What is a prescribing error?

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Abstract

***Objective*—To develop a practitioner led definition of a prescribing error for use in quantitative studies of their incidence.**

***Design*—Two stage Delphi technique.**

***Subjects*—A panel of 34 UK judges, which included physicians, surgeons, pharmacists, nurses and risk managers.**

***Main outcome measures*—The extent to which judges agreed with a general definition of a prescribing error, and the extent to which they agreed that each of 42 scenarios represented a prescribing error.**

***Results*—Responses were obtained from 30 (88%) of 34 judges in the first Delphi round, and from 26 (87%) of 30 in the second round. The general definition of a prescribing error was accepted. The panel reached consensus that 24 of the 42 scenarios should be included as prescribing errors and that five should be excluded. In general, transcription errors, failure to communicate essential information, and the use of drugs or doses inappropriate for the individual patient were considered prescribing errors; deviations from policies or guidelines were not.**

***Conclusions*—Health care professionals are in broad agreement about the types of events that should be included and excluded as prescribing errors. A general definition of a prescribing error has been developed, together with more detailed guidance regarding the types of events that should be included. This definition allows the comparison of prescribing error rates among different prescribing systems and different hospitals, and is suitable for use in both research and clinical governance initiatives.**

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Studies carried out in US hospitals suggest that prescribing errors occur in 0.4–1.9% of all medication orders written[1–3] and cause harm in about 1% of all inpatients.[4] No large scale studies of prescribing errors have been carried out in the UK, although studies of pharmacists' interventions suggest that many errors occur and are subsequently remedied following the interventions of ward pharmacists.[5 6] A recent report from the Department of Health recommended that serious errors in the use of prescribed drugs should be reduced by 40% by 2005, and that baseline rates of errors will need to be established.[7]

However, a major problem with interpreting quantitative prescribing error studies is that the definition of an error used by the researchers is often ambiguous or not given at all. Comparisons of error rates across the literature are therefore accompanied by significant uncertainty.

Where definitions are given, there may be marked differences among studies. A common approach has been to consider that a prescribing error has occurred if both doctor and pharmacist agree that this is the case.[1 2 8] While pragmatic, this approach is limited by potential differences in the knowledge and views of individual practitioners. Other studies have used outcome-based definitions, including as errors only those that result in harm to the patient. However, in many cases[1 8] pharmacists intervene to prevent errors from reaching the patient and so the outcome remains unknown. Even where prescribing errors are defined more explicitly, there is wide variation in the types of events included. For example, Betz and Levy[9] include "prescribing a medication without sufficient education of the patient on its proper uses and effects" while Tesh *et al*[10] include "the prescription of medication by brand (instead of generic) name". Others do not consider these to be prescribing errors. Consequently, it is almost impossible to compare data from different studies or to use prescribing error rates as a meaningful component of clinical governance. If alternative prescribing systems are to be evaluated in terms of their effects on prescribing error rates, a clear definition is needed. The objective of this study was to develop a practitioner led

Key messages

- A major problem with interpreting quantitative studies of prescribing errors is that definitions are often ambiguous or not given.
- The Delphi technique was used to develop a general definition of a prescribing error and to determine whether specific types of event should be included or excluded as prescribing errors.
- Health care professionals are in broad agreement about the types of events that should be considered prescribing errors.
- The definition developed can be used to determine the incidence of prescribing errors in UK hospitals.

What this paper adds to the area

This paper develops a general definition of a prescribing error and presents examples of the types of event that should be included and excluded as prescribing errors.

Table 1 Demographic details of the 34 judges who agreed to take part in the study: those marked with asterisks indicate non-responders in the first stage of the Delphi process

Profession	*Grade*	*Speciality*	*Employer*
Doctor	Consultant	Clinical pharmacology	Teaching hospital
Doctor	Consultant	Obstetrics & gynaecology	Independent hospital
Doctor	Specialist registrar	Infectious diseases	Teaching hospital
Doctor	Consultant	Infectious diseases	Teaching hospital
Doctor	Consultant	Anaesthetics	Teaching hospital
Doctor	Specialist registrar	Orthopaedic surgery	General hospital
Doctor	Specialist registrar	Renal/critical care	Teaching hospital
Doctor	Consultant	Emergency medicine	Teaching hospital
Doctor	Consultant	Endocrinology	Teaching hospital
Doctor	Consultant	General medicine	General hospital
Doctor	Consultant	Haematology	Teaching hospital
Doctor	Senior house officer	Paediatrics	General hospital
Doctor	Senior house officer	Paediatrics	General hospital
Doctor	Specialist registrar	Clinical pharmacology	Teaching hospital
Doctor	Consultant	General surgery	General hospital
Pharmacist	Principal	Infectious diseases	Teaching hospital
Pharmacist	Principal	Clinical pharmacy	General hospital
Pharmacist	Principal	Clinical pharmacy	General hospital
Pharmacist	Senior manager	Risk management	Other
Pharmacist	Principal	Renal medicine	Teaching hospital
Pharmacist	Chief	Cardiology	Teaching hospital
Pharmacist	Chief	Various	Teaching hospital
Pharmacist	Senior	Clinical pharmacy	Teaching hospital
Pharmacist	Chief	Risk management	General hospital
Pharmacist	Senior academic	Risk management	Other
Pharmacist	Academic	Risk management	Other
Pharmacist*	Chief	Risk management	General hospital
Nurse	Senior manager	Critical care	Teaching hospital
Nurse	Senior manager	Risk management	Teaching hospital
Nurse	Staff nurse	Neurology	General hospital
Nurse	Academic	Risk management	Other
Nurse*	Charge nurse	General medicine	Teaching hospital
Nurse*	Senior manager	Various	Teaching
Nurse*	Senior manager	Professional body	Other

operational definition of a prescribing error that can be used as a common foundation for future work in both research and practice.

Methods

METHODOLOGY

A two stage Delphi technique[11 12] was used to elicit the views of a panel of expert judges. Consensus methods such as the Delphi are being increasingly used in clinical guideline development[13]; the aim is to maximise the benefits of having an expert panel consider a problem while minimising the problem of domination often associated with group decision making. According to the Delphi technique, participants indicate the extent to which they agree with a series of statements in a postal questionnaire; their scores are then summarised and included in a repeat version of the questionnaire so that each participant can reconsider their scores in view of the group's responses. The views of each participant are treated equally, and each participant is anonymous to the remainder of the panel.

PANEL SELECTION

Forty three health care professionals were invited to participate in the study. These individuals, all of whom had experience in UK hospitals, were purposively selected to ensure that a wide range of health care professionals of different grades and different clinical specialities were included. Many were also chosen on the basis of their expertise in risk management or the study of prescribing errors.

FIRST STAGE OF THE DELPHI PROCESS

The questionnaire sent to the judges was in three parts.

Firstly, the investigators proposed the following preliminary definition of a prescribing error: "*A 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*". Each judge was asked to indicate their extent of agreement with this preliminary definition using a scale numbered from 1 (disagree) to 9 (agree), and to suggest ways in which the definition could be improved.

Secondly, the judges were asked to indicate the extent to which they agreed that each of 42 general scenarios represented a prescribing error. These scenarios were developed following a review of previous prescribing error studies[1 2 6 8–10] and included events that have been considered prescribing errors in some studies but not in others, together with other areas of potential ambiguity. Judges were encouraged to include written comments to justify or qualify their scores.

Finally, the judges were asked if they wished to make any additional comments on the general definition of a prescribing error, having considered the specific scenarios.

SECOND STAGE OF THE DELPHI PROCESS

Only those scenarios for which no consensus was reached were included in the second Delphi stage. In this stage, judges were asked to reconsider their scores having studied the whole panel's responses; they were given the median and interquartile range of the panel's scores for each scenario, any additional comments made by other judges together with the associated scores, and a reminder of their own personal scores. It has been suggested that the inclusion of the panel's comments as well as a summary of their scores increases the number of reasoned responses and decreases the number of rounds required to achieve consensus.[14]

ANALYSIS

The following definitions were specified prior to analysis:

"Consensus" was considered to exist if the interquartile range of the judges' responses fell within any three point range.

"Disagreement" existed if the interquartile range spanned both the 1–3 range and the 7–9 range.

If neither consensus nor disagreement existed, "partial agreement" was said to have occurred.

Where consensus existed, it was considered that the scenario should be included as a prescribing error if the median score fell within the 7–9 range, that it should be excluded if it fell within the 1–3 range, and that it was equivocal if it fell within the 4–6 range.[11]

Where the consensus was that a scenario was equivocal, or where no consensus was obtained at the end of the second stage, the judges' additional comments, together with their scores, were used to decide whether or not to classify each scenario as a prescribing error.

Table 2 Situations that should be included as prescribing errors

Scenario	Results		
	*Round 1**	*Round 2**	*Code†*
Errors in decision making			
Prescription inappropriate for the patient concerned			
Prescribing a drug for a patient for whom, as a result of a co-existing clinical condition, that drug is contraindicated	8, **9**, 9	N/A	C, I
Prescription of a drug to which the patient has a documented clinically significant allergy	8, **9**, 9	N/A	C, I
Not taking into account a potentially significant drug interaction	7, **8**, 9	N/A	C, I
Prescribing a drug in a dose that, according to British National Formulary or data sheet recommendations, is inappropriate for the patient's renal function	7, **8**, 9	N/A	C, I
Prescription of a drug in a dose below that recommended for the patient's clinical condition	5, 7, 8	6, 7, 7	C, I
Prescribing a drug with a narrow therapeutic index, in a dose predicted to give serum levels significantly above the desired therapeutic range	6, 7, 8.25	7, **8**, 8	C, I
Writing a prescription for a drug with a narrow therapeutic range in a dose predicted to give serum levels significantly below the desired therapeutic range	3.75, **7**, 8	6, **7**, 7,25	C, I
Not altering the dose following steady state serum levels significantly outside the therapeutic range	5, 7, 9	7, 7, 8	C, I
Continuing a drug in the event of a clinically significant adverse drug reaction	6.5, **8**, 9	7, **8**, 8.25	C, I
Prescribing two drugs for the same indication when only one of the drugs is necessary	5.75, 7, 8	6, 7, 8	C, I
Prescribing a drug for which there is no indication for that patient‡	5, 7, 8	5, **6**, 7	C, EQ
Pharmaceutical issues			
Prescribing a drug to be given by intravenous infusion in a diluent that is incompatible with the drug prescribed	8, **9**, 9	N/A	C, I
Prescribing a drug to be infused via an intravenous peripheral line, in a concentration greater than that recommended for peripheral administration	6, **8**, 9	7, **8**, 8	C, I
Errors in prescription writing			
Failure to communicate essential information			
Prescribing a drug, dose or route that is not that intended	9, **9**, 9	N/A	C, I
Writing illegibly	5, **8**, 9	7, **8**, 9	C, I
Writing a drug's name using abbreviations or other non-standard nomenclature	6, 7, 9	7, 7, 8.25	C, I
Writing an ambiguous medication order	6, **7.5**, 9	7, **8**, 9	C, I
Prescribing "one tablet" of a drug that is available in more than one strength of tablet	6, **7.5**, 9	7, **8**, 9	C, I
Omission of the route of administration for a drug that can be given by more than one route	6, **8**, 9	7, **8**, 9	C, I
Prescribing a drug to be given by intermittent intravenous infusion, without specifying the duration over which it is to be infused	5, **6**, 8	5, 7, 8	P, I
Omission of the prescriber's signature	5, **8**, 9	5.75, **8**, 9	P, I
Transcription errors			
On admission to hospital, unintentionally not prescribing a drug that the patient was taking prior to their admission	7, **8**, 9	N/A	C, I
Continuing a GP's prescribing error when writing a patient's drug chart on admission to hospital	7.75, **8.5**, 9	N/A	C, I
Transcribing a medication order incorrectly when rewriting a patient's drug chart	8, **9**, 9	N/A	C, I
Writing "milligrams" when "micrograms" was intended	9, **9**, 9	N/A	C, I
Writing a prescription for discharge medication that unintentionally deviates from the medication prescribed on the inpatient drug chart	8, **9**, 9	N/A	C, I
On admission to hospital, writing a medication order that unintentionally deviates from the patient's pre-admission prescription	6, **9**, 9	7, **9**, 9	C, I

*Figures refer to the lower limit of the interquartile range, the median score (in bold), and the upper limit of the interquartile range.
†C = consensus; P = partial agreement; I = include as a prescribing error; EQ = equivocal.
‡Originally worded as "prescribing a drug for which there is no *documented* indication for that patient". However, the judges considered that a prescribing error had not occurred if an indication existed but was not documented, while prescribing where no indication existed *was* considered a prescribing error. The word "documented" was therefore removed and the scenario included as a prescribing error.

Results

RESPONSE RATE

Thirty four (79%) of those approached agreed to take part. These comprised nine physicians, three surgeons, 12 pharmacists, seven nurses, two clinical pharmacologists, and an anaesthetist (table 1). A wide range of clinical specialities were represented; nine of the panel had extensive experience of medication error research and one was the editor of a relevant peer reviewed journal. In the first Delphi stage responses were received from 30 (88%) of the 34 judges. Responses to the second stage were received from 26 (87%) of the 30 judges to whom second stage questionnaires were sent.

DEFINITION OF A PRESCRIBING ERROR

When asked for their opinion on the definition proposed, the judges' median score was 7.0 and the interquartile range 6.5–8.0. This indicates that the consensus was to accept the researchers' preliminary definition. Many additional comments were made relating to this definition, most of which fell into three categories. Firstly, four respondents were unsure whether errors in the prescribing decision should be included as well as those in the prescription writing process. These judges considered the prescribing decision to be part of a broader concept of "clinical decision making" rather than "prescribing". However, other respondents emphasised the importance of including both elements of the definition, and it was concluded that both should remain. Secondly, six judges were concerned about the use of the word "significant" and considered that the inclusion of this word meant that the definition was only of a "serious" prescribing error. However, others felt that this word should be included for two reasons: (1) it was considered important to differentiate between clinically meaningful prescribing errors and those cases

Table 3 Situations that may be considered prescribing errors, depending on the individual clinical situation

Scenario	Results		
	*Round 1**	*Round 2**	*Code†*
Prescribing a drug in a dose above the maximum dose recommended in the British National Formulary or data sheet	4.75, **6**, 7	5, **6**, 6	C, EQ
Misspelling a drug name‡	4, **5**, 8	5, **5**, 7	C, EQ
Prescribing a dose that cannot readily be administered using the dosage forms available	3.75, **6**, 7	5, **6**, 7	C, EQ
Prescribing a dose regime (dose/frequency) that is not that recommended for the formulation prescribed	5, **6**, 7.25	5, **6**, 6	C, EQ
Continuing a prescription for a longer duration than necessary	5, **6**, 7.25	5, **6**, 7	C, EQ
Prescribing a drug that should be given at specific times in relation to meals without specifying this information on the prescription	4, **6**, 8	5, **6**, 7	C, EQ
Unintentionally not prescribing a drug for a clinical condition for which medication is indicated	1.5, **5**, 7.5	3.75, **5.5**, 7.25	P, EQ

*Figures refer to the lower limit of the interquartile range, the median score (in bold), and the upper limit of the interquartile range.
†C = consensus; P = partial agreement; EQ = equivocal.
‡The judges' comments suggested that major misspellings of a drug name that lead to ambiguity should be considered prescribing errors, whereas minor misspellings should not.

where some optimisation of treatment was possible but where a prescribing error could not be said to have occurred; (2) it was recognised that cognitive errors could occur in the prescribing process without there being any adverse consequences for the patient. For example, a doctor may prescribe drug X instead of the intended drug Y, but if both are equally safe and effective then the cognitive error is not clinically important. It was therefore considered that the word "significant" was necessary, but that it should be made clear that the definition is of a "clinically meaningful" prescribing error. Finally, three judges indicated that a comparator was needed within the definition as "reduction" and "increase" implied a baseline. It was therefore decided to add a statement to this effect.

The definition of a prescribing error finally adopted was therefore: "*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*".

TYPES OF EVENTS TO BE INCLUDED AS PRESCRIBING ERRORS

Following the first Delphi stage, consensus was achieved for 11 (26%) of the scenarios. Only the 31 for which no consensus was achieved were included in the second stage. Following the second stage, consensus was achieved for a further 25 scenarios. For the remaining six, partial agreement existed. Of the 36 scenarios for which consensus was reached, the consensus was to include it as a prescribing error in 24 cases, to exclude it in five cases, and that it was equivocal in seven cases. Of the six scenarios for which partial agreement existed, two were included as prescribing errors, three were excluded, and one was considered equivocal. The final classification of each scenario is shown in tables 2–4. Those classed as prescribing errors concerned the selection of drugs or doses that were inappropriate for the individual patient, failure to take into account pharmaceutical issues such as intravenous drug incompatibilities, failure to communicate essential information, and transcription errors. The majority of the scenarios not considered to be prescribing errors represented deviations from policies and guidelines.

Discussion

Using the Delphi technique, a general definition of a prescribing error has been developed together with guidance concerning the specific types of event that should be included. This is practitioner led, more detailed than the definitions used in previous studies, and concordant with human error theory. According to theories of human error, a series of planned actions may fail to achieve their desired outcome because the plan itself was inadequate or because the actions did not go as planned.[15] Our definition reflects this distinction, including failures both in the prescribing decision and the prescription writing process.

Table 4 Situations that should be excluded as prescribing errors

Scenario	Results		
	*Round 1**	*Round 2**	*Code†*
Prescribing by brand name (as opposed to generic name)	1, **2**, 3.5	1, **2**, 3	C, EX
Prescribing a drug without informing the patient of its uses and potential side effects	1.75, **3**, 5.25	2, **3**, 4	C, EX
Prescribing a drug for which there is no evidence of efficacy, because the patient wishes it	2, **3**, 5	2, **3**, 3	C, EX
Prescribing for a child a drug that has no product license for use in children	1, **2**, 4.25	1, **2**, 3	C, EX
Prescribing a drug that is not in the hospital formulary	1, **2**, 3.25	2, **2**, 3	C, EX
Prescribing contrary to hospital treatment guidelines	1.75, **3**, 5	1.75, **3**, 4.25	P, EX
Prescribing contrary to national treatment guidelines	2, **3**, 5	2, **3**, 5	P, EX
Prescribing for an indication that is not a drug's product license	1, **3**, 5	1, **3**, 3.25	P, EX

*Figures refer to the lower limit of the interquartile range, the median score (in bold), and the upper limit of the interquartile range.
†C = consensus; P = partial agreement; EX = exclude as a prescribing error.

The 42 scenarios assessed by the judges were classified into those considered to be prescribing errors, those not considered to be prescribing errors, and those about which the judges were equivocal. Prescribing without taking into account the patient's clinical status, not taking into account important pharmaceutical issues, failure to communicate essential information, and transcription errors were all considered to be prescribing errors. However, failures to adhere to standards such as hospital or national guidelines, or the drug's product licence, were not. This calls into question the validity of prescribing error studies that define errors based on deviations from such standards[1 2 10] and highlights the complexities of medical decision making. In relation to the scenarios considered equivocal, the judges' comments suggested that the individual clinical situation would have to be taken into account in order to determine whether or not a prescribing error had occurred. Of particular importance was whether or not the medication order arose following an informed decision according to generally accepted practice; it was decided that, if it did, it should not be considered a prescribing error but, if the medication order was not what had been intended, then it should be considered an error.

The results presented reflect the opinions of a panel that included selected experts rather than a random sample of health care professionals. It was considered that the selection of those with appropriate expertise would increase the validity of the study's findings. Of the 43 experts invited to take part, 34 (83%) agreed to do so; this high response rate reflects the fact that many of those approached were interested in the research area. A potential limitation is that, in each Delphi round, the response rate was less than 100%. It has been suggested that non-responders are likely to be those with scores furthest from the mean.[16] However, a response rate of 88% is high for a postal questionnaire, and examination of the data from the present study suggests those who did not respond in the second round had typical first round scores. It is also recognised that this study has a hospital bias; this reflects the investigators' aims. While the general definition would be likely to apply to community practice, further research would be needed to explore the specific types of events considered to be prescribing errors in a community setting.

We considered that consensus existed if at least 50% of the judges' scores fell within a 3-point range. This definition is relaxed in comparison with those used in other Delphi studies and consensus will have been reached in a larger number of cases than if a stricter definition had been adopted.[17] However, there is no standard way of defining consensus, and it is recommended that the definition used is chosen according to the study's objectives.[13] In the present study the objective was to decide how to classify each scenario; a very strict definition would have resulted in consensus being reached in few cases. An additional factor was that a wide range of scores was expected due to the heterogenous nature of the panel; it was therefore decided that a relaxed definition was appropriate. Another methodological issue in Delphi studies is the number of scoring rounds carried out. In the present study it was decided to use only two rounds; increasing the number of rounds can result in a higher degree of agreement among members of the panel but can also lead to decreased response rates.[12] In this study there was little change in median scores after the first round; the median changed by one point in only two (6%) of the 31 scenarios included in the second round and in no cases did the median change by more than one point. It was therefore considered that additional rounds would have contributed little to the results.

Our study was not intended to differentiate between prescribing errors in terms of their severity, but to aid distinction between those situations that should be included as prescribing errors and those that should not. It is recognised that prescribing errors vary considerably in terms of their severity. Because pharmacists correct many prescribing errors before significant harm ensues,[1 2 5 6] a severity assessment method that does not require knowledge of actual patient outcome is required to evaluate their significance. A visual analogue scale has proved to be valid and reliable for assessing medication administration errors[18] and we are currently testing it for use with prescribing errors.

The definition developed is now being used to measure the baseline incidence of prescribing errors in a UK hospital, and is proving very useful in deciding what should be included as a prescribing error and what should not. We hope others will adopt the definition for research and clinical governance initiatives so that meaningful comparisons can be made in this important area.

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"All the evidence suggests we are extinct."