PRACTICE

Exploring the causes of adverse events in NHS hospital practice

Graham Neale FRCP Maria Woloshynowych PhD Charles Vincent PhD

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SUMMARY

In a previous paper we reported that 10.8% of patients admitted to two large hospitals in Greater London experienced one or more adverse events, of which half were deemed preventable. Here we examine the underlying causes of errors in clinical practice. Rather than identifying specific errors made by individuals, we have looked at possible faults in the organization of care. Adverse events were grouped according to stages in the care process: diagnosis, preoperative assessment and care, operative or invasive procedure (including anaesthesia), ward management, use of drugs and intravenous fluids and discharge from hospital.

Less than 20% of preventable adverse events were directly related to surgical operations or invasive procedures and less than 10% to misdiagnoses. 53% of preventable adverse events occurred in general ward care (including initial assessment and the use of drugs and intravenous fluids) and 18% in care at the time of discharge. Probable contributory factors in these errors included dependence on diagnoses made by inexperienced clinicians, poor records, poor communication between professional carers, inadequate input by consultants into day-to-day care, and lack of detailed assessment of patients before discharge.

INTRODUCTION

The Chief Medical Officer's report *An Organisation with Memory*[1] suggests that, although most National Health Service (NHS) care is of a high clinical standard, there is considerable evidence of serious failures. The report cites evidence, for instance, that 400 people die or are seriously injured each year in events involving medical devices, that nearly 10 000 people experience serious adverse reactions to drugs and that hospital-acquired infection costs the NHS £1 billion per year. These adverse events are unintended injuries, caused by medical management rather than by the disease process.

Retrospective studies of case records in the United States and Australia have revealed a substantial rate of adverse events in hospital practice. The Harvard Medical Practice Study (HMPS)[2,3] identified adverse events in 3.7% of hospital admissions. In 70% the adverse event led to slight or short-lived disability but in 7% the disabilities were permanent and in 14% they contributed to death. Similar rates were found in a study from Colorado and Utah[4,5]. The Quality in Australian Healthcare Study (QAHCS)[6], using different criteria, identified adverse events in 16.6% of admissions, of which half were considered preventable. Adverse events were estimated to account for 8% of hospital bed-days and to cost the Australian healthcare system 4.7 billion dollars a year.

Information on adverse events in Britain

In Britain information on adverse events is indirectly available from sources including confidential enquiries, studies of claims and complaints, and research into critical incidents and also from rare but high-profile incidents such as those at the Bristol Royal Infirmary[7]. At a local level most trusts rely on a combination of incident reporting, complaints and claims data. Valuable though all these studies and enquiries are, even when taken together they offer only a partial view. Denominator information is not available for such studies so we cannot determine the rate of any class of adverse events.

We have recently reported the results of a preliminary study in two hospitals on the incidence and nature of adverse events (AEs) in patients admitted to hospital[8], using methodology developed for the HMPS and QAHCS[2,3,6]. These studies define AEs as injuries to patients caused by the management of the disease which led to prolongation of hospital stay or to temporary or permanent impairment or disability to the patient at time of discharge. 10.8% of patients were found to have experienced adverse events, half of which were judged preventable. Total costs of preventable adverse events in terms of additional days in hospital were estimated at around £1 billion per annum in

Clinical Risk Unit, Department of Psychology, University College London, London WC1E 6BT, UK

Correspondence: Dr Graham Neale

the acute sector alone. This figure is in addition to the costs of litigation, staff time, impact on patients and staff, and the wider economic consequences.

The causes of adverse events

In American studies drug-related events were found to be responsible for about 20% of incidents[3] and subsequently there have been several papers describing how AEs can be reduced by information[9] and decision-support[10–12] systems, as well by improved methods for ordering, transcribing, dispensing and administering medications[13–15]. The Americans also found that AEs arising from the organization of the care of medical emergencies are often preventable[3]—a finding supported by a study in the UK[16]. Of preventable surgical accidents, vascular surgery (including coronary artery bypass) and colonic surgery seemed to have more than other specialties[4].

Australian researchers initially focused on identifying specific errors and failures underlying adverse events[17]. The causes of error included: failure in technical performance (35%); failure to act appropriately on available information (16%); failure to arrange for an investigation, a procedure or a consultation (12%); and lack of care and attention to the patient (11%). Overall, cognitive error was deemed to play an important part in 57% of all adverse events. From these results the authors formulated preventive strategies including better implementation of policies or protocols (24%), better formal quality monitoring (21%), better education and training (19%) and more consultation (10%). They concluded that improvement was needed in agreed processes of care, supported by information systems providing knowledge of diseases, protocols for treatment and information on outcomes of care for each patient.

Investigating adverse events

Studies in medicine and other high-risk domains have led to a much broader understanding of accident causation, with less focus on the individual and more on pre-existing organizational factors that provide the conditions in which errors occur. While a particular action or omission may be the immediate cause of an incident, close analysis usually reveals a series of events and departures from safe practice, each influenced by the working environment and the wider organizational context[18].

Accident investigators, whether in medicine or elsewhere, typically rely on a combination of record review and detailed interviews with staff. Clearly some factors, such as fatigue or verbal communication, can only be assessed during interviews or from observation. Examination of the record alone, while providing rich clinical detail, is necessarily limited in the range of background factors that can be investigated. However, we believe that record review is potentially more powerful than has been realized. Rather than identifying specific errors made by individuals, our approach is to determine the point in the hospital process where care became suboptimal and to consider how modes of clinical practice may predispose to adverse events[19]. Simply identifying human errors may be unduly pejorative and could hinder our understanding of how complex systems fail. In seeking to expand the value of retrospective studies of case records we have critically assessed case-record narratives to identify weaknesses in the process of care and the factors contributing to these. Our aims were twofold—first, to define factors in clinical practice in NHS hospitals that predispose to adverse events; second, to explore the review process so that future investigators, including ourselves, may be able to design better methods for identifying causal factors.

METHOD

The method of adverse event review, developed during the course of our pilot study, has been described elsewhere[8] and builds on previous work[2,3,6]. Copies of the British review forms are available from the authors. A retrospective record review was conducted at two acute hospitals in the London area. 500 randomly drawn records from site 1 and 514 from site 2 were reviewed. 273 (26.9%) records were drawn from general medicine (including geriatrics), 290 (18.6%) from general surgery, 277 (27.3%) from orthopaedic surgery and 174 (17.2%) from obstetrics. This paper reports detailed findings of adverse events identified in the review of 840 cases from general medicine, general surgery and orthopaedics. Obstetric cases were not included because few AEs were identified and because we were particularly interested in examining problems of care arising from specialties in which the course of a hospital admission is much less structured than it is in the management of childbirth. In this study we categorized AEs according to the stage or timing of the process of medical care and then looked to see if there were common methods of practice within each stage that could predispose to an AE.

The review team consisted of an experienced nurse working with 4 part-time research nurses. A consultant physician acted as lead medical assessor, working with 2 clinicians (a consultant surgeon and a fully trained specialist registrar in orthopaedic surgery). Each reviewer screened practice sets of notes under supervision until judged fully conversant with the review process. Case records were assessed by the nurse reviewers working from 18 predefined screening criteria. 308 records, identified by the screening process, were then reviewed by clinicians who determined whether or not there was an adverse event and completed a detailed questionnaire. The clinical reviewers were required to write brief narratives of the key points of each patient's

Box 1 **Case example to demonstrate how narrative analysis can identify contributing factors**

> An elderly woman underwent surgery for a fractured neck of femur. Her general condition was not monitored closely; she was mobilized and discharged home. A few days later she was readmitted in a confused state with hyponatraemia. She was treated appropriately but took 24 days to recover. No single event caused the second illness but during the first admission the patient's mental state was not noted; fluid balance and food intake was not monitored; there were no clinical notes recorded during the 24 hours before discharge; and no details were recorded regarding arrangements for care at home after discharge.

hospital admission before completing detailed questionnaires. In cases in which a reviewer's judgment was hindered by lack of subspecialty knowledge the evidence was discussed within the clinical group, and when necessary outside specialist opinion was sought.

For each adverse event the clinicians assessed its impact on the patient, likely causation and preventability. Records were screened only once, but duplicate review and discussion between 2 or more assessors were used to resolve difficult issues.

Reliability of record review

In this preliminary study we did not formally assess the reliability of clinical judgments in the context of record review. However, after discussion with colleagues in the United States and Australia, we took several steps to maximize consistency and reliability. First, we attempted to replicate the approach of previous studies in which the reliability of record review was assessed. In American studies physician consensus causation scores showed a moderate to good correlation (κ=0.57)[20]. In the Australian study there was 80% agreement on the presence of an adverse event (κ=0.55), 58% agreement on preventability (κ=0.33) and 87% agreement for disability (κ=0.49)[6]. Second, the project manager and lead clinician (MW and GN) examined the work of reviewers and discussed difficulties in definition and assessment, especially in the early phase of their work. Previous studies had found that many inconsistencies occurred in the early stages, through incorrect understanding of the review process rather than differences in clinical judgment. In addition, the project manager reviewed all completed questionnaires and referred back questionnaires that were not completed satisfactorily.

Analysis of the case record

For the purposes of this paper the narrative case descriptions and review questionnaires were reanalysed by the lead clinician in the review team after the initial record review had been completed. From information in the case record the nature of the adverse event, in relation to clinical practice at the relevant point in the process of care, was determined. Where possible, supplementary information about the grade of the doctor present, the nature of the suboptimal care and any contributing factors in the notes were identified. From this information the following more general organizational questions were posed in order to identify likely contributory factors, as judged from written records, over the relevant periods:

- Was the grade of staff appropriate to the task?
- Were ward doctors sufficiently careful in assessing available evidence and recording conclusions?
- Was there evidence of lack of continuity of observation and care?
- Were nursing observations well recorded and integrated with clinical recordings?
- Was there evidence of adequate input by other professional staff (e.g. physiotherapists, occupational therapists, dietitians)?
- Was the patient adequately assessed immediately before discharge?
- Was there adequate communication with community services (including the general practitioner)?

In this way we were able to define weaknesses in practice that arose from errors occurring within defective clinical systems (see Box 1 for an example).

50 (49%) medical records of 103 patients with identified adverse events were reasonably clear and well structured. However, in the other 53 cases there were deficits including missing laboratory reports (11), inadequate discharge summaries (17), lack of initial medical assessment (7), insufficient clinical progress notes (19) and missing procedure documentation (3). It was difficult to extract information from 37 records because they were so poorly organized. Two or more deficiencies were recorded for 17 cases.

RESULTS

840 case records were studied (48% male, 52% female). The median age of patients was 56 years (range 16–102). The mean length of hospital stay for all patients was 11 days (range 1–193). For those who experienced an adverse event the median age was 70 years (mean length of stay 21 days); for those who did not it was 56 years (Table 1). Thus, patients who had an adverse event were older, $t(136)=-5.46$, $P<0.001$, and stayed longer, $t(113)=-4.32$, $P<0.001$, than those who did not. For those who experienced an adverse event in their terminal illness the median age was 77.5 years. In 3 instances a preventable adverse event contributed to, but did not cause, the death of patients who were already very sick.

Table 1 **Characteristics of cases with and without an adverse event**

Specialty	No. of cases	Mean (range) length of stay (days)	% of female patients	Age (years)	
				Median (mean)	Range
No adverse event					
General medicine	249	11 (1–149)	44	61 (56)	17–97
General surgery	249	8 (2–113)	53	51 (52)	16–94
Orthopaedics	239	11 (2–124)	57	56 (56)	18–98
Total	737	10 (1–149)	51	56 (54.5)	16–98
Adverse event					
General medicine	24	17 (1–461)	50	68.5 (63)	24–97
General surgery	41	22 (2–193)	49	62 (60)	18–90
Orthopaedics	38	23 (2–73)	68	77.5 (74)	24–102
Total	103	21 (1–193)	56	70 (65.9)	18–102

The narratives of 103 cases in which 112 adverse events had been identified previously were examined. In assessing the narratives 6 additional errors were identified, increasing the total to 118.

Table 2 shows the points in the process of care in which the principal problems occurred, broken down by specialty. Tables 3, 4 and 5 show the principal problems identified at each stage and the probable factors contributing to their occurrence, in medicine, surgery and orthopaedics, respectively. Both the tables and the text that follows are organized to reflect the actual process of care, with problems identified in the same sequence. In the text we provide a summary of the cases and consider the more general contributory factors that may impact on the delivery of care.

Problems arising at time of diagnosis

0.6% of admissions (5 cases) were associated with incorrect diagnoses, all of which seem to have been made by trainee doctors. In all 5 cases the errors occurred during the early assessment of emergency admissions.

Probable contributory factors

The incorrect diagnoses were made by non-consultant staff and were not corrected promptly.

Problems arising during preoperative assessment and care

In 3 cases there was failure to guard against postoperative problems (possible deep vein thrombosis, infection and chest disease); in 2 cases unnecessary urethral catheterization led to urinary tract infection; and in one case inadequate assessment led to an elderly patient undergoing an orthopaedic procedure when she was hypokalaemic.

Probable contributory factors

In these cases ward staff responsible for the preoperative care seemed not to be working to clear guidelines designed to minimize adverse events.

Problems arising during an operation or an invasive procedure (including anaesthesia)

This category yielded the highest number of problems (46, more than a third of the total) of which 10 were deemed preventable.

In general medicine the use of central venous catheters (3) and urinary catheters (1) caused 4 adverse events, of which 3 were infective. In general surgery 10 out of 21 adverse events were infective, 7 due to technical problems and 2 due to bleeding. Postoperative intestinal dysfunction occurred in 2 patients (in one due to obstruction). Overall, only 4 AEs were regarded as preventable (2 infective and 2 technical). In orthopaedics 6 out of 15 AEs were infective and 3 were due to bleeding; in 5 the eventual result was poor. Only 2 AEs were regarded as preventable (both bleeding). 6 problems were related to anaesthesia and only one of these was regarded as preventable.

Probable contributory factors

It seemed that problems arising from ward-based procedures were due to poor technique and poor monitoring of unsupervised junior staff. Additional evidence would be required to define underlying factors for AEs arising from procedures undertaken in operating theatres.

Table 2 **Number and types of problems identified in each segment of care (numbers in square brackets indicate those deemed probably preventable)**

Stage of care	***Medicine***	***Surgery***	***Orthopaedics***	***Total***
Diagnosis	Missed heart failure (2) 2 [2]	Incorrect assessment abdominal pain (2) 2 [2]	Missed fracture 1 [1]	5[5]
Preop assess/care	ERCP—prophylactic antibiotics not given 1 [1]	Urinary catheter infection (2) Failure to give anticoagulant prophylaxis Failure to assess chest disease 4[3]	Missed hypokalaemia 1 [1]	6 [5]
Anaesthesia		Problems with intubation (2) Bronchospasm during surgery Propofol seizure 4 [12]	Difficult intubation Propofol seizure 2 [0]	6 [1]
Operation/procedure	CV catheter infection (2) CV catheter haematoma Infection post urinary catheter 4[3]	Surgery not completely effective (2) Failure in internal suturing (2) Wound dehiscence (3) Wound infection (8) Postop intestinal obstruction/dysfunction (2) Post-cystoscopy prostatitis Central line infection Postop bleeding Postop dizzy turn 21 [4]	Poor result following surgery (5) Wound infection (6) Haematoma (3) Delayed inflammation after joint replacement 15 [2]	40 [9]
Ward management	Pressure areas (3) Cardiac arrest Alcoholic organ failure (2) Abdominal infection Weight loss/dehydration 8 [5]	Pressure areas (4) Care of chest (3) Care of urinary catheter (2) 9 [5]	Pressures areas (3) Care of chest (2) Multiple problems in the elderly (4) Fall in ward (3, 2#NOF) Care of food and fluid intake 13 [5]	30 [15]
Drug/i.v. fluid	Drug—inappropriate dose/treatment (3) Drug reaction Drug interaction Drug side-effects (3) Over-transfusion 9[5]	Drug—inappropriate dose/treatment Drug side-effects (2) Fluid overload (2) 5 [3]	Drug reaction Drug side-effect (2) 3 [1]	17 [9]
Discharge	Inadequate assessment—readmitted (4) Without plan (asthma)—readmitted Without medication—readmitted 6 [4]	Repair inguinal hernia not assessed—developed hydrocele 1 [0]	Inadequate assessment—readmitted Inadequate home support—readmitted (4, 2 with #NOF) Delayed discharge (waiting placement) (2) 7[6]	14 [10]
Total	30[20]	46 [18]	42 [16]	118 [54]

ERCP=endoscopic retrograde cholangiopancreatography; CV catheter=central venous catheter; #NOF=fractured neck of femur; i.v.=intravenous

Table 3 **Problems identified and contributory factors in medicine**

Stage in process of care	*Principal problems identified*	*Contributory factors*
Diagnosis	Incorrect or delayed diagnosis	Inadequate involvement of experienced clinicians
Pre-procedure assessment and care	Failure to provide prophylaxis	Lack of protocols
Invasive procedures	e.g. insertion of central venous lines	Insufficiently experienced ward clinical staff
Ward management	Poor management of complex disorders	Lack of facilities and/or experienced staff for high dependency care
	Pressure sores	Failure to identify at-risk patients and to undertake prophylactic measures
Use of drugs and intravenous fluids	Problems in prescribing Confusing prescription charts	Insufficient care in prescribing; lack of computer support
Discharge procedures	Patient's medical condition not adequately stabilized	Failure to assess condition 24 h before discharge
	Patient has insufficient knowledge of condition	Failure to 'educate' the patient
	Poor communication with GP/community services	Failure to provide adequate 'package for home care'
		No protocol for discharge

Table 4 **Problems identified and contributory factors in surgery**

Stage in process of care	*Principal problems identified*	*Contributory factors*
Diagnosis	Incorrect or delayed diagnosis	Inadequate involvement of experienced surgeons
Preoperative assessment and care	Inadequate preop assessment/care	Ward doctors inadequately monitored
	Failure to provide prophylaxis	Lack of protocols
Anaesthesia, operative and invasive procedures	Technical	?Competence of operator
	Infective	?Prophylactic measures
Ward management	Pressure sores Chest infection Catheter infection	Failure to identify at-risk patients and to undertake prophylactic measures (?relation to staffing)
Use of drugs and intravenous fluids	Fluid overload	Inadequate care and poor understanding of principles of fluid balance
Discharge procedures	None (problems largely resolved by surgery)	—

Ward management

Problems in ward management (other than the use of drugs and intravenous fluids, which are dealt with separately) totalled 30 (26% of all problems) of which 15 were thought to be preventable. Four deaths occurred in patients under 75 years of age, in two of which the adverse events were probably preventable. The other 5 patients who died were all elderly (aged 82–89 years) and the reviewers agreed that the adverse events might have been prevented but only with high-dependency care.

More specific problems arising from probable deficiencies in basic care were identified in 19 patients. Pressure sores occurred in 10 cases (7 deemed preventable), chest infections in 4 (one preventable) and falls in 3 (2 of whom fractured a neck of femur); in 2 cases there was poor care of urethral catheters.

Probable contributory factors

Inadequate day-to-day clinical care (i.e. that requiring complex care and input at consultant level) of the overall medical condition led to AEs in 11 patients and contributed to 4 deaths. Deficiencies in nursing care were thought to be responsible for at least some of the bed-sores, problems with catheters and falls in the ward.

Table 5 **Problems identified and contributory factors in orthopaedics**

Stage in process of care	*Principal problems identified*	*Contributory factors*
Diagnosis	Incorrect or delayed diagnosis	Lack of consultant involvement
Preoperative assessment and care	Inadequate preop assessment/care	Ward doctors inadequately monitored
Anaesthesia, operative and invasive procedures	Technical	?Competence of operator
	Infective	?Prophylactic measures
Ward management	Pressure sores Chest infection	Failure to identify at-risk patients and to undertake prophylactic measures
	Multiple disease processes in the elderly	Problems with care of the elderly
Use of drugs and intravenous fluids	Very few problems except for maintenance of regimens for medical conditions	Inadequate involvement of physicians with a special interest in care of the elderly
Discharge procedures	Patient's medical condition not adequately understood	Failure to involve geriatricians in care
	Inadequate assessment of mobility	Failure to provide adequate 'package for home care'
	Poor communication with GP/community services	No protocol for discharge

Use of drugs and intravenous fluids

Problems arising from the use of drugs and intravenous fluids were identified in 17 cases, 9 of which were judged preventable. More than half the cases occurred in a medical ward. 3 cases of overtransfusion were identified.

14 problems were related to the use of drugs, of which half were judged preventable. In 3 cases drugs were incorrectly prescribed and in 7 cases there were preventable side-effects of medication (e.g. failure to monitor the dose of digoxin leading to toxic effects; inappropriate prolongation of treatment with amiodarone causing thyroid dysfunction).

Probable contributory factors

In the case records surveyed, fluid balance charts were often poorly maintained and difficult to interpret. Clinical notes seldom included data on fluid and nutritional status. In adverse events related to drugs there were no references to possible side-effects until after an adverse event had occurred. Many drug charts were a confused and much-altered set of written instructions. Computers were apparently not available to aid prescribing.

Discharge procedures

Poor clinical assessment at the time of discharge from hospital or failure to educate the patient and/or to liaise adequately with community-based carers (including general practitioners) were identified as important causes of AEs in 14 case records. The problems occurred in 6 medical, 1 general surgical and 7 orthopaedic cases.

Discharge from medical wards without adequate assessment led to readmission of 3 patients with heart disease, 2 with anaemia and one with recurrent bronchial asthma. Inadequate pre-discharge assessment on orthopaedic wards also led to several adverse events. One orthopaedic patient was discharged with serious salt and water imbalance and was subsequently readmitted. Inadequate home care packages led to 4 patients being readmitted to hospital within a few days; 2 had fallen at home and as a result had fractured their femurs. Of 2 patients whose discharge from hospital was delayed, one died while awaiting placement.

Contributory factors

A detailed assessment of the patient's condition before discharge was found in very few case records. In both hospitals there appeared to be little liaison between members of care teams in preparing the patient for the transition from hospital to home care. Communication with the general practitioner and community support services regarding the condition of patients was patchy.

DISCUSSION

Adverse events that attract most publicity arise most commonly from errors in diagnosis, accidents in operative surgery and technical problems in undertaking invasive procedures[21,22]. However, in this pilot study misdiagnosis and invasive procedures accounted for less than half of the AEs identified and only 27% of those judged preventable. Diagnostic errors were identified in 5 cases (all regarded as preventable). The errors were made by trainees and not

picked up within 24 hours of admission. It has been shown previously that major errors at the time of admission of medical emergencies are strongly associated with a lack of trained specialist care[16].

Surgical and invasive procedures accounted for 46 AEs of which a quarter (10 cases) were deemed preventable. On the other hand 58% of AEs occurred on the wards (including preoperative and postoperative care, general management, administration of drugs and care at the time of discharge) and two-thirds of these were deemed preventable. The problems ranged from the development of bedsores to difficulties in the management of complex disease.

In 9 patients who died (4 medical and 5 orthopaedic) it seemed that resources were insufficient to provide high-dependency or specialist care, although the AE was regarded as preventable in only 3 cases. 7 of these patients were elderly (aged 70–102) and had multisystem disease (5 following orthopaedic procedures) and they may have been regarded as too frail to warrant elaborate support of failing organs. The other 2 patients had serious organ dysfunction secondary to alcohol abuse.

Hospital-acquired respiratory infection occurred in 4 cases and urinary tract infection in 2. Four of these infections were regarded as not preventable although it was not possible to determine whether or not the provision of more intensive physiotherapy and more scrupulous care of catheters would have prevented at least some of them. Inadequate care of urethral catheters was highlighted in one case, in which pressure necrosis developed on the dorsum of the glans penis. The prescribing of drugs and the use of intravenous infusions gave rise to 11% of the problems identified, half of which were deemed to be probably preventable. The number of problems in this category is probably an underestimate, because the poor quality of prescription records and fluid balance charts made assessment difficult.

At least 9 of the 11 readmissions to hospital (Table 2) could have been prevented by closer attention at the time of discharge from hospital. The main deficiency seems to have been a failure to assess the clinical condition of patients immediately before discharge. In addition there was little or no evidence of liaison between clinicians, nurses and other professional care workers (e.g. physiotherapists), and communication between hospital staff and general practitioners seems to have been poor. Similar problems have been demonstrated repeatedly over the past decade[23–25]. Inadequate care at the time of discharge continues to be an important contributor to AEs in the NHS.

In this study more than half of the problems stemmed from inadequacies of general care on the wards, of which more than half were preventable. If one includes cases related to medication and care taken at the time of discharge from hospital, two-thirds of clearly preventable adverse events arose from deficiencies in ward care. There has been no national programme of confidential enquiries into deaths or serious adverse events arising from ward care in NHS hospitals to parallel those for perioperative, maternal and neonatal deaths. Hence, it is not possible to define optimal strategies for improvement. Contributory factors are likely to include: increasing specialization of senior staff[26]; insufficient input by trained staff in the ongoing care of patients; inadequate numbers of junior staff, who are insufficiently trained and supervised[27]; poor organization of ward work and inadequate liaison between professional staff within hospitals; and sloppy discharge procedures[23–25]. The importance of these findings is underlined by studies from the US which indicate that lack of experience of ward doctors leads to longer stays in hospital, more diagnostic tests and hence increased costs[27,28]. Box 2 provides recommendations as a result of this pilot study.

The value of this analysis is limited by the small scale of the study and the fact that we made changes to the questionnaire during the collection of data. Judgments of preventability were difficult and would need refinement before the launch of a larger study, which would also enable formal reliability of the methods to be tested in the British context. This report shows the potential value of: first, undertaking a much larger carefully designed study based on the retrospective analysis of hospital records, including a planned use of case narratives; secondly, using case record analysis as part of planned reviews of the service provided by individual healthcare trusts; and thirdly, of providing objective evidence on which to base the reorganization of hospital care in the NHS. In particular this pilot study provides objective support for improved *general* medical care in hospitals as units are becoming increasingly specialized[26,29].

Box 2 **Suggestions for improvements in general care arising from this pilot study**

- Greater input by fully trained specialists for the assessment of patients (especially emergency admissions) in order to reduce the number of incorrect diagnoses
- Improved note-keeping during inpatient care and the development of integrated records so that clinicians, nurses and other therapists are aware of all observations made on a patient's progress
- Improved handover of care between clinicians
- Improved monitoring of sick patients at weekends and over holiday periods by sufficiently experienced staff
- The development of computer-based systems to minimize prescribing and transcription errors
- Fully integrated assessment of the patient's condition and needs together with a detailed plan for aftercare immediately before discharge from hospital.

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