

# Integrated hospital information systems

JAMES P. SWEENEY, *Partner*

ALASTAIR MASON, *Senior Manager\**

*Arthur Andersen & Co., Management Consultants, London*

In the late 1960s the DHSS funded an ambitious and innovative experiment to develop hospital computer systems. Considerable progress was made at two of the four pilot sites and by the early 1970s the best NHS systems were as advanced as any in the world.

It was at this stage that central funding for the projects ceased and, with insufficient development money, little further progress has been made. The absence of central support for further work in developing hospital computer systems was the prime cause of the resignation of the clinicians from the DHSS Computing Committee and the Committee's subsequent dissolution in 1980.

The lack of development in NHS hospital computing over the last 10 years has become apparent with the widespread implementation of patient administration systems in District General Hospitals. The systems currently being installed are considerably less advanced than were the leading ones in the mid 1970s.

While hospital computing in the UK has marked time, elsewhere in the world there have been major advances both in the scope of the systems and in the arrangements for implementing and supporting them. The pioneer hospital systems were developed by clinicians and computer staff in large university hospitals. The advanced systems currently being implemented are commercially developed and supported and hospitals taking them no longer need a large in-house team of computing professionals.

The commercial availability of advanced systems has led to a renewed interest in the UK in integrated hospital information systems. Last year, work started on piloting two such systems. At Bangour Hospital, Edinburgh, HOMER is being installed, an Australian system running on McDonnell Douglas equipment. One of the leading American products, Technicon, is being implemented on IBM hardware at the Royal Hampshire County Hospital, Winchester.

## Integrated hospital information systems

The currently available integrated hospital information systems bring together four basic components in a single computing application:

- patient administration
- patient care

- aggregate patient information
- medical records.

The relationships between these components are shown in Fig. 1.

*Patient administration* functions are broadly similar to those present in the current generation of patient administration systems. Linked with a master patient index are modules to book and schedule out-patient attendances, track the movements of patients in hospital and administer waiting lists. It is also possible to register attendances at an accident and emergency department.

*Patient care* modules support the work of all the key groups of health professionals. The major functions available to physicians are the ability to order tests, investigations and drugs and to review the results of investigations from terminals which are provided in every clinical area. Not only can a physician obtain the results of recently ordered investigations but a complete record of all tests performed can also be produced either as a table or a graph.

Although some of the London teaching hospital systems which were developed in-house have either an ordering or report reviewing capability or both, the patient administration systems currently being implemented do not perform these functions.

The ability to produce *aggregate patient information* has become an increasingly important component of an integrated system. The pioneer systems in the 1970s had little information production capability because there was little call either from clinicians or administrators for information. The managerial and clinical climate has changed dramatically. Not only is there now a demand for more and better information but it has also been realised that the most cost-effective way to produce information is as a by-product of operational procedures. When major clinical procedures are ordered via ward-based terminals it is relatively easy to produce aggregate information about them. The information is also more likely to be accurate and complete because it has been derived from operational data. The much criticised regional Hospital Activity Analysis systems are unrelated to operational management, and because of this clinicians tend to have little faith in the credibility of the data.

Aggregate patient information is of importance to both physicians and managers. Physicians are becoming increasingly interested in evaluating the quality of care they provide. Medical audit and peer review, although slow to

\*Address for correspondence: A. Mason, Arthur Andersen & Co., Management Consultants, 1 Surrey Street, London WC2R 2PS.

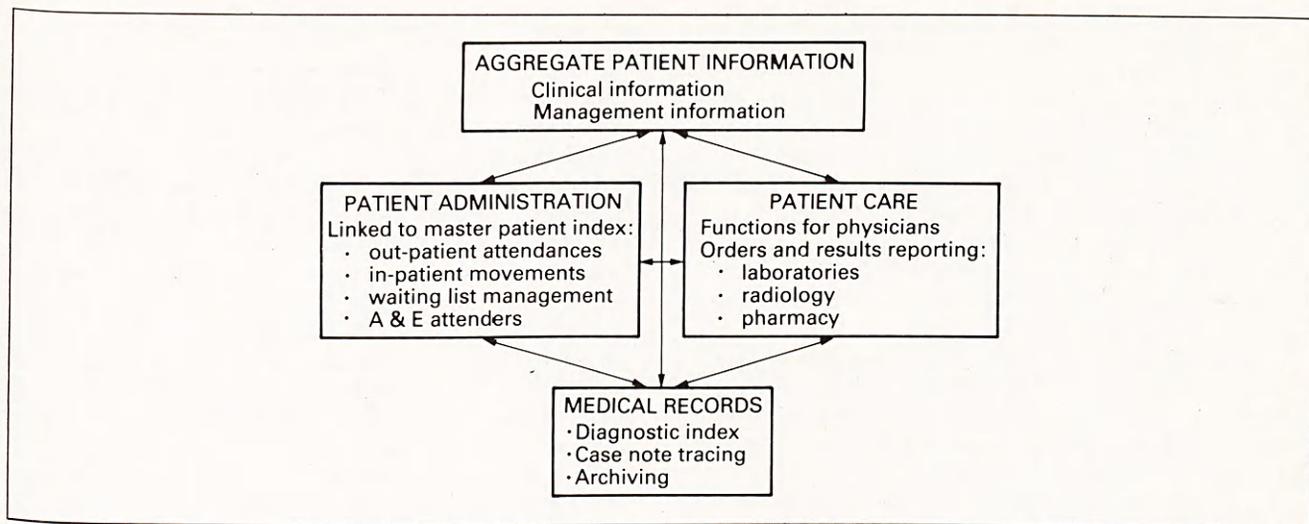


Fig. 1. Components of integrated hospital information systems.

get off the ground, are being introduced into District General Hospitals. The work of the Körner Steering Group has highlighted the need for management information and the NHS Management Board is promoting more sophisticated costing and budgeting systems using techniques like the diagnostic related groups originally developed at Yale University.

The *medical records* component of an integrated hospital information system is closely allied to the master patient index which is part of the patient administration function. Key functions available on the current systems are the ability to produce diagnostic indexes, to track case notes using bar codes on the notes and to archive patient information.

### Characteristics of integrated systems

An integrated hospital information system has a number of features which distinguish it from the hospital systems currently used in the UK. The scope of the system is not constrained by organisational boundaries. Historically, a hospital has had a variety of unconnected computer systems concerned with patient care. Many hospitals have a radiology or pathology system to improve the operational management of these departments. A patient administration system, often on separate and different hardware, holds the master patient index and may provide modules for improving the management of in-patients and elective admission lists. A few clinicians have microcomputer systems holding clinical and research data. The major source of information about patients, the Hospital Activity Analysis system, is totally separate from all other systems as the data are processed on a regional mainframe computer. An integrated hospital system cuts across these traditional arbitrary barriers and brings together the different components in one application.

To permit integration and the transfer of data between the different components of an integrated system, it is

essential that the technical environment is appropriate. The software for integrated systems tends to be supplied by one vendor and to be run on one machine, because not only is there a requirement to transfer data but also to relate data held in one part of the system with another, and to merge data from different parts of the system.

The data content of the system must also be tightly controlled. A key feature of integrated systems is that they are designed around a common data model with all the data items defined and classified and the relationships between them identified.

The final distinguishing feature is that in an integrated system data are entered on the computer by the person who generates them. Health professionals are the major users of these systems and to facilitate use many of the leading applications allow data to be entered with light pens or touch screens rather than through a keyboard.

### Integrated systems in action

An integrated hospital information system provides a wide range of facilities that can benefit all health professionals and areas of clinical activity. The delivery of out-patient services provides a good illustration of the system's capabilities.

Clerical staff use the system to make appointments for clinics either after an initial referral or when a subsequent appointment is required. Before the clinic the computer prints a schedule listing the case notes required and their likely whereabouts. At the clinic, clerical and nursing staff record the arrival and departure of each patient and, if required, amend the patient's basic details such as address or general practitioner. During the consultation the physician may review the patient's medication or investigation results on the terminal in the consulting room. The computer can also be used for ordering investigations and drugs and for referring patients to other doctors and health professionals.

One outcome of a consultation may be the need to put a patient on an elective admission list. This can be done on the computer either by the physician or staff in the clinic. If the patient is given a date for admission during the consultation, the administrative arrangements can be finalised and confirmed. The system provides a computerised elective admission list for each consultant, organised according to the consultant's criteria for admission and giving details of the reason for admission, the urgency of treatment and the flexibility of the patient with regard to being called into hospital.

An important component of the computer support to out-patient clinics is a link with the ambulance services. Terminals in out-patient departments can be used to order ambulances and to record the ambulance delivery and collection times for individual patients.

As well as the operational benefits outlined, an integrated system has the capability of producing information about out-patient activity. This can be used to address management issues such as the rate of non-attendance at clinics or the district of origin of out-patient referrals, as well as clinical matters such as the medication and tests ordered for particular groups of patients.

### **The benefits to physicians**

Comprehensive hospital computer systems provide benefits to all professional groups and managers. Physicians

benefit in several ways. There are major improvements in the operational procedures underpinning patient care. Case notes are present when required; investigation results are available more quickly and are not mislaid. Fewer investigations need repeating because of administrative inefficiencies. A further benefit is the availability of credible information which has been produced as a by-product of operational procedures. Up-to-date information about bed states and out-patient bookings will improve the operational efficiency of the service.

Information to review the quality of care delivered can be assembled either for an individual or a group of patients. Activity data can be linked with costs to provide financial information that will help the physician justify the use of the resources available to him.

In the USA, it is considered that the benefits justify the investment in integrated hospital information systems. The unanswered question in the UK is whether these systems will prove to be cost-effective within the financial and managerial culture of the NHS. We believe that they will justify the investment if the systems are properly implemented and there are the organisational and social changes that are essential to realising the benefits for both health professionals and managers.

*This article is based on a paper given at a conference on Computers for Physicians held at the Royal College of Physicians, London in December 1986.*