibited particularly challenging behaviour and had been referred from NHS hospitals for this reason. We studied medicines administration by a relatively small number of nurses and not all nurses approached agreed to participate. These are important limitations, and because of the small number of nurses observed, we were unable to report on whether errors were associated with particular nurse characteristics. A study conducted in a paediatric hospital reported that error rates were higher for student nurses and nurses who did not regularly work on the unit [8]. All the nurses in our study were permanent staff on the wards concerned.

Conclusion

The observational technique can usefully be applied in psychiatry, although informed consent must be obtained from nurse participants. Medication administration errors in our study were very common, although fortunately most were not serious. The fact that the error rate varied widely between nurses and also the absence of annual refresher courses in medicines administration at our hospital suggests some form of regular standardized training might impact on the error rate. We plan to repeat the study at a later date once training has taken place to see if practice has improved. However, a recent systematic review found little research on the efficacy of nurse educational interventions in reducing medication administration errors [26]. In a randomized controlled trial, the use of dedicated medication nurses who had undergone brief review training in safe medication use did not result in a reduction in medication administration errors compared with the control group [27]. The reporting of errors using incident reports needs to be encouraged, although several authors have highlighted the many reasons why staff are reluctant to report errors [28, 29].

Acknowledgement

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References


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