Editorial

Computing in occupational health practice

Computers have offered the potential for streamlining several important organisational and record keeping activities in occupational health for some time. Fulfilment of that potential has awaited the development of systems of sufficient capacity, flexibility, operability, and reliability at a cost low enough to compete realistically with traditional paper systems. The time is now here.

The words in the previous paragraph chosen to describe the necessary characteristics of an acceptable system have each been selected with care. Many of us will remember from childhood or earlier adulthood the creation of the first electrical computers, huge machines yet puny in power by modern standards. Fewer of us will have read the memoirs of the early computer pioneers who recorded how temperamental the machines could be and what skilled manipulation and maintenance they needed. Naturally their use was limited in application to the most important work of scientific and national interest. The replacement of electrical equipment by electronics has led to a rapid downward spiral in cost and physical size and a concomitant upward spiral in overall availability and usability.

In occupational health the first generation of equipment used in the late 1960s and early 1970s was main-frame hardware of high capital cost. Typically, such a system required the services of several dedicated, highly trained staff to operate efficiently. Needless to say, such equipment was thus only of interest to the largest companies and government departments of the more affluent nations. Now, some 10-15 years later, the same power combined with much superior usability is available at a hundredth of the cost in small computers. They are now able to compete on cost with older systems and will to a greater or lesser extent supplant them.

These handy tools have come into our hands when there is unprecedented general public interest in occupational health issues. Legislative pressure to improve record keeping and analysis is an inevitable consequence. This a classic case of the chicken and the egg where previous successes in epidemiology (such as the links between smoking, occupations, and cancer) fuel a public demand for more effort, not to mention the expectation of results. This pressure in

the United Kingdom has been embodied by the proposed Control of Substances Hazardous to Health regulations but similar ideas are extant in many other countries. Those with a sceptical and historical turn of mind will recall that the scientific importance of epidemiology, and public enthusiasm for it, is a cyclical phenomenon, as with Malthus and Farr. The rate limiting factors are technical capacity and quality of data. The latter of these issues, and the more important, has in our time generated the first great computing cliché: rubbish in, rubbish out.

The function options available in occupational health computing may be bewildering. Most reviews discuss a basic format addressing the now familiar triad of "people, places, and things." This format, however, and more complex spin offs such as job/environment matrices, are actually sophisticated applications that presuppose the existence of a back-cloth of supportive data collection and analysis operations. A more fundamental set of basics are such ordinary things as accurate personal identifier data (name, age, and address), sickness absence recording, accident recording, inoculations, and so on. Whereas such data collection may be taken for granted in the most advanced organisations, most of us will in fact fall short to a greater or lesser degree.

Looking at the problems this way though gives hope even to those of us with the most rudimentary recording facilities; in fact the easiest way to start is with a clean sheet. On this sheet may be set down a "shopping list" of discrete blocks of data to be captured. Each of these blocks of data may at first be stored and analysed separately. Then at some future stage of development of a computer system selected blocks of data may be brought together for more sophisticated analysis (sickness absence related to specific environmental exposure for example). The only proviso is that the potential for growth must be built into the system when it is set up.

Before examining how such conceptual models match up to existing hardware and software it is worth examining all the options. These are three: to ignore computerisation, to buy "off the peg," or to develop your own system. Each of these options has advantages but perhaps the most difficult choice is the first: it is hard to resist the bandwagon. There is no

point, however, in buying computer equipment if you are unable to develop a clear view of objectives in data capture and analysis. This sadly is the case in organisations with ambivalent attitudes to occupational health or where the development of occupational health is at an early stage. Attempts to develop computerisation in these circumstances have a high risk of failure and that failure will add to the credibility problems that the occupational health function may already be facing. Equally clearly there is little benefit in buying something if recording needs are simple or the equipment cannot be used. This may occur if there are no data to capture or no revenue funding to run the system: even microcomputers need someone to operate them however user friendly they may be. If you recognise yourself here then it is better to concentrate on developing the traditional occupational health services until sufficient credibility and demand build up for more thorough and systematic record keeping.

When buying a system or trying to develop your own it is essential to have well developed ideas of what you are trying to achieve: a shopping list, in other words. You must also be satisfied that the human resources needed are available and will continue to be available for several years. For small computers this usually means a staff willing to learn and some input from a more skilled person acting as systems manager. Depending on the conclusions drawn from your analysis, you have the choice of going to the market place for an occupational health package or purchasing a system to grow yourself. This is the difference between buying a car and buying a chassis.

Off the peg systems are fine if the match between your requirements and the system that you choose is close. Some degree of individual tailoring, however, is usually necessary. This is costly and may be unsatisfactory. Further, once you have bought into a particular system you are locked into the developments that the supplier chooses to put into it. Naturally, the supplier will endeavour to respond to customer demand but what is put in will be a response to a consensus demand and not necessarily exactly suited to the direction or pace of your own endeavours. Timing and, to some extent, cost are out of your control. On the positive side, there are enormous advantages. A good system will have struggled with and overcome many of the problems which you would otherwise have to work through. The learning and development phases will still be there and should not be underestimated; nevertheless, they will be considerably foreshortened. With good systems it should also be possible to activate parts that you want without necessarily running the whole range of options.

The alternative approach of "growing it yourself" is based on the relatively recent availability of general

data handling systems on small computers that are big enough and flexible enough to handle the demands of an occupational health records system. Here an accretive approach may be developed with discrete data handling packages being put together subject by subject like building blocks (specific medical screening call up procedure, inoculation call up, and recording, to name a few). This approach, known as end user computing, is slower, more time consuming, and a little cheaper. The advantages lie in the control of development and growth, the precise tailoring to in house requirements, and existing systems, and the more thorough knowledge of computing that users acquire. Also such systems are within the capacity of the committed amateur to develop albeit with regular and easy access to advice from an expert systems manager or programmer.

At this stage, it may be useful to look at the action in the market place. In the United States, in those organisations where the first generation of occupational health computing developed, small computers are replacing existing mainframe installations: big computers are no longer economic or necessary. Nevertheless, the concepts used in developing these older systems are of interest and were exhaustively, if somewhat repetitiously, brought together in a special issue of the *Journal of Occupational Medicine*.¹ In Europe, and specifically in the United Kingdom, centre stage has been occupied by the second generation, small computer based, COSTAR system² developed in ICI and now marketed by CDS. This was created out of an existing United States hospital based program of substantial complexity and has been successfully adapted to occupational health use. It is now operating in several United Kingdom and overseas locations. By comparison with mainframes it is cheap, usable, and has a proved track record of reliability. Equally, it would be true to say that it is targeted at the larger and more advanced organisation and takes the application of some expertise to deliver its full potential. At the bottom end of the market the last year or two has seen the arrival of simple, cheap systems. They represent the rise of end user computing and are packaged adaptations of general data handling systems, often having limited storage and analysis facilities. Bolt on expansions of such systems tend to make them quite costly, slow, and cumbersome. Nevertheless, they are useful both as learning tools and in achieving strictly limited recording objectives.

Another interesting development in the past year has been the emergence in the United States market of several powerful dedicated information systems producing hazard data sheets of varying complexity. These could go a long way towards dealing with the acute health and safety information supply problems that many organisations are currently experiencing.

Some research is now being done to assess the translatability of United States material into a format suitable for United Kingdom and overseas needs. A final word of caution is necessary when reviewing the field of occupational health computing and indeed computing generally. Because of the dominance of IBM hardware it is necessary for many software houses to offer "IBM compatibility" even if they are using other hardware. The convolutions necessary to achieve this can sometimes make whole systems impracticable. The answer is to try before buying and try thoroughly.

Moving from the processing machinery, it is essential briefly to consider the raw material with which the computer system will work; the data. The prerequisites for a properly organised system are adequate, accurate personnel identification data. Subsequently, the prime need is for clean data by which is meant reliable and accurate information where the number of independent variables is minimised (or at least known). This seems so obvious as to be hardly worth saying yet all of us have been bogged down by unsatisfactory data from time to time in the middle of a study. It is far better to try and anticipate data quality problems.

Computerisation, at least when analysis is contemplated, lends itself more easily to recording some data than others. Thus occupational hygiene, crude accident rates, or specific biological parameters may be easily and effectually captured and analysed for individual and group trends. Subjective data and rare events may be effectively captured but tend to defy useful analysis. When considering the design of a system it helps to think on these facts and to set the order of priorities for development accordingly. Analysis within one field over short periods (months to a few years) is relatively simple. Analysis using a number of merged fields, as in job/environment matrices, is complex, particularly if attempted over longer periods approaching human lifespan. Complex analysis is probably still better attempted as a series of one off special projects rather than written into the basic system.

Given human nature, it is perhaps not surprising that the complex technical problems of occupational health computerisation have been given less attention than the vexed issues of confidentiality and the law. The most public manifestation of a concern that amounts to paranoia is the Data Protection Act (DPA). It is worth noting that I write as one who regards paranoia as a justifiable and prudent human sentiment. Be that as it may, it is educative to consider why this Act exists and where it has led us. Its original purpose was to try and ensure that the records held about people by consumer credit organisations were accurate and that people had a right to see them and

seek amendment and redress if the records were not accurate. The Act as promulgated became much more broad ranging and set down rules for the storage of all computerised information held about people with only a few specified exemptions. Occupational health records, by and large, are not, at the time of writing, exempt.

No one can argue against what are called the "principles of DPA." They are common sense in any society that aspires to decency in its transactions with individual citizens. What one may and perhaps should argue with is the bureaucracy of registration and inspection and the "knock on" impact of the "right to know" concept with regard to traditional medical records. These are real, weighty, and contentious issues but deserve more space than can be given them here, so I will not pursue them. Suffice it to say that, properly done, the mechanics of registration are simple enough. Also, experience from other countries suggests that data subject access inquiries—that is, individuals seeking to know what is in their files—are rare.

Returning to confidentiality, there is an important distinction to be made between real and imagined problems. For some inexplicable set of reasons many individuals and the media are obsessed with the idea that computerisation makes access to records, and particularly medical records, easier. It may well be that the explanation for this is to be found in the rich vein of doom laden prophetic literature symbolised by Orwell's *1984*. Maybe it is pointless to assert that a main characteristic of totalitarian control is its gross inefficiency, for random victimisation is in many ways more frightening than the systematic. The main vulnerability of computers lies in the volume of information stored and the speed with which it is supposed that it can be disgorged. Ease of access is an illusion fuelled by film fantasies of "hackers" breaking into networked mainframe systems. Nevertheless, anyone can break into paper record stores using no more than a crowbar or just the subterfuge of putting on a white coat, whereas talented hackers are relatively few and far between. Even a hacker of genius abilities cannot access a system that is not networked except by physically breaking into the place where the equipment is kept. This is no different from paper records. The real problems of confidentiality are much more mundane. The record left up on the screen when attending to other tasks is just like leaving paper notes on a desk. Reprogramming new passwords and access areas and getting the appropriate people to remember them are the tedious and time consuming procedures that make systems managers tear their hair out.

A search of references to occupational health computing will currently yield over 50 citations, yet a diligent reading of these is more likely to yield indi-

gestion than enlightenment. A more profitable approach is to look down the path and see if others, with similar problems, have trodden it before us. The most relevant model is probably that provided by the general practitioners whose general needs and population sizes have many similarities to our own. Their document "Computers in Primary Care,"³ although now somewhat dated, provides a useful summary and starting point. In occupational medicine the Society of Occupational Medicine research panel has established a working party to create a guidance document for occupational health practitioners. This working party has sent out a questionnaire to tap the experience of all those who have already sallied into this field. The guidance is scheduled to be complete and available towards the end of 1987.

During the next dozen or so years we can probably expect to see a series of essays in occupational health computing with different objectives, methodologies, and outcomes. Out of the accumulated experience within the specialty should gradually develop a clear perception of the possibilities of computerisation. By the end of the century, it seems reasonable to predict that most of us will be operating partially or wholly automated systems of varying complexity. We should have become computer literate.

Over and above the achievement of competence lies a more fundamental problem that should, but probably will not, be faced now. This is the paradox lurking in prospective legislation such as the Control of Substances Hazardous to Health when its objectives come up against the realities of speed of change in our society. The maximal benefit of computerised records is obtained if they can be used for periods up to or greater than the span of adult human life. Yet industries change shape, take over, are taken over, merge, and alter direction generationally. The duration of industrial generations is much shorter in years than the span of human life, 10–15 years and falling. Herein lies the paradox, for if we cannot create an infrastructure to store and manage the information

much of it will be lost or become useless or irretrievable. Such an infrastructure would need to provide for the adequate storage and availability of data whatever happened to a specific organisation or set of organisations. It is tempting, in times of financial stringency, to shuffle off responsibility to industries or trade associations but in the time scale needed even mighty industries can rise, fall, and fade away. If the thing is to be done it must be done nationally. Some Scandinavian countries have shown the potential practicability of such schemes. The cost is high but not unendurable if the political will is there. Cost could be reduced by piloting a limited project or targeting on specified occupations. The problem, however, then becomes the long term prediction of "high risk." When looking ahead over such long periods, it is worth remembering that few had much to say against asbestos before the 1930s.

We should not delude ourselves that computers will make life miraculously easier for any of us. They will allow us to do quickly and well some of the things that we previously struggled to do badly or at all. These will rapidly become common place and amortised into the expected routines of occupational health function. It is the ability to do new things, however, especially in analysis, that forces us up against a series of fresh technical and intellectual challenges. Bottlenecks move on; they don't go away.

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