Improving Health Outcomes

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East Anglian regional audit of hip fracture

Geographical Area covered: East Anglia
Focus: Case studies focusing on effectiveness

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Editorial comments on how case study is linked to improving health outcomes: (also published in Volume 1)

Todd and Freeman describe how a regional group audited current practice in East Anglia of the management of hip fracture against recommendations of the Royal College of Physicians and a local consensus conference. A wide range of outcome indicators were used. There was diversity in clinical management and health outcomes at a provider level. There were significant differences between hospitals in mortality and development of pressure sores and in indicators of good practice such as prophylaxis against deep vein thrombosis, antibiotic prophylaxis, delays to surgery and early mobilisation. They conclude that lower mortality appears to be associated with the cumulative effects of a number of aspects of the organisation of treatment and the management of hip fracture, including specialist team management, thromboembolic pharmaceutical prophylaxis, antibiotic prophylaxis and early mobilisation. They did not examine variations in health outcome at a district level. They emphasise how examination of differences in health outcome (including case fatality) between provider units must take into account case mix and other potential confounders.

Abstract (also published in Volume 1)
**Aim:** The East Anglian Regional Audit of Hip fracture aimed to demonstrate and improve quality of services for patients admitted with hip fracture.

**Introduction:** At a Regional Consensus Conference on Osteoporosis held in 1990 the development of a regional policy towards fractured neck of femur patients was discussed. Recommendations highlighted the need for further information on treatments being provided around the region and the outcomes associated with these treatment regimens. A group was formed with representatives from various specialties with interests in hip fracture. This group decided to audit current practice against recommendations of the Royal College of Physicians (RCP) and the consensus conference. The first regional hip fracture audit was conducted in 1992.

**Method:** Audit indicators were drawn from the Royal College of Physicians report and Regional Consensus Conference on Osteoporosis. Data were obtained by interviewing orthopaedic consultants and by conducting a prospective audit of consecutive patients admitted for hip fracture. Patients were interviewed in hospital, soon after admission and followed up by telephone survey at 30 days regarding satisfaction with services, and again at 90 days to assess Activities of Daily Living, pain, home support and residential status. Data regarding in-hospital care and outcome including mortality were obtained from medical and nursing notes.

**Results:** Orthopaedic surgeons and geriatricians in all 8 acute hospitals participated. Of the 28 relevant orthopaedic surgeons, 22 were interviewed. Data were collected on 580 patient episodes. There was diversity in clinical management and significant differences between hospitals in indicators of good practice, for example in prophylaxis against deep vein thrombosis, antibiotic prophylaxis, delays to surgery and early mobilisation. There were also significant differences between hospitals in mortality (18%, range 5-24%) and development of pressure sores (22%, range 11-36%). There was notable long term morbidity, with 42% of surviving patients needing increased community resources 90 days after admission.

**Conclusions:** Lower mortality appears to be associated with the cumulative effects of a number of aspects of the organisation of treatment and the management of hip fracture, including specialist team management, thromboembolic pharmaceutical prophylaxis, antibiotic prophylaxis and early mobilisation. This study shows that regional (multi-district) audits are feasible and allow comparison using the same measurement tool between units as well as within units. Regional audit can demonstrate a diversity of practice and outcome. There are a number of lessons from this audit that are relevant to the purchasing and monitoring of orthopaedic services at a district level, for example routine monitoring of case fatality may be simple, however, examination of differences in health outcome (including case fatality) between provider units must take into account case mix and other potential confounders.

**Introduction:**

**Why this clinical area was choosen:**

In 1990 a Regional Consensus Conference on Osteoporosis was held at which the recommendations of a Cambridge Working Group (CWG) were presented (Cambridge Working Group 1990). This involved the development of a policy towards fractured neck of femur patients. These recommendations highlighted the need for further information on the treatments being provided within the then East Anglian Regional Health Authority (RHA) and the outcomes associated with these treatment regimens. The recommendations were endorsed by clinicians, from a variety of specialties and from all districts in East Anglia.

At the consensus conference a group was formed with representatives from various specialties, all of whom were interested in hip fracture. The first issue which attracted the attention of this group was the great disparity in mean lengths of hospital stay following hip fracture (range 22.5-48.2 days) in the 8 different districts of the former East Anglian RHA. There was no obvious reason for these differences. On the basis of initial discussions it was decided to audit current practice against recommendations of the Royal College of Physicians (RCP) (Royal College of Physicians of London 1989) and the Cambridge Working Group, and to suggest how these indicators could be improved. A proposal to develop this work was funded by the East Anglian Regional Health Authority Clinical Audit Team.

**Hip fracture is important to consider for five main reasons:**

- It is a common and important condition. The vast majority of fractures are clinically recognised and result in in-patient treatment. The increase in the incidence of hip fracture is likely to have substantial effects on health services. It has been estimated that in 1991/92, 56,613 hip fractures cost the hospital sector in England £288 million in direct costs alone. Unless treatment patterns alter or age specific incidence falls, by 2031 the predicted 96,000 cases will cost £507 million (1991/92 prices) to treat in hospital. Perhaps even more
importantly these patients will require over 1.6 million extra bed days per year (Hollingworth et al. 1995).

- It is by no means trivial since it causes considerable disability and mortality in the population, to say nothing of the suffering associated with fracture and treatment. Added to this is the disruption and worry it causes families and friends of the elderly people who experience fractures.
- It is reasonably well understood (at least in terms of procedures for treatment) and there is a wide literature describing aetiology, treatment and outcomes.
- There are reasonably well defined outcomes, the most obvious of which is mortality.
- Since commencing our work, hip fracture treatment has been suggested repeatedly as a tracer condition that can be used as a marker for the quality of care for elderly people. Both the Audit Commission enquiry (Audit Commission 1995) into the care of the elderly and the Clinical Standards Advisory Group (Clinical Standards Advisory Group 1995) have chosen hip fracture as the primary marker condition of interest in assessing care of elderly people. One reason for this interest in hip fracture is the recognition that when examining standards of care, it is preferable to anchor an investigation to a specific condition rather than retrospectively correcting for differences in disease processes and case mix. In addition the Department of Health (DoH) have commissioned members of the present team to develop a series of outcome targets for hip fracture (Sutton et al. 1996). This latter report has fed into work being undertaken to develop outcome indicators for a number of conditions by the Central Health Outcomes Unit of the DoH (Fractured Proximal Femur Working Group 1996).

Further information that was required:

It became immediately clear to the group that there was little information on the diversity of practice in treatment of hip fracture in the 8 hospitals around the region. Routine data on numbers of admissions and length of stay were uninterpretable (except in the crudest terms) without collection of further data. One of the reasons for this was that at the time this study was being developed, not all hospitals in the region were able to provide the relevant data. As the group had decided to audit process and outcomes against RCP and CWG standards, data about a number of process and outcome measures were required that were not routinely collected. Specifically the standards to be investigated were as follows.

- In each health district there should be a person or team with specific responsibility for reviewing local services for hip fractures, for producing a strategy and for monitoring standards of care and outcome.
- Post-operative care should be carried out by a multi-disciplinary team.
- There should be established links between departments of orthopaedics and geriatrics.
- Patients should be assessed pre-operatively. This should involve technical examination of the fracture and a general examination including assessment of medical problems, mental function and social circumstance.
- Plans for mobilisation, rehabilitation and discharge or transfer should be made for all patients within four days of operation.
- Patients should be discharged when they are medically fit for discharge.
- At three months after admission patients' medical condition and social functioning should be as good as prior to admission.
- At three months after admission patients should not require additional community resources beyond those needed before fracture.
- At three months after admission patients should be satisfied with the care which they received.

Information about other indicators of good practice or important outcomes was also collected (table 1). These indicators were chosen from the RCP and CWG documents and 4 further sources (Sainsbury 1991; Lips and Obrant 1991; Devas 1977; THRIFT 1992).

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<th>Practice</th>
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<td>Administration of prophylactic antibiotics;</td>
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<td>Administration of pharmacological thrombo-prophylactic agents;</td>
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- Operation within 24 hours of admission to hospital;
- Operation by senior grades of staff;
- Operation by day;
- Early mobilisation;
- Appropriate length of stay in hospital.

Outcomes
- Death
- Hip joint infection
- Wound infection
- Myocardial infarction
- Pulmonary embolism
- Thrombo-embolic disease
- Pneumonia
- Development of pressure sores
- Urinary tract infection
- Re-operation
- Pain
- Patient view of recovery

Consultant opinion
A structured interview enquiring about consultant perception of service structure and process was developed by the audit team. This was administered between January and March 1992 to consultants in trauma and orthopaedics who provided routine care for hip fracture patients in the 8 hospitals in East Anglia in which treatment is provided for orthopaedic trauma.

Prospective audit of hip fracture treatment and outcome
The audit sample consisted of a consecutive series of patients admitted with fractured neck of femur to each of 8 acute hospitals, between April and August 1992. It was estimated that 80 consecutive patients from each hospital should be included to obtain a large enough sample to permit inter-hospital comparisons on major variables.

Informed consent was obtained from all patients who took part in the audit. The audit was registered under the Data Protection Act as part of the University of Cambridge Clinical School registration. In addition, although this was an audit, ethical approval was gained from the relevant local research ethical committees.

Patients were interviewed in hospital soon after admission, regarding pre-morbid residential and social status, pre-injury activities of daily living (ADL) and home support. Patients were followed up by a telephone survey at 30 days regarding satisfaction with services, and again at 90 days to assess ADL, pain, home support and residential status. Functional ability was estimated using a modified Townsend score (Townsend 1979). The difference between a patient’s pre-fracture score and their score at 3 months gives a measure of change in social functioning.

Data regarding in-hospital care and outcome were obtained from medical and nursing notes. Processes of care were recorded on a standard proforma developed from previous work by members of the project group (Todd et al. 1991). This was piloted in two hospitals before commencement of the audit. Mortality data were obtained from hospital records and from 90 day follow up contacts. Statistical analysis was conducted using SPSS-PC and SPSS for Windows 6.0 and data were subjected to the appropriate parametric or non-parametric tests (Siegel 1956).

Data validity studies:
This audit relied primarily on data from two sources:

- clinical records;
- patient (or patient proxy) report.
Clinical record data were obtained by pulling medical, theatre, nursing, physiotherapy and occupational therapy notes for each patient and contacting general practitioners for follow up outside of hospital. Nursing, medical and other therapy staff notes were cross referenced to ensure that information was consistent. For example, when deciding at what point a patient was mobilised physiotherapist records would be cross referenced with nursing records to ensure that there was agreement on the date when weight bearing mobilisation was achieved. Patient report data are dependent on patients’ psychological state. However these data are always considered as self report in nature and are primarily related to activities of daily living and satisfaction with treatment. In those instances when “matters of fact” (e.g. living arrangements pre-fracture) were sought from patients they were validated as far as possible by checking against other sources, (e.g. carers and nursing notes).

Data entry was undertaken by two independent data entry personnel. Double entry permitted us to ensure that data were accurately entered onto computer for analysis. By visual checking and use of a simple programme the two datasets are compared for any discrepancies. Discrepancies can then be checked against the data collection forms and corrected. Use of two individuals (rather than one individual entering data twice) is preferable since a single individual may have idiosyncratic key entry errors.

Mortality data were carefully checked against hospital and general practitioner records. It was not possible, in 1992, to compare HES data with the data collected for this audit as there were major changes in district boundaries over this period and denominator values were not strictly comparable. In addition this project collected data from hospitals over a period of 145 days which is not simply comparable with the annual data collated for HES. In one hospital (because mortality was significantly lower than in the other hospitals) all records were checked at the time of data analysis (during 1993) to ensure that no deaths had been missed. The death recording was found to be 100% accurate. All subjects were followed up at 90 days. It was thus clear whether patients were alive at this point. Of 580 patients recruited at 90 days 104 were dead and 8 “lost to follow up”. Of these 8 we were reliably informed that they were all alive; their lost to follow up status was accorded because of difficulty in contacting the patient in time to obtain ADL data at 3 months, for example, if they had moved out of region with no contact telephone number.

In addition 200 (34%) of notes were checked by a second research associate after initial data collection. Discrepancies between the two sets of recordings were resolved by thorough cross referencing of notes by independent observer and an independent decision being drawn where an ambiguous record was evident.

Findings

Fuller results are reported elsewhere (Todd et al. 1995; Camilleri-Ferrante et al. 1994; Laxton et al. submitted; Parker et al. submitted). We found a diversity of practice between hospitals, which suggested that the publication of recommendations had not led to universal changes in service. There were also differences between some consultants’ practice and both hospital and their own stated policies.

There was notable long term morbidity associated with hip fracture. After three months 42% of surviving patients showed significant deterioration in their ability to perform activities of daily living. At 90 days, 42% of surviving patients needed increased community resources beyond those needed prior to fracture. It was difficult to relate this to reported team work or to data collected about multi-disciplinary involvement.

The audit highlighted significant variation between hospitals in the following areas:

- Death: one of the most striking findings of this study were the significant differences in 90 day mortality rates between hospitals (mean 18%; range 5-24%). This was investigated further using logistic regression modelling, which found that age, pre-injury ADL, sex and the presence of cardiovascular disease were important determinants of death. The model also included admission to hospital 6 as an independent protective factor.
- Pressure sores: the incidence of pressure sores also differed significantly between hospitals (mean 22%; range 11% - 36%). It should also be noted that 12% (range 5-20%) patients who survived for at least 3 months, reported developing a pressure sore post
discharge. The DoH has described pressure sores as a key quality indicator.

- **Pharmacological thrombo-embolic prophylaxis**: there was a discrepancy between policy and practice in some hospitals and considerable variation between individual hospitals (mean 46%, range 10-91% of patients). Fatal pulmonary embolism correlated with lack of pharmacological thrombo-embolic prophylaxis.

- **Early mobilisation**: 50% of patients were mobilised by day 2, post operation. This varied significantly between hospitals (range 1-3 days). Early mobilisation is important to hip fracture patients as it is associated with reduced thrombo-embolism, pneumonia and pressure sores.

- **Antibiotic prophylaxis**: the use of prophylactic antibiotics was high (mean 93% patients) but there was still significant variation between hospitals (range 81-99%).

- **Surgery within 24 hours of admission**: 56% of operations were conducted within 24 hours of admission. In 28% cases, delays in surgery occurred which were not explained on medical grounds. Surgery within 48 hours of admission to hospital also differed significantly between hospitals (mean 80%, range 47-92%).

- **Length of hospital stay**: there were significant differences between hospitals in the median length of hospital stay (20 days, range 13-28) and in the median length of stay on the orthopaedic ward (15 days, range 12-19).

**Summary findings from initial work:**

**Changes which were made:**

In this audit, being region wide, it was not our policy to attempt to change practice by prescriptive means. It had been decided that the only viable approach was to report back to colleagues in the various hospitals taking part and allow them to decide upon changes to be made at a local level. It is therefore difficult to ascertain at present what local changes were instituted. At the time of writing we are about to commence a re-audit of hip fracture treatment in the same hospitals. Once this is complete it will be clearer what changes in practice have occurred since the original audit round. Below we outline one area in which changes appear to have occurred and one in which there were differences between units in response.

**Pressure sores**: The very high prevalence of pressure sores (regional rate 22%) was a major finding of this his. This was based on the recorded presence of a pressure sore from the nursing records and if anything it was likely to be an under-recording of the "true" rate. At about the same time as we reported our findings, the DoH produced a guide to pressure sore care (Department of Health 1995) which was distributed by ourselves to all units which had taken part in the audit. This was followed up by the Regional Clinical Audit Team who have organised a series of pressure sore study days in the region. These study days attracted staff from various professions, including nurses, doctors, audit staff, and managers from both providers and purchasers. Each district was encouraged to form a multi-disciplinary pressure sore group to develop strategies to reduce incidence of pressure sores and improve the risk assessment of all patients not only elderly trauma-orthopaedic patients. A number of the Trusts appointed "skin viability" nurses and some trauma orthopaedic units designated specific nurses to pressure area care in an attempt to reduce incidence of pressure sores. Specific audit of pressure area care has been conducted in some units since the original hip fracture audit. Outside the region we understand that our published finding of such high pressure sore rates has acted as one spur to other hospitals to check on the rates of pressure sores. A report on target setting for pressure sores is being undertaken for the DoH (James et al. 1996) and a recent Effective Health Care Bulletin has focused on pressure sore prevention and treatment (Cullum et al. 1995). These two initiatives should also impact on the incidence of such complications.

**Thrombo-prophylaxis**: Differences in the use of thrombo-prophylaxis was another area that proved to be a major finding related to process. This area caused considerable debate, both in the literature (Calder et al. 1995) and locally. The use of pharmacological thrombo-embolic prophylaxis appears to be an important element of the service. In the absence of therapy, hip fracture patients are known to be at high risk of deep vein thrombosis (DVT), (40-80%), proximal venous thrombosis (20%), and fatal pulmonary embolism (1-10%) (Sainsbury 1991). The Thrombo-embolic Risk Factors Consensus Group (THRIFT 1992) recommended that all hip fracture patients should be assessed for risk of venous thrombosis, and should receive pharmacological prophylaxis in addition to early mobilisation.

Despite the recommendations of the THRIFT group, there remains controversy about the substantial residual risk of DVT and the increased risk of bleeding associated with pharmacological prophylaxis, and uncertainty about the most effective regimen. This was reflected by responses around the region.
There was clearly resistance from some surgeons to the idea of routinely using pharmaceutical thrombo-prophylaxis with this patient group. The degree to which practice has changed amongst individual surgeons requires further investigation, since there was clear discrepancy between stated policies and observed practice.

**How changes will be monitored:**

Changes that have (or may have) occurred following the initial audit will be identified at the next round of audit to be conducted during 1996/97. It should be noted that it will not be possible to infer that any differences in either process or outcome which may be observed between the audit cycles are causally related to the audit per se. It should also be noted that this is not only because of time delay between cycles, but is in fact a logical point.

**Resource Implication:**

Hip fracture is an important public health issue with increasing incidence. For the NHS the treatment of hip fracture has implications for both the primary and secondary sectors. For hospitals much of the cost of hip fracture treatment is loaded at the beginning of the hospital stay and comprises theatre, drug, implant etc. costs. One area which would permit reduction in hospital costs would be reduction of length of stay. However, such reductions may be disappointing in the amount saved because (a) average per diem rates would overestimate the possible savings as the days for which savings are possible are days which are "cheaper" anyway (b) the "savings" may not be financial in nature since such savings only accrue if beds are actually closed down. The "saving" relates to opportunity benefits (or costs) which accrue from the beds being used for some other purpose. Whether these are costs or benefits from the point of view of the hospital depends on the type of contract that exists between purchaser and provider.

More important perhaps is the shift of costs from the secondary to the primary sector. This often also entails a shift of costs from a hospital to a community trust. Such cost shifting has been assumed to result in reduced overall costs because some of the overheads associated with hospitals do not apply to the community. Whilst empirical work conducted by ourselves has demonstrated that a Hospital at Home service provides care at some £722 per patient less, this potential reduction is itself not without drawbacks and may entail cost shifting to patients, their carers and GPs.

At present it appears that many patients stay in hospital longer than would be strictly necessary if there were adequate resources in the community to support rehabilitation at home. It is incumbent upon purchasers and providers to consider ways of using resources as efficiently as possible.

The total grants made by the RHA for this work has amounted to £66,547 (approximately cost of 13 patients' hospital treatment). This includes present funding for re-audit. The time of members of the steering group has not been costed. Changes made to clinical practice have been funded from within Trust budgets.

**Practical lessons learnt:**

**Time:** An important lesson from a practical viewpoint that comes from this work is that undertaking research or audit is time consuming and inevitably takes longer than initially envisaged. Thus when planning work such as this research teams and commissioning agencies or funders must budget for sufficient time and personnel to not only collect data but to analyse and write it up.

**Committee planning:** During the planning stage of the audit the management committee had numerous meetings to design the data collection protocol. As may be expected from a committee there were differences in opinion as to what were important variables to collect, how questions should be posed and what were valid response sets. Unless great care is taken questions may be included for no particularly good reason or omitted simply by oversight. This is particularly pertinent if more than one piece of information is needed to permit calculation of a derived variable and or interpretation. For example in order to examine delay to surgery we needed to collect date and time of admission to hospital (from A&E records), date and time of commencement of surgery (from theatre records) and reasons for any delay to surgery (from medical and nursing notes). However, this does not adequately cover those cases in which the patient fractured her hip whilst an inpatient. In these cases we needed to use a different "entry" variable (date and time of fracture). Decisions as to whether date of admission or date of fracture was the most appropriate depended primarily on whichever came more recently, (i.e. a negative value for fracture to hospital admission). Reason for delay could then be used to differentiate between valid clinical reasons and those unrelated to the patient (e.g. theatre unavailable).
Careful checking of data collection forms prior to commencement of the study is imperative to ensure that all relevant data are collected. Such checking should be conducted as part of a pilot study, involving implementation of the study protocol and analysis of data so that the operations for the calculation of derived variables can be checked and any “bugs” in the data collection form identified.

Clear records of discussions when designing the data collection protocol need to be made so that it is possible to understand the logic of decisions at later dates. One person (the research associate in this case) must take responsibility for the protocol design to ensure that it is consistent and coherent. Fortunately we did make such notes, most decisions did make sense retrospectively, and the research associate did maintain the comprehensiveness of the protocol.

Data collection: An important decision for a multi-centre audit, such as this, is whether to have one data collector responsible for data collection in all sites, or whether to employ data collectors in each site. Because data quality could be assured by having a single data collector, we chose this approach in the original audit. The disadvantages were:

- **Travel**: As the hospitals were up to 90 miles apart the data collector spent much of her time travelling;
- **Numbers of subjects**: As there are seasonal variations in incidence and possibly outcome of hip fracture, we wanted to collect consecutive admissions in all hospitals commencing at the same date. Collection of 80 subjects in each hospital was only just feasible for one individual. Greater numbers would be beyond the capacity of a single data collector;
- **Local knowledge**: A single data collector could not have intimate knowledge of the variations in record keeping systems in different hospitals. Local data collectors would be on site when records were available and have local knowledge of where records may be found.

For the re-audit we have decided to use local audit staff (who are more plentiful than during the first audit) and to use a single supervisor to ensure data quality by thorough training, clear data collection protocol and careful checking of data. This will be in part conducted by having the supervisor act as a second coder for a selection of records to check on reliability (Todd and Bradley 1994).

**Data variables**: As with all research it must be made very explicit what variables are to be collected and from where. For example, when recording type of operation it was not uncommon for the planned operation to be different from that actually carried out. No doubt this reflected decisions of a senior surgeon made in theatre. Occasionally the discharge summary was different from the clinical or surgical notes. In both cases the notes recorded during surgery were considered to be the most accurate and recorded for audit use.

**Data quality**: The following issues became clear when analysing data:

- **The specificity of each question**: Each question should be specific, clear and unambiguous. In addition the data collector needs to understand the context in which each datum is collected and why it is needed;
- **The standard of clinical records**: What is likely to be recorded and the accuracy and completeness of each entry will affect the quality of audit data directly. For example, under what circumstances is the answer to a question ‘No’ indicating that a person did not receive this treatment and when is lack of entry into notes indicative that this information ‘missing’? This needs to be understood when designing and piloting the data collection protocol. We took a simple decision: if it was not recorded it did not occur;
- **The ability of the data collector to read and interpret medical notes**: Clinical notes are not always straightforward to find, read or interpret.

**(a) Finding records**: Whilst the patient is in hospital many (but not all) notes are available on the ward. Once the patient has been discharged the records normally are filed in the medical records library/registrar (but again not all). It is a truism that some records will be more difficult to locate than others and local knowledge is often very useful here (e.g. knowing which consultant’s secretary is likely to have a backlog of records in the office).

**(b) Acronyms**: Understanding of abbreviations is essential and ambiguous abbreviations should be avoided at all costs (e.g. AMP is sometimes used as an acronym for Austin Moore Prosthesis (This acronym should be discouraged especially in relation to theatre).

**(c) Nomenclature**: Different hospitals and in fact different clinicians use differing conventions in naming drugs (i.e. proprietary versus generic drug names) diagnoses (i.e. there are a number of different diagnostic classification schemes for hip fracture e.g. AO classification, Evans classification,
Purchasers, may in the future, allow resources to be directed to areas where improvements in care could be made. It is possible that hospitals may work to improve their results if patients from hospitals where the care was perfectly adequate but not outstanding. Identification of hospitals to pressure from the press, as identification of individual hospitals may decrease public confidence in the hospital's performance. It was considered to be important to maintain anonymity, especially under emergency cases. It was thought that once a core set of units were recruited into the study sufficient “momentum” was achieved so that other centres also decided to participate. Through interim reports and presentations interest in the study continued to grow. In 1992 local audit teams were in the infancy. Now there are experienced lead audit facilitators and audit teams who know their hospital well, have established links with medical records departments and regularly work with multi-disciplinary teams. Regional audit training has helped to improve the quality of the data collected and the confidence of local personnel. It is important to involve audit teams and to be aware of their existing working relationships wherever possible. In 1992 local audit teams were in their infancy. Now there are experienced lead audit facilitators and audit teams who know their hospital well, have established links with medical records departments and regularly work with multi-disciplinary teams. Regional audit training has helped to improve the quality and knowledge of staff who understand audit methodology and are experienced in collecting and interpreting routine clinical data. Collection of data by local personnel should improve the quality of the data collected and the confidence of clinicians in those data.

Access: This depended on good working relations existing between members of the audit team and departments of orthopaedics and health care for elderly people at the outset. To date, no problems have been encountered with access to medical records or to interview patients. Consent was obtained from consultants, patients and local ethics committees before any data were collected.

Anonymity: In the first round of this audit consultants were promised anonymity and this was maintained by numbering the hospitals in reports and papers. It was felt by the audit group that such anonymity was essential, because unless it could be guaranteed, co-operation of medical and surgical colleagues would not be forthcoming. Identification of specific units is not something that would be advantageous to members of the general public. Hip fracture is not a condition in which individuals can choose where and when it occurs. Each surgeon was informed of the results pertaining to his (no female consultants) unit by identifying the code number for his unit to him. The results of other units remained anonymous by not identifying code numbers allocated to other units. At the first presentation of results to clinical staff, a number of consultant orthopaedists were able to identify the hospitals with best and worst rates, and they may also have broken the code to colleagues. Clearly these surgeons were able to identify the hospitals with best and worst rates, and they may also have broken the code to colleagues. It is not clear that “league tables” would be useful for hip fracture patients, who are admitted as emergency cases. It was considered to be important to maintain anonymity, especially under pressure from the press, as identification of individual hospitals may decrease public confidence in hospitals where the care was perfectly adequate but not outstanding. Identification of hospitals to purchasers, may in the future, allow resources to be directed to areas where improvements in care

Co-operation of orthopaedic surgeons: Orthopaedic surgeons were initially involved in this audit at the Regional Consensus Conference on Osteoporosis. Two orthopaedic surgeons are members of the hip fracture audit group and details of the audit were discussed at meetings of orthopaedic consultants from around the region on a number of occasions. At the outset consultants were involved through a series of individual interviews at which their views were sought and they were asked to specify areas of care they felt were important to audit. As well as providing data this may have helped by providing a sense of “ownership” in the initial stages of the audit. It is also probable that once a core set of units were recruited into the study sufficient “momentum” was achieved so that other centres also decided to participate. Through interim reports and presentations interest in the work was maintained.

Confidence of local personnel: It is important to involve audit teams and to be aware of their existing working relationships wherever possible. In 1992 local audit teams were in their infancy. Now there are experienced lead audit facilitators and audit teams who know their hospital well, have established links with medical records departments and regularly work with multi-disciplinary teams. Regional audit training has helped to improve the quality and knowledge of staff who understand audit methodology and are experienced in collecting and interpreting routine clinical data. Collection of data by local personnel should improve the quality of the data collected and the confidence of clinicians in those data.

Protocol design: This must be clear and unambiguous throughout and always allow for a ‘missing data’ code so that data collectors are not tempted to guess the answer. Staff using a protocol must not feel professionally compromised if they ask seemingly simple questions for clarification. They should realise that even a committee of senior research staff and consultants often interpret questions differently. An instruction booklet with a list of abbreviations, categories of drugs and surgical techniques, where to look for each piece of information and what to do if they are not sure is useful if not essential.

Pilot study: A pilot study should always be undertaken as it uncovers ambiguous questions, improves clarity and ensures the data are actually available in a form that can be interpreted. It is also important to analyse data, to ensure that the data are in a form that can be easily entered onto a computer and analysed meaningfully. The data entry clerk should not be required to interpret data but simply to enter them accurately.

Handwriting: The handwriting in clinical notes is not always legible.
and the way they are used in a purchasing strategy will require careful thinking through of the issues by compare process and outcome between differen orthopaedic services at a district level. It is clearly feasible to undertake multi-Th

An elderly person with a hip fracture is seldom admitted without further co-morbid conditions. Thus one must check whether any observed difference in survival between hospitals for example is actually a function of the differences between hospitals per se, or differences between the populations of patients treated in each hospital such as patient age, sex, number of co-morbid conditions, or other case-mix variables which may exert influence on mortality.

**Analysis**: The following analytic issues became clear during the planning, conduct and analysis of the audit.

- **Sample size**: It is imperative to collect data on sufficient numbers of patients to permit the required data analysis. It is therefore recommended that statistical advice be obtained prior to commencement of the study. It is recommended that groups undertaking studies/audits such as this include from the beginning a medical statistician;
- **Alpha-numerics and dates**: Whilst contemporary versions of SPSS (i.e. Versions 6.0 6.1) are more user friendly than earlier versions alpha-numeric codes pose often unforeseen difficulties. In SPSS dates are best entered using the date handling facility. Dates of birth of elderly people should be coded so as to include the century (i.e. 1898, 1904) otherwise transformations are required for a small number of aberrant data points which appear to suggest that the patient is for example -2 years old or less than 10 years of age.

**Individual identifiers**: As with all research patients need to be identifiable using an unique identifier. For this audit we simply sequentially numbered each patient in each hospital (i.e. 01/077, hospital 1 patient 77 04/005 hospital 4 patient 5). Whilst this works internally it does not permit searching for records across settings. This can only be done using hospital numbers, district numbers, community trust numbers, etc. At present the only unified patient identifier (NHS number) is not routinely recorded in many clinical notes. First names can be abbreviated or preferred name may differ from official name (Ginni, Virginia; Edward, Ted) and instances such as the examples can result in inappropriate initials being entered. Family names can be misspelled (Smith, Smithe, Smyth) and dates of birth incorrectly recorded. Thus it is imperative to cross check names and dates of birth. An usable (and in fact used) unique identifier system is urgently required.

**Fit for discharge date**: At the beginning of the audit it was planned to request nursing and medical staff to record in the notes of each patient when the patient became fit for discharge. Our intention was to attempt to identify how long patients spent as inpatients inappropriately (if at all). Despite regular reminders only a minority of patients had recorded in their notes a date at which they became physically fit for discharge. It is thus very difficult to bring about a simple change in recording practice. In re-audit a modified approach to this will be attempted.

**Conclusion**:

This study shows that regional (multi-district) audits are feasible and allow comparison between a number of hospitals using local standards rather than standards derived from (for example) studies conducted in Scandinavia. This regional audit has demonstrated that it is possible to detect differences both in practice and outcome in orthopaedic units located in the same part of the UK by using the same measurement tools in each. Such findings are inevitably of interest to purchasers and providers alike.

There are a number of lessons from this audit that are relevant to the purchasing and monitoring of orthopaedic services at a district level. It is clearly feasible to undertake multi-centre audit such as this and compare process and outcome between different hospitals, wards or units. Interpretation of such results and the way they are used in a purchasing strategy will require careful thinking through of the issues by
purhchers. However, it would seem to many that a better approach is to use the "carrots" of good practice rather than the "sticks" of poor practice. Routine monitoring of case fatality is clearly a feasible approach and 90 day survival has been demonstrated to be a relatively simple measure of the effectiveness of the service provided. Another measure which revealed significant differences between hospitals in this audit was the incidence of pressure sores. The measurement of pressure sore incidence has been recommended as a key quality indicator for use by both purchasers and providers (Department of Health 1995). However, any examination of differences in health outcome (including both case fatality and pressure sore incidence) especially if the comparison is between provider units, must take into account case mix and other confounding factors. In addition a number of measures must also take into account baseline levels otherwise the complication cannot be attributed to the treatment regimen under consideration (and prevalence rather than incidence is what is measured). Pressure sores are one such complication, and steps must be taken to ensure they did not exist on admission (Sutton et al. 1996). All of the above areas and other suggested outcomes for hip fracture (table 2) could be routinely monitored, but this will have resource implications and would have to be adequately funded. Clear definitions are essential for non-medical audit personnel, and any information would have to be easily located and its source clearly specified.

Table 2: Outcome domains for hip fracture patients

<table>
<thead>
<tr>
<th>General complications</th>
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</thead>
<tbody>
<tr>
<td>Pneumonia</td>
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<tr>
<td>Pulmonary embolism</td>
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<tr>
<td>Myocardial infarction</td>
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<tr>
<td>Wound infection</td>
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<table>
<thead>
<tr>
<th>Pressure sores</th>
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<tbody>
<tr>
<td>Intact tissue (Stage i)</td>
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<tr>
<td>Skin ulcers (Stage ii)</td>
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<tr>
<td>Deeper tissue sores (Stages iii-iv)</td>
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<table>
<thead>
<tr>
<th>Intracapsular postoperative complications</th>
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<tbody>
<tr>
<td>Mechanical failure of internal fixation</td>
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<tr>
<td>Dislocation</td>
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<tr>
<td>Re-operation with hip arthroplasty</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Extracapsular postoperative complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure of internal fixation</td>
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<tr>
<td>Re-operation and late extraction of device</td>
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<table>
<thead>
<tr>
<th>Mortality</th>
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<tbody>
<tr>
<td>Mortality at 3 months</td>
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<table>
<thead>
<tr>
<th>Physical and social function</th>
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</thead>
<tbody>
<tr>
<td>Pain free</td>
</tr>
<tr>
<td>Return to pre-fracture level of social integration</td>
</tr>
<tr>
<td>Return to pre-fracture level of ADL</td>
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<tr>
<td>Return to pre-fracture level of instrumental ADL</td>
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<tr>
<td>Return to pre-fracture level of walking outdoors</td>
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<tr>
<td>Return to pre-fracture accommodation</td>
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<tr>
<th>Quality of life</th>
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<tbody>
<tr>
<td>Self reported health status (e.g. as measured by NHQ or SF-36)</td>
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<tr>
<td>Global health related quality of life</td>
</tr>
<tr>
<td>Social integration</td>
</tr>
<tr>
<td>Cognitive function</td>
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<tr>
<td>Life satisfaction</td>
</tr>
<tr>
<td>Fear of falling (fall efficacy)</td>
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<tr>
<td>Self esteem</td>
</tr>
<tr>
<td>Anxiety depression psychiatric morbidity</td>
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<tr>
<td>Satisfaction with care</td>
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</tbody>
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<table>
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<tr>
<th>Carer outcomes</th>
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</thead>
<tbody>
<tr>
<td>Quality of life and health status measures</td>
</tr>
<tr>
<td>Impact on physical health</td>
</tr>
<tr>
<td>Carer stress or burden</td>
</tr>
<tr>
<td>Satisfaction with care</td>
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</tbody>
</table>


Measurement of physical and social function, quality of life and carer outcome necessitate both baseline
data and follow-up of the patient after discharge. Collection of these data therefore has resource implications for both hospital and community NHS Trusts. Quality of life measurements can be complex to collect and interpret. They are therefore unlikely to be practical at a time when even unequivocal and obvious information such as death are not routinely recorded for outcomes monitoring purposes. Other clinical data useful for outcomes monitoring, for example the presence or absence of pressure sores, should be relatively inexpensive to collect and are routinely recorded in nursing notes. Once again it is important to collect data on confounding variables to permit interpretation of differences in pressure sore incidence between units. Routine monitoring of other post-operative complications, for example, pulmonary embolism, should already be possible but again details of pre-existing illness, for example thrombembolic disease, are needed to make sense of any differences found. Case mix factors are difficult to define, and will have to be based on sound research evidence for each clinical condition that is monitored. Other differences may appear simpler to interpret. For example, if nurses and medical staff were to record a fit for discharge date then delays to discharge would be easier to monitor. However, an elderly patient may be orthopaedically fit but not medically or mentally fit for discharge, and may require subsequent care in a nursing home or psychogeriatric unit. Again, grey areas are abundant and monitoring using one simple variable may not be as informative as may be hoped.

References:


SAHFE group (1996). Standardisation of audit of hip fracture in Europe. SAHFE is an EU funded Biomed2 concerted action coordinated by Prof. K-G Thorngren, Dept of Orthopaedics, Lund University Hospital, S-221 85 Lund, Sweden. Contact address for England: Mr Martyn Parker, Department of Orthopaedics, Peterborough District Hospital, Peterborough PE3 6DA. Contact address for Scotland: Dr Colin Currie, Geriatric Medicine Unit, University of Edinburgh, Royal Infirmary of Edinburgh, Edinburgh, EH3 9EW.


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**Organisational Context:**