Informatics and health
Health informatics

New solutions to old challenges

by Salah Mandil

"If the aircraft industry had evolved as spectacularly as the computer industry over the past 25 years, a Boeing 767 today would cost US$500 and could circle the globe in 20 minutes on 20 litres of fuel."

This much-quoted comparison reflects the recent dramatic developments in the computer industry. Developments to date in health informatics are less sensational but the potential is enormous. Though it is tempting to make another comparison with the snail-pace progress in the global health scene, this article is only concerned with health informatics: the applications of computing methodology and technology to information systems in the health sector.

The informatics challenges in the health sector are both exciting and enormous. The problems involved in collecting health data are well-known but knowledge is piling up exponentially. Each day new discoveries are made and more data are collected. So there are two main challenges that face us at once:

- Firstly, how to manage the mountains of data and information selectively, economically and creatively.
- Secondly, how to acquire knowledge and disseminate it selectively, synergistically and creatively to those who need it, in a form they can use.

New computer methodologies and technology offer some cost-effective solutions. Microcomputers, hand-held computers, expert systems, videotex, compact disks and telecommunications - all these can be applied in efficient and effective ways to solve the many
problems in the health field. Also important is the need for informatics professionals to craft their skills so as to meet the challenges that lie ahead.

A key tool

The importance of informatics to development has been recognised and expressed in many different fashions. The overall message, however, is that informatics technology is an all-embracing technology and one which will affect strategic and operational issues. It is not a sector of development but has become a key tool and strategy to development.

In this issue of World Health, Professor Mahdi Elmandjra, President of the World Future Studies Federation, points out that no country can afford not to join the information revolution, nor can it avoid its all-pervasive impact. As to the question of whether developing countries should embrace informatics, he categorically states that having recourse to the most advanced technology is not a luxury for the poorest countries. His view is that they are the ones that most need to own such technology, since they can then shape its development and ensure its social relevance and cultural coherence.

The uses of informatics in the health sector are manifold. Viewed from the highest level possible, informatics should (a) support the management—in the broadest sense of the word—of health care services, and (b) support the actual delivery of health care. The developed countries are vigorously spreading the uses of informatics in their health sector. Indeed, some regional groups such as the European Economic Community are already working on a common strategy for “advances of informatics in medicine (AIM).”

Health uses

Most developing countries have made or are making a start in the use of informatics in health even before working out a national policy and strategy for health informatics. Some examples are referred to in the various “boxes” in this issue. The making of a national health informatics policy involves setting up objectives and priorities; defining standards for data, software and hardware; and drawing up a plan for human resources development, allocation and utilisation, with a corresponding plan for financial and material resources.

Since computers help greatly in the processing of data and information, and as they become readily accessible, users have become far less apprehensive about seeking and generating data and information, sometimes to the extent of not being sufficiently selective. Coupled with the generally increased sophistication of health services, this forces the health care institutions to cope with an increasing amount of all sorts of data. This phenomenon is known as the “information explosion” in health care.

Dr Shigekoto Kaihara, of the University of Tokyo Hospital Computing Centre, describes this in his article, examines the current state of the art and looks at the hospital information systems of the future.

Knowledge base

Computers are increasingly used to manage another type of information, commonly referred to as “a knowledge base.” Briefly, a knowledge base is not only a collection of information items but also contains the rules and interrelationships between the various items of information. The increases in what are known as “knowledge-based systems” are a present-day phenomenon frequently seen in the health sector. Sometimes referred to as “expert systems,” these typically provide support to the medical doctor, technician or other health workers.

The user submits certain facts (such as diagnostic data on a patient) to the system together with other information (for instance, previous medical history), and the system then examines its knowledge base and suggests to its user a possible diagnosis and related treatment. The same systems could also serve as training tools, and this is probably the area in which expert systems will produce the best results in the short term.

Nevertheless, a number of issues remain to be dealt with satisfactorily before the development and uses of knowledge bases in the health sector globally catch on. How to acquire the knowledge; how to validate the accuracy and conditions of applicability of such knowledge; and how to represent

In China as in Saudi Arabia, the new technology is playing a growing role in public health. Facing page: Young patients watch a video film in a Tanzanian hospital.
such knowledge in expert systems - these are but examples of areas that require a great deal of further investigation. Dr Roger Salamon of the Department of Medical Informatics, University of Bordeaux II, France, discusses the history and present status of expert systems in medicine.

Signal analysis

Another aspect, albeit more sophisticated, of the support that informatics can bring to health care involves the use of computers to analyse signals and produce related diagnoses or trends. In his article, Professor Jos Willems, of the University of Leuven in Belgium, traces the history of computer-assisted signal analysis and describes the state of the art, taking electrocardiograms as example.

The importance of "information support" has been appreciated for decades. The related data collection, validation, processing, dissemination and, equally important, feedback to the original suppliers of the data, are areas that ultimately determine the quality and the usability of information support. Recent informatics tools have significantly improved in these areas. For example, hand-written forms and reports can readily be replaced by hand-held computers (some costing as little as US$200) capable of holding electronic images of the forms, and thus ensuring the validation of the data at its source and eliminating transcription errors. In turn this drastically improves the efficiency and economy of such operations. Dr K. C. Lun, Associate Professor at the National University of Singapore, reviews the improvements brought about by the uses of hand-held computers and highlights their advantages. He cites a practical study carried out in Singapore in collaboration with WHO and reviews examples of relevant products available in the market today.

Telematics

Telematics, or computing combined with telecommunications, is just beginning to help alleviate the problems of feedback. Providers of data are greatly motivated when they receive feedback showing the uses and the relevance of their efforts in collecting and transmitting their data. Informatics has greatly improved this two-way flow. Whether by making it easy to generate and duplicate high-quality reports, in hard copy or in computer-readable media (e.g. microcomputers diskettes or magnetic tape), or by enabling feedback transmission by telecommunications, the technology of feedback has certainly improved in recent years. The article by Dr Ilana Fogelman and Dr Eduardo Chaves of the Secretariat of Health for the State of Sao Paolo, Brazil, describes the use of videotext technology to transmit feedback to providers of data. Of course, this presumes the availability of a reliable telephone and television service.

Another significant contribution of informatics technology is in the field of health literature. First, desktop publishing or the use of microcomputers to produce reasonable quality "publications" speedily and economically has contributed to the increasing availability of written materials from a much wider spectrum of sources. Second, the advent of compact disks (CD) and their interface with microcomputers has made it possible for a "remote library" to come to its user instead of the user requiring reliable telecommunications links to it. Compact disk technology permits the contents of whole libraries to be contained on a few compact disks, which can be read by a

Telex room at WHO headquarters in Geneva, and radio operations of the onchocerciasis control programme in Ghana.
CD-reader (some cost about US$350) and searched using a microcomputer. Mr Claudio Brito of the Pan American Health Organization, Washington DC, explains here the significance of compact disk technology to health literature services.

The reason why I am personally optimistic that informatics can significantly support development in general is that it is a technology which relies more on software than hardware. In other words, it relies more on people than on equipment. It is quite safe to assert that most uses of informatics depend almost 80 per cent on software and 20 per cent on hardware.

Developing countries have great numbers of professionals whose training in informatics can readily be used. Indeed, it is already a reality today that many Third World countries (for instance, Egypt, India, Mexico, Philippines) take on massive software development contracts for industrially developed countries. Since the existence of appropriately trained human resources is the most critical factor in the use of informatics, several developing countries have already taken significant steps in this direction, and with notable results. Dr Denis Protti, Director of the School of Health Information Science at the University of Victoria, Canada, points out the importance of training information professionals on the needs of the health sector.

Standards

The growth of informatics technology and the corresponding growth of its applications in the health field are both so rapid that they often occur before norms and standards are set up and agreed to. Standards for health data, for software and hardware, and for the procedures involved, all require to be set up so that the multitude of application areas may relate to each other. This is essential for sharing and exchanging data and for making economies in the use of hardware and software. A number of international organizations are working in this all-important domain of standards, and a great deal of investigation and hard bargaining is still to come.

The use of informatics in the health sector also influences the way in which health care is to be provided. It therefore has an effect on the norms and standards for the “evaluation of the medical actions taken.” The article by Professor Jean-Raoul Scherrer and Dr Francois Borst, of the Centre for Medical Informatics at the University Hospital of Geneva, Switzerland, argues that the uses of health informatics call for the standards of “medical management” to be developed or revised.

In a number of policy statements, Dr Hiroshi Nakajima, Director-General of WHO, has emphasised the importance of informatics to health and has underlined health as one of the principal pillars of the technology. WHO is engaged on a number of collaborative activities with member states that are either directly concerned with informatics or include an informatics element. The WHO secretariat itself is a heavy user of informatics support, and is actively establishing an electronic mail service with networks to its collaborating institutions.

Though we have found a number of informatics solutions to old challenges, many other challenges still remain. Making computing support available in local languages, providing tele-links to remote and outer-city areas, establishing codes of ethics that govern the access to and uses of medical data and computerised systems, and drawing up appropriate legislation—these are but examples of what remains to be done.

The advent of computing, and particularly the informatics explosion of recent years which has put the new technology within reach of millions of users in developed and developing countries alike, has been compared to the coming of electricity. We are still discovering new uses for it, and it is indispensable. This is already the case for the business and financial sector, and it is only a matter of time — a very short time — before it will be true too for health informatics.
Information explosion
by Shigekoto Kaihara

Hospital personnel today have to cope with an enormous amount of information per patient - a phenomenon which is now often referred to as the information explosion.

All hospital personnel directly involved in looking after patients are obliged to process a large amount of information, so as to provide good care. Physicians, for instance, must obtain each patient's demographic data and a history of the illness, note the signs and symptoms manifested, and compile a past treatment history and associated information in order to arrive at a diagnosis for treatment. Nurses, in turn, need much of this information to formulate a proper care plan, after which they must note the patient's daily progress. Laboratory technicians require details as well, to conduct tests that the doctor has ordered, the results of which are sent back to physicians. Pharmacists too need certain data, to supply the necessary medication. All these examples show that a large part of the daily work of doctors, nurses, laboratory technicians, and pharmacists consists of information handling, perhaps up to 40 per cent of their hospital working day.

One trend all modern hospitals have in common is that the amount of processed information generated per patient is constantly increasing. One survey in a Japanese hospital has shown that the number of clinical tests given to their patients has doubled every seven years for the past 30 years. Similarly, the variety of drugs that are used at hospitals is constantly increasing. Much of this is due to the great advances that have been made by modern medical science and, fortunately, this is reflected in better hospital care. But the reverse side of this coin is that hospital personnel must now cope with an enormous amount of information per patient - a phenomenon often referred to as the information explosion.

Naturally, the information that directly concerns the patient's care is of paramount importance. But it also serves other purposes essential to health care.

First, when such information is properly compiled and aggregated, it provides basic data for efficient hospital administration. How each patient is treated can yield important statistical data, while the number of patients handled, categorised by sex, age, and diagnosis, provides basic information required by administrators to plan for the future of the hospital. Similarly, compiled data about clinical testing are vital for the efficient management of the hospital laboratory, and information as to the type and number of prescriptions issued allows the hospital to estimate the drugs the hospital will need for the year.

Second, health information provided by the hospital is needed by civic health administrators at the district level. Such data, accumulated from all the district's hospitals, are essential in formulating health planning for the district, by matching with population statistics, other demographic data and the health resources of the district. The more limited these health resources are, the more accurate will be the data necessary to conserve them. This medical information then progresses upwards - to the level of national health care, where the central government digests the aggregated district level health statistics for national health planning. Thus each root of this informational evolution starts with the physician's first encounter with the patients.

Third, this medical information, containing not only data about the patient's illness but also the success or failure of therapy, is a valuable source of clinical training for medical students, nurses and allied health care personnel who are privy to such information. It is not an exaggeration to say that a large part of clinical training involves the proper use and the accessibility of this medical data.

The fourth and last point is that medical information is a source of new medicine and therapies. The development of new therapeutic drugs is built upon the careful observations of experienced physicians, and the comparison and analyses of the effects of previously administered drugs, gleaned from the patient's data. This in turn leads to continued medical progress in, say, uncovering a new entity of a disease or a new method of diagnosis.

Using computers in the United Kingdom to track down diabetes cases.
it is still processed manually in a majority of hospitals the world over. This inefficient method results in delays in reaching crucial treatment decisions, for instance when test results fail to get back to the physicians in time, or in delayed action by administrations when a prompt response is needed. In the fast-paced, populous world of today, it is no longer possible to compile accurate statistics manually from such routine data as grading the patients by sex, age and diagnosis. Simply counting such entries can overwhelm the staff of a small hospital.

**Time-savers**

Fortunately, new technologies are now emerging which help to process this information far more accurately and efficiently. To the computer are now added allied machines that can undertake, for instance, imaging in the audio-visual field and rapid data transmission. Gradually, all these time-savers have been brought into hospitals to solve the problems created by the information explosion. Such technologies have been melded into a uniform system which is designed to meet hospital needs and is generally called a hospital information system.

The basic concept of such a system is to create a cumulative file of each patient's data, which can be quickly updated on a continuing basis. This type of data file in computer terminology is called a database.

Once each patient's database is created and regularly updated, data handling at the hospital improves tremendously, enabling a section requiring specific information on a patient to obtain it rapidly from the database. The information is delivered by a printout from a computer terminal in a standardized form. Or the physician may type an order into the computer database, which the computer then transmits to the laboratory as an instruction to perform clinical tests for a certain patient, the laboratory also receiving pertinent data that is stored in the patient's database. Similarly, when a physician uses his or her computer terminal to write a prescription into the patient's database, the computer transmits the prescription immediately to the pharmacy, while the prescription information is kept and accumulated in the database, which provides this information to the administrator in the form of hospital supply statistics.

Statistics become far easier to compile, and the data can be easily copied on to a diskette for transmission to the district level, where similar medical data from all the district's hospitals can be compiled by another computer into a statistical analysis of any district-wide health matter.

Hospital information systems based on the above concepts have been installed in some large hospitals in various countries and are successfully in operation. As many as 300 terminals have been placed in doctors' offices, in outpatient clinics, in wards, laboratories, pharmacies, administrative offices, and at other necessary locations. The system can be tailored to each department's specific needs, and this adaptation is then called a departmental system. Doctors and nurses have already become so accustomed to computer use that written memos, the traditional form of communicating medical instructions, are a thing of the past. Until recently, however, these systems have required expensive, large computers, or main-frame computers, so that smaller hospitals with limited budgets have been unable to consider buying them.

Yet there are sufficient reasons to believe that, even if hospitals spend three per cent of their budget on information handling technologies, they still reap rewards. Although this figure may not be reached in a short time, it is advisable for the cost of improving information handling in hospitals to be itemised in the hospital budget, whether or not computers are installed.

**The future**

What of the hospital information systems of the future? They will be even more sophisticated and versatile since constant advances are being made in information handling technologies. Even small hospitals will be able to afford them, and they are destined to become a convenience as common as the telephone.

The first technological advancement has already appeared - the microcomputer, which is now in use in all parts of the world. The advantages of microcomputers are many: they are economical, compact and, unlike the sensitive mainframe which requires a constantly cool environment, they can be used in a natural climate. So in many developing countries microcomputers have blossomed and since they can be programmed to operate in any language, their adaptability to any country is assured. Hospital information systems based on these microcomputers are being developed and will revolutionise the system of health care globally.

Another technological advancement is information transmission, which allows for direct computer-to-computer data transfers. But even communication on a smaller scale, such as the sending of diskettes full of data, remains an important method of ensuring the interchange of valuable medical information.

Clinics and physicians will in future be able to take advantage of data from the hospitals. In the health care systems of most countries, people normally visit clinics or health centres for simple ailments, and are only sent to hospitals if their illness is serious. Without access by the clinics to the data that the hospital may have, the present hospital...
information system does not satisfy the requirement for total patient health care.

However, technological progress will make it possible to transmit the data contained in hospital information systems through a telephone line to the clinics. Once this computer networking is established, the health care provided to the patient at either the clinic or the hospital will be more accurate. And while the privacy of each patient must always be protected, the accumulation of accurate data concerning matters of health that can be achieved through computer linkage with other health care facilities within a district and, ultimately, throughout the country will contribute to better health research and planning for the benefit of all.

Thailand's national system

The present National Health Information System of Thailand was developed during the fourth Five-Year National Socio-economic Development Plan, 1977-1981. This set up a Central Health Information Centre to collect and disseminate all health information. The system processes three types of data: health programme activities, disease/epidemiological data, and vital statistics. These data are collected from the village level or peripheral health infrastructure and passed on to the District Health Office, then to the Provincial Chief Medical Office, and finally to the Ministry of Public Health. The Information Centre houses two minicomputers, one used for epidemiological analysis and the other for general purpose data processing. Microcomputers have gradually infiltrated at the periphery and are used to support the management of projects, hospitals, districts and provinces.

Health administrators are satisfied with the system, although informatics professionals recognise many areas for improvement, generally involving problems common to developed and developing countries alike. Data are often inaccurate and incomplete, and suffer from a lack of standard definitions. The Ministry is correcting these problems by setting up standard data definitions and improving the recording and reporting forms. Personnel are often not qualified for their data collection and processing tasks, but this is being attacked with an intensive training programme for health personnel which will also help users to make use of the information available to them in their daily activities.

An information processing network will encourage units responsible for separate functions to cooperate more effectively. This will be supported by a mainframe in the central computer service centre and a local area network covering parts of the Ministry.

As part of its strategy, Thailand is encouraging the use of microcomputers. These are already in wide use by hospitals but their purchase and software development has generally been handled locally by users, and this has resulted in incompatibility in hardware, operating systems, and software. Experience and information cannot be easily shared. The Ministry has drawn up a "Masterplan on Computerisation" which encourages the use of standard software throughout the country.

Dr Shigekoto KAIHARA is with the Hospital Computer Center of the University of Tokyo, Japan.
In the coming years there will be a strong global demand, especially from developing countries, for health personnel trained in the effective use of these data processing tools.

Epidemiology is the health discipline that deals with the "distribution and determinants of disease frequency" in human populations. It should be quite obvious from this definition that epidemiology is essentially a quantitative science that deals basically with the need to collect, process, analyse, evaluate and disseminate statistical information about diseases occurring in communities.

It is a fact that no other health discipline handles such huge volumes of data. Large cohort studies often involve monitoring thousands of individuals over a long follow-up period to determine disease incidence. Probably the largest such study ever conducted was the Salk vaccine field trial of 1954 for the prevention of poliomyelitis, which involved the participation of nearly a million schoolchildren.

Epidemiology has traditionally been closely associated with health statistics and, in turn, with the use of computers because of the need to handle data. Computer programmes for data-processing and statistical analyses have been in use or mainframe computers for more than 20 years. Many of these statistical programmes could now also run on microcomputers, making it possible to perform "number-crunching" activities of epidemiological data on desk-top machines.

The principal sources of epidemiological data include health surveys, institutional records containing demographic and medical data, clinical trials and laboratory investigations. Conventionally, data collection is made by filling in recording forms, which occupy storage space and often get damaged or misplaced if insufficient care is exercised. The information collected on forms has to be subsequently checked, coded and processed, and experience has shown that errors commonly occur at this point.

Health data

The use of computers for health data acquisition has received much attention in recent years. These include computers that are directly interfaced with laboratory instruments such as lung function machines and spectrophotometers, use of touch screen technology, light pens and optical card readers. The main drawback of these devices is their dependence on mains power supply, which restricts their value for field data collection.

A recently completed collaborative project between WHO's Division of Information Systems Support (ISS) and the Department of Community, Occupational and Family Medicine of the National University of Singapore has paved the way for a revolutionary approach to health data collection by using hand-held computers (HHC). These are basically battery-powered,
portable computers not much larger than pocket calculators. Their attractive feature lies in their ability to capture and retain data which could subsequently be uploaded directly to a host computer locally or transmitted accurately to a host computer from a remote site over standard telephone lines.

Battery power

Once an electronic version of the recording form has been generated either on the HHC itself or on a microcomputer and downloaded to the HHC, the device is ready for data capture. Information recorded on a HHC is sustained in its memory by a rechargeable battery power pack that has an operational time of between 10 and 15 hours for fully charged nickel-cadmium batteries. In most models, data protection is further ensured by the presence of a lithium battery back-up power source, which is activated when the battery runs low or is being replaced.

On completion of data collection each day, the information captured on the HHC is uploaded to a host computer either locally through direct connection or remotely through data communication over a telephone line using modems. The batteries are then recharged overnight ready for field operations the next day.

As a "number-crunching" machine, the computer has long been associated with health statistics and epidemiology because of the need to process and analyse large quantities of data. Powerful statistical packages have been available on mainframe computers for as long as 20 years (a "package" is computer jargon for a collection of computer programmes put together to enable the end-user to access a variety of data-processing and/or statistical

A project to use computerised bulletin board software as a means of disseminating health information has already been successfully tried out at the National University of Singapore. Known as MEDISTAT, the project offers a microcomputer-based, on-line information service for health and population statistics. MEDISTAT was launched as a free public service by the Department of Community, Occupational and Family Medicine of the NUS in July 1988.

Statistical information is extracted from published sources like annual reports, country reports and yearbooks of statistics, and is converted into electronic form by scanning the printed materials into a word-processor and cataloguing them as statistical bulletins.

Statistical information on MEDISTAT is organised into three sections – Singapore, Asia and the World. The Singapore section includes statistics relating to health facts and figures, mortality rates, fertility rates and population. The Asian section carries statistics about selected Asian countries derived mainly from country reports, and access to the World section gives users a global perspective of health and population issues.

With the Medistat service, statistical information on health and population in Singapore is now only a telephone call (776-5074) away!
procedures within a single job execution). An interesting development in recent years is the “microtisation” of many of these sophisticated statistical packages, obviously a direct consequence of the advent of powerful microcomputers. Today the latest generation of microcomputers with their extensive hard-disk storage, relatively large memory capacities and excellent graphics support are almost, if not fully, compatible with their mainframe version. These PC versions can be installed on microcomputer hard-disks in modules, depending on requirements of the user and availability of hard-disk storage space.

Data files

An activity that is invariably associated with the use of statistical packages is the creation of data files that store the raw data prior to processing and analysis. There are several ways by which data can be entered, edited and stored in electronic form, but a distinction should be made between those statistical packages that can perform processing of raw data as well as statistical analysis of partially or fully processed data, and those statistical packages that support little or no data-processing functions.

The ability to communicate data and information over public telecommunications networks has introduced some exciting applications of the computer in the field of epidemiology. In his excellent paper in 1988 on "Epidemiologic Practice in the Year 2000: From Cholera to Computers", Dr. C. Tyler outlined the important role that telematics could play in disease surveillance. This means of transmission could ensure the timely reporting of key pieces of epidemiological information from the problem source to a communicable disease centre for monitoring. In principle, this will eventually permit the timely tracking of epidemics globally.

Dr. Tyler also foresaw dedicated computerised bulletin boards that would give epidemiologists access to regularly-scheduled publications of information. He envisaged that state-of-the-art bulletin board software would also have powerful mapping capabilities, so that electronic atlases showing global distribution of disease frequencies could be generated.

Health professionals are increasingly interested in the use of computers and especially micro-computers, for health statistics and epidemiology, not least because the price of today’s microcomputer hardware now makes these machines affordable to them and, in some cases, to students. Microcomputers can now be found on the office desks of doctors and in the research laboratories of health scientists. These individuals have been asking about microcomputer-based statistical software that they could use with their desk-top machines to carry out data handling and management functions.

Now that the tools are becoming increasingly available, it is conceivable that within the next few years there will be a strong global demand, particularly from developing countries, for health manpower to be trained in the effective use of these tools, the better to support the data processing and activities that are urgently needed for better health care planning and management.

---

**HCC aids eye care**

In developing countries, blindness is a major health problem whose control depends on the application of simple measures by frontline health workers, because specialist medical care is not always readily available. To help primary health workers in managing common and potentially blinding eye disorders, WHO’s Collaborating Centre for Prevention of Blindness and Trachoma at Brown University, Providence, Rhode Island, U.S.A., has developed a prototype system to run on a hand-held computer, which incorporates a set of WHO guidelines for primary eye care, including diagnosis and treatment. With the aid of the expert knowledge that can readily be extracted from this system, the health worker manages patients with eye problems by one of three actions: definitive treatment with no referral necessary; initial treatment with referral to a secondary care centre; or referral with no treatment.

The prototype of the hand-held computer version of this system has been field-tested with primary health workers in Egypt and Tunisia, where the prevalence of serious eye diseases such as trachoma is relatively high.

---

The ISS/National University of Singapore collaborative project on the use of hand-held computers for health data capture started in July 1987 and ended in May 1988. Three models of HHC were tested and evaluated and the results from field trials demonstrated the following advantages over the use of recording forms:

- **Problems associated with forms such as carrying – or losing – them are eliminated.** Data collection with HHC now involves only a hand-held machine and a master form for reference.
- **As data captured on a HHIC can be uploaded to a microcomputer for direct processing, there are no transcription errors associated with data coding and keyboard entries of coded information.** It also substantially reduces data throughput time.
- **Incorporating a ‘question-branching’ facility eliminates errors when the person filling in the form omits a reply.** Failure to skip questions that are inapplicable often causes data errors on conventional recording forms.
Medicine is a discipline that requires both judgment and action. Information science can help in several aspects:

- it can help the physician in collecting complete and relevant data;
- it can support the physician by providing access to the rapidly increasing sets of medical knowledge through different kinds of databases;
- it can facilitate the management of medical records which may be used for clinical follow-up of patients, clinical research, evaluation of medical action and education.

In all these aspects, information science gives indirect help to medical decision. But there are many other practical uses designed to help the physician directly in what he considers as his personal privilege: the decision process itself.

The physician considers diagnosis as both a science and an art. It is a science because it uses all the components of a scientific method of observation, generation and expression of hypotheses, experimentation and verification. It is an art because it frequently requires a large degree of intuition.

Two types of medical approach can be distinguished. The first is related to the "recognition of forms." The physician recognises the disease and identifies it, as he would recognise a well-known face, not analytically but in an overall manner. This approach is intuitive, the analysis of the various factors involved in the diagnostic decision being reached unconsciously and not by a reasoning process.

In a certain number of cases, however, the overall approach proves ineffective, and a sequential analysis of the parameters is required. In these cases "diagnostic aid methods" find their place, and the computer may become a useful tool, especially when the small amount of data that the human brain can process simultaneously is considered.

Research on computer-aided diagnosis began in the 1960s; the objectives were to resolve clinical problems by the use of mathematical formulations. Therefore, most of the work centred on the application of either logical or probabilistic methods.

But, except in extremely narrow clinical domains, these two techniques proved to have little or no practical value. Most observers were led to believe that, for a programme to have expert capability, it must in some fashion mimic the behaviour of experts.

Components

Expert Systems are built on three components. The Knowledge Base contains the granular elements of problem solving (descriptive knowledge) and the expression of the links that have to be applied between those elements (operating knowledge). The Inference Engine allows for selection of the appropriate elements of knowledge and application of the rules; interrogation of the use (regarding questions which cannot be inferred or resolved by the system itself); management of the events' uncertainty; and explanation of the results. The Events Base describes the treated case, possibly enriched by the inferred events.

Expert systems incorrectly became almost synonymous with the term "artificial intelligence" in the mind of most physicians and this was probably one of the reasons for their first success. Pioneering work was done on rule-based systems, and was designed to deal with medical applications, but their greatest successes have occurred in fields other than medical ones. This not surprising because so much medical knowledge is difficult to grasp and to summarise with simple rules.

By the late 1970s, dissatisfaction with rule-based systems led investigators into new directions; they became aware that clinical findings must be linked with pathophysiological knowledge. Such knowledge is complex; its representation is done either by "frames systems" or by "semantic networks", which are able to organize information with many links and a hierarchical order. Only programmes relying on such reasoning would be able to cope with the enormous diversity with which
diseases can exist, evolve and interact with each other.

Associative procedures are still in a research phase and have not yet reached a stage of practical application in the clinical field; unfortunately this situation will probably remain the same for several years.

Before the development of Expert Systems, the clinical uses of medical decision-making programmes were very limited. The methodology used (in particular probabilistic procedures) were too distant from the usual way of thinking of the physicians, and the programmes were applied to only a few limited clinical situations. The procedures used "non-fuzzy" data known with a high degree of certainty (a situation which is relatively rare in medicine), and these systems were unable to explain to the physician how they reached their conclusions. A further criticism from an informatics perspective was that their programming was too rigid.

**Fuzzy data**

Expert Systems avoid these major pitfalls by using symbolic reasoning, being capable of handling fuzzy data, and explaining their proposed conclusions. Instead of "procedural" programming, Expert Systems are based on "declarative" programming which allows for a large degree of flexibility. Nevertheless, with experience covering several years, we must acknowledge a certain failure in the sense that expert systems have not yet proven to have great practical value. The main reason for this failure seems to be related to initial underestimating of the difficulty of mastering medical knowledge.

To date, there is sufficient evidence to assert that the original stated goal of Expert Systems to support physicians in medical decisions may have been a bit presumptuous. Most probably, Expert Systems will not be able to provide conclusive evidence to reach such an objective. The use of such systems may nevertheless be worthwhile in medicine if the objectives are narrowed down and orientated towards such very precise targets as the communication of simple knowledge to non-experts, and alarm function (sometimes called the "watchdog" role), and assistance in education and teaching in health-related fields.

---

Professor Roger Salamon is in the Department of Medical Informatics at the University of Bordeaux II, France.
For most people, informatics in health is associated with sophisticated computer systems operating in ultra-modern hospital installations. It need not be so. The term "informatics" has quite a broad meaning, and the term "health" perhaps an even broader one.

One form of health informatics requires a particularly simple infrastructure at the user's end. Videotex starts out, as far as the user is concerned, with equipment which is readily available in developed countries and in most developing countries: a telephone and a television set.

A Videotex-based communications network has been in operation in the health system of the Brazilian city of Sao Paulo since December 1987. Carried out by the Secretariat of Health for the State of Sao Paulo, the project involves the large-scale introduction of information technology, from the central to the peripheral levels of the health system, so as to allow fast and dynamic dissemination and exchange of information among people who have never before been exposed to computer technology. Specifically, the network was proposed as a means of improving communication and interaction among all levels of the health system, to provide information feedback to data collectors, to improve data collection itself, and to increase the access of health workers to technical and scientific information. Videotex was the chosen technology because of its extreme user-friendliness — it requires no specialised manpower — and its relative low cost when compared to alternative systems. An initial eight-month pilot experiment, involving 40 health units, preceded the current expansion of the project. There are now 100 Videotex terminals installed in health units in the city of Sao Paulo, and others should be installed in the interior of the State in the near future. The terminals (inexpensive MSX-compatible microcomputers emulating Videotex terminals) were rented from the local state telephone company and distributed to 18 divisions of the Secretariat at the central level, to all regional administrative offices in the city of Sao Paulo, to 58 primary care centres, to hospitals, and to laboratories and supply units. At the central level, the coordinating team consists of only four people — two physicians and two Videotex technicians.

Videotex's user-friendliness has been a key factor in the expansion of the system, since new, non-specialised users can be trained to operate the system in a two-hour session. The trained users, in turn, teach other colleagues. When connecting to the system, users can access the electronic mail service (E-mail), transmit collected data or consult information stored in the Secretariat's data bases.

E-mail has been offered to users as an alternative to the regular telephone and mail systems. It is useful for general intercommunication and for specific applications, such as the reporting of cases of infectious diseases, transmission of laboratory test results, requests for supplies, or scheduling consultations in
Videotex is a communications technology derived from the combination of telephone, television and computers. Users only need their telephone lines and a Videotex terminal (which can be a television set, a microcomputer or a stand-alone Videotex terminal) to access information stored in other computers. The technology allows a two-way transmission of text and graphics over the telephone lines. The innovative aspect of Videotex is the use of telephone lines to allow the general public to access information, or to communicate among themselves, using their own television sets as display units, and small, cheap keyboards as data entry units. Indeed, it was originally conceived for non-technical users.

referral hospitals. Primary care centres and regional administrative offices use E-mail to exchange data among themselves. They also make contact with upper levels of the health system, for example, to request statistical information related to their region, to clarify doubts about technical and administrative issues, to check that information they have sent has been received, to request materials and even to complain when their demands are not answered!

E-mail has also made its contribution to the epidemiological surveillance system of the city. Central agencies and surveillance teams in regional administrative offices are swiftly informed when patients are referred to hospitals with communicable diseases, and this allows control measures to be triggered in good time at the central, regional and peripheral levels. The timely dispatch of such warnings used to be extremely difficult because of the obstacles imposed by the old insufficient and inefficient communication methods.

Videotex also supports data collection by making it easy to introduce pre-formatted questionnaires into the system. Primary care centres have used this facility to send their weekly reports on infectious diseases by telephone lines, so that they are immediately received by regional and central agencies. Users only have to select the appropriate questionnaire from a menu and fill it out on their keyboard.

Reports on communicable diseases received at the central level are arranged in a series of “feedback bulletins” at one of the Secretariat’s databases. These bulletins become readily available to any user with access to a Videotex terminal, even outside the Health Secretariat. Epidemiological data are displayed in tables, histograms and maps. Detailed information on any disease can be obtained, as well as the number of cases reported in each region and each neighbourhood of the city. Further “feedback bulletins” on statistical and demographic information are also available as well as abstracts of medical journals, a calendar of events, and new legislation.

The expansion of the project has been encouraged by an unexpected factor: users’ demand. There has been general agreement among users about the present and potential benefits of the system. This fact, as well as the ease with which the technology can be mastered and the reasonably low cost of adding a user to the system (the equipment is rented for about US $15 a month and use of the telephone line is comparatively inexpensive in Brazil), have led to a rapid spread of the network.

E-mail has been the most-used feature of the system. It allows information to be sent to specific users, protected by passwords, or to be displayed on bulletin boards, when of general interest. Bureaucratic tasks can be simplified, since a message can be automatically forwarded to one or several receiving parties.

E-mail and other applications of the network do not have, of course, to be implemented through Videotex technology. Other technologies might even offer more sophisticated services. But in a country like Brazil, where scarce financial and specialised human resources are an obstacle to the extensive computerisation of the health system, Videotex does play a major role in the viability of a large-scale communications network. Its low installation and operating costs, its user-friendliness (requiring no specialised manpower for its operation) and its easy and rapid expansion make it particularly interesting for countries with a medium level of technological development.

The Escola Paulista de Medicina in Sao Paulo, Brazil, with backing from WHO’s Division of Information Systems Support (ISS) and the Research Promotion and Development (RFD) Programme, is helping to put into effect a ministerial decision to unify the nation’s health care services while at the same time decentralising decision-making. One contribution the Medical School has made to this effort is the development of a “semi-expert” system, delivered on microcomputers to points in an integrated network of primary health care centres, for the diagnosis and proposed therapy of a number of diseases.

The first prototype of such a system deals with tuberculosis and is at present being reviewed by the WHO Tuberculosis Programme and ISS. It is designed to support the diagnosis and treatment of individual patients who show symptoms or are confirmed cases of tuberculosis. The system also records the logistical support of patient care management such as patient care registration, physicians’ appointments, and scheduling of follow-up treatment. It is planned that the prototype, and an updated version of it, will be field tested in one or two other countries besides Brazil.

Dr Ilana FOGELMAN and Dr Eduardo O. C. CHAVES are in the Centre for Health Informatics, Secretariat of Health for the State of Sao Paulo, Brazil.
Non-proprietary drug names

As the same drug is often sold under many different privately-owned commercial trade names, there is a need to identify each drug substance by a unique, universally available and accepted generic name that can be used in the labelling and advertising of medicinal products in international commerce.

For over 30 years, WHO has selected international non-proprietary names (INN) by coordinating the activities of national drug nomenclature commissions. Instances where official national generic names are different from the INN are now exceptional. To date, some 5,700 names have been published in 60 lists of international proprietary names.

The INN are maintained by the Pharmaceutical Unit of WHO’s Division of Drug Management and Policies on a computerised database operated on a mainframe computer in Geneva. This was one of the first computer applications developed by WHO in the early 1960s. Today, the computerised database simplifies the regular publication of the Cumulative List of International Non-proprietary Names.

Member governments as well as private corporations use the database to identify new international non-proprietary names and as a reference related to the use of trademarks. This information is currently distributed to WHO’s member governments and is available in hard copy or on computer tapes. Users of the INN system may in future have access to on-line query facilities of the database, which may also be available on CD-ROM disks.

Informatics and Telematics in Health

The new science of informatics – the science of dissemination of information by computers – is now being used in public health. Here are just three examples of how this technology can be used to share information with its 166 member countries.
Sources of food contamination

The joint UNEP/FAO/WHO Food Contamination Monitoring Programme studies the contamination of food by chemical agents arising from environmental and industrial pollution, from agricultural technology, from food processing practices and from natural sources. Information on contamination from all these sources is collected at 37 collaborating centres throughout the world and forwarded to the WHO Environmental Health (EHE) Programme in Geneva for inclusion in a computer database maintained by the Information Systems Support (ISS) Division of WHO.

Since its inception in 1979, the database has grown to its present volume of more than 7,000 records on contaminants in food. The system currently accounts for more than 1,200 food types, and a number of contaminants among which are pesticides, phosphates, lead, mercury and tin. The system records the results of food sampling by the collaborating laboratories. Data items reflect the name of the food, the contaminant, year of sampling, origin of the food, the number of samples analysed, the detection limit and median, and the minimum and maximum measurements of the contaminant detected. The database is used by national health authorities, and in particular public health laboratories, to compare test results and conditions in other countries. The Food Safety unit of WHO's EHE Division produces printed status reports on food contamination every two years which are distributed to all member states.

The database and attendant system software are maintained and operated on a large mainframe computer in Geneva. The possibility of providing remote users with access to the database, either through on-line query facilities or on CD-ROM diskettes, or both, is at present being explored.
Compact disks

by Claudio J. Brito

About the size of a computer floppy disk, each CD-ROM disk can hold over 550 megabytes of data – equivalent to the data found in 1,000 books of 200 pages each.

In many instances, dissemination of basic knowledge, or information, is the best way to help developing countries. Unfortunately, the traditional information systems have always been based on reliable and expensive communications networks which do not exist in that environment. The Pan American Health Organization (PAHO/WHO) based in Washington, D.C., resorted to CD-ROM technology to overcome the high cost of the communication links among and within developing countries.

For more than 20 years, the Latin American Center for Health Sciences Information, BIREME, located in Sao Paulo, Brazil, has been creating a regional bibliographical information system dedicated to public health. Another PAHO centre, the Centro Panamericano de Ingenieria Sanitaria y Ciencias del Ambiente (CEPIS) in Lima, Peru, coordinates the development of a data base on sanitary engineering and environmental health called REPISDISCA.

The strategy of BIREME and CEPIS is to collect bibliographical references to locally generated material by coordinating the efforts of several smaller documentation centres located in countries of the region. BIREME stores the references in the LILACS data base (Literatura Latino Americana en Ciencias de la Salud). Today both networks encompass more than 700 institutions dedicated to collecting and distributing health information throughout Latin America and the Caribbean. The LILACS and REPISDISCA data bases are often the only sources of information on certain health-related problems still affecting the region. Because some diseases are no longer a concern in more developed countries, information about them is not to be found in the traditional health data bases.

The work of BIREME and CEPIS has always been hindered by deficient communication links between both centres and the members of their respective networks. The constant use of telex or mail tended to make the information delivery process extremely slow. This inefficient system was also weakening the willingness of the cooperating centres to continue their contribution to the expansion of both central data bases.

In the United States and Europe, information dissemination systems are profitable. The advanced communication networks already in place offer low costs and contribute to profits that pay for the capital-intensive central facilities, making on-line data bases an economical way of conveying information over vast areas. In the developing countries, on the other hand, only the governments can stand the losses that an on-line information service will generate. In order to benefit its society, the country must pay for the central facilities, and subsidise the cost of communications and terminals to users.

In such situations, because of the communication requirements, the cost of the operation will grow exponentially as the number of users increases and the information disseminated gets more voluminous. Many information dissemination projects that were started by the investment of external resources in developing countries have failed because, after they were set up, the local governments were unable to maintain them.

Like any typical developing country, PAHO also faces difficulties in disseminating information because of severe financial limitations. For this reason, PAHO decided to experiment with the new information system model offered by the CD-ROM technology. The use of a non-erasable storage medium such as the CD-ROM, accessed by small personal computers independent of communications facilities, seemed a promising way of disseminating the stable data bases that PAHO was willing to share with its member countries.

What is the CD-ROM? The name stands for Compact Disc-Read Only Memory. Each CD-ROM disk, about the size of a computer floppy disk, can hold more than 550 megabytes of data. This is equivalent to the data found in 1,000 books of 200 pages each.

A small CD-ROM reader (costing around US $700) attached to a personal computer makes available all the information contained in a disk. The unit requires no linkage to a large and expensive central site or costly technical personnel for maintenance. The production cost of CD-ROMs in the

PAHO - OPS - OPAS
Organización Panamericana de la Salud
Base de Datos LILACS
Lilacs en Ciencias de la Salud

PAHO, 1988
DIC - Coordinación de Información
Departamento de Información, 88.5. (High Sierra),
Sistema de Recuperación
UNESCO Micro CD-ROM/ISIS
United States, including the preparation of the master, may vary from $2.50 to $6.00 for each disk. The unit cost will depend on the quantity produced. The price of a CD-ROM gets lower as the number of disks produced increases. The advantages therefore become clear immediately. The investment made in a less expensive central site requiring reduced maintenance, and the low cost of the disks, result in lower prices for the users of CD-ROM data bases. And in fact the price trend has been downward since the technology became available.

In 1987 PAHO’s Office of Information Coordination (DIC) produced the first experimental CD-ROM containing a subset of the LILACS database. The retrieval software adopted was a modified version of the UNESCO Micro CD/ISIS, a package very well-known in the region and free of charge to PAHO. Those two factors reduced both the need for training and the cost of the product.

The results obtained with the experimental CD-ROM were encouraging enough to justify the allocation of additional funds to start a one-year project. Initially, PAHO distributed around 100 CD-ROM readers to the cooperating centres of both BIREME and CEPIIS, half of them attached to personal computers. As expected, after the initial deployment of equipment, many libraries, universities, hospitals and government agencies of member countries in the region acquired CD-ROM readers by their own means and became users of the PAHO CD-ROM.

Around 215 registered users received the first formal edition of the PAHO CD-ROM in early August of 1988. The release of the second edition, in the High Sierra format, took place in January this year, and henceforth CD-ROM production will become a regular operation in PAHO. The new media will deliver not only data bases, but all sorts of information which may be of interest for the region.

Besides demonstrating the viability of the technology, the production of the PAHO CD-ROMs also brought to light some interesting facts. There was clearly a thirst for information interchange among agencies developing CD-ROM projects. The widespread knowledge about CD-ROM-equipped locations can minimise the cost of deploying equipment where it already exists. There proved to be a possibility for cooperation in production. Each of the data bases placed on PAHO’s CD-ROMs takes less than 20 per cent of the disk’s available space. This means that it is possible to record data bases of different owners in a single disk. As a result, information owners could share production and distribution costs. It was also found possible to reduce training needs through a certain degree of standardisation in the retrieval language. All the different data bases recorded in the PAHO CD-ROMs use Micro CDS/ISIS data structures. In this way, a user able to retrieve information from one data base can easily use any other.

The PAHO CD-ROM project came up with some other unsuspected results. The governments of developing countries, as unique sponsors of information dissemination projects, may reduce their costs by adopting the CD-ROM technology. Data bases stored in minicomputers and delivered through a shared CD-ROM premastering facility are

These shelves hold the medical records of a few thousand patients. Today, one small compact disc could accommodate all of these.
much less expensive than the traditional on-line information dissemination systems. And the investment in less powerful, less complicated computer systems ensures that subsequent maintenance costs will be proportionately reduced.

By making CD-ROM readers available to educational institutions, the governments can increase the understanding of the general population about the importance of information. The typical “user friendliness” and constant availability of the CD-ROM accessed by a PC will attract users who otherwise would not be looking for information. Most developing countries have always wanted to bring international data bases for use within their borders. By purchasing CD-ROMs abroad, they will now be able to accomplish that objective.

When more recent information is needed, the same search formulations created for the CD-ROM can also retrieve information from the corresponding on-line data bases. In this way the connect time to foreign data bases can be cut to a minimum and their use will be less expensive. Finally, the CD-ROM technology can potentially eliminate the ever-present concerns regarding transborder data flows and their political implications.

Keeping a check on the distribution of medicaments, as here in a Mali village, could be speeded up and simplified by storing information on compact discs.

CEIS informs the world

The computerised EPI Programme Information System (CEIS) was developed in 1984 to enable a microcomputer to monitor, evaluate and report the activities of WHO's Expanded Programme on Immunization (EPI). Programme managers both in WHO and its member states need information for planning, evaluation and disease control. The CEIS contain six core indicators: immunization coverage, disease incidence, coverage surveys, training courses, funding and demographic data. A stock control facility and a graphic presentation of immunization coverage and achievement of targets were added in June 1988. The system is menu-driven and it requires minimal computer literacy and training to operate.

The CEIS is currently used and maintained in Geneva. Since 1988 it has been modified and is now operational in five WHO regional offices - AFRO, AMRO, EMRO, SEARO and WPRO. It has also been installed in 18 developing countries (among them China, Egypt, Indonesia and Kenya) while several other countries (including Burma, Burundi, Czechoslovakia, Sudan and Vietnam) are planning installations and training this year. By the end of 1989, the target is to have five countries in each of the WHO Regions (30 countries in total) with an operational CEIS. Based in WHO's headquarters in Geneva, EPI provides support to member states and WHO regional offices, on request, for the installation and adaptation of the system, and training of users.
Computer Analysis of the ECG

by Jos L. Willems

Computer analysis of electrocardiogram readings can be of value to both general practitioners and small hospitals.

As early as 1887, A.D. Waller of London University discovered a measurable amount of current in the human body corresponding to the cardiac contraction. It was not until 1901, however, that an accurate and quantitative recording (electrocardiogram, or ECG) was made possible by the introduction of the string galvanometer by the Dutch physiologist Willem Einthoven. For this invention and the discovery of the mechanism of the ECG, Einthoven was awarded the Nobel Prize for Medicine in 1924. Since then, remarkable progress in the field of electrocardiography has led to the registration of millions of ECGs. In the USA alone close to 100 million ECGs are recorded each year, and a similar figure is true for the European Community.

Computer-aided ECG processing, introduced by H.V. Pipberger 30 years ago, enhances the ability to handle such high volumes of recordings. This benefit is particularly evident in large hospitals or groups of hospitals, and has been one of the major incentives for the involvement of industry in this novel technological market. As a result, small self-contained and relatively inexpensive microcomputer-based ECG systems became available in recent years.

Potentially, computer analysis of the ECG can offer a major service to general practitioners and smaller hospitals as well, and is valuable also in emergency situations where a cardiologist is not available. In addition, computer analysis markedly reduces subjective differences in interpretation and ensures correct classification. These are the major reasons why electrocardiography has been the proving ground for developing many basic concepts in medical decision-making by computer.

The ECG is a graphic record of voltage changes transmitted to the body surface by electrical events in the heart muscle, thus providing direct evidence of certain aspects of myocardial anatomy and function. During its propagation to the surface, extracardiac tissues may intervene and influence the ECG.

The conventional ECG at present contains a minimum of 12 leads. For certain special purposes other leads are recorded and in some research centres, so-called body surface maps are obtained by placing more than 100 closely spaced and evenly distributed electrodes around the torso.

In an ECG data-processing system a
A series of sequential processes happen that are interrelated but, to some extent, independent. They are respectively acquisition and transmission of signals; wave recognition and measurement; parameter extraction; rhythm analysis and classification; and, finally, reporting and database management for programmes performing serial ECG comparison.

Initially, as for many applications, computer-assisted ECG interpretation was performed centrally in larger hospitals on dedicated mini-computers – not time-shared for any other purposes – or on medium- to large-scale computers of regional service bureaus. In recent years, stand-alone microcomputer systems have been introduced which acquire and process data and print results at the bedside.

The computer receives the ECG signals either by means of a MODEM over standard telephone lines, or directly from the ECG recording device, at a sampling rate of 250 to 500 samples per second. The data are stored on disc for further processing, in total between 40,000 and 60,000 samples of a 12-lead conventional ECG recording over 10 seconds. In some ECG processing systems, on-line quality control of the data is performed. The signal quality is checked for noise, baseline wandering, and other artifacts. The technician is informed through a visual or audible signal that the ECG was acceptable so that the patient may be disconnected.

The main task of the ECG measurement programme is the automatic detection of the on- and off-sets of the P, QRS and T waves, that is the main deflections of the ECG in the various leads. The data are first filtered by various techniques. In the next stage QRS complexes are located and the regularity of the heart rate is established. Subsequently, a more refined arrhythmia analysis and wave typing of the various complexes can be carried out to detect whether the beats are all of the same origin.

Because detection methods vary, the results of different programmes are not always concordant even when identical tracings are being analysed. To overcome this problem, a large international standardisation project was undertaken between 1980 and 1985, with support from the European Commission and the Division of Medical Informatics of Leuven University as Coordinating Centre. ECG computer programme developers from Canada, Japan and the USA also participated.

Once on- and off-sets have been determined, the amplitude and duration as well as other measurements of the various waves can be calculated. These measurements are then used in the interpretation phase to arrive at diagnostic classification results.

Classification strategies used by programme developers can be divided into two major groups. In the first and most widely used strategy, the programme sequentially follows a logical decision path, with yes-no branching, to arrive ultimately at a set of non-conflicting statements about the ECG. When certain measurements exceed the limits of normal, the findings are used to arrive at a diagnostic conclusion which may be qualified by a second or third measurement before a final diagnostic statement is made.

The second strategy uses statistics to calculate the probabilities of a particular classification. A large number of ECG variables are used simultaneously, instead of consecutively as in the previous approach, and various statistical techniques make it possible to maximise correct and minimise incorrect classifications of the ECG. A prerequisite for developing such programmes is the availability of a large data base, consisting of records from patients with diagnoses firmly documented by methods independent of the ECG.

Detection of cardiac arrhythmias remains one of the intriguing problems in computer analysis of the ECG. It is widely accepted that complex arrhythmias can hardly be recognised on short strip recordings of surface ECG leads routinely submitted for computer analysis. Most programmes, therefore, only attempt to recognise the most common rhythm abnormalities. Fortunately the incidence of complex arrhythmias is very low.

Comparative analysis of serial electrocardiograms is another feature that is still not fully developed and clinically used. A prerequisite for analysis of serial tracings is a centralised system with efficient storage and retrieval capabilities providing rapid access to old records to which the new incoming records are to be compared. Practicality and economics usually dictate decisions
concerning such retrieval. Disc space limitations impose severe constraints on the length of records, measurement and classification results to be stored. The volume of ECGs processed in several large hospitals in Europe, for instance at the Leuven University Hospitals, exceeds 45,000 per year. Optical laser-disc storage devices are increasingly suggested as a solution to this problem.

After the computer has processed the ECG, it generates an unconfirmed analysis report, which is either forwarded directly to the physician who requested the ECG, or to a cardiologist centrally or remotely located, for approval or over-reading. Indeed, computer-generated reports in most countries still need to be verified or annotated by a reviewer cardiologist, due to legal and other requirements. The over-reader may return the comments to the central computer site for editing of the computer diagnosis or may communicate the comments directly to the user.

One of the most important consequences of the use of computers in large hospitals has been a decrease in the time required by the cardiologist to interpret ECGs - as much as 30 to 70 per cent. Similarly, clerical time for transcribing interpretations and for other administrative functions, such as billing, has been markedly reduced. The consistency of the computer interpretation in content, format and language is also viewed as an important benefit. To attending physicians such as surgeons, gynaecologists or general practitioners - who generally do not have special expertise in ECG interpretation - the major change is an improvement in the service provided to them by the ECG department.

A key question that has to be answered concerns the evaluation of diagnostic programme accuracy. What is the programme's ability to identify properly the patient's condition? Several studies have already provided evidence for an increased, or at least equal, accuracy of computer analysis compared with visual ECG interpretation made by an average cardiologist.

The growing importance of informatics in medicine has been demonstrated by the widespread use of computers in hospitals not only for administrative but also for medical purposes, for laboratory automation, intensive patient care monitoring, nuclear medicine, radiology, medical records and so on. Small self-contained and relatively inexpensive microcomputer systems are now becoming available for the private physician's office and ambulatory care applications.

The ECG is only one of many pieces of information used by physicians in making diagnostic and/or therapeutic decisions. So, although the computer may have quite an important impact on the use, the availability or the timeliness of the ECG, actual patient care is affected in only certain cases and the overall impact of ECG computer processing on health care delivery is still only very modest. However, considering the extent and ever increasing costs of health care, and the importance of cardiovascular diseases, it is evident that even a modest improvement contributes to the care of many people and may have considerable economic benefit.

The time required by a cardiologist to interpret ECGs has been cut by as much as 70% through the use of computers.

Professor Jos L. Willems is at the Medical Informatics Department at the University of Leuven, in Belgium.

Dental Passports

WHO's Oral Health (ORH) Programme has been collaborating with a number of member states and national institutions in developing better ways of monitoring and managing oral health care programmes.

An initial effort towards this end was aimed at developing a simple system for recording dental patient information. This "dental passport" system, as it was called, provided the health workers with more complete and readily accessible information on a patient coming for treatment.

A prototype microcomputer-based system for storing and processing the data contained in these "passports" was developed jointly by ORH and the International Centre for Oral Health in Chiang Mai, Thailand, together with technical support from WHO's Information Systems Support Division and its Collaborating Centre for Medical Informatics in Tokyo, Japan.

Field testing of this prototype encouraged the Programme to consider upgrading it to a knowledge base system. One major use of such a system is to support the diagnosis and proposed treatment of oral health conditions, and to produce information which would help health care managers with the planning, monitoring and evaluation of oral health care services.
A common standard

by Jean-Raoul Scherrer and François Borst

A standard of medical management is not a rule that must be obeyed. It is simply a reference, helping us to evaluate the medical action taken.

Several experts have stressed that even in large teaching hospitals there are obvious needs for something more than the intern's personal "cook books," in other words, to have a tool of diffusion of institutionally standard medical management charts through an EDP-Communication Network. Even if there are many difficulties involved in including a particular patient within any predefined scheme, this approach is useful to the management of the patient — providing one keeps in mind the gap between him and the scheme. The first main advantage that the formulation of standard medical management would have is to promote a standard controlled vocabulary throughout the hospital, thus making it easier to define the medical entities and the measurement of the clinical state of the patients.

Our initial intention was not to provide some short cut that might replace the need to consult existing medical and health literature collated on such international databases as MEDLINE (from the National Library of Medicine, Washington D.C.). The intention was rather to provide quick and easy references to papers, and even summaries based on the selection of key words.

The idea was simply to formulate precisely and diffuse as widely as possible the basic medical knowledge that every physician knows or should know. And where can one obtain such knowledge? This knowledge is simply that which is used in the day-to-day life of every specialised department of a teaching hospital. From the cardiologists, for example, will come the management of a patient with an arrhythmic heart, and the digestive surgeons will explain how to handle gastro-intestinal bleeding. This simple

A computerised laboratory in Tokyo. All over the world, stored knowledge is a vital part of the day-to-day life of every specialised department of a hospital.
knowledge is elementary to a physician who often sees patients with such problems, but will be very useful to other physicians who only rarely have to manage them – which is often the case in a teaching hospital where the different medical departments are separated and even widely scattered.

Besides, a particular advantage of an on-line system or of the regular production of diskettes is to have immediate availability to the latest updates.

Of course a standard of medical management is not a "rule" with an absolute "must" to be obeyed. It is simply a reference, helping us to evaluate the medical action, and it may offer both warnings and recommendations. For example: given ten physicians and ten patients with acute pulmonary oedema, there will be ten different approaches. Some differences are due to the particularities of the patient, but others will depend more on the physicians. If we now try to compare two patients with acute pulmonary oedema who have a favourable issue with 'the usual treatment' what do we really compare? Nothing indeed if the 'usual treatment' varies between one physician and another.

The basic software that we have started to use in our own initial mainframe environment has been designed for supporting on-line charts or manuals with the following basic features:
- hierarchically, with the table of contents presented as usual as a "menu,"
- sequentially, as a book, allowing one to see successive "pages" on a given subject,
- with an index, giving access to the "pages" by means of appropriate keywords.

It is advisable to select a schema as close as possible to the state of the patient under investigation, taking into consideration the following elements or built-in check list:
- determine the stage of severity of the disease;
- determine the management of the patient at this stage (including diagnostic and therapeutic procedures);
- determine patient monitoring in order to detect the onset of a complication or of a wrong diagnostic direction ("diagnostic monitoring");
- determine adequate reference to specialists (neither too soon nor too late);
- provide precise information about practical procedures (for instance, how to prepare an insulin infusion, rate of infusion, dilution and so on).

Hypertext is a set of mechanisms for connecting pieces of text to one another in such a way that one can traverse the links that connect these text units. In a hypertext system, information is stored in a small unit, variously called a frame, a node, a card or a note. For example, a laboratory test result in a patient's record may be connected to a laboratory medicine textbook which describes the test and the proper interpretation of its results. That textbook section may in turn be connected to other documents, such as the specialist journal where the test was first reported or a clinical handbook suggesting the preferred treatment for specific types of test result. Each note contains individual text items and links to other notes, so that a user may navigate through a set of notes by selecting the right links.

Hypertexts, or more broadly "hypermedia", can become the appropriate tool making it easy for new charts to be recorded on microcomputers.

Basic knowledge of the management of patients in emergency situations can be learned before the physicians join the emergency room, which greatly facilitates and improves the teaching. Since this chart system was introduced in our own emergency room, simultaneously with a medical reorganization, the mean cost of out-patient stay has decreased by about 15 per cent, mainly due to a better balance between the patient's situation and the investigational approach, that is, a decrease in the "routine investigational package".

There are no rules in medicine about the management of particular patients, yet we need them. Teaching hospitals lack medical standards that apply to all the diversity of their departments; what we have described here is a system for distributing medical standards throughout. The availability of new means such as hypermedia, as well as the popularity of microcomputers in general, lead us to foresee considerable use of our charts system with its special emphasis on medical standards.
A need for information professionals
by Denis Protti

A health information professional must understand why information is important before using a computer to process it and communication technology to transmit it.

A health care system is a complex network of integrated, though largely autonomous, public and private sector components. These include individuals, institutions such as hospitals, community health agencies, occupational health departments, public health departments, clinics and doctors' offices, laboratories, medical, nursing and other health professional schools, accrediting and licensing bodies, local and central government bodies and vendors of goods and services.

All of these organizations use information to support decisions about health promotion, disease prevention, provision of care, monitoring, evaluating and controlling health care resources, planning and formulating policy, and advancing knowledge through education and research.

Information systems and the application of information technology are an extension of the study of organizations, organizational functions, and management. The most outstanding features of any information system are its emphasis upon the flow of information and the impact it has on the people who use it. Health Information Science, as a field of study, is particularly concerned with the effectiveness of these information flows within health care organization.

So what is the role of a Health Information Professional, and how does he or she become an integrated member of the health care team? Such a professional is concerned with the nature of information and information processes in a health care setting; the organization of information and its effect on the performance of health care delivery; the communication of information between individuals, health care providers, administrators, evaluators, planners and legislators; and the behaviour of these participants with respect to the generation and use of information.

Not once has a computer been mentioned - nor should it have been! To be effective, physicians must understand why a stethoscope is important before they can use it as a diagnostic tool. Engineers must understand why a steel beam of a certain type can only withstand certain stress or certain conditions, before they can build a bridge. In a similar fashion a health information professional must understand why information is important to someone before starting to use a computer to process it, and communication technology to receive or transmit it. One cannot over-stress the importance of understanding one's environment; understanding the people involved, their roles, their background, their values; understanding the organization, its structure, its history, even its politics!

Health care is acknowledged by almost everyone who has worked in the field as the most complex system in society. After all, how many industries deal with life and death? How many industries deal with a product that cannot be defined? Or operate in an environment that has, for the past 40 years, been the most complex system in society?
years, virtually ignored costs, an industry which virtually has not had a bottom line? How many industries deal with the unique situation that the individuals responsible for the majority of the costs do not even work for the company? How many industries have regular customers who do not pay for the products they receive?

Until one has been taught or has spent a number of years working in the system it is difficult to understand why sound management principles which have been proven in the private sector and other public sector agencies simply do not work in health care.

Only recently have health care organizations begun to view information as a corporate resource. Only recently have hospitals begun to realise that 40 to 50 per cent of their operating budgets are for the processing of data. Only recently have provincial ministries of health begun to realise that they are spending billions of dollars moving data around in the health care system. And only recently has health care begun to accept the notion that information is indeed a valuable resource which, like other resources, must be planned, managed, conserved, recycled and protected.

Health care systems are gradually recognising that they are indeed in the information business; that information is an essential commodity; and that information is a key ingredient to being successful.

Health care is gradually recognising that it needs someone to establish and implement a long range information systems plan which is consistent with the organization's objectives and direction. That person has to determine the investment to be made in information technology and provide a rigorous and disciplined framework for evaluating information benefits versus information costs; anticipate and understand the consequences of new information technology; and plan and coordinate all information resources within the organization - not just computers. Even more important, such a person must explain the impact of information technology to staff at all levels of the organization.

A multitude of forces - for instance, an aging population which is living longer, and a doubling of medical knowledge every five years thus forcing health care disciplines into more and more specialisation which fractionalises care and complicates communications - are generating increasing demands for more reliable and timely information,
Informatics and telematics: the future
by Mahdi Elmandjra

Informatics is of course not a panacea, especially if it is used as a purchased gadget implanted as a foreign body. Yet it represents today the most efficient instrument man has so far invented to help him to analyse and solve problems.

Within the next 20 years, informatics and telematics will have entered almost every form of social, economic, scientific and educational activity. Way before the turn of the century, a majority of the high school leavers and practically all of the technical college and university graduates, throughout the world, will be familiar with the use of computers, telecommunication databanks and information services.

The ensuing informatics literacy will represent a significant socio-cultural leap because it will bring about substantial changes in mental structures, ways of thinking and decision-making processes in all sectors of life. This transformation has already begun and will gain great momentum within the next decade.

The "informatisation" of society which the world is undergoing requires a future-oriented perspective of a minimum of 10 to 15 years for the elaboration of strategies in these advanced technologies, as well as in the defining of policies for their application to national and regional development. This approach is rather different from the one used in preparing medium-term (three to five years) plans, which tend to favour linear projections of past trends and to neglect the future impact of the mutations in gestation.

One of the constraints of long-term strategies is the urgency of starting immediately so as not to accumulate delays which can be quite costly.

Informatics and telematics are not just new technologies, their capacity for being readily integrated into activities is much more important than the speed with which they operate or the volume of information which they handle. It is not just a question of doing things more rapidly but of doing them more meaningfully.

Let me first clarify two fundamental issues. First, the recourse to the most advanced technologies is not a luxury for the poorest countries of the world; they are the ones who need it most to make the quantum jump which they will never be able to achieve with "appropriate" or "adapted" technologies alone. (The latter may even become a cause of backwardness!)

Second, introducing these technologies does not necessarily lead to an imitation of the development models of the industrialised countries. If a political choice has been made for an endogenous development with its system of sociocultural values, there is no reason why these technologies cannot be harnessed to achieve the societal goals which are sought. The bias does not come from the technologies themselves but from the environment.

It is true that we are going through a transitional phase where, throughout the world, the commercial supply of informatic and telematic products, with the help of huge publicity campaigns and a very dynamic salesmanship, is way ahead of the social demand. The suppliers are therefore imposing a type and rate of consumption which does not always correspond to the needs. Identifying such needs requires a policy and clearly defined objectives which the majority of users have not taken the trouble to elaborate.

Notwithstanding the great diversity of the world and the great differences in the levels of economic development, the irreversible trend which no one any longer questions is that we are moving from a society of production based on raw materials and capital to a society of knowledge, the ingredients of which are human resources and information.

Information-related activities already represent over 55 per cent of the gross national product and of the labour force of the industrialised countries. This is the area in which the North-South gap is the most blatant (the Third World accounts for less than three per cent of the world production and activities in information), and it is also the major cause of the growth of this gap.

People dealing with health are those who ought to be most at ease with informatics and telematics, if only because their development owes a great deal to the biological model which has inspired cyberneticians, systems specialists and computer information scientists. In addition, we can think of organic life as a process of absorption, processing and transmission of information. Life stops when the body can no longer receive or emit information. Today the proper and efficient use of relevant information has become indispensable for the survival of human societies as well.

The main issues which strategies and policies in informatics and telematics for health have to face are those of finance, management, training and research. What ought to be emphasised is that the need for these new technologies is, at times, inversely proportional to the level of development of a country. Informatics may well become one of the basic ingredients of any health policy, and may even turn out to be a very efficient instrument for primary health care strategies.

One does not have to undertake sophisticated cost analyses to assess what can be gained by investing in informatics support to such areas as the management of drinkable water or the control of epidemics. No country, as poor as it may be, can afford not to make a minimal effort to use informatics and telematics to effectively improve the health of its population, especially at a time when human resources have become the main key to development.

Such a strategy must bear in mind the specific characteristic of all the advanced technologies: their need for a critical
mass, an economy of scale and investment in research and development. All these conditions need to be fulfilled if we are to expect viable results. As many developing countries cannot meet these requirements on their own, special attention ought to be given to sub-regional and regional strategies without losing sight of the specific needs of each country.

As we have already said, one of the great strengths of informatics and telematics is their high integrative capacities, particularly through the use of information networks which are becoming the nervous system of modern society. Regional economic integration and South-South cooperation are thus becoming a necessity, for reasons which go beyond the traditional geopolitical and socio-cultural arguments.

That informatics, telematics and all of the information-related industries have become political phenomena, nationally and internationally, due to their economic and cultural weight, is a reality to be taken into account by those who make political choices which condition the technological options. I stress this point in order to highlight the role of decision-makers and the need to associate them at the highest level possible in the elaboration of such strategies before the experts can do their work efficiently.

One of the greatest challenges facing humanity, in its attempts to improve the quality of life, is the management of an ever-increasing complexity, which is more and more felt in every area including health care. This is a result of the fast rate of increase of knowledge and of the inability of society to handle this new knowledge in a socially relevant manner. The reliance on informatics, telematics and artificial intelligence can be of great help in reducing the gap between the development of knowledge and its proper social use.

One could very well ask: What is the relevance of all of this to primary health care, to the reduction of infant mortality, to the eradication of disease, to the supply of drinkable water, to the undertaking of immunization campaigns or to the control of malnutrition? The answer is "information." None of these vital issues can find proper solutions without proper information. Hence any improvement in information processing represents a direct contribution to the objectives sought, provided one has a policy which promotes the collection of such information and its rational use.

Knowledge - which has become the most strategic raw material in all the domains of human activity - is simply information produced by sound research and managed by people well-trained in the pursuit of clear objectives and goals. Informatics is of course not a panacea, especially if it is used as a purchased gadget and implanted as a foreign body in an environment which does not meet its minimum conditions. Yet it represents today the most efficient instrument which man has so far invented to help him to analyse and solve problems.

Strategies in informatics and telematics, in the health sector, cannot afford not to be inserted in broader national, regional and international strategies. Open systems of information and experience exchange in a spirit of true international cooperation are more vital than narrow schemes of technical "assistance." The mission of WHO in this area will probably turn out to be one of the most stimulating and rewarding enterprises for its member states.

Professor Mahdi ELMANDJRA is President of the World Future Studies Federation, based in Paris, France.

**Microcomputers gain ground in Egypt**

Egypt has had a health information system with a wide-based data collection system for many years. It collects a wide range of routine data from the points of service delivery throughout the country, and forwards them to a centre for processing and analysis by the Ministry of Health.

At this centre the entry, processing, and analysis of the entire nation's data are carried out, partly because adequate expertise and facilities do not exist at intermediate levels. Despite the use of informatics support at the central level, the immense workload has led to long delays and the preparation of information of limited practical use in health planning, management, and training.

This situation led to a joint WHO-Egypt study in support of the five-year health plan (1979-82) with a view to strengthening health information systems for the management of health resources. For this study a pilot operation was established in two provinces, Fayoum and South Cairo. These operations used microcomputers to support data collection, validation, processing, printing, and distribution from and to users.

Microcomputers are particularly appropriate to the conditions prevailing in Third World countries such as Egypt, and help to ensure the timeliness and quality of usable health information. They are less sensitive to environmental conditions than mainframes and need no expensive flooring or air-conditioned rooms. The joint study project demonstrated the viability of processing data at an intermediate point in the hierarchy. It also showed that less time was used for servicing the information system, and accuracy was increased when the data were keyed in by those who collected them. It satisfied critics who cited lack of expertise, difficulties in maintenance, cost of operation, and effects on employment as reasons against this approach in Third World countries. Indeed health personnel in developing countries have proved perfectly competent to operate microcomputers with proper training.

Microcomputers are now used in four out of 28 provinces in Egypt and the system is gradually expanding to cover the remaining provinces. The centre supplies software, trains in its use and provides back-up services. The funds for purchasing the equipment come from the provincial level.
"Facts for Life"

WHO, UNESCO and UNICEF, in partnership with many non-governmental agencies, have jointly published an educational booklet entitled "Facts for Life," aimed at communicators and anyone else who wishes to improve the health of the world's children.

The booklet brings, within reach of all, the essential knowledge that everyone should have for the improvement of health. It presents a few extremely simple "golden rules" which, if followed, can help to bring about considerable improvements in the health of children, women, families and communities.

The booklet is divided into ten chapters: family planning, safe motherhood, breastfeeding, growth and development, immunization, diarrhoea, respiratory infections, hygiene, malaria and AIDS.

"Facts for Life" spearheads a major initiative by the three UN agencies to tackle the terrible loss of life among infants and young children — as many as five million are estimated to die, particularly in developing countries, before their first birthdays. Millions more do not develop and grow as they should because of a variety of causes that include malnutrition, diarrhoea, malaria and other endemic diseases.

This initiative was launched during the XIX International Congress of Paediatrics, held in Paris in July. To mark the opening day of the Congress, Dr Hiroshi Nakajima, Director-General of WHO, stated in the Panorama du Medecin, the Paris-based daily medical newspaper: "This is a small book with great impact. All those who deal with communication, health and development — including my colleagues the doctors — should read it, and all those who have read it should communicate to others its principles and its spirit."

During a press conference on the same day, Dr Mark Belsey, Chief of the Maternal and Child Health unit at WHO, told journalists that the simple messages contained in the book are the result of years of scientific research and field testing, and that all the technology "represents a deeper understanding of science."

Copies of the initial print-run of the booklet can be obtained at the price of US $1 from UNICEF DIPA, Facts for Life unit, 3 UN Plaza, New York, NY 10017, USA, or from UNICEF country offices. Further editions will follow.

Media seminars on AIDS . . .

The WHO Global programme on AIDS is stepping up its activities for developing country press and broadcasters. Media seminars on AIDS have been held by WHO/GPA, or are scheduled this year, in the Americas, the Western Pacific, Africa and Oceania.

A first global media workshop on AIDS for developing country journalists held in Ottawa and Montreal during the Vth International Conference on AIDS, in June 1989, produced worldwide coverage of the meeting, with a strong emphasis on developing country interests. The Ottawa-Montreal workshop was organized by WHO and the International Development Research Council of Canada, and involved over 31 journalists from press, radio and television in 21 countries. Plans call for a similar workshop for the media to be arranged prior to the Vth International Conference on AIDS, scheduled for San Francisco, USA, in June 1990.

Last June, over 30 journalists and public health workers from more than a dozen countries came together in Tokyo to attend the first Regional Workshop on the role of broadcast media in the prevention and control of HIV infection and AIDS. The meeting was organized by the WHO Regional Office of WHO in Manila, with the support and participation of WHO. Journalists exchanged information about their respective countries and declared that "all media reporting on AIDS should be accurate and relevant, should respect privacy, avoid sensationalism and promote positive attitudes and behaviour."

The group also issued a strong appeal for a greater interchange of information and audio-visual materials on AIDS throughout the region and with WHO. The WPRQ office plans to run another media seminar for broadcasters in Oceania in December.

The African Regional Office of WHO, with the support of GPA, arranged the first Regional Workshop on AIDS for the African media in Brazzaville, Congo, scheduled for September. The workshop was intended to bring together journalists from throughout the region and develop a list of priorities for media coverage of AIDS, as well as issuing an appeal for accurate and solid reporting.

Plans call for a series of media workshops to be held throughout the world in 1990 and beyond.

. . . and a Cameroon symposium

The key weapon in the fight against AIDS is health promotion - empowering people with the knowledge and awareness needed to take advantage of the preventive methods offered by medical science. Some of the most promising new initiatives in this field are to be the focus of the largest AIDS conference ever held in Africa.

The "2nd International Symposium on AIDS Information and Education," scheduled for 22-26 October in Yaounde, Cameroon, will bring together some 400 specialists from around the world engaged in health promotion activities aimed at groups as diverse as schoolchildren, sex counsellors and traditional healers. The meeting is being organized by the Governments of Cameroon and WHO, together with the co-sponsorship of UNESCO, UNICEF and the International Union of Health Educators (IUHE).

The symposium will stress innovation in AIDS education. Panels, workshops, poster sessions, exhibits of educational materials, drama, music and films will provide a varied forum for sharing front-line experiences. Panels will discuss how to reach the hard-to-reach, such as drug injectors or men having sex with men; counselling, including peer outreach methods and using people living with AIDS as counsellors; and the special problems of young people both in and out of school. Special workshops will deal with discrimination, AIDS in the workplace and the role of the press, condom promotion.

The conference will also see the world premiere of "Survivors," a cartoon on AIDS prevention aimed at young adolescents in developing countries. Produced by Street Kids International and the Canadian National Film Board, with WHO support, the
cartoon has a wide appeal among urban children and was designed to be used alongside an accompanying comic book as an educational tool.

The performing arts will also be represented at the conference. From disco music to serious drama, from the Caribbean to Africa, educational entertainments will illustrate the potential of the artistic community for building public awareness of AIDS and stimulating the demand to know more.

The symposium is intended to spark more imaginative adaptations of health promotion techniques, as well as encouraging more rigorous, scientific methodology to bolster education and information efforts against AIDS.

For further information on this important conference, telephone Yaounde Symposium 89 at WHO Headquarters (0041) (022) 791.22.58, or write to Yaounde Symposium 89, WHO Global Programme on AIDS, 1211 Geneva 27, Switzerland.

Cancer pain relief

WHO estimates that at least four million cancer patients world-wide are at present suffering needlessly from pain, even though painkillers and a proven method to ease suffering exist. The WHO Expert Committee on Cancer Pain Relief and Active Support Care, which met in Geneva in July, concluded that "cancer pain relief is still a neglected subject."

The experts cited, as examples of the neglect, studies of around 2,000 patients in Canada, the United Kingdom and the United States showing between 50 and 80 per cent of them not receiving "satisfactory relief" from pain. There are some 14 million cancer patients throughout the world and the disease claims about five million lives each year - two-thirds of them in developing countries.

Apart from the inadequacy of education about cancer pain therapy, many doctors and nurses tend to under-prescribe and under-dose pain-killing drugs through fear of causing addiction in patients. There is also a chronically insufficient supply of drugs, notably morphine, as a result of national regulations limiting their availability.

WHO has devised a "three-step ladder for pain relief," using increasing doses of such drugs as aspirin, codeine and morphine. In the words of Dr. Jan Stjernswärd, chief of WHO's cancer unit: "A relatively inexpensive, scientifically valid method is available. It should be applied now. Patients cannot wait."

Newsbriefs

* Urban slums. WHO has published an 80-page book which examines what conditions in today's urban slums and squatter settlements mean for millions of poor children. Urbanization and its implications for child health; potential for action are examined in more than 100 reports of field research to document the realities of slum life. Copies may be ordered from: WHO, EPR Panafriican Centre, P.O. Box 3050, Addis Ababa, Ethiopia.

* Emergencies in Africa. The Ark is the title chosen by WHO's Panafriican Centre for Emergency Preparedness and Response for its new newsletter, focusing attention on the practical measures that can be taken to cope with disasters when they strike. The name of Noah's ship which saved animals from the great flood, the Ark stresses that it is possible to reduce the effects of disasters. "The Ark did not prevent the flood but it did reduce the loss of human lives in the flood." Copies may be ordered from: WHO, EPR Panafriican Centre, P.O. Box 3050, Addis Ababa, Ethiopia.

* Women at special risk. A meeting held earlier this year in Geneva to examine the risk factors for infection and disease in women concluded that pregnancy is a particularly perilous time for women. Sponsored by the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR), the meeting spotlighted women's vulnerability to such diseases as leprosy, malaria and schistosomiasis. A full report appears in the June issue of the newsletter TDR News, obtainable from TDR, WHO, 1211 Geneva 27, Switzerland.


In the next issue

There is still no sign of a vaccine against the new plague of AIDS. There is still no sign of an effective treatment for persons with AIDS. So what is WHO's Global Programme on AIDS able to do today and in the next few years? The October issue of World Health tries to answer this question.

If you would like to obtain the catalogue of WHO publications, or receive sample copies of other WHO periodicals which you want to evaluate before placing a subscription, please contact: World Health Organization, Distribution and Sales, 1211 Geneva 27, Switzerland
Health uses of satellite technology