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,

Data collection in the form of a questionnaire still has to be hand-written. The processing can be undertaken by computer.
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!

Dr K.C. Lun is Associate Professor with the Division of Biostatistics and Health Informatics at the Department of Community, Occupational and Family Medicine, at the National University of Singapore.
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 telemedicine 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.