Trauma services requirements in a district general hospital serving a rural area

S J Kinney, D H A Jones

Abstract

Objective—To assess the demands made on a regional trauma centre by a district trauma unit.

Design—Two part study. (1) Prospective analysis of one month's workload. (2) Retrospective analysis of one year's workload by using a computer based records system. Comparison of two sets of results.

Setting—Accident unit in Gwynedd Hospital, Bangor.

Patients—(1) All patients who attended the accident unit in August 1988. (2) All patients who attended the accident unit in the calendar year April 1988 – April 1989.

Main outcome measure—Workload of a district trauma unit.

Results—In August 1988 there were 2325 attendances; 2302 of these were analysed. In all, 1904 attendances were for trauma; 213 patients were admitted to the trauma ward and 103 required an operation that entailed incision. Patients who attended the unit had a mean (range) injury severity score of 2.13 (0–25). Only two patients had injuries that a district general hospital would not be expected to cope with (injury severity score >20). In the year

April 1988 – April 1989, 21 007 patients attended the unit. In all, 17 958 attendances were for orthopaedic injuries or injuries caused by an accident; 1966 patients were admitted to the unit.

Conclusions—Most trauma is musculoskeletal and relatively minor according to the injury severity score. All but a few injuries can be managed in district general hospitals. In their recent report the Royal College of Surgeons has overestimated the requirements that a British district general hospital would have of a regional trauma centre.

Introduction

All staff providing trauma services throughout the United Kingdom are facing major changes in organisation and practice. There is overwhelming evidence in support of centralisation of trauma care and reduction in the number of hospitals receiving injured patients within a district.^{1,2} In particular the recent Royal College of Surgeons report on the management of patients with major injuries² recommends that each district should have only one major accident and emergency department.

A separate study by the British Orthopaedic Association endorses this view and recommends that each district should have only one hospital receiving patients with major trauma.⁴ The management of multiple injuries and complex musculoskeletal trauma is generally not possible in small units, and patients should be taken directly to hospitals that have the equipment and staff to deal with them.^{2,4} Non-designated hospitals might incur an increased workload of patients admitted for elective orthopaedic procedures who may be relocated from the district trauma centre.

Set against these arguments for centralising trauma services are factors particularly relevant to rural areas, such as transport difficulties and the traditional bonds and loyalties of patients and staff to local hospitals.⁵ Changes in accident and emergency departments have "knock-on" effects on other departments—for example, reduction or closure of an accident and emergency unit may deprive another specialty of admission facilities for patients with severe problems. The reasons for altering the services must be explained to staff in other departments and the community. Community health councils should be involved early, and they in turn should help educate the public whose welfare is their brief. With regard to the establishment of regional trauma units the British Orthopaedic Association states that it is not possible to assess how pressing the need is for such units until the results of accurate audit are available from district trauma centres.

Gwynedd is a large county comprising Snowdonia, Anglesey, the Llyn Peninsula, and the coastal strip including the population centres of Bangor, Llandudno, and Caernarfon (figure). The resident population was approaching 240 000 in 1988 and is subject to a constant and large seasonal increase caused by holiday-makers.

The major accident centre is in our hospital, which is

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Map of Gwynedd

sited well geographically, being in the heart of the county and close to the A55—the North Wales coast road. The accident unit is part of the trauma and orthopaedic service for Gwynedd, which is based at Bangor. The total medical staffing consists of three orthopaedic consultants, an associate specialist, two orthopaedic registrars, and seven senior house officers. All staff work at various times in different parts of the service. At the time of writing the unit comprised an accident and emergency department, a 23 bed severe trauma ward, and two trauma theatres. Accident unit staff deal with all emergencies within their capabilities, but they normally offer continuing care only for those patients with musculoskeletal, head, thermal, chest, and spinal injuries. Patients within the province of other specialties are referred directly to the relevant departments; in cases of multisystem injury the destination of the patient is decided according to clinical priorities. First line cover in the accident unit is provided by one senior house officer in the accident and emergency department (two at busy times) and one in the trauma ward, each working a one in three rota. More senior staff back up the senior house officers, conduct daily trauma operating lists, and undertake fracture and hand clinics in premises adjoining the unit.

There are lesser accident and emergency departments in hospitals at Llandudno, Holyhead, Porthmadog, Pwllheli, and Blaenau Ffestiniog. Patients with serious injuries presenting to these hospitals are referred to our hospital. There are also community hospitals at Dolgellau and Tywyn at the edges of the county, and patients presenting there may be referred to nearer hospitals in adjoining counties. Ambulance staff usually take patients with major trauma directly to our hospital.

We present the workload of our hospital in an attempt to quantify the demands made on it and its regional supporting services.

Methods

Our study comprised two parts. Firstly, we performed a prospective detailed analysis of all patients who attended the unit in August 1988, a seasonally busy month. Accident and emergency and necropsy records were reviewed by one of us (SJK), and the following were assessed: diagnosis, injury severity score,⁶ and outcome. The demands created by these patients on the trauma ward, theatres, and outpatient clinics were also assessed.

Secondly, for the calendar year April 1988 to April 1989 we performed a retrospective analysis of the general workload of the unit by using the computer based accident and emergency records system together with a manual study of the necropsy records for the same period. These figures were correlated with those for August 1988. We also estimated the error factor of such a computer system.

Results

AUGUST 1988

In August 1988 there were 2296 patients who created 2325 attendances (there were 29 revisits); 37 patients did not wait to be seen. The accident and emergency records of 13 patients were missing, and two patients could not be classified owing to inadequate information having been recorded. However, the presenting complaint as recorded by the clerical staff at the time of arrival of the patient in the incomplete records and the records of those who did not wait allowed many of these cases to be classified at least as trauma or non-trauma, and in some cases the injury severity score could be calculated.

We analysed 2302 patient attendances. Revisiting patients or any presenting late after trauma (for example, with an infected laceration) were given the same injury severity score as would have applied to the initial injury. We thought that this would most accurately reflect the time demand such patients had made on the unit.

Of the 2302 attendances, 1904 (82.7%) were for trauma. Of these, 478 (25.1%) were for contusions and abrasions, 413 (21.7%) for fractures or dislocations, 366 (19.2%) for lacerations, 242 (12.7%) for ligament sprains, and 120 (6.3%) for the presence of foreign bodies (including those affecting the eye); all other types of injury each accounted for less than 4% of attendances. Seventy one patients (3.1%) had more than one injury.

In all, 213 (9.2%) patients were admitted to the trauma ward. Of these, 103 required an operation that entailed incision. The operations included fixation or hemiarthroplasty for fractured neck of the femur (33 cases), fixation of ankle fractures (14 cases), and repair of hand injuries (21 cases). Eighty patients required manipulations that did not entail incision and were performed under general, regional, or local anaesthesia, either as overnight or day cases. These included 56 patients with displaced forearm or wrist fractures, seven with displaced midshaft tibial fractures, and eight with dislocated shoulders.

Some patients who required an operation or manipulation were admitted directly to the trauma ward from other hospitals and were included in the operation or manipulation figures. Other admissions to the unit (those not requiring an operation) included mainly elderly patients with minor injuries who were unable to manage on their own and patients with head injuries who were admitted for observation.

Two patients died in the unit, one after failed resuscitation after drowning and another after suffering trauma (an elderly person with a fractured neck of the femur). Two patients required transfer to the regional neurosurgical unit at Liverpool. A patient with a complex acetabular fracture was transferred for consideration of pelvic reconstruction. Only one patient was admitted to general surgery after trauma (the patient had perirenal haematoma). Two patients died outside hospital: one was a pedestrian who had been hit by a car and received instantly fatal head injuries, and the other had a C2/3 fracture dislocation after falling into shallow water.

Those who attended the hospital had a mean (range) injury severity score of 2.13 (0-25) (table I). All patients with an injury severity score >11 required admission. All those with a score of ≥ 8 either required admission or had a displaced fracture requiring manipulation under anaesthesia as a day case. All displaced radial fractures such as Colles' fractures scored nine (3³), as did all fractured necks of the femur. Only two patients had a score of >20. The patients who died outside hospital both had a score of 75.

APRIL 1988-APRIL 1989

In the calendar year April 1988 to April 1989, 21 007 patients attended the unit. Tables II and III show the nature of injury and outcome (by the method of departure) in the patients. Notable features are that 88.2% (17 958) of the attendances were for orthopaedic injuries or those caused by an accident, or both, including deliberate self harm and assault, and 8.6% (1746) were for medical emergencies; this compares with similar figures of 86.2% (1980) and 9.5% (218), obtained for August. A total of 2175 (10.7%) were referred to one of the outpatient clinics directly, and 1966 (9.7%) were admitted to the unit. Most of these patients were also followed up in the outpatient clinics; some, however, were referred back to their own

TABLE I—Injury severity scores in patients with trauma who attended in August 1988

Score	No of patients
0	7
1	1385
2	31
3	1
4	284
5	21
6	2
8	5
9	126
10	6
13	2
14	1
16	1
17	1
25	2

regions for follow up or to their general practitioner.

Tables IV and V give a breakdown of the patients' age and type of injury. The annual figures for the four largest age groups are very similar to those obtained above for August alone. About three fifths (10 601) of our patients were aged 30 or under, and over three quarters (13 658) were aged 45 or under. Table VI shows workload in terms of place of residence. In all, 84.4% (17 603) of the patients were resident in Gwynedd, 15.6% (3255) coming from elsewhere in the United Kingdom or overseas. In August, proportions

TABLE II—Category of injury or circumstance in patients who attended in April 1988 – April 1989

	No	%
Orthopaedic/caused by accident	17577	86.3
Self harm	265	1.3
Assault	116	0.6
Medical	1746	8.6
Surgical	346	1.7
Psychiatric	45	0.2
No abnormality	127	0.6
Did not wait	101	0.5
Brought in dead	12	0.1
Referred from other hospital	31	0.1
Total by computer	20366	100
Coding error	641	
Actual total	21007	

TABLE III—Outcome in patients who attended in April 1988 – April 1989

	No	%
Discharged	10525	51.7
Referred to general practitioner	3436	16.9
Advised to revisit	148	0.7
Referred to outpatient department:		
With fracture	2009	9.8
With orthopaedic injury	33	0.2
With hand injury	143	0.7
Admitted to accident unit	1966	9.7
Admitted to other specialties	1263	6.2
Referred to other specialty	676	3.3
Left or refused treatment	137	0.7
Died	30	0.1
Total by computer	20366	100
Coding error	641	
Actual total	21007	

TABLE IV—Age of patients with trauma who attended in April 1988 – April 1989

Age (years)	No	%
0-15	4646	26.4
16-30	5955	34.1
31-45	3057	17.4
46-60	1773	10.1
61-75	1274	7.3
76-90	748	4.3
91-110	68	0.4
Total by computer	17521	100
Coding error	3486	
Actual total	21007	

TABLE V—Types of injury in patients with trauma who attended in April 1988 – April 1989

	No	%
Contusion/abrasion	4734	27.2
Fracture/dislocation	3929	22.4
Laceration	3033	17.3
Sprain	2424	13.8
Presence of foreign body	1049	6.0
Soft tissue infection	457	2.6
Bites/stings	338	1.9
Thermal injury	280	1.6
Poisoning/optical defect	235	1.3
Other*	1042	5.9
Total by computer	17521	100
Coding error	3486	
Actual total	21007	

*Includes injuries that were not classified.

TABLE VI—Place of residence of patients with trauma who attended in August 1988 and those who attended in April 1988 – April 1989. Figures are numbers (percentages) of patients

Place of residence	August 1988	April 1988 – April 1989
Gwynedd (permanently)	1460 (63.6)	1728.5 (82.9)
Gwynedd (temporarily)	3 (0.1)	320 (1.5)
Other parts of Wales	58 (2.5)	331 (1.6)
Other parts in rest of UK	743 (32.4)	2804 (13.4)
Overseas	32 (1.4)	120 (0.6)
Total	2296	20858
Coding error		149
Actual total		21007

TABLE VII—Causes of death in patients with trauma according to Gwynedd county necropsy records for April 1988 – April 1989

Cause of death	No
Head injury (including two self inflicted gunshot wounds)	11
Cervical spine injury (two acute)	3
Crushed chest	2
Traumatic aortic rupture	2
Ruptured liver (one acute)	2
Multiple injuries (road traffic accident and falls)	9
Explosion	2
Exanguination (self-inflicted neck laceration)	1
Hanging	3
Myocardial infarct secondary to burns	1
Pulmonary embolus after leg injury	3
Medical complications after fractured neck of femur	4
Drowning	7
Total	50

TABLE VIII—Place and cause of death in patients with trauma according to Gwynedd county necropsy records for April 1988 – April 1989

Place and cause of death	Total
Scene of incident	31
Resuscitation room:	
After drowning, failed resuscitation	11
Of multiple injuries, including lacerated liver	11
Of ruptured thoracic aorta	21
Of ruptured aorta and thoracic spine fracture/dislocation	11
Another hospital before transfer:	
Of multiple injuries, including fatal head injury	11
Of lacerated liver and disrupted pelvis	11
Of massive cervical spine disruption	11
At home or in another hospital after discharge or transfer:	
Of pneumonia after cervical spine injury	11
Of pneumonia after fractured neck of femur and lymphoma	11
Of pulmonary embolus at home after fractured neck of femur	11
Gwynedd Hospital:	
Of pulmonary embolus after lower leg fracture	21
Of pulmonary embolus after leg haematoma	11
Of pneumonia after fractured neck of femur	11
Of pneumonia after lacerated liver	11
Of myocardial infarct after 25% burns	11
Of fatal head injury	11
Of myocardial infarct after fractured neck of femur	11

were 63.7% (1463) and 36.3% (833) respectively, reflecting the large seasonal increase due to holiday-makers.

Necropsy records showed 50 deaths from trauma during the same year. Tables VII and VIII list the causes and places of death.

COMPUTER ERROR

There was an input omission of 2.0% regarding age and a similar error regarding place of residence; 14.0% of patients had not had their type of injury coded correctly. We calculated that reliable data were available on 83.4% of patients.

Discussion

The Royal College of Surgeon's report makes the following recommendations:

- Regional trauma centres should be established for treating patients with an injury severity score of ≥ 20 . Patients who would benefit from transfer to a trauma centre would be those with major damage to thoracic

and abdominal viscera, severe head injury, or complex orthopaedic trauma such as major pelvic fractures

- The centres should serve a population catchment area of about two million people
- The centres should be staffed by people working the equivalent of three eight hour shifts per day, with staff on standby exclusively for treating victims of major injury. This would entail more than 1000 admissions per year ($1095 = 1$ per shift) to give such staff a justifiable workload and adequate experience.

We thought that some evidence of workload was necessary to establish the accuracy of such proposed figures. There was good correlation between the manual study and the one year computer analysis, which, though subject to certain user induced errors, still accurately reflects a unit's workload and can be used for study purposes.

The analysis for August 1988 found only two patients with injuries that a district general hospital might not "be expected to provide a full service for" according to the Royal College of Surgeons' report (injury severity score >20), although other studies have used slightly lower scores to define serious injury.⁷ One of the two patients had a head injury with an intracranial collection and required transfer for neurosurgical drainage (injury severity score $= 5^2 = 25$), the other as a result of a road traffic accident had a flail chest with haemopneumothorax plus a basal skull fracture (injury severity score $= 4^2 + 3^2 = 25$) and was successfully managed in our intensive care unit. We think that our unit would encounter about 24 such cases per year—that is, only one for every 10 000 of the population served. On this basis a regional trauma centre would need to serve a population not of two million, but 10 million, to justify its independent existence with "set aside" staffing. Using the injury severity score definition of major trauma (≥ 16) we still found only four patients fitting the definition, meaning that a regional trauma centre would still require a population of about five million. Clearly Britain does not generate as many patients with major trauma as an equivalent American population, and thus a modified approach to centralisation of trauma facilities that is more suitable to British conditions is necessary. This does not mean that we are reluctant to accept centralisation of trauma services. We strongly advocate it and already practise it within our district to allow quality care of traumatised patients, the benefits of which are clearly shown in previous studies.^{1,8,9}

Though the injury severity score has proved to be of benefit in predicting prognosis in terms of mortality, morbidity, and length of hospital stay,^{10,11} in cases of blunt trauma and most penetrating injuries other than gunshot wounds¹² we found that it had many drawbacks. For instance, it cannot predict the need for patients' transfer; it is difficult to ascribe a score to patients with head injuries on admission; it was not able to predict whether a patient would require an operation, with its associated risks; and in patients with multiple limb fractures more than one fracture does not merit an increased score.

Thus we think that the score alone should not become the benchmark for the need for transfer of patients when organising more centralised trauma services such as those currently contemplated.

The Royal College of Surgeons' report also suggests the following breakdown of the workload of an accident and emergency department in a typical district general hospital: 60% patients with trauma, 20% patients with acute non-traumatic conditions requiring surgery, and 20% patients with medical, paediatric, and psychiatric conditions. Our figures, which are at variance with these, are 88.2% patients with trauma, only 1.7% patients with acute surgical problems, and 8.8%

patients with acute medical, paediatric, and psychiatric problems.

Our figures were achieved by the following policies:

- Patients with acute surgical and medical problems who require admission and are seen firstly by general practitioners should be referred directly to the relevant specialties and not to the accident and emergency department unless the problems are life threatening. This requires the cooperation and goodwill of the general practitioner and hospital colleagues plus regular explanation of policies to new doctors
- Patients must not be allowed to use an accident and emergency unit as an after hours general practice. A patient attending with a condition that is not urgent should be examined but then normally redirected to seek treatment from a general practitioner
- Rates of reattendance should be kept to a minimum and patients directed to separate outpatient clinics or back to their general practitioners for follow up. In particular, removal of suture from simple lacerations should be done by general practitioners in almost all cases. As 17.3% of our annual attendances were for lacerations, most of which would have required suturing, our workload could have been increased by about 15% if these patients all came back to the accident and emergency department for removal of suture.

Only three of the 2296 patients attending in August were directed to reattend the unit. All three were holidaymakers who had sustained superficial burns and were asked to attend for dressings. Otherwise, dressings can be done by district nurses or family doctors. If all patients with wounds attended for second dressings the workload of the unit might be increased by up to 50%.

From our results a district general hospital can expect to generate the following minimum workload: 8.75% of the local population served can be expected to attend annually; almost 10% of those presenting are likely to require admission for trauma, and half of these are likely to require an open operation; an additional 3.5% will require closed manipulations; a further 10% will need referral for follow up in the outpatient clinic.

As nearly all manipulations and most admissions to the trauma ward also require local follow up in clinics about 20% of all patients attending the accident and emergency department will eventually need outpatient follow up. Many will require more than one visit. A corollary of these figures is that an inefficiently managed accident unit, which permits or even encourages patients to reattend for aftercare of wounds or follow up of fractures rather than redirecting them to general practitioners and separate clinics, would be able to reduce its workload by up to 25% by narrowing the service to the quality care of acute trauma.

Our study supports the view that major trauma should be centralised at district level, wherein a single district general hospital builds up expertise in the management of all patients with trauma of medium severity⁴ and at least competent initial management and stabilisation of patients with major multiple injuries. Such expertise can be gained only when district health authorities, with the advice of senior medical staff, designate one hospital within their district as the receiving centre for all but trivial cases of trauma. The medical staff responsible for that hospital's accident and emergency department must then have an active role in consultation with colleagues in other specialties to make sure that it becomes an efficient unit.

With regard to the planning of regional trauma centres we believe that further studies from other district general hospitals are needed before the criteria

for their establishment can be decided. In general, musculoskeletal as opposed to multisystem trauma is well managed at district general hospital level in Britain, and the Royal College of Surgeons's report may well have overestimated district general hospital requirements for regional trauma centres.

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Hearing disability in people aged 50-65: effectiveness and acceptability of rehabilitative intervention

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Abstract

Objective—To determine the best means of detecting hearing disability in subjects aged 50-65 and whether rehabilitative intervention is acceptable in this age group.

Design—Questionnaire survey of patients on general practice age-sex registers. Two types of questionnaire were used, one being based on the closed set approach of the Institute of Hearing Research questionnaire, which had been used in a pilot study, and the other being a simplified version of this questionnaire developed by the Welsh Hearing Institute and based on open set questions. Questionnaires were sent up to three times, and any patients who had not responded two months after the last posting were personally contacted.

Setting—Two general practices in Glyncoirwg and Blaengwynfi in the Afan valley, West Glamorgan.

Patients—271 Patients in Glyncoirwg (136 men, 135 women) and 333 patients in Blaengwynfi (173 men, 160 women) aged 50-65.

Interventions—All patients indicating hearing disability in answering the questionnaires were invited to attend for a evaluative session in their village. After audiometric testing advice and arrangements for fitting a hearing aid were offered as appropriate.

Main outcome measures—Response rates and prevalence of hearing disability before intervention and of possession of hearing aids before and after intervention.

Results—After three postings and personal contact the response rate was 98% (266/271) in Glyncoirwg, where the complex questionnaire was used, and 97% (322/333) in Blaengwynfi. The prevalence of hearing disability was respectively 53% (141/266) and 46% (148/322) and the prevalence of owning a hearing aid 7% (19/266) and 8% (24/322). After intervention the possession of hearing aids rose to 24% (64/266) in Glyncoirwg and 22% (71/322) in Blaengwynfi; six months later the aids were being used regularly. A direct comparison of the two questionnaires in 69 subjects from Blaengwynfi showed no significant differences in the amount of disability detected by each one. The first posting of questionnaires detected 65% (189/289) of the hearing disability in the two villages or 78% (72/92) of those prepared to accept hearing aids for the first time; 96% (88/92) of those

who accepted hearing aids were detected by two postings.

Conclusions—Simple questionnaires are effective in detecting hearing disabilities in people aged 50-65, and intervention was acceptable in many of those who reported having difficulties in hearing. The response rates from successive postings suggest that two postings are sufficient in terms of the return in detecting those who will accept intervention.

Introduction

The average patient presenting at a hearing aid or rehabilitation clinic for the first time is aged about 70 years and has had hearing problems for about 15 years.^{1,2} By then the patient and his or her family have experienced considerable frustration because of this disability. Difficulties in adapting to new listening conditions and to handling hearing aids are more likely in such patients than in those presenting earlier.

One way of reducing this delay would be to introduce a secondary prevention programme by screening for hearing disability and impairment. The most effective people to target with such a programme are those aged 50-65, in whom the prevalence of hearing impairment and disability begins to increase noticeably.^{1,4} At an earlier age screening would not be cost effective because of the low prevalence. At a later age it would be too late.

We consequently performed a pilot study in suburban Cardiff in which we contacted patients aged 50-65 from a group practice age-sex register by either sending a disability questionnaire or performing domiciliary audiometric screening. Rates for the acceptance of hearing aids were similar with the two approaches, and after intervention the rate of using hearing aids rose from 3.5% to 8.9% in this population.⁵

Several substantive and clinical problems were associated with the pilot study, and we extended it to a different population with a higher proportion of subjects from the manual social classes. We were also interested in comparing two types of screening questionnaire, a closed set approach as used previously⁵ and an open set question as used in the Cardiff health survey.⁴ We therefore approached all patients aged 50-65 in two practices (Glyncoirwg and Blaengwynfi) in the upper Afan valley in West Glamorgan to determine the best techniques for detecting disability and to

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