The technological development of computers has made their use in laboratories not only practically feasible but also economically possible. Efficient service in terms of a direct improvement in patient care is an essential aim of all laboratories. The realization of this aim can be facilitated by the use of computers.


Rapid developments in computer technology have resulted in the production of small yet extremely powerful computers capable of carrying out many of the functions of the very large, expensive and complex computers of yesterday. This rapid advance in technology has had two important benefits. Firstly, computer operation has been made more 'friendly', and secondly, computers are decreasing in cost. These factors not only make computers a practical feasibility but also an economic possibility for every laboratory in this country. Questions as to the value of computerization in a clinical diagnostic laboratory and which aspects of laboratory functions can adequately be handled by computers now arise.

For the purposes of discussion I have categorized the functions of the clinical diagnostic laboratory as follows: (i) management — the flow of data within the laboratory; (ii) technical — performance of required tests; (iii) interpretative — analysis of laboratory results; and (iv) communication — flow of data from the laboratory to the clinician.

Management

Computer applications in the improvement of management within a laboratory are well known.2 Of particular value is the use of a computer for accessing past laboratory results, thus allowing rapid retrieval of duplicate patient reports. Very often conventional manual card index systems not only become unmanageable but require large storage areas in laboratories with a high patient turnover. Use of simple computer coding systems allows storage of literally thousands of patient data on a
small disc (13 cm x 13 cm), and access to any specific laboratory report can be achieved within seconds. Cumulative reporting of patient results thus becomes practical and rapid.

Worksheets listing all the tests requested can easily be generated by the computer, thus considerably reducing tedious, repetitive tasks. The computer can also be programmed to list all the tests of importance to the laboratory diagnosis of a particular disease. Specifically urgent tests can be noted on the worksheet to allow a priority rating. If required, these worksheets can be generated at specific work stations and thus lead to considerable time-saving in a very large laboratory.

Computer checking of completed results can also be valuable in maintaining control over outstanding or urgently required tests for a particular patient. A simple security code can be used to ensure that no reports are sent out of the laboratory without the approval of the laboratory manager. The laboratory manager is therefore immediately able to assess the present state of any particular report while at the same time exercising full control over laboratory data.

Technical functions

The direct technical expertise of the medical laboratory technologist can never be superceded by a computer. Computer applications in the role of microprocessors can, however, play a major role in easing many of the tedious tasks carried out in clinical diagnostic laboratories. Owing to their particular nature, these tedious and time-consuming tasks are often prone to errors when carried out manually; computer-assisted processes can often produce more consistent results. A further advantage of using microprocessor-controlled equipment is that results can be electronically transferred direct to the central control computer, thus eliminating mistakes arising from manual transcription. Use of these techniques very often requires more sophisticated training of laboratory personnel in order to allow maximum utilization of equipment.

Interpretative functions

More interesting, and probably more controversial, is the role of the computer in the interpretation of laboratory results. It is in this role that the computer has a major contribution to make in the running of a clinical diagnostic laboratory, yet for various reasons it remains the least utilized. Interpretation of laboratory results is a determinative process, requiring a systematic approach particularly suited to computer applications which allow a rapid correlation of related laboratory results while at the same time comparing present results with a battery of standardized normal or expected values. All laboratory data can therefore be subjected to a rigid evaluation, thus allowing even an average laboratory to maintain a consistently high standard of results. It must be emphasized that in the interpretative sphere the computer in no way replaces the laboratory manager, but serves only as a powerful aid in this very complex function. Final interpretation must and will lie under the control of the laboratory manager.

Communication

Too often clinical laboratories confine themselves to the development of the first three functions, which are important in themselves but of no value if the ultimate link with the clinician is not meaningful. In the final analysis it is the last component, communication between laboratory and clinician and its translation into patient care, that is the primary measure of a laboratory's effectiveness. Indeed, our capacity to produce laboratory results can often exceed the capacity to use these results efficiently. Most modern laboratories have a variety of highly sophisticated machines and diagnostic techniques available, and this advanced analytical performance means that the clinician is often presented with masses of complex laboratory data for clinical interpretation. Many of the problems that arise are related to the difficulty in interpretation of the laboratory results, which places a major emphasis on good communication between laboratory and clinician. The laboratory must provide a decision-support system of background information in order to allow the clinician to make meaningful conclusions.

It is at this level that the computer can play a decisive role, allowing as it does constant and rapid access to interpretative background information. This can be done in the form of graphic displays illustrating normal values or depicting frequency distributions of specific test results. Of particular value is the ease of retrieval of results of rare cases, which allows the clinician to refresh his memory as regards exceptions to the rule. This communication process must be ongoing, 24 hours a day, and can only be realized practically with the aid of computers.

Conclusions

One must guard against the development of a modern clinical laboratory to the stage of technocratic indifference to the end result. For this reason a new concept concerning the evaluation of clinical laboratories has developed in the USA, and is expressed as the expected value of clinical information (EVI). A test will have a positive EVCI if: (i) the laboratory result is accurate and communicated to the attending clinician within a relevant time frame; (ii) the results influence decisions regarding diagnosis or treatment; (iii) the tests of importance are known before diagnosis or treatment. If results influence clinical decisions, and if these decisions provide added value for the patient, the EVCI is positive. If results have no effect on clinical decisions or treatment, the EVCI is zero, and if results lead the clinician away from safe and effective treatment for a curable condition, the EVCI is negative.

The evaluation of laboratories in South Africa along these lines might well be meaningful. It will certainly pinpoint some of the superfluous data accumulated in our laboratories and may well generate more effective management procedures in general. By improving efficiency within a clinical laboratory and enhancing communication from laboratory to clinician, computer applications can thus play a major role. The role of computers in South African clinical laboratories has not been fully developed, but in the evolving sophistication of clinical laboratory management this should certainly receive a high priority.

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REFERENCES