APPENDIX

The new NHS IT systems will prevent unnecessary deaths.

Key to an understanding how the systems being developed can play a part in reducing adverse events, particularly medication errors, are an appreciation of :

- the scale of the problem,
- the root causes of any avoidable errors
- the evidence supporting the role of IT in reducing some of the root causes, and
- an explanation of the new systems themselves.

Scale of the Problem:

There is evidence from international literature that medication errors occur in all health care settings, with some errors occurring repeatedly not just within one healthcare system, but across healthcare systems worldwide. Whilst the UK evidence base is not as strong as it is in other countries, particularly the United States, this does not mean that the NHS in England is immune from this problem. A UK based study which looked specifically into adverse drug reactions as a cause of hospital admission. This study, published in the British Medical Journal in 2004[1] concluded that:

- 1 in 16 hospital admissions are the result of an adverse drug reaction (ADR) – 72% of which are avoidable
- This equates to 4% of hospital bed capacity
- At any one time the equivalent of 7 x 800 bed hospitals are occupied by patients admitted with ADRs
- ADRs causing hospital admissions are responsible for the death of 5,700 patients every year
- Cost to the NHS = £466m

Whilst neither this nor other studies quoted below are without their limitations, they nevertheless are extremely important in helping to quantifying the scale of the problem. Academic studies such as these do not become irrelevant just because they were conducted a number of years ago or because the situation may have improved since the study was conducted.

Root Causes:

Although patient safety incidents are diverse in nature, a study carried out by National Audit Office in 2003/04 and reported in “A Safer Place for Patients”[2] revealed that the most common patient safety incidents in hospitals after

[1] Pirmohamed, M. et al: Adverse drug reactions as a cause of admission to hospital: prospective analysis of 18,820 patients: BMJ 2004; 329: 15-19

[2] A Safer Place for Patients: National Audit Office, HC 456 Session 2005-2006

patient falls related to medication errors, record documentation error and communication failure.

This is supported by the Audit Commission in their report "A Spoonful of Sugar"[3] which came to the following conclusions:

- Complications arising from medicines treatment are the most common cause of adverse events in hospital patients.
- Errors may occur from the initial decision to prescribe to the final administration of the medicine, and these include choice of the wrong medicine, dose, route, form, and frequency.
- Most errors are caused by the prescriber not having immediate access to accurate information about either the medicine (its indications, contraindications, interactions, therapeutic dose, or side effects); or the patient (allergies, other medical conditions, or the latest laboratory results).
- Hand-written prescriptions or patients' notes also contribute to errors as they may be illegible, incomplete, subject to transcription errors or make use of inappropriate shorthand.
- Prescription sheets themselves may also be temporarily unavailable or lost.

Safe, effective clinical care also depends on reliable, error-free communication between different providers of care. Communication breakdowns between healthcare providers are a common feature in episodes of avoidable patient harm. This was highlighted in the Department of Health publication "Building a Safer NHS for Patients: Improving Medication Safety":

"Effective communications are critically important when patients move from one care setting to another; many medication errors occur at such "handover points". Serious errors have occurred because of poor communication between primary and secondary care. Accurate information about current treatment is essential when patients are admitted to hospital to enable an accurate clinical assessment and to plan future treatment. And on discharge, the patient's drug regimen and treatment plan need to be communicated in a timely and reliable way to ensure safe and seamless transfer of care back to the primary care team"[4].

Information Technology & Patient Safety – The Evidence

Research sources provide ample evidence that information technology can improve patient safety through eliminating many of the root causes described above. The **Annex** to this Appendix provides a summary of just some of the available evidence. The Department of Health has taken account of this research evidence in framing the scope of the NHS IT Programme.

The following is a brief explanation of how some of the elements of the overall NHS Care Record Service will contribute to reducing incidents of patient harm. In places this includes data obtained from the [then] National Patient

[3] A Spoonful of Sugar: medicine management in NHS hospitals: Audit Commission 2001
[4] Building a Safer NHS for Patients: Improving Medication Safety- Department of Health 2004

Safety Agency's, National Reporting & Learning System (NRLS) to help highlight the potential patient safety benefits. However, it should be noted that whilst the reporting of patient safety incidents is becoming more established practice, and is now a core standard the NHS is expected to adhere to, the figures are still likely to underestimate the full scale of such patient safety incidents.

Personal Demographics Service - Right Patient, Right Care:

Use of the NHS number as the unique identifier in all healthcare interactions in England will, when fully achieved, make a major contribution to patient safety.

Even today, an individual patient may have different identifying numbers in different NHS organisations and sometimes even within the same NHS organisation.

The dangers of this are well illustrated by information extracted from the NRLS which shows that between November 2003 and May 2006 there were 600 patient safety incidents reported which related directly to patients' identifying numbers. Furthermore, the NRLS also reveals that between January 06 and December 06 alone there were 7,984 patient safety incidents reported where the incident type was "Patient Incorrectly Identified".

In this respect, the Personal Demographic Service (PDS) – which allows authorised NHS health and social care practitioners to accurately and efficiently trace patients against the patient's most up to date demographic details, thus identifying the patient's unique NHS number- will make a key contribution to patients safety benefits.

PDS underpins all current and future National Programme for IT products and, with approximately 50 million demographic records for everyone in England stored on the database, it is already supporting the delivery of the Choose and Book Service and the Electronic Prescription Service.

NHS Summary Care Record:

The Summary Care Record (SCR) forms the national element of the NHS Care Record Service and will provide authorised health care professionals with access to key clinical information about a patient anywhere, at any time.

The record (subject to patient consent) will initially contain the following information held on the GPs record:

- Known allergies
- Known adverse reactions
- Medications – acute prescriptions in past 6mths and repeat prescriptions in past 18mths

The importance of having access to this basic patient information is highlighted by the following information obtained from the NRLS (England only) between January and December 2006:

- 1,678 reported patient safety incidents where the patient was allergic to the treatment given.
- 916 patient safety incidents where the patient suffered an adverse drug reaction (when the drug was used as intended).
- 1,147 reported patient safety incidents where the treatment given was contraindicated in relation to drugs or conditions.
- 821 patient safety incidents reported where the primary cause given for the incident was "missing / inadequate / illegible referral letter".
- 28,875 patient safety incidents reported relating to "documentation" e.g. missing / illegible / misfiled (See footnote for specific search filters)[5]

Electronic Prescription Service (EPS):

With some 1.5 million prescriptions now being issued every working day in England (a figure continuing to rise by 5% each year) the development of the EPS, which replaces a paper based system with an electronic one which is more efficient and consistently accurate, is absolutely critical to providing health care professionals with up to date and accurate information about the range of medications a patient might be taking at any point in time.

In a study of older people at the University Hospital of North Durham, a structured review of patients' medication was conducted after admission. An average of almost 1 drug per patient was found to be inappropriate and stopped and an average of approximately 1 drug per 2 patients was started following identification of omissions in the drug history.[6]

The importance of having up to date medication information for older patients is further illustrated as follows[7]:

- As people get older, their use of medication tends to increase. Four in 5 people over 75 take at least 1 prescribed medicine, with 36% taking 4 or more medicines.
- Adverse reactions are implicated in between 5% and 17% of hospital admissions for older people
- While in hospital, between 6% and 17% of older inpatients experience adverse drug reactions
- Older people who are taking four or more medicines have increased risk of suffering an adverse reaction to a medicine and being readmitted to hospital as a result

[5] NRLS Search Filters = "Documentation- no access to" + "Documentation- missing / inadequate / illegible referral letter or healthcare record / card" + "Documentation- delay in obtaining healthcare record / card" + "Documentation- misfiled"

[6] Building a Safer NHS for Patients: Improving Medication Safety- Department of Health 2004

[7] A Spoonful of Sugar: medicine management in NHS hospitals: Audit Commission 2001

The EPS has been designed to provide medication data to the NHS Care Record. The NHS Care Record, populated by data from the EPS will, over time, provide a single, authoritative point of reference for the medication a patient has been prescribed and dispensed and has the potential to lead to a significant reduction in medication errors caused by a lack of instantly available medication information.

E-Prescribing:

Whereas the patient safety benefits of the Electronic Prescription Service lie principally in providing clinicians with up to date information about a patient's medications through links to the NHS Care Record, the benefits of e-Prescribing systems lie in reducing actual prescribing errors and administration errors often associated with prescribing.
A study[8] into the incidence of adverse drug events and potential adverse drug events reviewed 4031 patient records and found an incidence of 6.5% actual and 5.5% potential errors. Of these:

- 56% related to errors at the ordering stage
- 34% related to administrative errors
- 6% were transcription errors
- 4% were dispensing errors

The Agency for Health Care Policy and Research (USA) published a research in action paper claiming that computerised medication order entry (also known as e-Prescribing systems) has the potential to prevent an estimated 84% of dose, frequency and route errors in prescribing. This report cites numerous other research studies, which claim safety benefits from computerised medication order entry systems or e-prescribing systems.[9]

The local detailed record solutions being developed under the NHS IT programme will allow for:

- Computerised entry and management of prescriptions.
- Decision support, aiding the choice of medicine and other therapies, with alerts covering, for example, drug interactions, contra-indications, allergic reactions and other safety-related issues.
- Knowledge support, giving users immediate access to up-to-date drug information such as the British National Formulary.
- Electronic links between hospital wards/departments and pharmacies.
- A robust audit trail for the entire medicines provision process.

E-Prescribing systems will be underpinned by the Dictionary of Medicines and Devices (dm+d), a dictionary containing agreed unique identifiers and associated textual descriptions for medicines and medical devices. The dm+d

[8] Bates DW, Cullen DJ, Laird N, Petersen LA, Small SD, Servi D, et al. Incidence of adverse drug events and potential adverse drug events. JAMA 1995; 274: 29-34
[9] Reducing and Preventing Adverse Drug Events to Decrease Hospital Costs. Research in Action, Issue1 AHRQ Publication Number 01-0020 March 2001. Agency for Healthcare Research and Quality, Rockville .MD. http://www.ahrq.gov/qual/aderia/aderia.htm

will help make e-Prescribing systems interoperable with other NHS IT systems, enabling safe and reliable exchanges of information on medicines and devices and effective decision support through linkages of data.

ANNEX

SUPPORTING EVIDENCE

Bates and Gawande 2003. The conclusions of the work by Bates, et al. reports the following benefits -

- Information technology can substantially improve the safety of medical care by structuring actions, catching errors, and bringing evidence-based, patient-centred decision support to the point of care to allow necessary customisation.
- The use of decision support for clinical decisions can also result in major reductions in the rate of complications associated with antibiotics, and can decrease costs and the rate of nosocomial infections.
- 53% - 83% reduction in serious medication errors.

Bates, D.W. and Gawande, A.A., Improving Safety with Information Technology. New England Journal of Medicine 2003, 348:2526-34
(http://content.nejm.org/cgi/content/short/348/25/2526)

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Reducing and Preventing Adverse Drug Events to Decrease Hospital Costs. Research in Action, Issue1 AHRQ Publication Number 01-0020 March 2001. Agency for Healthcare Research and Quality, Rockville .MD.
http://www.ahrq.gov/qual/aderia/aderia.htm

The LEAPFROG Group for patient safety Rewarding Higher Standards (USA) quotes the following examples of safety benefits from physician order entry systems:

(i) A study by David Bates, MD, Chief of General Medicine at Boston's Brigham and Women's Hospital, demonstrated that their Computer Physician Order Entry (CPOE) system reduced error rates by 55% from 10.7 to 4.9 per 1000 patient days.
Bates DW, Leape LL, Cullen DJ, Laird N, et al. Effect of computerized physician order entry and team intervention on prevention of serious medication errors JAMA. 1998;280:1311-6.

(ii) Rates of serious medication errors fell by 86% in a subsequent study by the same group. The prevention of errors was attributed to the CPOE system's structured orders and medication checks.
Bates DW, Teich JM Lee J Seger D, Kuperman GJ, Ma'Luf N, Boyle D, Leape L. The impact of computerized physician order entry on medication error prevention JAMIA. 1999;6:313-21

(iii) John Birkmeyer, MD, a surgeon and health services researcher at Dartmouth Medical School, estimates that implementation of CPOE systems at all non-rural US hospitals could prevent over 500,000 serious medication errors each year.
Birkmeyer JD, Birkmeyer CM, Wennberg DE, Young MP. Leapfrog safety standards: potential benefits of universal adoption. The Laepfrog Group. Washington DC: 2000

E-prescribing report prepared by First Consulting Group for California Healthcare Foundation claims patient safety benefits from e-prescribing and references a Movement championed by the Institute for Safe Medication Practices, calling for the universal adoption of e-prescribing and the abandonment of hand written prescriptions by 2004, for the improvement of prescribing safety.
Kilbridge Peter, MDE & Gladysheva Katy, First Consulting Group, E-Prescribing prepared for California Healthcare Foundation 2001

A report on the prevention of medical errors by First Consulting asserts that it is through understanding and altering the processes by which complex systems operate that quality is best achieved and improved. Healthcare quality requires, perhaps more than anything does, access to reliable information at the point of medical decision-making. As such, the provision of clinical care is an information-dependent process.

Two principal kinds of information management support care quality. The first is collection of and access to real-time clinical data at the point of care. What did this patient's X-ray reveal? What medications is she receiving? Access to point-of-care information assists the clinician in treating the patient "here and now." A second kind of information is aggregate data on populations of patients. This data can be retrospectively examined to identify practice patterns, incidence of disease or complications, and the like. It can also be used to target specific practitioner behaviours for improvement.

Both types of information management are required as part of any coherent strategy to measure and improve the quality of healthcare delivered. Implementing evidence-based medicine in a healthcare delivery organization requires a substantial investment in rethinking and fine-tuning clinical processes across the continuum of care. Moreover, creating more reliable and effective clinical processes and practices necessitates introducing information technology into the hands of physicians and other caregivers.
Classen D and Kilbridge P - Health quality and the prevention of medical errors, First Consulting Group June 2000.

Smart tags and packaging are already saving lives, preventing illnesses and sharply reducing costs in healthcare. The Protti World Review Report 14 cites examples of radio frequency identification technology and its benefits in healthcare.
Radio-frequency identification: Its potential in Healthcare. Health Devices 34(5), May 2005:149-60 (no Authors listed)
(http://www.connectingforhealth.nhs.uk/worldview?searchterm=Protti)

Right patient, right blood new advice for safer transfusions – NHS Connecting for Health has supported the National Patient Safety Agency in the development of new measures to improve the safety of blood transfusions, including photo ID cards and electronic tracking systems for patients and blood.
(http://www.npsa.nhs.uk/display?contentId=5354)

Protti World View Report 8 is the first of two reports providing an overview of clinical information technologies that are helping to save lives and improve the quality of life for patients. This report includes references to the benefits of Picture Archiving and Communications Systems (PACS) such as improved speed and accuracy of diagnosis.
(http://www.connectingforhealth.nhs.uk/worldview?searchterm=Protti)

Protti World View Report 3 shows how the value of computers in healthcare can be about improving decision-making. This report includes references to the benefits of computerised electronic patient record systems. It suggests that electronic systems enable physicians and nurses to make better, quicker decisions with the aid of on-line access to evidence-based results, assistance in placing orders, detecting drug interactions, and receiving alerts after abnormal test results. This delivers more efficiency with fewer errors.
(http://www.connectingforhealth.nhs.uk/worldview?searchterm=Protti)

Protti World View Report 2 specifically focuses on how the use of computers in healthcare can reduce errors, improve patient safety and enhance the quality of care. Incomplete information in records and the difficulty that clinicians have in keeping up with the rapidly growing clinical evidence base are significant problems that can be mediated by IT. The US Institute of Medicine - Quality Chasm report 2001 is quoted "The current care systems cannot do the job. Trying harder will not work. If we want safer, higher-quality care, we will need to have redesigned systems of care, including the use of IT to support clinical and administrative processes.
(http://www.connectingforhealth.nhs.uk/worldview?searchterm=Protti)

The Audit Commission report "a spoonful of sugar – medicines management in NHS hospitals – 2001" reported that:

- Electronic prescribing reduces medicine errors significantly by providing timely, legible information. One study concluded that improved information systems could contribute to the prevention of 78 per cent of transcription errors leading to adverse medicine events.

- Computerised systems containing rules to prevent incorrect or inappropriate prescribing have also reduced the incidence of errors and increased the appropriateness of medicine treatment
- Computerised prescribing linked with electronic health records will radically alter the way in which care is provided and will deliver significant improvements in the quality of patient care (Ref. 86). The introduction of these systems, which ultimately need to be accessible by primary care and other hospitals, is vital to provide access to common clinical data. It is one of the biggest challenges currently facing the NHS.

(http://www.audit-commission.gov.uk/Products/NATIONAL-REPORT/E83C8921-6CEA-4b2c-83E7-F80954A80F85/nrspoonfulsugar.pdf)