"Worse than a crime"
Medication errors and how to avoid them

Co-editor: Stephens’ Detection and Evaluation of Adverse Drug Reactions

Editor
Meyler’s Side Effects of Drugs

Editor
Side Effects of Drugs Annuals
C'est pire qu'un crime; c'est une faute

Execution of the Duc d'Enghien

C'est pire qu'un crime; c'est une faute

Charles Maurice de Talleyrand-Périgord

Joseph Fouché
SHCOOL
Where you learn how to shpell
Reported errors

Unnoticed errors

Unreported errors

Potential errors (near misses)

Insignificant errors

Errors that cause harm
Frequencies of medication errors

1.5 million prescriptions are written every day in general practice in the UK.
0.5 million are written every day in hospitals.
1–2% of patients in UK hospitals are thought to be harmed by medication errors.
Most arise from prescription errors.
Frequency of medication errors

- 550 bed London teaching hospital
- 135 drug errors a week
- 25% potentially serious
- Most were dosing errors
- 89% were made by junior/senior house officers

Dean et al. Qual Saf Health Care 2002;11:340-4
Medication Errors

### Time period

<table>
<thead>
<tr>
<th>Time period</th>
<th>Number of medication incidents reported to the RLS</th>
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<tr>
<td>Jan 2005 to Dec 2005</td>
<td>36,335</td>
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<tr>
<td>Jan 2006 to Dec 2006</td>
<td>64,678</td>
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<td>Jan 2007 to Dec 2007</td>
<td>86,085</td>
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### Care setting

<table>
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<tr>
<th>Care setting</th>
<th>Incidents</th>
<th>Percentage</th>
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<tr>
<td>Acute hospitals</td>
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<td>76</td>
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<tr>
<td>Mental health service</td>
<td>6,551</td>
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<tr>
<td>Community nursing, medical and therapy service (including community hospitals)</td>
<td>5,563</td>
<td>8</td>
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<tr>
<td>Community pharmacy</td>
<td>3,521</td>
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<td>Learning disabilities service</td>
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<td>General practice</td>
<td>738</td>
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</table>
Degrees of harm from incidents reported to the UK’s National Reporting and Learning System
FINAL report

An in depth investigation into causes of prescribing errors by foundation trainees in relation to their medical education. EQUIP study.

Tim Dornan (Principal Investigator), Darren Ashcroft, Heather Heathfield, Penny Lewis, Jon Miles, David Taylor, Mary Tully, Val Wass
<table>
<thead>
<tr>
<th>Prescriber</th>
<th>Description</th>
<th>On admission</th>
<th>During stay</th>
<th>When drug chart rewritten</th>
<th>TTA\textsuperscript{1}/Discharge Rx</th>
<th>Not known</th>
<th>Not given</th>
<th>NA</th>
<th>TOTAL</th>
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<tr>
<td>FY1</td>
<td>Orders written</td>
<td>14487</td>
<td>10365</td>
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<td>1038</td>
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<td>12.9</td>
<td>8.5</td>
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<td>8.6</td>
<td>3.2</td>
<td>6.7</td>
<td>8.9</td>
<td>8.0</td>
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<td>17</td>
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<td>Errors - %</td>
<td>11.8</td>
<td>6.3</td>
<td>4.7</td>
<td>5.9</td>
<td>7.5</td>
<td>8.5</td>
<td>6.5</td>
<td>8.3</td>
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<td>NCCG\textsuperscript{3}s</td>
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<td>1268</td>
<td>1447</td>
<td>820</td>
<td>622</td>
<td>120</td>
<td>111</td>
<td>7</td>
<td>4395</td>
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<tr>
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<td>Errors - number</td>
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<td>80</td>
<td>30</td>
<td>37</td>
<td>3</td>
<td>8</td>
<td>1</td>
<td>200</td>
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<tr>
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<td>5.5</td>
<td>3.7</td>
<td>5.9</td>
<td>2.5</td>
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<td>77</td>
<td>8</td>
<td>25</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>188</td>
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<td>Errors - %</td>
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<td>5.4</td>
<td>4.8</td>
<td>5.6</td>
<td>7.1</td>
<td>0.0</td>
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<td>5.9</td>
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<td>Univariate analysis OR (95% CI)†</td>
<td>Multivariate analysis OR (95% CI)†</td>
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<tr>
<td>FY 1</td>
<td>1.90 (1.61 – 2.24)</td>
<td>2.13 (1.80 – 2.52)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>FY 2</td>
<td>2.24 (1.90 – 2.65)</td>
<td>2.23 (1.89 – 2.65)</td>
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<td></td>
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<tr>
<td>FTSTA</td>
<td>1.89 (1.59 – 2.24)</td>
<td>1.84 (1.54 – 2.19)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>NCCG</td>
<td>1.42 (1.16 – 1.75)</td>
<td>1.58 (1.29 – 1.94)</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Pharmacist</td>
<td>0.55 (0.24 – 1.27)</td>
<td>0.84 (0.36 – 1.93)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Nurse</td>
<td>1.15 (0.83 – 1.58)</td>
<td>1.00 (0.71 – 1.39)</td>
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<td></td>
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</tr>
</tbody>
</table>
6.0 Recommendations

This research has identified five main targets for interventions to improve patient safety by minimising prescribing errors. Because of the dearth of prior evidence about the causes of prescribing errors and efficacy of interventions, these recommendations are made with the proviso that exploratory research will be required to demonstrate their efficacy. The targets are:

- Clinical working environments
- Undergraduate medical education programmes
- Foundation Year 1 education
- Other parts of the medical education continuum
- Interprofessional education
Range of errors = 4 to 82%

"It is vital that future research is well constructed and generalizable using standard definitions and methods."
Principles of definition

1. Must describe all the essential attributes of the thing defined
2. Should avoid circularity (circulus in definiendo)

Must state the true essence—Aristotle 
τό τί ἦν εἶναι
Circular definition

One that uses as a part of the definition a term or terms being defined

Formally: a description of the meaning of a lexeme that is constructed using one or more synonymous lexemes that are all defined in terms of each other.
Circular definitions

HIND ... The she to a stag
STAG ... The male of the hind

A medication error = an error in medication
Principles of definition

1. Must describe all the essential attributes of the thing defined
2. Should avoid circularity (circulus in definiendo)
3. Must not be too wide or too narrow (de-fine)
4. Must not be obscure (obscurum per obscurius)
5. Should be positive if possible, not negative

A medication error is an error in medication—Aristotle
“Τό τί ἦν εἶναι”
“Do not miss anything out
Do not include any things to which the defined term does not apply
Use commonly understood terms with clear meanings
Wisdom: the absence of folly
An action that is contrary to my beliefs and actions

Ambrose Bierce

A failure to adjust from a preconception to an actuality

John Cage
Clarification of Terminology in Medication Errors
Definitions and Classification

Robin E. Ferner$^{1}$ and Jeffrey K. Aronson$^{2}$

1 West Midlands Centre for Adverse Drug Reactions, City Hospital, Birmingham, UK
2 Department of Clinical Pharmacology, Radcliffe Infirmary, Oxford, UK

Abstract

We have previously described and analysed some terms that are used in drug safety and have proposed definitions. Here we discuss and define terms that are used in the field of medication errors, particularly terms that are sometimes misunderstood or misused. We also discuss the classification of medication errors. A medication error is a failure in the treatment process that leads to, or has the potential to lead to, harm to the patient. Errors can be classified according to whether they are mistakes, slips or lapses. Mistakes are errors in the planning of an action. They can be knowledge based or rule based. Slips and lapses are errors in carrying out an action – a slip through an erroneous performance and a lapse through an erroneous memory. Classification of medication errors is important because the probabilities of errors of different classes are different, as are the potential remedies.
Defining a medication error

Things to define or include

Define “error” carefully and particularly indicate how an error can be recognized
Include (or imply) all parts of the medication process
Include (or imply) all outcomes (harmful or otherwise)
Defining a medication error

Things not to include

Preventability — not relevant
The individual responsible — not relevant
Standard or recommended practice or advice — not a touchstone
- hospital policies
- national guidelines
- manufacturers’ instructions
Defining “medication” and “error”

Medication:

A drug or drugs prescribed or given as medical treatment; a medicine (i.e. a medication)

The action of treating medically; treatment with a medicinal substance [product] (i.e. the process of medication)

Error:

The failure of planned actions to achieve their desired ends without the intervention of some unforeseeable event [James Reason]
A medication error is a failure in the treatment process, through either omission or commission, that leads to, or has the potential to lead to, harm to the patient

Adapted from Ferner & Aronson
Notes on the definition

A medication error is a *failure* in the treatment process, through either omission or commission, that leads to, or has the potential to lead to, harm to the patient.

‘failure’ signifies that the process has fallen below some attainable benchmark.

It is the criterion whereby an error is recognized.
A medication error is a failure in the treatment process, through either omission or commission, that leads to, or has the potential to lead to, harm to the patient.

- The “treatment process” relates to therapy, prevention, or investigation of disease or physiological changes.
- It includes not only therapeutic drugs but also oral contraceptives, hormones used in replacement therapy, radiographic contrast media.
- It includes the manufacturing or compounding, prescribing, transcribing, dispensing, and administration of a drug, and monitoring of outcomes.
A medication error is a failure in the treatment process, through either omission or commission, that leads to, or has the potential to lead to, harm to the patient

"without the intervention of some unforeseeable event"
A medication error is a failure in the treatment process, through either omission or commission, that leads to, or has the potential to lead to, harm to the patient.

The definition does not specify who makes the error; it could be a doctor, a nurse, a pharmacist, a carer, or another.

It does not specify who is responsible for preventing errors or include any notion of preventability.
ORIGINAL ARTICLE

Multiplicity of medication safety terms, definitions and functional meanings: when is enough enough?

K H Yu, R L Nation, M J Dooley

See end of article for authors' affiliations

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Accepted for publication
30 July 2005

Objectives: To identify the terms and definitions used by organisations involved in medication safety and to examine differences in functional meaning using a novel scenario assignment method. Methods: Medication safety related terms and definitions were sought from websites of organisations associated with medication safety. The functional meanings of terms and definitions were analysed and compared using a scenario assignment method where each definition found was assessed against four scenarios with a central theme. Main outcome measures: Medication safety related terms and definitions currently in use, similarities and differences in their functional meanings, and practical implications of the use of these terms and definitions. Results: Thirty three of 160 websites searched were found to have one or more definitions for medication safety related terms. Twenty five different terms with 119 definitions were found. The most frequently defined groups of terms were “adverse event” (8 different definitions), “error” (n = 9), “near miss” (n = 12), “adverse reaction” (n = 8), and “incident” (n = 4). Substantial diversity of functional meanings of definitions was demonstrated using the scenario-assignment method. Of the five groups of frequently defined terms, definitions within the “adverse event”, “near miss”, and “incident” groups resulted in three functional meanings each, while two functional meanings resulted for “error” and “adverse reaction”. Conclusion: The multiplicity of terms, definitions and, most importantly, functional meanings demonstrates the urgent need for agreement on standardisation of nomenclature describing medication related occurrences. This is an essential prerequisite to enable meaningful analysis of incidence data and development of medication safety improvement strategies.
Manufacturing or compounding
Prescribing
Transcribing
Dispensing
Administration
Monitoring
Manufacturing or compounding

Contaminated Heparin Associated with Adverse Clinical Events and Activation of the Contact System
Prescribing and prescription

Prescribing is (a) the act of deciding what to prescribe and naming it and (b) the act of writing the prescription.

Prescription is (a) the act of writing a prescription and (b) the prescription itself.

Therefore, distinguish

- prescribing faults (in the decision-making process)
- prescription errors (in the act of writing)

Together these are ‘prescribing errors’
Prescribing faults & Prescription errors

Prescribing faults

A prescribing fault is a failure in the prescribing decision-making process, by omission or commission, that leads to, or has the potential to lead to, harm to the patient.

Includes:
- irrational prescribing
- inappropriate prescribing
- underprescribing
- overprescribing
- ineffective prescribing

Balanced prescribing is the use of a medicine appropriate to the patient’s condition and, within the limits created by the uncertainty that attends therapeutic decisions, in a dosage regimen that optimizes the balance of benefit to harm.
Prescribing faults & Prescription errors

Prescription errors

A prescription error is a failure in the prescription writing process, by omission or commission, that results in a wrong instruction about one or more of the normal features of a prescription.

The ‘normal features’ include:

- the identity of the recipient
- the formulation
- the route
- the frequency
- the identity of the drug
- the dose
- the timing
- the duration
<table>
<thead>
<tr>
<th>Drug (Approved Name)</th>
<th>Dose</th>
<th>Start Date</th>
<th>Route</th>
<th>Frequency</th>
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<tbody>
<tr>
<td>Morphine Sulfate MR Tablets (USP)</td>
<td>06 00</td>
<td>4/8/13</td>
<td>PO</td>
<td>BD 08 00</td>
</tr>
<tr>
<td>Additional Instructions</td>
<td>12 00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valid Period</td>
<td>14 00</td>
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<td></td>
</tr>
<tr>
<td>Signature</td>
<td></td>
<td>22 00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 20 g
- 20 mg
- 200 g
- 200 mg
<table>
<thead>
<tr>
<th>DRUG</th>
<th>MORPHINE SULPHATE MR (MST) TABLETS</th>
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</thead>
<tbody>
<tr>
<td>ROUTE</td>
<td>PO</td>
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<tr>
<td>DOSE/FREQUENCY</td>
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<tr>
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<td>9/8/10</td>
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<td>Mark D</td>
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<tr>
<td>ADDITIONAL INSTRUCTIONS</td>
<td></td>
</tr>
<tr>
<td>PHARMACY</td>
<td>20th of Mar W</td>
</tr>
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</table>
So there were errors with regard to documentation, errors with regard to following the protocol and the actual writing up of [redacted]'s vindications, and an understanding of the relationship between his medications was shown to be lacking, in particular there was a clear misunderstanding of the relationship between his MST and his Oramorph, and this misunderstanding seems to have started in the acute hospital and continued in the hospice. The evidence revealed a clear need for good training probably from the acute hospital pharmacology department and for a better understanding of the importance of discharge documentation and information.
Intention – plan – outcome

**Mistake:**
Plan is flawed

**Slip/lapse:**
Error in implementing the plan

**Error**
Intended outcome

**Error**
Unintended outcome
Classification of medication errors

- Good rules not applied
- Bad rules
- Technical errors
- Knowledge-based errors
- Rule-based errors
- Action-based errors
- Memory-based errors

Mistake: Plan is flawed

Intended outcome

Unintended outcome

Slip/lapse: Error in implementing the plan
## Examples of medication errors

<table>
<thead>
<tr>
<th>Type of error</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge-based</td>
<td>Giving penicillin without establishing if the patient is allergic</td>
</tr>
<tr>
<td>Rule-based</td>
<td>Injecting diclofenac into the thigh</td>
</tr>
<tr>
<td>High-dose</td>
<td>Captopril</td>
</tr>
<tr>
<td>Action-based</td>
<td>Writing 'chlorpromazine' instead of 'chlorpropamide'</td>
</tr>
<tr>
<td>Memory-based</td>
<td>Giving penicillin, knowing the patient to be allergic, but forgetting</td>
</tr>
</tbody>
</table>
Correct execution of a plan

Step 1: Take isotonic saline solution 1 L

Step 2: Add KCl 20 mmol

Step 3: Mix

Step 4: Infuse over 1 hour
Knowledge-based error

Step 1: Take isotonic saline solution 1 L

Step 2: Add KCl 80 mmol

Step 3: Mix

Step 4: Infuse over 1 hour
Rule-based error

Step 1: Take isotonic saline solution 1 L

Step 2: Add KCl 80 mmol

Step 3: Don’t mix

Step 4: Infuse over 1 hour
Action-based error

Step 1: Take isotonic saline solution 1 L
Step 2: Add NaCl 20 mmol
Step 3: Mix
Step 4: Infuse over 1 hour
Memory-based error

Step 1: Take isotonic saline solution 1 L

Step 2

Step 3

Step 4: Infuse over 1 hour
Susceptibility factors

- new tasks
- complex tasks
- ambiguously specified tasks
- distractors: noise, competing tasks...
- tiredness
- when effects cannot be observed
Prescribing is complex ...

<p>| | |</p>
<table>
<thead>
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<th></th>
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<tbody>
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<td>Date of admission</td>
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<td>10.</td>
<td>Height</td>
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<td>12.</td>
<td>Weight</td>
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<tr>
<td>13.</td>
<td>Oral contraceptive</td>
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<td>14.</td>
<td>Date</td>
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<td>15.</td>
<td>Route</td>
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<td>16.</td>
<td>Dose</td>
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<td>18.</td>
<td>Directions</td>
</tr>
<tr>
<td>19.</td>
<td>Signature</td>
</tr>
</tbody>
</table>
...and many people are involved
Drug names can be confusing

- aripiprazole
- cisplatin
- dactinomycin
- dobutamine
- doxorubicin HCl
- infliximab
- lamivudine
- tramadol HCl
- amiodarone

- rabeprazole
- carboplatin
- daptomycin
- dopamine
- doxorubicin liposomal
- abciximab
- lamotrigine
- trazodone HCl
- amrinone
Medication errors resulting from the confusion of drug names

Jeffrey K Aronson
University Department of Clinical Pharmacology, Radcliffe Infirmary, Woodstock Road, Oxford OX2 6HE, UK

If drug names are similar, errors can occur. Problems arise when different drugs have similar names (whether proprietary or non-proprietary), when formulations with the same brand name contain different drugs, when the same drug is marketed in formulations with different names, and when drug names are abbreviated. The risk of errors could be reduced by some simple precautions at different stages of drug development, prescribing, supply, and administration. Regulatory authorities and manufacturers should maintain their vigilance when naming new drugs and formulations, and should be prepared to change names if errors occur. Before they write an unfamiliar name on a prescription, prescribers should check what they are prescribing and what other medications the patient is taking (patients should be familiar with their medicines), and pharmacists should check patients’ medicines. At all times there should be good communication among those who prescribe, supply, and administer medicines, and those who take them.

Keywords: drug names, medication errors

## Reducing the risks of medication errors

<table>
<thead>
<tr>
<th>Type of error</th>
<th>Risk reduction strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge-based</td>
<td>Improved teaching; computerized decision-support systems</td>
</tr>
<tr>
<td>Rule-based</td>
<td>Improved teaching; computerized decision-support systems; systematic examination of and improvement to rules</td>
</tr>
<tr>
<td>Action-based</td>
<td>Technical Increased checking systems to detect slips; increased 'triangulation' when drug, patient and condition are specified; increased use of unique identifiers or barcodes</td>
</tr>
<tr>
<td>Memory-based</td>
<td>Skills training</td>
</tr>
</tbody>
</table>
Errors are inevitable
Errors are common in complex processes
Primary prevention is possible but poor
Secondary prevention depends on good, blame-free reporting and root-cause analysis
Teaching is essential—clinical pharmacology saves lives
“To err is human
To forgive divine”

“To err is human
But it feels divine!”