Computer generated discharge summaries and their use as a case mix sensitive audit engine.

A TALE OF TWO CITIES

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ABSTRACT - Background: An ‘audit engine’ allows critical appraisal of clinical practice without necessitating cumbersome data input, editing or analysis. This is achieved by capturing data from an otherwise necessary task, in this case writing discharge summaries, and using standardised analyses to illustrate the effects of operational changes.

Design and setting: Retrospective analysis of clinical outcome of 1,829 sequential discharges from one consultant’s team in two geriatric medicine departments.

Main outcome measures: Mortality, discharge destination and functional performance.

Results: Median length of stay in the two departments differed significantly (8 vs 13 days; p <0.0001), but patients in the latter department were more disabled, with almost twice as many needing domiciliary services after discharge and suffering impaired mobility or incontinence. Despite this disparity, a similar proportion of survivors was placed in institutional care (31/300 (10%) vs 94/1,100 (8%); NS).

Conclusions: This audit engine demonstrated that apparently worse performance indicators were explained by adverse case mix in one department, and the similar institutionalisation rates suggest superior care there.

Discharge letters form a major strand in the communication between primary and secondary health care, ideally providing all the information necessary for continuing patient care. They may conveniently summarise the key aspects of a patient’s admission for use by hospital doctors on subsequent admissions or at outpatient clinics. They are also used in coding and outcome audit of clinical activity.

For geriatric medicine, a structured discharge summary, produced in consultation with general practitioners (GPs), has been used in South Birmingham for a decade (Fig 1). The information recorded closely matches that regarded by GPs and hospital doctors as ideal for general medical discharges.

Such repeated recording and reproduction of a standardised data set to produce a structured letter lends itself to automation, so the report-writing facility of a shareware database has been adapted to generate discharge summaries and notices of death. The essential task of writing these makes data collection an effortless by-product. The database search facility then allows rapid retrieval of discharge summaries, thus constituting an alternative record system. A standardised analysis program, accessed by a single command, has turned the system into a powerful audit engine. As an example of the utility of this audit engine, the system has been used to demonstrate the difference in the performance of one consultant working first in Liverpool and subsequently in Birmingham.

Materials and methods

The system and its requirements

Hardware. Any personal computer capable of running DOS-based software can be used.

The database. The system uses PC-File, a dBase-compatible shareware product (cost £49), which can communicate with other standard software and is easy to customise. The database can use ‘memo’ fields, thus allowing the inclusion of a free text section in the letter.

Analysis. The ‘number cruncher’ analysis utilises the public domain Epi Info 6. A simple command reads the records in the database and performs a standard analysis that can be printed out or scrutinised on the screen. The analysis program also excludes incredible information: for example, entry of a date of birth as a date of admission might add 99 years to the calculated stay of that patient. Allowance is made for the ‘century bug’, where computers that record only the last two digits of a date of birth make dramatic errors when calculating the age of subjects born in the 19th century.

Data entry. The doctor fills in a standard sheet, which is then transcribed on to the computer by the medical secretary. Common responses are offered in pick lists, and some are ready written on to the database as default entries which can be overtyped. Macros (hot keys) also speed up this process.
Validation of information. As the data produce a letter, incorrect entry (rubbish in) is usually immediately detected when the letter is printed (rubbish out). The production of an acceptable letter therefore automatically edits inappropriate entries.

Security and back-up. Both the system and the software are password protected, and there is automatic back-up to a floppy disk on exit from the program.

Training. The system is easily accessed from a menu, and the software has on-screen information as well as being 'intuitive'. No specific training beyond a demonstration is usually necessary. An instruction booklet has been written to complement the software manual. The discharge summaries for this study were produced by 15 doctors and entered by two permanent secretaries and several temporary ones.

The discharge summaries and notices of deaths

All discharge summaries and notices of death relating to unselected admissions under the care of a geriatrician over a 30-month period were included. The consultant worked in Liverpool for the first two years of this period, and then in Birmingham. The latter sample is smaller than that for Liverpool both because the length of time covered was shorter, and because integration of the departments of geriatric and general medicine in Birmingham invalidated subsequent comparisons of the

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| DISCHARGE SUMMARY | Name: | Sex: |
|-------------------|-------|------|
| GP (Sticker)      |       |      |
| Date of admission:|       |      |
| Route of admission:| GP A&E OPD DV Transfer |
| Presenting problem:|       |      |
| Other problems:    |       |      |
| Discharge medication: (TTOS) | None? or (please state) |
| Unresolved problems: | Unrestricted? or (please state) |
| Information to carer: | Unrestricted? or (please state) |
| Information to patient: | Usual residence? or (please state) |
| Date of discharge: |       |      |
| Destination: |       |      |
| Mental test: |       |      |
| Mobility: | Independent | Supervision | Dependent | With Aid |
| Washing: | Independent | Supervision | Dependent |
| Dressing: | Independent | Supervision | Dependent |
| Feeding: | Independent | Supervision | Dependent |
| Incontinence (urine): | Never | Occasionally | Usually | Catheterized |
| Sailing: | Never | Occasionally | Usually |
| Home support: | Home care | DN | MoW | CPN or (please state) |
| Lives: | Alone | House | Flat | Sheltered accommodation | PNH | RH |
| Key carer (at home): |       |      |
| Follow-up: |       |      |
| Comments: |       |      |
| Signed: |       | Ward: |
consultant's practice. A completed sample discharge summary is shown in Figure 2.

**Statistical analysis**

Statistical analysis was carried out using Epi Info 6 and Arcus Prostat software. Age and length of stay were not normally distributed as shown by the Shapiro-Wilk test, so the Mann Whitney U test was employed. Mortality and functional assessment items were compared using Yates corrected χ-square tests.

**Results**

Of 1,877 consecutive discharge summaries and notices of death, 1,829 (97%) were suitable for analysis (Liverpool: 1,450; Birmingham: 379); 48 records were automatically rejected by the analysis program because of incomplete or incredible data. There was no manual editing of data. The results for the survivors (Liverpool: 1,180; Birmingham: 300) are shown in Table 1. Patients discharged from hospital in Birmingham were more disabled than those in Liverpool, and therefore more dependent, but there was a similar number of new placements in institutional care in both groups.

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**Key Points**

- Computer generated discharge summaries allow rapid production of letters of a uniform standard.
- An integrated analysis routine uses these to provide case mix sensitive performance indicators.
- The system can detect variations in performance due to service changes without special data collection or analysis.

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Dear Dr Taylor,

Your patient was admitted via GP referral on the 05/11/98 because of a fall.

**OTHER SIGNIFICANT PROBLEMS**

1. mild cognitive impairment  
2. chronic glaucoma  
3. postural hypotension  
4. congestive cardiac failure

**COMMENTS**

Mrs. Trip was found lying on the floor where she had lain for 7 hours. She fell forwards whilst rising from the toilet without premonitory giddiness nor obvious precipitating factor. She now has a door entry system, a pendant alarm and a home risk assessment has been completed. We noticed postural hypotension here and hence substituted betaxolol for timolol eye drops and tentatively withdrew enalapril. We will see her in the Well Balanced Clinic for further assessment, and a full report about falls risk factors and their modification will follow.

The patient was discharged on 17/11/98 to: Usual residence.

**DISCHARGE MEDICATION**

1. beta-xolol 0.5% b.d. both eyes  
2. frusemide 40mg. mane

**FUNCTIONAL ASSESSMENT AT DISCHARGE**

- **MOBILITY**: With aid  
- **WASHING**: Independent  
- **DRESSING**: Independent  
- **FEEDING**: Independent  
- **INCONTINENCE**: Usually  
- **SOILING**: Never  
- **DOMICILIARY SERVICES**: Home care 'get up' daily  
- **LIVES**: Alone in a house  
- **KEY CARER**: Daughter – Mrs Care  
- **INFORMATION TO PATIENT**: Unrestricted  
- **INFORMATION TO CARER**: Unrestricted  
- **UNRESOLVED PROBLEMS**: Some falls risk factors  
- **FOLLOW UP**: Well Balanced Clinic: 02/12/98

Yours sincerely,  
Alex Ball, SHOs to Dr Jed Rowe

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Fig 2. A completed sample discharge summary.
Table 1. Comparison of audit results in Liverpool and Birmingham.

|                          | Liverpool (n = 1,450) | Birmingham (n = 379) |
|--------------------------|------------------------|-----------------------|
| Length of hospital stay (days) | 8                      | 13                    |
| Median age (years)       | 82                     | 83                    |
| Mortality*               | 270 (19)               | 79 (21)               |
| Survivors**              | 1,180 (81)             | 300 (79)              |
| Urinary incontinence     | 345 (29)               | 165 (55)              |
| Impaired mobility        | 143 (12)               | 69 (23)               |
| Dressing difficulties    | 309 (26)               | 140 (47)              |
| Place in institutional care* | 94 (8)               | 31 (10)               |

* Not significant. All other parameters were significant (p < 0.0001).
** Percentages below are of survivors.

Discussion

Contracting is presently based on finished consultant episodes and occupied bed days. These are crude factors probably reflecting local resources and case mix rather than effectiveness. Local pay bargaining and hospital league tables may also use these variables. The introduction of clinical governance will further highlight the use of such measures.

In this study, simple comparison of performance indicators appears to suggest deterioration in the consultant's work following the move to Birmingham. However, longer hospital stay may be explained by a case mix of patients with greater disability. The similar institutional placement rates then argue for improved quality of care.

Previously, information necessary to show up apparent anomalies in practice could be derived only from scrutinising individual case records. Our system is designed to produce discharge summaries of a uniformly high quality, with retention of the data for later perusal. The standardised analysis routine then completes the components necessary to produce an 'audit engine' capable of explaining performance indicators by considering the case mix.

References

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3 PC-File. Atlantic Coast Software, Devon, EX13 6HA.
4 Epi Info 6. Atlanta: Centers for Disease Control; Geneva: World Health Organisation.
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