The age of the computer?

THE general practitioner who purchases a computer system requires a tool that will provide an information service for the foreseeable future, but computer systems are vulnerable to ageing. The component parts of a system will age at differing rates, and failure to face this issue when selecting the system can leave a time-bomb ticking away in the practice.

All computer systems contain three component parts — 'hardware', 'software' and 'data'. Hardware embraces the electronic and mechanical parts of the system, while software is a coded set of instructions which control the hardware. Various studies have examined the features of particular software and hardware choices.[1,2] Hardware and software together allow the system to manipulate its third, and most important component — the data. It is inevitable that each component will ultimately become obsolete.

In the case of hardware, continuous use produces mechanical wear. Disc drives and keyboards are particularly vulnerable. Changes in the pattern of use contribute to ageing; hardware which was adequate one year ago is suddenly found to have insufficient memory, or lacks the ability to interface with some newly required device. The ageing rate of hardware exceeds that of any other part of the system, and although general practitioners may be unwilling to accept the fast ageing rate which large commercial organizations tolerate, it is worth noting that at the moment the typical life expectancy of a microcomputer in industry is about two years.

Professionally written software will usually age more slowly than the hardware on which it runs. Eventually it will reach a stage when the effort of upgrading it to meet new requirements is no longer cost-effective. Software continuously evolves by virtue of corrections applied to fix 'bugs'. This process will reach a plateau level where so many corrections have been applied that intrinsic logical structures become confused, and can result in a situation where each correction of a bug in its turn creates further bugs of its own. System manufacturers deliberately ensure that software life exceeds the life of one individual installed machine, for the reason that hardware development is mainly capital-intensive, whereas software is essentially labour-intensive; and a good software team is difficult to assemble and expensive to keep. The manufacturer will try to ensure that the software lives long enough to give an adequate return on the development investment.

The desired life expectancy of data stored in a general practitioner's computer system will vary considerably, but patient records, drug indices, and other long-term data are likely to need a life-span of well over 10 years. A discrepancy therefore exists between the ageing rates of hardware, software and data. What happens to the data, meticulously collected and maintained, when the hardware and software reach the end of their useful life? The value of the accumulated data can be considered in terms of the cost of replacing it, and over a 10-year period this will have grown until it probably greatly exceeds the initial cost of the system. There are three main strategies available for managing this situation — a throw-away strategy, an upgrade strategy, and a network strategy.

The 'throw-away' is the easiest of the three strategies to plan and implement. When the information stored reaches its useful limit, the system as a unit is 'thrown away' and the information ceases to be available, except perhaps as a paper printout. Although few general practitioners will feel this is justified, there is a real danger of this strategy being adopted by default if a computer is introduced in an *ad hoc* fashion.

The 'upgrade' strategy includes several variants. Existing hardware and software may be upgraded by replacing modules with others of greater scope, or existing modules may be extended. In the case of hardware this may be as simple as adding a disc drive or more memory, or at the other extreme a complete machine may be replaced by the next generation of machine which explicitly offers upward compatibility. The upgrade strategy requires that a reasonable number of options exist for the next generation of the system, without constraining them too heavily. If the strategy it to be adopted, at least one clear upgrade path should be visible when the system is purchased.

Due caution needs to be exercised to ensure that compatibility exists at all required levels. There is, for instance, no such thing as a 'standard' disc format at either hardware or software level. The IBM PC runs PC-DOS using 5.25 inch floppy discs, while the Apricot runs MS-DOS from 3.5 inch Sony-standard discs. The Acorn BBC does use 5.25 inch floppy discs, but their software format is gibberish to an IBM PC. Interestingly Amstrad have adopted the 3 inch Hitachi/Panasonic standard. Various manufacturers offer free exchange of data between their own general-purpose packages (Psion on the Sinclair QL, for instance, or Lotus 1-2-3 on IBM PC-compatibles, and the 'clipboard' facility on the Apple Mackintosh) but free exchange between disparate health care packages is harder to find.

In the long term, the 'network' strategy is likely to be the best option as there is no doubt that the information systems of the future will be network-based, providing a community of users with selective access to computing resources and information. This group may consist of general practitioners and ancilliary staff within one surgery (a SAN, or small area network), or possibly staff in different buildings of a campus (a LAN, or local area network), or a nationwide grouping (a WAN, or wide area network). It is important to realize that these networks are in everyday commercial use in banks, travel agents, supermarkets and industry already, while much of the vitally important information of primary health care is still being handled by manual methods.

The network strategy provides an extension of the basic philosophy of transferability of records already considered desirable in existing manual systems both in Britain and elsewhere.[3,4] It should facilitate the fast and accurate exchange of information between all concerned with patient care — intra-practice, inter-practice and across the boundaries of primary and secondary health care systems. This transferability is central to the Körner strategy on information systems within the National Health Service,[5] and primary care systems should provide a compatible interface to those in secondary care. The network technology to achieve this is already available.

The best prospect is likely to result from using a network which will interconnect a reasonable variety of computers from different manufacturers, and experience gained in commerce and education shows that this is feasible, despite the apprehensions of some.[6] So far it is the independent network specialist companies who have offered products to achieve this, rather than computer manufacturers.

In the microprocessor field networks have often been based on the internationally accepted V24/RS232 or RS423 standard socket, using either direct wiring or modem links to the telephone network. A recent development, however, has been the provision as part of the computer package of an integral network interface which conforms to some independent non-proprietary standard. The X25 interface provided by the Torch XXX, or the Ethernet-based interfaces for some of the IBM PC clones are examples of this trend. When a general practitioner's first computer system begins to age, the planned attachment of the next generation machine via a network allows familiarization and a smooth transition. Since the lifespan of the network will be required to exceed that of any individual computer system attached to it, the question of which network to plan for deserves considerable attention.

Individual general practitioners will vary in their judgement of what strategy is most appropriate for their own practice, but it is essential that considerable thought is devoted to the different updating strategies before the first machine is acquired. Any practice which has gone through the exercise of putting its patient records into a computer[2] and ensuring their correctness will agree that the time and effort involved precludes any possibility of typing the data in again as a viable strategy for continuity in computer-based information systems. Once input, the data must be transferable to succeeding generations of computer system as an integral part of the system design. Adopting a network strategy will not only help to insure the general practitioner against hardware and software ageing, but will also provide the interfaces for future exchange of information both within and outside the practice.

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Regional patterns of AIDS and HIV infection

THE acquired immune deficiency syndrome (AIDS) has been described as potentially the greatest health crisis of the century. Already over 24 000 cases have been diagnosed in the USA and as many as 1.5 million Americans may be infected with human immunodeficiency virus (HIV). The situation in Africa is reported to be worse, the disease being endemic throughout the population in some sub-Saharan countries. By contrast, and probably owing to the later arrival of the virus in this country, only 490 cases of AIDS had been reported in Britain by the end of August 1986, although this number is expected to double at least every 12 months as many thousands more are already infected.[1]

HIV (formerly known as HTLV-III/LAV) is now accepted as the causal agent in the development of AIDS and is known to be spread sexually, regardless of gender, and through the mixing of contaminated blood. Action has been taken to prevent blood or blood products used in medical treatment from providing a route for HIV transmission, so three groups remain significantly at risk of infection. First, and as yet the most widely reported are homo/bisexual men at risk sexually, secondly injecting drug users at risk through the mixing of blood during the sharing of needles and syringes and, finally, the non-drug-using heterosexual population who are sexually-active.

Recently, however, variations in the prevalence of AIDS and HIV infection within and between these risk groups at different locations have been observed. Among the first 1000 cases of AIDS reported in the USA, 70.3% of all cases in injecting drug users and 45.8% in homo/bisexual men were diagnosed in New York, as compared with California which accounted for 27.9% of cases in homo/bisexual men, but only 3.9% of the injecting drug users.[2] Similar variations exist in the United Kingdom. Of the cases of AIDS reported so far, 438 (89%) are among homo/bisexual men and only four (0.8%) among injecting drug users.[1] In contrast, figures for known HIV antibody seropositivity for risk groups in Scotland alone show a radically different pattern. Of 795 individuals known to be seropositive in Scotland by July 1986, 503 (63.3%) were injecting drug users and only 122 (15.3%) homo/bisexual men.[3] The majority of those presenting with AIDS or AIDS-related illnesses in Scotland are therefore likely to be from a different risk group to those elsewhere in Britain. This is of some importance, as it is this drug user group who, being predominantly heterosexual, may provide the 'bridge' for HIV transmission to the general population.

In Scotland the distribution of infection within risk groups throughout the country is not even, 482 (60.6%) of known seropositive patients coming from Edinburgh, compared with only 176 (22.1%) from Glasgow.[3] Similarly, whereas 51% of injecting drug users in Edinburgh are reported to be infected with HIV, the corresponding prevalence in Glasgow is less than 5%.[4,5] One study has attributed this variation in nearby cities to differing patterns of needle and syringe sharing in the two drug-using communities.[6]

What implications are there for general practice in this information? It is clear that AIDS will soon become a major problem for the medical profession in much of Britain, and despite being dubbed a 'gay plague' by the popular press, will affect other groups in different areas. Sadly, there is a lack of detailed local information about HIV infection, with few regions having sufficient knowledge to enable health authorities to predict the quantity and pattern of forthcoming problems.

Inevitably, general practitioners will become responsible for much of the health care of those with AIDS or HIV infection. It may take from four to 10 or more years for individuals to develop AIDS following HIV infection (some never becoming unwell) and it must be assumed that they will all remain infectious throughout this time. In addition, it is estimated that, once infected, those developing AIDS will spend only about 5% of this time as inpatients, the rest of their time being spent within the community. Britain has an excellent opportunity through its primary health care system to develop appropriate community care for those with AIDS and HIV infection. The success of this will depend largely on the willingness of general practitioners to acquire new knowledge and to become involved with these patients. Already general practitioners are recognized to be the main interface between drug users and medical services and such contact could be fruitfully developed and exploited.[7]