The potential role of IT in supporting the work of junior doctors

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ABSTRACT - Objectives: To develop an information system using hand-held personal computers to support the work of junior doctors.

Design: A user-driven design process was used. Functionality reflected the core work of house officers (HOs) and senior house officers (SHOs); ie ward round lists, immediate discharge summaries, patient handover, laboratory and guidelines reference information and a personal record of clinical experience.

Setting: Salford Royal Hospital NHS Trust is a university hospital with a large acute medical case load.

Subjects: Several ‘generations’ of HOs and SHOs working in two of the four medical firms. Predominantly acute medical case load.

Main outcome measures: Robustness, acceptability and benefits, assessed by observations and questionnaires.

Results: The system has proved robust. It is time neutral for the juniors and minimal time is needed for training/adaptation. Most felt the system to have either made their lives easier or to have had no detrimental impact. Ward round lists and printed immediate discharge summaries have been particularly successful.

Conclusions: A hand-held IT system designed for house doctors can provide immediate, low-cost support for their activities.

Many of the pressures on junior doctors might be reduced by appropriate IT support: the workload in major acute hospital specialties continues to increase and has an appreciable administrative component; clinical practice is becoming more complex; doctors are increasingly expected to refer to guidelines and other reference material during acute patient care; patient expectations are rising; junior doctors are often responsible for patients on several wards; the reduction in the hours that junior doctors legally can work means that ‘on call’ junior doctors may be responsible for varying numbers of patients about whom they have little prior knowledge; and finally, GPs and patients are rightly requesting more accurate, comprehensive, legible and immediate communication from secondary care teams at discharge. The advent of clinical governance suggests that hospitals will need to be able to demonstrate that they have a system for handover of patients and that junior doctors have easy access to clinical guidelines.

Accordingly, we have investigated whether a simple IT system, using a hand-held personal computer (HHPC) could support junior doctors in these areas. We report our experience from first implementation in November 1995 to the present.

Background concepts

Underlying the software development were several key ideas.

Ward round list

Junior doctors and consultants wanted an easily available, up-to-date list of patients and their active diagnoses. The backbone of the system was to be a list of the junior doctors’ patients, their demographic/administration details and their (continually updated and amended) diagnoses and procedures.

Typed discharge summary

Previous audits had identified that local GPs were keen to receive information within 48 hours of discharge but rated illegibility and incompleteness of the standard handwritten, multi-part, carbonised letters as major drawbacks. A comprehensive, immediate, printed discharge document including all the information required by GPs, produced at the point of discharge 24 hours a day, seven days a week and constructed, as far as possible, from data already entered earlier in the admission, was a key objective.

Handover

It has been suggested that formal handover of patients is likely to become the norm¹. It was envisaged that ‘electronic’ handover of patients between juniors could be effected using the portable IT system. The system would involve the use of Psion Flash SSD disks, which perform the same function as floppy disks on personal computers (PCs).

The registrars’ database

Each of the firms that tested the system comprised two distinct HO/SHO teams with sex- or ward-based case loads,
hence only the registrar or consultant required a 'whole firm' view of current inpatients. Consultants found the printed ward listing more useful for ward rounds and other interactions with the junior doctors than keeping a copy record on their own HHPC. Registrars required a full picture of the firm case load and this was achieved by providing an automatic update facility using the Flash SSD disk to merge data from the two sides of the firm.

Access to clinical guidelines and other reference material

Guidelines are only useful if easily available to staff at the point of care delivery. We thought that providing guidelines as reference material alongside the clinical system (ie on the HHPC) might lead to their more effective use. In addition, it was anticipated that frequently consulted reference lists, such as details of the hospital formulary, the bleep list, telephone numbers, speed dial codes and normative values for tests would be useful, time-saving accessories to store as database files or look-up lists.

Comprehensive skills register for HOs and SHOs

It is increasingly necessary for doctors in training to keep a real-time training record, including the diagnoses of patients seen and procedures performed. It was reasoned that a doctor-specific HHPC used to manage patient case load and produce documentation etc could provide these data as a by-product of day-to-day activity on the wards. Following discharge, each patient's record would automatically be archived to a discharge file. This file would then be downloaded to a spreadsheet and/or database for presentation or analysis.

Aides-memoire

A 'to do' list indexed against the individual patient was identified by our junior staff during piloting as a valuable tool to help manage the multiple daily ward tasks.

Clinical audit

Barriers to easy aggregation and analysis of clinical data are a major obstacle to routine clinical audit. It was recognised that by using an HHPC's ability to export discharge files (containing all completed episodes) to a desktop PC running, for example, Microsoft ACCESS, such analysis might be simplified.

Methods

Technical aspects

Software was developed for Psion 3A and 3C Organiser HHPCs.

Key Points

A hand-held portable IT system customised to the demands of junior doctors can support many of their needs.

Successful implementation depends upon the firm commitment of senior clinical staff.

Hand-held PC technology can be implemented with minimal interfacing, training and support.

The truly personal nature of the system facilitates clinical audit and the production of individual training records.

The 'DOCTOR' program. A batch file comprising the demographic and admission data for all medical patients admitted to the unit over the previous seven days is produced automatically once each day from the PAS system on the hospital network. The file is downloaded and copied onto the Psions using a Flash SSD disk. Junior staff enter and amend each of their patient's diagnostic and procedure data daily. These files are merged automatically to produce comprehensive ward round lists. Prior to discharge, the junior doctors add further clinical data. Five copies of an immediate discharge summary labelled with their destination (GP, clinical coding, patient, secretary's copy file, and case note) are then printed. Pharmacy add clearly printed discharge prescription data to the GP copy and the case note copy. For patients logged temporarily (eg when on call) a parallel file exists with the same functionality. After discharge, records are archived into a discharge file. This can be downloaded into Microsoft ACCESS and analysed to provide summary data for firm clinical audit or junior doctor 'log books' (Table 1).

Reference material. The reference material is stored as Microsoft Word documents, except for the formulary which uses a database file. It includes clinical guidelines for acute general medical cases; normative values for immunology and biochemistry; the hospital formulary; the postgraduate diary; and useful hospital telephone and pager numbers.

Psion Organisers. We used the 1Mb version of the Psion 3A Organiser. The cost of each machine was in the region of £270. We have also tried the Psion 3C Organiser and have used the infra red printing features. The core program works well with either device.

Printing. Each ward already had a PC and printer in place. An RS232 type serial link costing around £80 (including software) can be used to print via a PC, or a parallel link can be used directly between the HHPC and the printer. Any of the Hewlett Packard Deskjet printer range can be used and printers can be bought for around £150.

Transferring data. 250 or 500k Flash SSD disks (approximately £60) were used to transfer data between Psions and from the unit PAS system to Psions.
User development

Extensive consultation took place between the project group and the clinical teams involved in the scheme. The background to the project, its aims, objectives and methodology were fully explained at meetings with each lead clinician and with the junior doctors themselves. Preparatory meetings with departments on whom the system would have most impact (e.g. pharmacy, coding) led to agreed changes in procedure. During implementation, regular meetings with the clinical staff users elicited constructive criticisms, queries and suggestions. Agreed amendments were swiftly incorporated.

Implementation

At the start of the project, a user manual was prepared and issued to each doctor. The junior doctors for each firm were released for two half days of training prior to the introduction of the system and the project manager operated an open door system of follow-on training as well as providing an unofficial help desk from 8.00 am to 5.30 pm each weekday.

The practice that emerged at each firm was that the HO maintained the up-to-date patient case load, while the SHO received regular updated copies of the 'live' file. Arrangements for handover between successive groups of junior doctors required some development. Initially, at the August/February changeovers, the Psions were recalled from outgoing SHOs whilst the firm HOs maintained the patient case load. The incoming HOs were then trained in the use of the system during induction, and at changeover day the firm's live file was simply copied on to the new doctors' machines. The outgoing HOs then handed in their Psions, which were given to the new intake of SHOs.

Successive groups of doctors have found the handover progressively easier and to a large extent new staff are now trained by their outgoing predecessors with help desk support available but little needed.

Evaluation

Project evaluation was carried out prior to implementation and at intervals thereafter. Other medical firms were used as control groups. A structured questionnaire was completed by both active and control groups to ascertain the views of junior doctors on discharge documentation and process, handover, administrative duties, general control of the working environment and the health status of junior medical staff. The questionnaire was re-administered to doctors in the active group at the end of their posts.

Results

Time factor

Use of the Psion system was considered time neutral, taking into account the production of the discharge document and the time taken for input and housekeeping.

Ward round list

This list of active inpatients printed from the database was used invariably and continually. (HOS and SHOs kept 'to do' lists in this format as well as electronically.) Registrars and consultants found this list extremely useful on ward rounds and, with annotation, it has proved a good way of feeding back diagnostic/procedure information to HOS thereby improving the accuracy of discharge communications.

Table 1. Typical example of data that might be downloaded from junior doctors' HHPCs into Microsoft ACCESS for analysis.

| Surname/Forename | Number  | Admitted  | Discharged  | Ward | Diagnosis 1                        | Diagnosis 2                   |
|------------------|---------|-----------|-------------|------|------------------------------------|-----------------------------|
| Patient 1        | H123456 | 31/08/99 | 05/10/99    | H2   | Unstable angina – MI excluded      | CABG                        |
| Patient 2        | H456789 | 30/08/99 | 06/10/99    | H2   | Paraesthesia                       | MS                          |
| Patient 3        | H789123 | 28/08/99 | 03/10/99    | H2   | Angina                             | MI x 3                      |
| Patient 4        | H159753 | 26/08/99 | 14/10/99    | H2   | Acute on chronic confusion         | UTI                         |
| Patient 5        | H852963 | 28/08/99 | 21/10/99    | H2   | Collapse                           | LVF MI                      |
| Patient 6        | H147852 | 28/08/99 | 05/09/99    | H2   | Acute LVF – secondary to atrial flutter | Past RF                    |
| Patient 7        | H789852 | 01/10/99 | 03/10/99    | H2   | Acute LVF – secondary to paroxysmal AF | Mentally handicapped   |
| Patient 8        | H958637 | 01/10/99 | 02/10/99    | H2   | Collapse with LOC                  | Hysterectomy                |
| Patient 9        | H484968 | 02/10/99 | 15/10/99    | H2   | Chest infection                    | CVD                         |
| Patient 10       | H858888 | 03/10/99 | 16/10/99    | H2   | Pleuritic chest pain               | Pleurisy 10 years ago      |
Discharge document
The system is reliable and robust. Consultants considered the document more legible, more complete and more accurate than the handwritten documents. GPs also rated the printed summaries a huge improvement.

House changeover
Unfortunately this area has been difficult to evaluate because the system is being used by only two of four firms.

Reference material
From the outset, other reference data were accessed enthusiastically. In particular the list of hospital bleep numbers, the speed dial codes for local hospitals, the abridged version of the hospital telephone directory and the dosage regimes included in the hospital formulary proved popular. After a slow start, guidelines are being consulted with increasing frequency.

The Psion 3A
To date two machines have been stolen from the wards. Although generally reliable, two Psions (5%) have had to be replaced over three years, due to hardware failure.

User evaluation
A structured questionnaire about the use of the Psion system was completed by junior staff at the end of each house(Table 2). Forty-five junior doctors were asked to evaluate the system, 78% of whom had no prior IT experience. On a 10 point scale of ease of use (1 = very easy, 10 = very difficult), the system was rated 4.5 on average.

Data extracts for clinical audit and analysis
Data can easily be downloaded from the Psion system to a PC and subsequently imported into a Microsoft ACCESS database for analysis. This data transfer also provides the material for a junior doctor ‘skills register’, listing the types of patients treated and interventions made. A floppy disk containing the diagnostic details of patients treated is given to junior doctors when they leave the hospital.

Cost
The project was supported by a £40,000 R&D allocation from the North West Regional Health Authority and approximately £20,000 had been spent on the project at the time of writing.

Discussion
This system has now been operating routinely and successfully with eight successive groups of junior doctors for forty months. Overall, it has been considered time neutral. The immediate printed discharge summary is much appreciated by all who receive it (GPs, patients and coding department) but regarded as slightly laborious to prepare by about half of junior doctors. The regular legible production of a ward round list has been advantageous – it aids communication and ensures that diagnostic details are agreed between consultants and junior doctors. Other features of the Psion system have been increasingly used, particularly the clinical protocols, the reference data and the ‘to do’ lists.

A number of problems had to be overcome – ‘technophobia’ was a major problem in the first cohorts of juniors, but diminished with each successive group of junior staff. The system appears to be rapidly integrated and to support care if the firm has a highly structured work plan; attempts to introduce the Psion into less structured working arrangements have not proved successful so far. The fact that a fallback system of handwritten discharge documentation still exists has provided a continuing escape route for those reluctant to use the discharge summary module, but senior staff insistence can overcome this.

We believe that four aspects of the implementation have been important to success. First, the provision of adequate training to give doctors sufficient confidence. Project training was made as flexible as possible and ongoing advice and retraining was offered throughout the ‘live’ period. Second, the system was robust and technically reliable from the outset and this minimised the chances of rejection. Pre-piloting using two more senior medical staff eliminated a number of technical ‘bugs’. Third, there was unequivocal support from the consultants involved in the active firms. Use of the system varied between doctors; as currently configured it is of most help to the HO. Whether a doctor uses the system

| Table 2. User evaluation of the hand-held IT system by 45 junior doctors (copy of full questionnaire can be obtained from the authors) |
|----------------------------------------------------------|
| **How did your use of the system affect your ability to monitor your patients?** |
| Made it easier/much easier | 57% |
| Made it more difficult | 11% |
| No difference | 29% |
| Not recorded | 3% |
| **How did your use of the system affect the discharge process?** |
| Made it easier/much easier | 54% |
| Made it more difficult | 31% |
| No difference | 13% |
| Not recorded | 2% |
| **How did your use of the system affect your working day?** |
| Saved time | 24% |
| Added some time/been time-consuming | 38% |
| No difference | 36% |
| Not recorded | 2% |
or not seems primarily to depend on what their seniors expect. Fourth, coherence and momentum was maintained by the project board, which reconciled diverse user views into practicable amendments and ensured prompt software modification as well as continuing support.

It might be argued that a networked PC-based system would be faster and more convenient than doctor-held palmtop IT. No doubt this will become possible in time but meanwhile suitable software and unrestricted terminal access in all departments are unusual in NHS hospitals. Accordingly, the system described represents a stepping stone towards the use of an electronic patient record. It is hoped the experience gained, particularly in respect of how junior doctors use IT, may feed forward into the next generation of systems.

We have shown that simple IT can be integrated into the routine work of junior doctors in a generally acceptable way. Quality improvements in ward round management and discharge documentation also brought some personal benefits to the doctors in respect of routine hospital data access, clinical audit and training records.

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Reference

1 Severs M. The junior doctor handover: current practices and future expectations. J R Coll Physicians Lond 1996;30:213–14.

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Guidelines for Clinicians Entering Research

Clinical practice benefits from research carried out by doctors with a training in the methods and ethics of medical research because they are in a position to ask clinically relevant questions and direct the results of such studies towards better care of patients.

These guidelines have been prepared by the Academic Medicine Group of the Medical Royal Colleges for doctors in training who wish to undertake research as an integral part of a career in academic medicine. They complement the recommendation for some research experience for trainees who aim for a clinical career or NHS consultants. The guidelines offer advice on why, when and where to undertake this training in research. Before setting out, the future clinician-researcher is advised to be clear about the area of research, the arrangements for continuing clinical training and the absolute need for full-time support by the funding bodies. Because all these considerations have implications for university and NHS authorities, and research institutes, the guidelines helpfully provide a list of contact addresses, medical organisations and regional postgraduate deans, from whom further advice may be obtained.

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