Occasional articles

Pathologists and training in information technology

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Introduction

The present large scale investment by hospitals in information technology (IT) presents opportunities and challenges to pathologists within a new information dominated service which is concerned with local audit, budget setting and control, and the effective and efficient provision of service.

All disciplines of pathology, to varying extents, use computers in the routine management of analytical and reporting procedures. The need for information on which to base resource management decisions implies a new role and a new importance for laboratory computers. They will be required as feeders for the emerging case-mix and hospital information (HIS) systems that will provide the costing and other data required for contracting and management purposes.[1] The long history of computerisation in pathology has created a variety of established, though somewhat prescribed, routine laboratory data management systems many of which are available commercially. Pathology is therefore well placed in terms of available systems compared with other case-mix feeder services such as radiology, operating theatres, and pharmacy. Although expenditure on pathology is a relatively small proportion of total healthcare budgets, pathology costs are frequently questioned in terms of value for money.[2] It is not surprising, therefore, that many pathology laboratories are being provided with new or replacement computer systems and encouraged to participate in and contribute data to the resource management process. As a result the laboratory computer is becoming part of a hospital or district information system and is no longer necessarily under the laboratory's total control. Laboratory staff therefore need to understand basic concepts of the technology that will affect (and effect) provision of service and the interface with users, both within and outside the hospital.

Previously the terms "computerisation" and "data processing" have been applied to the intralaboratory deployment of (usually) standalone computers. IT has broader connotations and includes the computer systems; the communication networks linking them with each other and with users on a local, area, or national basis; and the various levels of software (operating systems and application programs) which are essential for computer based information systems to operate. Also included in IT are the electronic, systems analysis, programming and operational skills required to specify, design, and implement component parts, and their successful integration as working systems. IT is and will remain a highly specialised field supporting a variety of professional qualifications and career structures, but non-specialists require a reasonable level of literacy if computers are to be used efficiently and effectively. This does not, however, imply a need for detailed knowledge of electronics, binary arithmetic, or programming languages.

There are more immediate reasons why pathologists should become more involved. The Audit Commission in its recent report on the pathology services[2] emphasised the need to use information systems to analyse and produce information to facilitate the laboratory management process; for example, the management of demand, of resources, and costing processes, etc. The local audit process, to which pathologists will need to contribute in the same way as their clinical colleagues, relies on IT. Increasingly, information will become power. For pathologists to retain considerable management responsibility for the running and budgeting of their departments, they must be able to understand and direct the work of computer literate colleagues responsible for processing departmental data from whatever source, in the same way that they understand and direct analytical processes. This cannot be achieved without some element of formal (and formally recognised) training.

Although there is an almost total reliance on computer technology for *delivery* of service in several pathology disciplines, the formal acquisition and recognition of IT skills have not been taken seriously. The selection of laboratory systems is often an act of faith (not always rewarded), rather than a highly reasoned process. This omission may be due to a variety of factors: including a perceived lack of status associated with the pursuance of a technology regarded as peripheral to the goals of the profession; failure to appreciate the growing importance of the technology in management; lack of training opportunities; and lack of money. Nevertheless, it is illogical and ultimately damaging that at both a technical and professional level, scant attention has been given to the provision of training in IT.

What do you need to know?

The training of laboratory workers should be sufficient to enable them to converse intelligently with IT experts (having first differentiated these from those acquainted with, but not necessarily understanding, the jargon); to ask the right questions and to interpret answers; to

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take an active role in specifying and purchasing those elements of hospital information systems that affect laboratory operation; and to understand the advantages and limitations inherent in the technology.

COMPUTER HARDWARE AND OPERATING SYSTEMS

Knowledge of the basic building blocks contained in all computer systems is essential to any pathologist likely, directly or indirectly, to authorise the purchase of one. Price is not a reliable guide. Differences between various hardware architectures and therefore between operating systems should be appreciated in broad terms so that user requirements can be matched against performance capability, and future expectations against realisable potential. The various forms of input and output and data storage devices should be understood in terms of optimum use and cost effective implementations, and the potential (and cost) of newer technologies, such as voice and sound and image representation, understood. The rapidity with which hardware evolves, in terms of scope, speed, capacity and miniaturisation, makes it particularly difficult for the non-specialist to maintain a current awareness. Once a basic grasp of essentials is gained, however, the technology pages of many national newspapers are good sources of information.

COMMUNICATIONS

The functional relation of the laboratory computer to analytical instrumentation and to other computer based systems within the hospital and general practice will characterise the laboratory and the service it provides.

Analytical instrumentation

Interfacing between laboratory computer systems and analytical instrumentation, as required in some disciplines of pathology, has become less of a problem as the instruments have themselves become more computerised, and as the RS232C connection standard has been generally adopted. Problems remain, however, and solutions require some understanding of communication protocols, operating systems, and application programs, etc, as well as how the laboratory wishes to operate the instrument. For example, most modern analysers are discretionary and require to be told which tests are to be performed on each specimen. This information should obviously be provided by the laboratory computer, and a bi-directional electronic and software interface between it and the instrument is needed to allow each machine to inform the other of requirements and results, and to deal with the appropriate packaging of information and completion/error indicators. This interface will probably be provided by the computer system supplier, but its correct specification will depend on an adequate understanding by laboratory staff of the technical issues involved.

Other computer systems and users outside the laboratory

Pathology computers can no longer be considered in isolation from other healthcare systems—for example, systems in other departments, in general practice, etc. The way in which pathology systems can communicate with other systems should be understood in detail at a functional level and in concept at a technical level. It is important that the limitations inherent in any communication network, both in the network itself and in the systems it serves, are appreciated so that expectations are at a realistic level. Superficial grasp is dangerous and leads to disappointment and an inability to provide the service planned. Types of networks, their various abilities to deal with traffic volumes, networked micros *v* multiuser central processors—the major pros and cons of each should be appreciated so that informed discussions can be held.

WORD PROCESSING

The ability to use IT to assist in the preparation of reports, manuscripts, brochures, posters, visual aids, etc, is invaluable for many laboratory workers. Expertise in word processing can be acquired by motivated staff without formal tuition, but exposure to specialist knowledge allows the self-taught to expand their grasp of the subject and so improve their efficiency. Many laboratory secretaries now have word processing skills. Those with basic skills frequently have limited knowledge or confidence relating to the management of document files, archiving, backup and other good practice. This restricts use and produces inefficiencies and occasional crises. Management of secretarial services requires a working knowledge of word processing. Decisions concerning the selection of and standardisation on word processing packages; their possible integration within laboratory data processing systems or the provision of separate office networks, etc, all contribute to the overall output of the laboratory and require understanding as part of the procurement process.

SPREADSHEETS, STATISTICS, AND GRAPHICS PACKAGES

The conversion of laboratory data to information which is readily assimilable by others, frequently requires tabulation, statistical analysis, and graphical presentation techniques. Without exception all senior laboratory workers should have the necessary skills to use the large number of commercially available, personal computer (PC) based, spreadsheet, statistical, and graphical packages to process data. The PC/spreadsheet combination permits the tabulation, manipulation, and presentation of data in ways akin to basic accountancy, and facilitates costing of laboratory procedures, inhouse invoicing systems, and budgeting. The PC/statistics combination provides a convenient environment for statistical analysis of user supplied data, replacing and supplementing older work aids, such as log book, slide rule, pocket calculator. The PC/graphics combination in effect replaces graph paper and provides display facilities previously unrealisable in any practical sense. All three types of package, with variants of some or all, may be present on one

PC and usually data can be passed between them. The greater the facilities available, the greater the understanding of statistical and presentation techniques required. Ideally the PC should be linked to the laboratory data processing system from which data can be extracted, and should be equipped with a laser printer for production of high quality hard copy. The cost of such an approach, in terms of investment in both training, hardware, and software, is justified by the improvement in management and dissemination of ideas, etc, that can be brought about by facts and figures.[2]

DATABASES

All routine laboratory data processing systems rely on database methodology to organise, store, and retrieve data. The structure and organisation of databases materially affects the response time of laboratory systems. It is important that underlying principles of methodology are understood so that serious errors in selection can be avoided. The creation of local personal electronic filing systems is often a useful adjunct to the analytical procedures described above. Practical experience in handling some of the different types of databases may be obtained from using those commercially available for low cost PCs.

PROGRAMMING

Nowadays there is little need for laboratory workers to learn a programming language. Only when a non-trivial program has been attempted, however, is it possible to appreciate that a computer is a machine which knows nothing, has to be told everything (at some point), and only understands 0s and 1s.

PURCHASING A COMPUTER SYSTEM

Although specialist advice should be available, it is important that pathologists have a basic understanding of the procurement process—that is, the steps involved in purchasing a computer system of any magnitude, if the needs of the laboratory are to be met.

The purchase of a laboratory computer system catering for all disciplines of pathology will probably be the largest capital outlay (say £500 000–£750 000) in the experience of many pathologists, and its specification calls for closer cooperation between disciplines than often obtains. Whatever system is ultimately purchased it will be an important determinant in the provision of service and character of the laboratories for a considerable period of time; it is therefore important to get it right. This needs an appreciation of all the factors described above, together with the ability to analyse the laboratory's operation, and to define and prioritise the functions required in precise terms within an operational requirement that will ultimately form part of a legally binding contract of sale. Preparation of such documents requires a balanced appreciation of what is possible in terms of money, technology, and functionality, coupled with a blend of foresight and pragmatism. Some of this can be taught, the rest can only come from experience. It is important to visit and learn from other laboratories with experience (remembering that few people readily admit expensive mistakes). Common basic errors are failure to recognise the time and effort involved in the procurement process; failure to provide the appropriate mechanisms within the laboratory for essential work to be done; and exclusion of junior staff from the process, preventing their acquisition of valuable experience.

What needs to be done?

The need for formalised training must be recognised by the relevant professional bodies and finance made available. The IT topics outlined above comprise a basic curriculum for study. Formal tuition, by recognised bodies, similar to that for management skills, should be made available nationally or regionally, and supplemented by locally organised workshops, seminars, and meetings. Training should be provided for all laboratory staff and must always be at more than token level—discussion is needed with and between professional bodies to ensure that this is tackled in a consistent manner. Project work involving IT should be encouraged and should be a recognised part of career development. As the subject develops new developments and applications of IT in pathology will need to be disseminated, and established journals should encourage publication of papers in these areas.

Conclusion

It has been suggested that the importance of IT in pathology is such that pathology informatics should be recognised as an additional discipline.[3] The benefits of this approach are said to be increased efficiency in the identification of IT solutions, and better management of information, resulting in increased political power. The creation of a separate section of pathology informatics is perhaps a little extreme, but it is clear that running a successful laboratory in the United Kingdom will increasingly depend on having adequate management information, and IT is increasingly promoted as the enabling mechanism for this. The subject is of sufficient importance to pathologists that it cannot be left to chance and training needs to be extended to ensure that laboratory staff at all levels have sufficient grounding in IT to allow them to participate successfully within an information dominated service.

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1 Department of Health. Working for patients. London: HMSO, 1989.
2 The Audit Commission. *The pathology services-A Management Review*. London: HMSO, 1991.
3 Friedman BA. Informatics as a separate section within a department of pathology. *Am J Clin Pathol* 1990; **94**(suppl 1):S2–S6.