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# Why we need ePrescribing?

**Dr David Cousins**
**Head of Patient Safety**
**Medication Practice and Medical Devices**

# Learning objective

- To describe the burden of medication errors and the requirement for better designed medication systems to reduce preventable harms to patients

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# Background

# What is an error?

- The failure of planned actions to achieve their intended outcome.
- A deviation between what was actually done and what should have been done.

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- A deviation between what was actually done and what should have been done.

# Human Factors – Confront Two Myths

- The perfection myth
  - If people try hard enough they will not commit patient safety incidents.

- The punishment myth
  - If we punish people when they make patient safety incidents they will make fewer of them.

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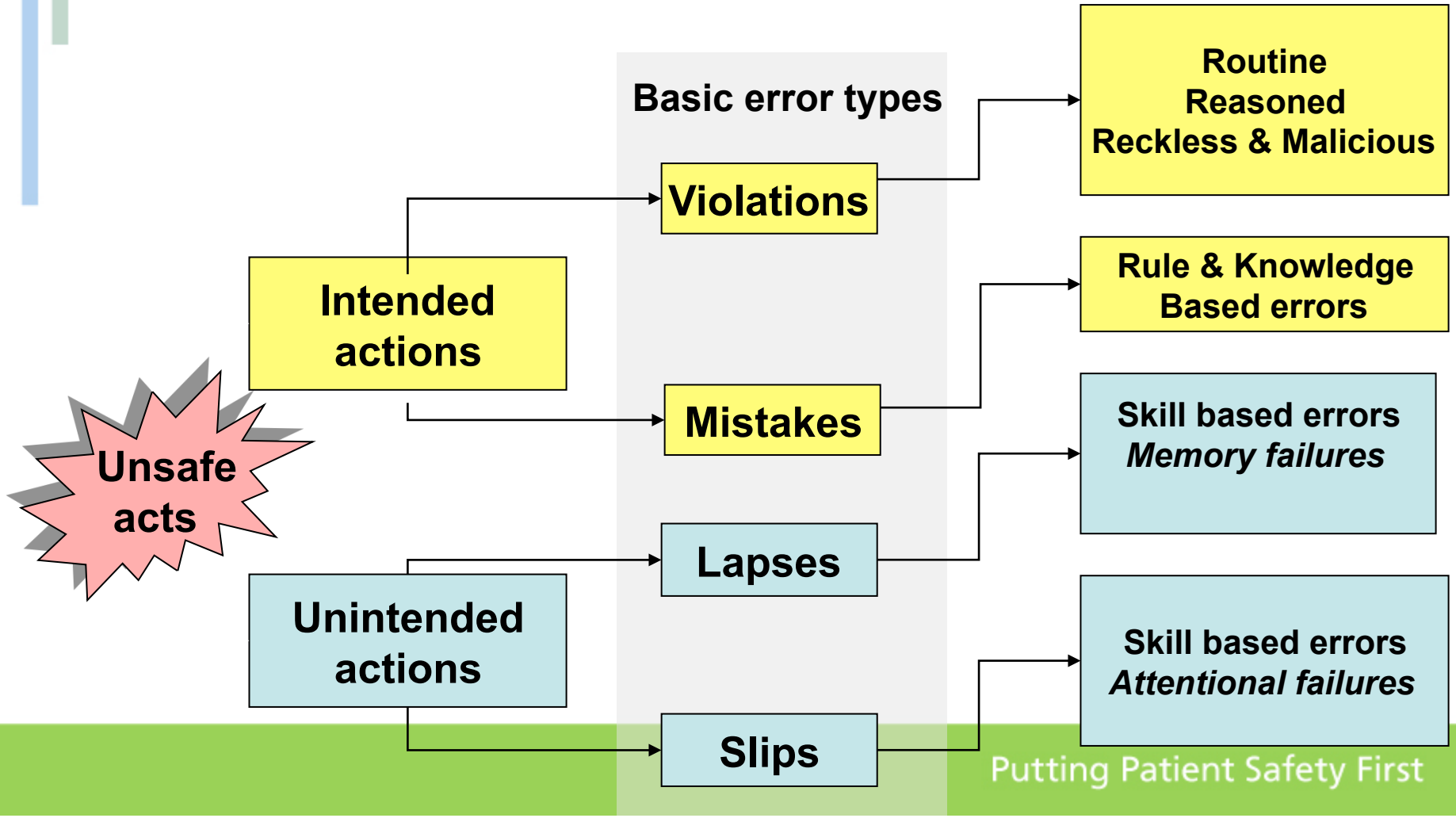
# Human Factors – Error Types



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# Learning from other safety critical industries

To minimise patient safety incidents, healthcare should learn from safety-critical industries and target the underlying systems failures


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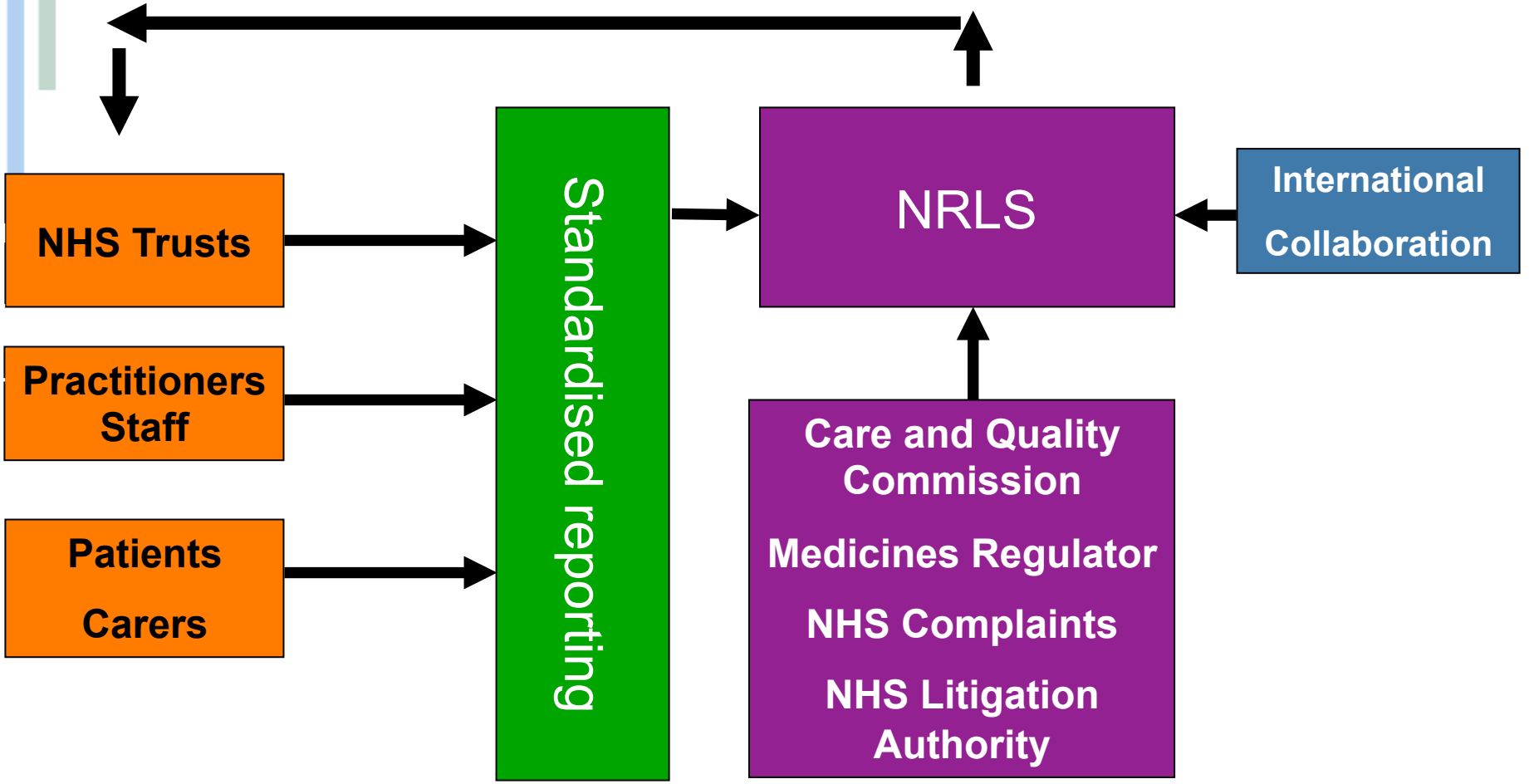
# The National Reporting and Learning System



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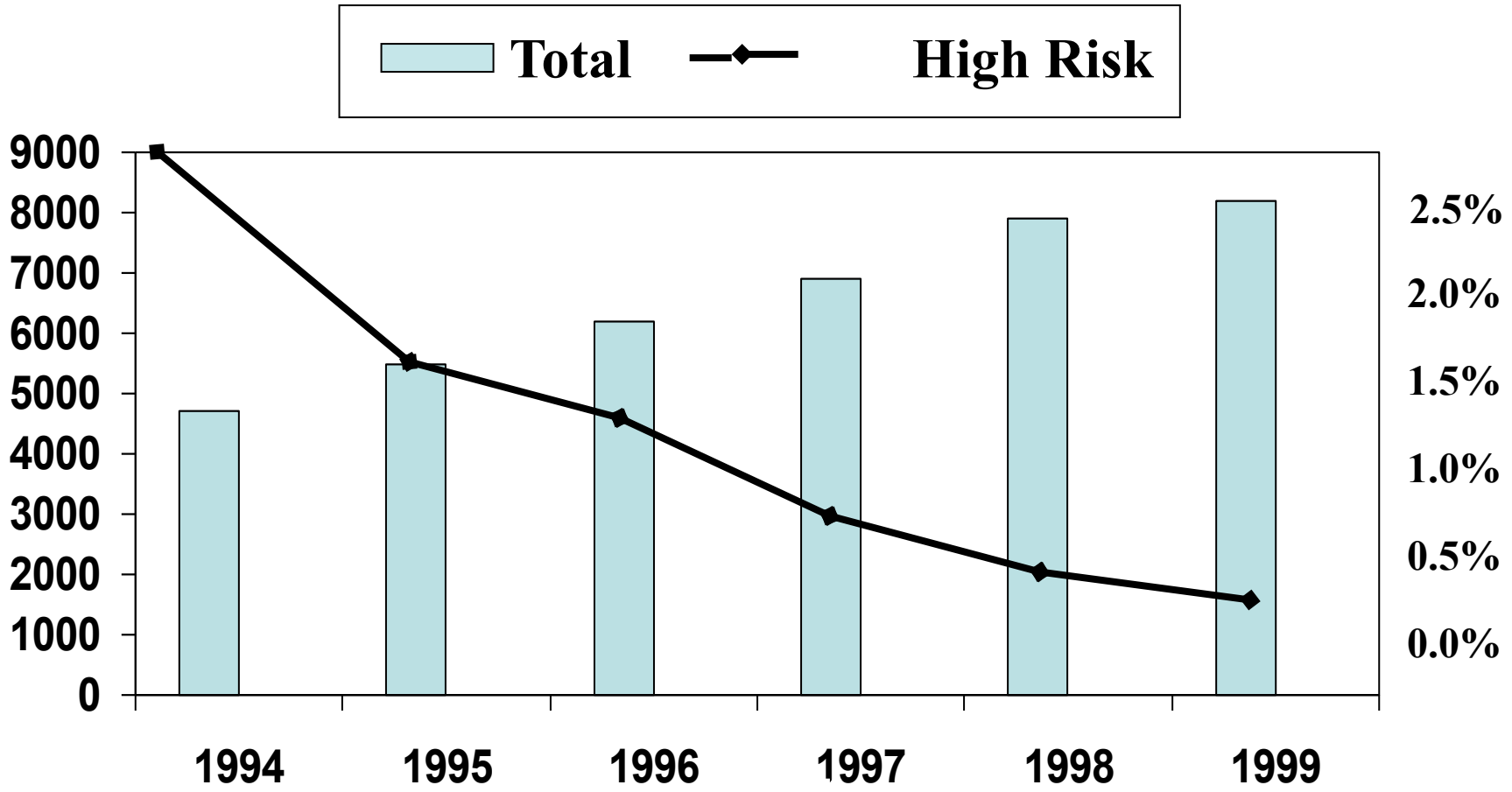
# Air Safety Reports: Volume & Risk



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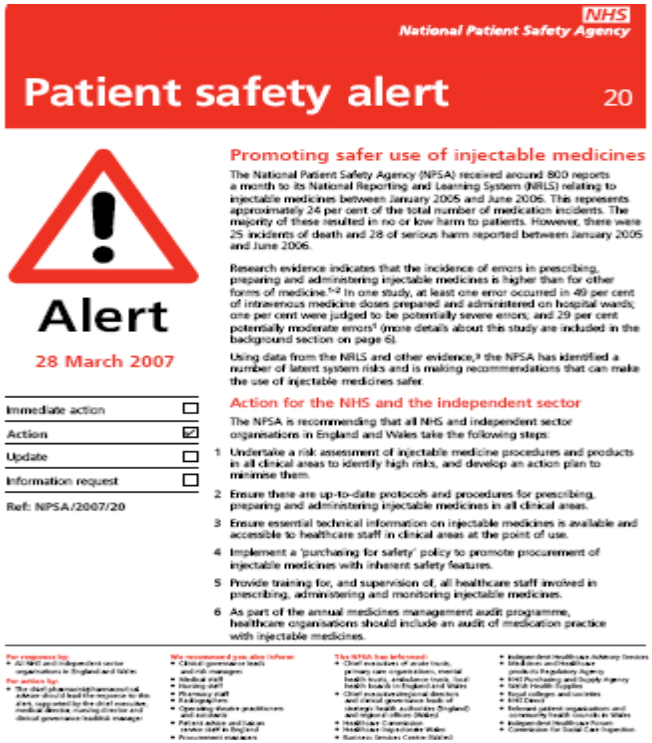
# NPSA guidance on safe medication practice



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**Patient safety alert** 20

**Alert**

28 March 2007

| | |
|---|---|
| Immediate action | ☐ |
| Action | ☑ |
| Update | ☐ |
| Information request | ☐ |

Ref: NPSA/2007/20

## Promoting safer use of injectable medicines

The National Patient Safety Agency (NPSA) received around 800 reports a month to its National Reporting and Learning System (NRLS) relating to injectable medicines between January 2005 and June 2006. This represents approximately 24 per cent of the total number of medication incidents. The majority of these resulted in no or low harm to patients. However, there were 25 incidents of death and 28 of serious harm reported between January 2005 and June 2006.

Research evidence indicates that the incidence of errors in prescribing, preparing and administering injectable medicines is higher than for other forms of medicine.[1,2] In one study, at least one error occurred in 49 per cent of intravenous medicine doses prepared and administered on hospital wards; one per cent were judged to be potentially severe errors, and 29 per cent potentially moderate errors[3] (more details about this study are included in the background section on page 6).

Using data from the NRLS and other evidence,[4] the NPSA has identified a number of latent system risks and is making recommendations that can make the use of injectable medicines safer.

### Action for the NHS and the independent sector

The NPSA is recommending that all NHS and independent sector organisations in England and Wales take the following steps:

1 Undertake a risk assessment of injectable medicine procedures and products in all clinical areas to identify high risks, and develop an action plan to minimise them.

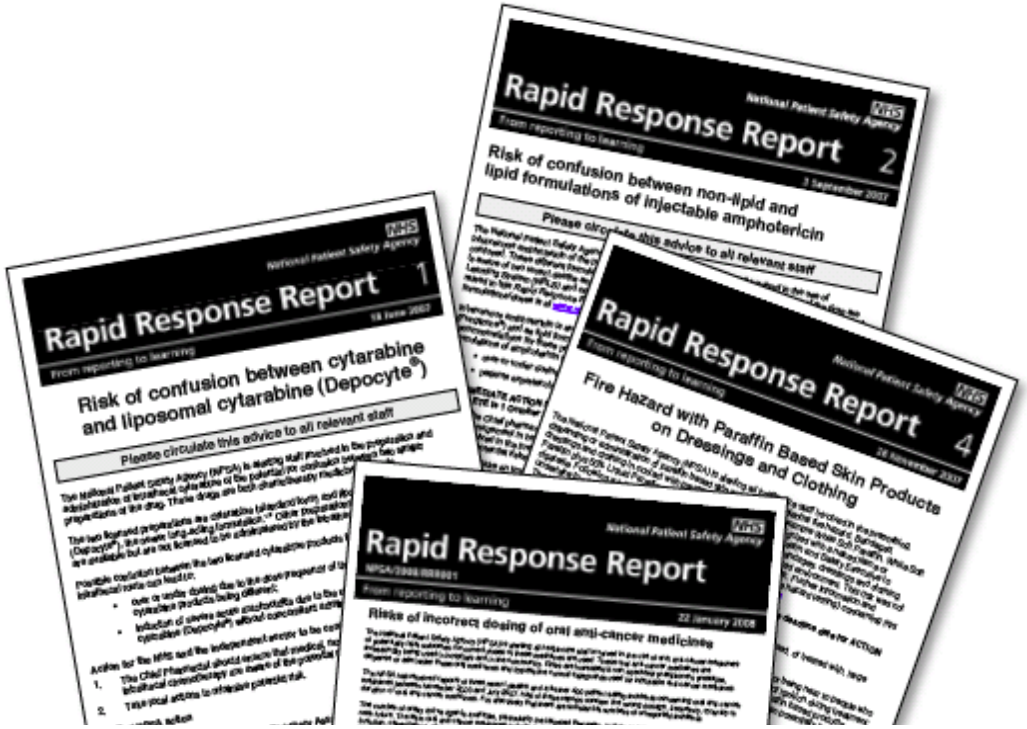
2 Ensure there are up-to-date protocols and procedures for prescribing, preparing and administering injectable medicines in all clinical areas.

3 Ensure essential technical information on injectable medicines is available and accessible to healthcare staff in clinical areas at the point of use.

4 Implement a 'purchasing for safety' policy to promote procurement of injectable medicines with inherent safety features.

5 Provide training for, and supervision of, all healthcare staff involved in prescribing, administering and monitoring injectable medicines.

6 As part of the annual medicines management audit programme, healthcare organisations should include an audit of medication practice with injectable medicines.



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# The Importance of Design for Patient Safety


2002

NHS

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# Patient safety alert 03

Alert

29 July 2004

## Reducing the harm caused by oral methotrexate

Oral methotrexate is a safe and effective medication if taken at the right dose and with appropriate monitoring. However, the NPSA is aware of 137 patient safety incidents over the last ten years in England alone due to problems with taking the medication. This includes 25 patient deaths and 26 cases of serious harm.

### Action for the NHS

NHS acute trusts, primary care organisations and local health boards in England and Wales should take the following steps by March 2005:

1 **Agree local action required**
Agree appropriate local risk reduction actions through your Drugs/Medicines and Therapeutic Committee.

2 **Provide patient information before and during treatment**

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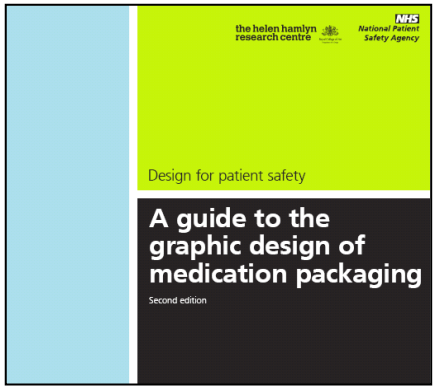
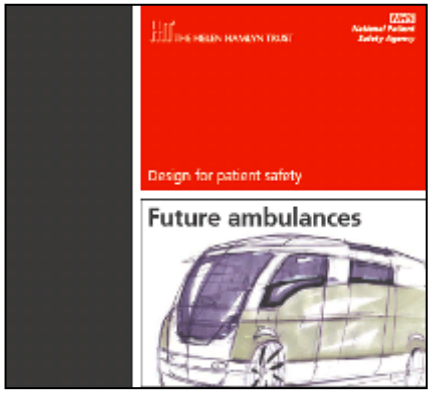
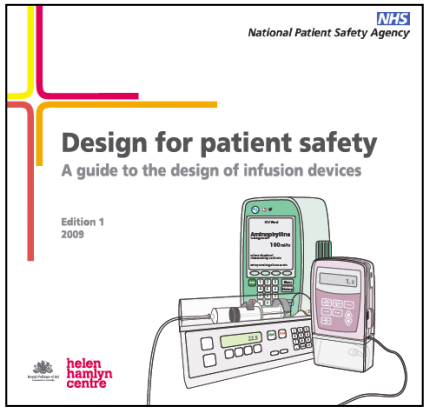
# Design For Patient Safety Series











Putting Patient Safety First

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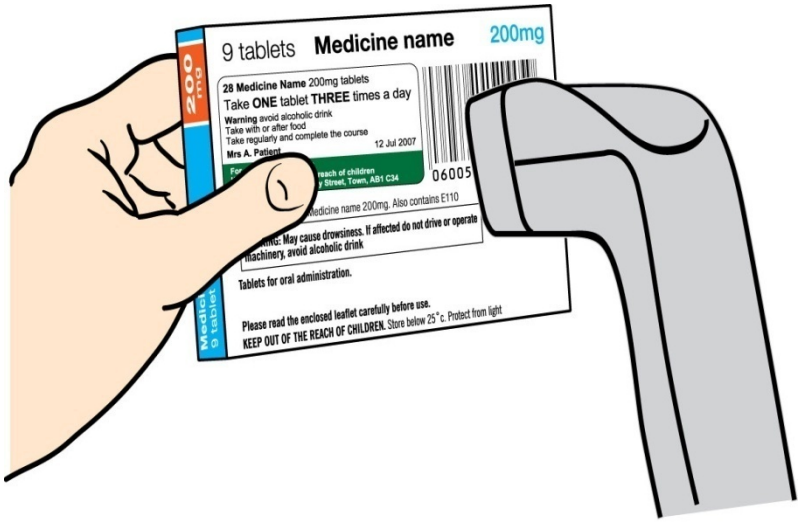


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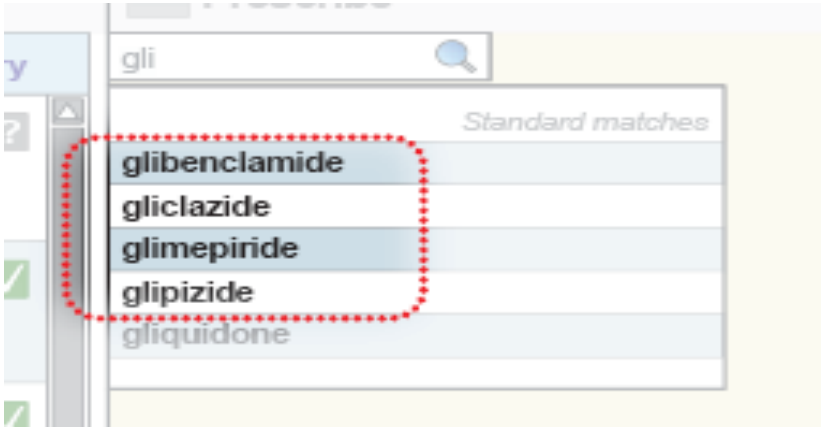


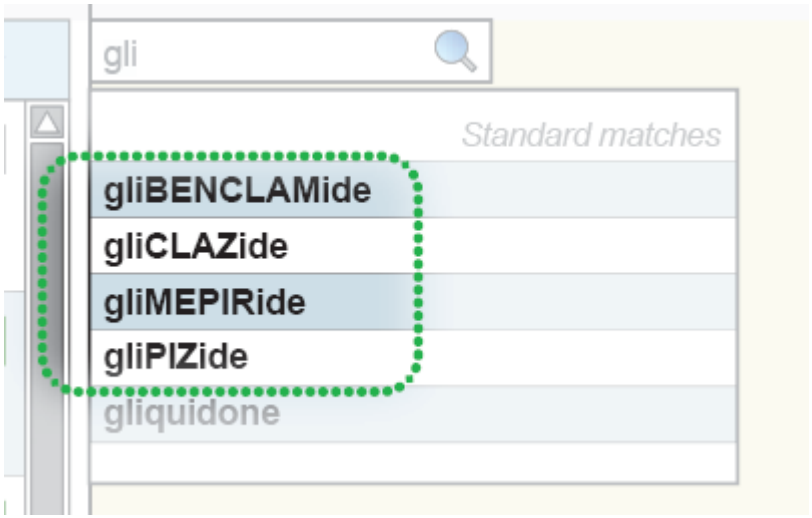

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# The problem

## - suboptimal hospital medication systems

**FINAL report** 2009

***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

## Prevalence

11,077 errors were detected in 124,260 medication orders checked on seven 'census days' in 19 acute hospital trusts in North-west England, a mean error rate of 8.9 errors per 100 medication orders. There were 4190 errors in 50,016 medication orders written by FY1 doctors, an error rate of 8.4%. All grades of doctor (including consultants) made prescribing errors and the highest error rate (of 10.3%) was in foundation year 2 doctors. Errors were most often made at the time of patients' admission to hospital. The classes of drug most commonly involved were analgesics, antibacterials, bronchodilators, and antianginals. Almost all errors were intercepted by pharmacists before they could affect patients.

JCN Journal of Clinical Nursing

Journal of
Clinical Nursing

ORIGINAL ARTICLE

# Medicine administration errors and their severity in secondary care older persons' ward: a multi-centre observational study

2011

Jennifer Kelly and David Wright

Aim and objectives. To assess the severity of medicine administration errors to older patients.
Background. Severity of medicine administration errors has been determined in a variety of settings but not in care-of-older-person wards, which this study aims to do.
Design. Undisguised observational study.
Participants. Sixty-two nurses were observed administering oral medicines to 625 patients.
Interventions. Data were collected on the preparation and administration of oral medicines. Thirty-five cases of error were selected and analysed for their severity.
Results. In the 65 drug rounds observed 2129 potential drug administrations were made to 625 patients, of which 817 doses (38·4%) were given incorrectly (95% CI = 36·3–40·4). The overall mean harm score of the 35 incidents analysed was 4·1 (range 1·1–8·6, SD 1·8) on a scale of 0–10.
Conclusions. The number and severity of MAEs observed is high compared with previous studies.
Relevance to clinical practice. There is a need to decrease the number and severity of MAEs, by increasing nurse awareness and error reporting.

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# E-prescribing and bar coding

## - important design solutions to improve current poor systems

*Review Paper* ■

# The Effect of Electronic Prescribing on Medication Errors and Adverse Drug Events: A Systematic Review

ELSKE AMMENWERTH, PHD, PETRA SCHNELL-INDERST, PHD, CHRISTOF MACHAN, MSC, UWE SIEBERT, PHD

■ J Am Med Inform Assoc. 2008;15:585–600.

**Abstract** The objective of this systematic review is to analyse the relative risk reduction on medication error and adverse drug events (ADE) by computerized physician order entry systems (CPOE). We included controlled field studies and pretest-posttest studies, evaluating all types of CPOE systems, drugs and clinical settings. We present the results in evidence tables, calculate the risk ratio with 95% confidence interval and perform subgroup analyses for categorical factors, such as the level of care, patient group, type of drug, type of system, functionality of the system, comparison group type, study design, and the method for detecting errors. Of the 25 studies that analysed the effects on the medication error rate, 23 showed a significant relative risk reduction of 13% to 99%. Six of the nine studies that analysed the effects on potential ADEs showed a significant relative risk reduction of 35% to 98%. Four of the seven studies that analysed the effect on ADEs showed a significant relative risk reduction of 30% to 84%. Reporting quality and study quality was often insufficient to exclude major

# Effects of Two Commercial Electronic Prescribing Systems on Prescribing Error Rates in Hospital In-Patients: A Before and After Study

**Johanna I. Westbrook[1]*, Margaret Reckmann[1], Ling Li[1], William B. Runciman[2], Rosemary Burke[3], Connie Lo[1¤], Melissa T. Baysari[4], Jeffrey Braithwaite[5], Richard O. Day[6]**

**1** Centre for Health Systems and Safety Research, Australian Institute of Health Innovation, Faculty of Medicine, University of New South Wales, Sydney, Australia, **2** School of Psychology, Social Work & Social Policy, University of South Australia, Adelaide, Australia, **3** Pharmacy Department, Concord Repatriation General Hospital, Sydney, Australia, **4** Australian Institute of Health Innovation, Faculty of Medicine, University of New South Wales, Sydney, Australia, **5** Centre for Clinical Governance Research, Australian Institute of Health Innovation, Faculty of Medicine, University of New South Wales, Sydney, Australia, **6** Department of Clinical Pharmacology and Toxicology, St Vincent's Hospital, Sydney, and Faculty of Medicine, University of New South Wales, Sydney, Australia



*Conclusions:* Implementation of these commercial e-prescribing systems resulted in statistically significant reductions in prescribing error rates. Reductions in clinical errors were limited in the absence of substantial decision support, but a statistically significant decline in serious errors was observed. System-related errors require close attention as they are frequent, but are potentially remediable by system redesign and user training. Limitations included a lack of control wards at Hospital B and an inability to randomize wards to the intervention.

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Br J Clin Pharmacol 2012

# A review of medication incidents reported to the National Reporting and Learning System in England and Wales over six years (2005 – 2010)

Cousins DH, Gerrett D and Warner B

**Table 1** Number of patient safety incidents and medication incidents received by the NRLS 2005 -2010*

| Year | Total number of incident reports* | Number of medication incident reports† | Medication incident reports as a percentage of all incident reports received |
|---|---|---|---|
| 2005 | 517415 | 42398 | 8.19 |
| 2006 | 742418 | 64484 | 8.69 |
| 2007 | 874148 | 79118 | 9.05 |
| 2008 | 986981 | 94280 | 9.55 |
| 2009 | 1118336 | 113837 | 10.18 |
| 2010 | 1198701 | 132069 | 11.02 |
| Total | 5,437,999 | 526,186 | |

**Table 2 Categories of incidents reported to the NRLS 2005 – 2010***

| Incident Category | Number of incidents | Percentage of all incident reports |
|---|---|---|
| Patient accident | 1,785,537 | 32.83 |
| Medication | 526,186 | 9.68 |
| Treatment/procedure | 521,265 | 9.59 |
| Access, admission, transfer and discharge, missing patients | 434,559 | 7.99 |
| All other types of incidents | 2,170,452 | 39.91 |
| Total | 5,437,999 | 100.00 |

**Table 3** Number of patient safety incidents and medication incidents received by healthcare sector*

| Healthcare sector | Total number of incident reports | Number of medication incident reports* | Medication incidents as a percentage of total incident reports |
|---|---|---|---|
| Acute / general hospital | 3,921,212 | 394,951 | 10.07 |
| Mental health service | 754,812 | 48,951 | 6.49 |
| Community nursing, medical and therapy service (incl. community hospital) | 542,323 | 48,594 | 8.96 |
| Learning disabilities service | 155,914 | 8,154 | 5.23 |
| General practice | 22,587 | 5,358 | 23.72 |
| Community pharmacy | 19,696 | 19,245 | 97.71 |
| Ambulance service | 18,415 | 712 | 3.87 |
| Community and general dental service | 2,560 | 133 | 5.20 |
| Community optometry / optician service | 82 | 4 | 4.88 |
| Not stated | 398 | 84 | 21.11 |
| Total | 5,437,999 | 526,186 | 9.68 |

Table 4 Medication incidents reported by the acute care cluster type*

| Acute Organisation *Cluster | Number of reporting organisations | Acute organisations that have not reported any medication incidents | Lower Quartile | Median | Upper Quartile |
|---|---|---|---|---|---|
| Acute specialist trust | 20 | 1 | 31 | 131 | 291 |
| Acute teaching trust | 25 | 0 | 478 | 813 | 986 |
| Large acute trust | 44 | 0 | 164 | 376 | 493 |
| Medium acute trust | 51 | 1 | 150 | 265 | 440 |
| Small acute trust | 30 | 1 | 112 | 203.5 | 264 |
| Total | 170 | 3 | | | |

**Table 5 Medication incidents reported by clinical outcome***

| Actual clinical outcome | Incidents | Percent of medication incidents |
|---|---|---|
| Death | 271 | 0.05 |
| Severe | 551 | 0.10 |
| Moderate | 17421 | 3.31 |
| Low | 68578 | 13.03 |
| No harm | 439318 | 83.46 |
| N/A | 240 | 0.05 |
| **Total** | 526379 | 100.00 |

**Table 6 Medication Incidents by stage of medication process***

| Stage of medication process | Incidents | Percent of medication incidents |
|---|---|---|
| Administration of medicines | 263228 | 50.01 |
| Prescribing of medicines | 97097 | 18.45 |
| Preparation / dispensing of medicines | 87057 | 16.54 |
| Other | 48410 | 9.20 |
| Monitoring / follow-up of medicine use | 23648 | 4.49 |
| Advice | 3537 | 0.67 |
| Supply or use of over-the-counter (OTC) medicine | 3045 | 0.58 |
| N/A | 240 | 0.05 |
| (blank) | 117 | 0.02 |
| Other / Unspecified | 48410 | 9.20 |
| Total | 526379 | 100.00 |

Table 7 Medication Incidents by category of error reported*

| Category of error | Incidents | Percent of medication incidents |
|---|---|---|
| Omitted and delayed medicine | 82028 | 15.58 |
| Wrong dose or strength | 80170 | 15.23 |
| Wrong medicine | 48834 | 9.28 |
| Wrong frequency | 44165 | 8.39 |
| Wrong quantity | 28764 | 5.46 |
| Mismatching between patient and medicine | 21915 | 4.16 |
| Wrong / transposed / omitted medicine label | 13755 | 2.61 |
| Patient allergic to treatment | 11695 | 2.22 |

**Table 8** **Medicines/therapeutic groups identified in incident reports with clinical outcomes of death and severe harm***

| Medicine or therapeutic group* | Death | Severe | Total | Percentage of medication incidents with fatal and severe harm outcome† |
|---|---|---|---|---|
| Opioids | 46 | 43 | 89 | 10.83 |
| Antibiotics | 10 | 38 | 48 | 5.84 |
| Warfarin | 15 | 30 | 45 | 5.6 |
| LMWH‡ | 23 | 23 | 46 | 5.6 |
| Insulin | 9 | 37 | 46 | 5.6 |
| Benzodiazepines | 15 | 12 | 27 | 3.28 |
| NSAIDs§ | 1 | 17 | 18 | 2.19 |
| Potassium | 7 | 8 | 15 | 1.82 |
| Adrenaline | 8 | 4 | 12 | 1.46 |
| Phenytoin | 1 | 11 | 12 | 1.46 |
| Amiodarone | 3 | 4 | 7 | 0.85 |
| Anti-psychotics | 2 | 5 | 7 | 0.85 |
| Methotrexate | 2 | 3 | 5 | 0.61 |
| Total | 142 | 235 | 377 | 45.99 |

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# Omitted medicines - antibiotics

Female patient admitted to A&E with pneumonia confirmed on chest x-ray , with severe sepsis at 1600 on 30th August . Admitted to ward under care of physicians at 19.30 hours on 30th August . Condition deteriorated on 31st August and admitted to Intensive Care Unit at 1800 hours on 31st August .

As at 1st September  patient is poorly and ventilated . Poor prognosis . Patient was not prescribed antibiotic therapy in A&E department . Prescribed antibiotics at 2200 hours on 30th August on ward - 6 hours after admission to A&E department .  Antibiotic therapy was not administered until 17.15 on 31st August  25 hours after admission to A&E department . Following intervention by outreach team

# Omitted medicines – anticoagulants

The patient who died had not received warfarin for 5 days. Was prescribed warfarin on 23 February but due to INR being elevated had been omitted . After that the chart must have been lost or misplaced because a new prescription chart had been written on the 24 February. It is unclear when the original chart had been found . The prescription chart for the 1 March had warfarin prescribed for that evening but the patient died prior to administration of medication . Between the two dates stated there had been no warfarin prescribed

# Omitted medicines - insulin

Type 1 diabetes 75 years. Once daily insulin glargine.
Not eating so insulin not given for three days
Developed diabetic ketoacidosis PH 7.19  BM 22.6.
Treated but prognosis poor and failed to recover from operation  C. Difficile and DKA

Clin Med. 2009 Dec;9(6):515-8.

# Omission after admission: failure in prescribed medications being given to inpatients.

Green CJ, Du-Pre P, Elahi N, Duncklev P, McIntyre AS.

Wycombe Hospital (Buckinghamshire NHS Trust), High Wycombe.

## Abstract

Prescribing errors are a recognised problem on admission to acute medical wards which may be detrimental to patient care. The authors had anecdotal evidence that prescribed **medicines** do not always reach patients and the aim of this audit was to quantify this problem. Admission prescription charts on two separate occasions were studied in detail and all drugs prescribed but not given in the first 48 hours were recorded along with the reason given for omission. In total, 271 patient charts were analysed. Of these, 20% of prescriptions affecting 17% of patients did not reach patients. The two dominant reasons for medications not being given to patients were that the medication was not available on the ward (38% of omissions) or that the patient was nil by mouth (32% of omissions). In 10% of cases the patient refused the medication, in 19% no reason for omission was given and in only a minority (0.3%) was the patient off the ward. This audit demonstrates that even when medications are prescribed they are not always given. This may lead to increased morbidity and length of stay. Strategies need to be put in place to reduce this problem. The current system that permits omission of medications with inadequate justification must be revised.

# Wrong dose - opioids

A patient was started on MST (morphine) 60mg twice a day for arthritic pain as an initial dose. Prior to this the patient was using tramadol 50mg three times a day for analgesia. After taking four doses of the MST the patient was confused, hallucinating and drowsy

An SHO made an error in transcribing the prescription of fentanyl patch . The correct prescription was 12 micrograms patch , but the SHO prescribed the 125 microgram patch in error . The incorrect high dose patch was applied at 08:00hrs . Error was noted at about midnight when patient was observed to be confused and had a decreased respiratory rate

# Wrong dose - insulin

Patient had hypoglycaemic attack which led to arrest and unsuccessful resuscitation. Patient received double doses of insulin due to insulin prescribed on Diabetes Treatment Chart and drug kardex

Insulin incorrectly prescribed on the patient drug chart . F1 informed and came to the ward to represcribe . Started a second drug chart and prescribed the insulin at 10pm instead of 6pm . Therefore the patient was given a dose at 6pm as prescribed and a further dose at 10pm . Overnight the patient had a hypo and cardiac arrest and RIP SUI 195

# Wrong dose – antibiotics

Patient admitted with infected right knee ( Staphylococcus aureus sensitive Flucloxacillin and Fucidin . Rheumatoid on cyclosporin , steroids , methotrexate . IV Fucidin ( 500mg TDS ) for 2 weeks , changed to oral on 5 days ago . Patient received 1gram Fucidin orally QDS but maximum dose according BNF is 750mg TDS ( i.e . patient received 4 grams daily instead of a maximum of 2.25 grams per day) . Patient developed jaundice, renal failure hypotension , and transferred to ITU

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# Wrong dose – low molecular weight heparin

Patient was prescribed 15,000 units of Fragmin, but when weighed on admission [date] was only 46kg. Treatment dose for this weight is only 10,000 units, so a 50% overdose was prescribed and administered. Patient subsequently transferred to ICU for respiratory support. Incidental APTT result checked on Intensive Care Unit was 129 seconds (ratio 4.3) and when repeated had risen to 178 seconds (ratio 6)

# Wrong - medicine

Prescribed and administered the wrong type of Insulin
Patient precribed Humalog insulin bd instead got Humalog Mix Insulin . Episodes of severe and presistant hypoglycaemia

Patient went into severe Hypoglycaemia, Noted to be fitting Insulin prescribed & given as Humalog which should have been Humalog Mix25 . Noted prescribing error

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# Wrong medicine

- carbamazepine - carbimazole
- clobetasone – clobetasol
- clomifene - clomipramine
- cyclosporine - cycloserine
- dipyridamole – disopyramide
- folic acid – folinic acid
- gliclazide – glimepiride
- glimepiride – glibenclamide
- glipizide – gliclazide
- lormetazepam – lorazepam
- mercaptopurine – mercaptamine
- nifedipine – nicardipine
- oxbutynin - oxycodone
- oxycodone - oxybutynin
- oxycodone - oxycontin
- penicillamine – penicillin
- prednisolone - propranolol
- procyclidine – prochlorperazine
- promethazine – promazine
- quinine – quinidine
- riboflavin – ribavirin
- rifampicin - rifabutin
- sertindole – sertraline
- vinblastine - vincristine

# Medicine - allergy

Known allergy to amoxicillin . Wearing red armband . Prescribed co - amoxiclav and given initial dose on ward . Attended ED next day with severe drug reaction rash , needed IV piriton & fluid.

Patient allergic to penicillin ( written in allergy box ) . Patient prescribed tazocin ( contains a penicillin ) . Florid rash developed over body - maculopapular  rash .

# Clinical support in e-prescribing systems

## Current systems

- Drug – drug interactions
- Medicine – allergy
- Therapeutic duplication
- Limited dose checking

- IV's, anticoagulants, insulin frequently – excluded

## Additional functional specifications

- Omitted and delayed medicines
- Dose checking – weight, renal function, labs and previous therapy
- Additional measures for frequent wrong medicines
- Specific patient safety guidance
- IV's, anticoagulants, insulin to be included *ASAP*

NHS
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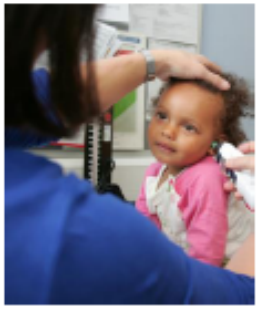
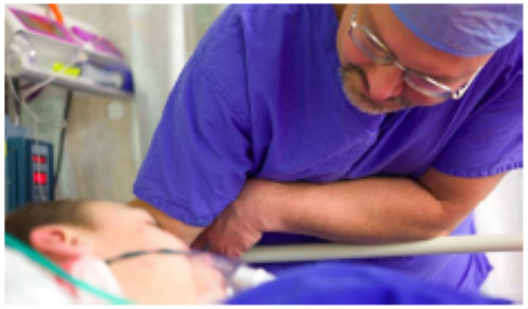
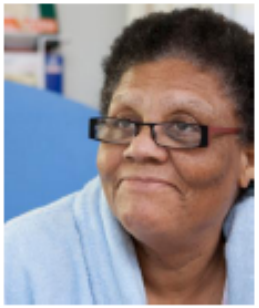
A special health authority

# Design of the NHS Commissioning Board







NHS Commissioning Board
Authority
Board Meeting
2 February 2012

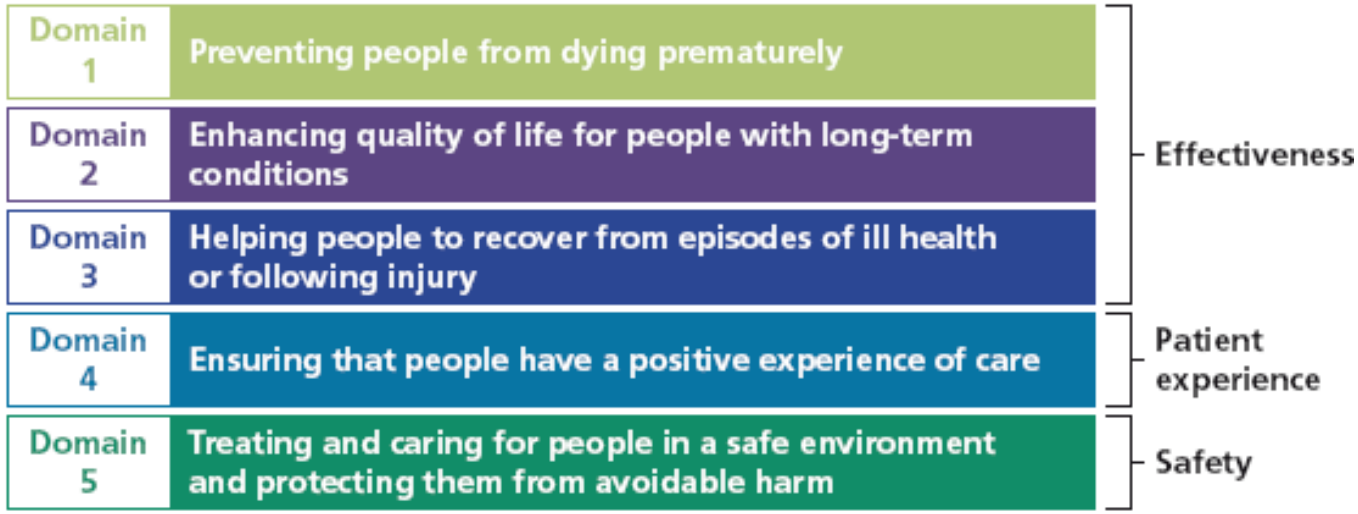
THE NHS CONSTITUTION
the NHS belongs to us all

Putting Patient Safety First

# The NHS Outcomes Framework 2011/12

Department of Health

NHS Commissioning Board
A special health authority



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# Indicators for patient safety

- **Patient safety incident reporting**
  This should be initially increasing, probably for several years, as the culture of reporting all incidents spreads more widely and deeply across the NHS, and then eventually remaining steady or even decreasing, as the habit of reporting incidents becomes routine and incidents are learnt from.

- **Severity of harm (measuring the number of incidents resulting in severe harm or death)**
  This should be decreasing as fewer serious incidents should occur if a patient safety culture is developing and lessons are being learnt.

- **Number of similar incidents**
  This should be decreasing as organisations learn from specific kinds of safety incidents and take action to ensure that they do not happen again.

# Summary

- Medication errors occur and are reported frequently.
- A substantial number of preventable harms are reported
- There is an urgent requirement for better designed medication systems to minimise preventable harms

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# Key note message

- Other countries have introduced e-prescribing and bar code administration systems that improve patient safety
- NHS patients deserve safer care from the introduction of this technology
- There has been a long delay in the NHS in implementing this technology

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# Get on with it!

Putting Patient Safety First