

Bahrain Health Information System

Sameer Khalfan, MD, DRPH*

BACKGROUND

The first population census was held in Bahrain in 1941 and subsequent censuses were conducted in 1950, 1959, 1965, 1971, 1981 and 1991. The need for a national body to deal with the statistics generated by these censuses led to the creation of the Office of Statistics in the 1960s. The office was upgraded in the 1970s to what is known today as the Central Statistics Organisation (CSO). CSO is a government organisation reporting directly to the Council of Ministers, who are responsible for promoting, collecting and disseminating national statistics, as well as promoting computerisation within the government and Bahrain in general; also for maintaining national databases such as the Central Population Registry (CPR) which contains demographic information on every citizen in Bahrain.

The Directorate of Public Health at the Ministry of Health, Bahrain, was responsible for collecting and disseminating national health statistics until 1982 when it was passed to Bahrain Health Information Centre (BHIC). BHIC is a Ministry of Health organisation reporting directly to H.E. The Minister of Health and is responsible for:

- promoting national health statistics
- collecting and disseminating national health statistics
- implementing computerised health information systems for the Ministry of Health
- promoting computerisation within the Ministry of Health
- collaborating with other national and international organisations on matters relating to health statistics and information

BHIS CONCEPTS AND OBJECTIVES

Following its establishment in 1982, BHIC was actively involved in the implementation of a computerised health information system called Bahrain Health Information System (BHIS). Such systems are designed to function in a multi-hospital environment where hospitals, health centres and other health facilities can be run as individual units with the possibility of data sharing and exchange. Exploiting the latest technology and concepts, the systems are designed to provide better and more efficient patient management and care. A unified system for medical information about individuals and groups is placed at the disposal of health practitioners and researchers, assuring ready availability of reliable information. Data is captured on line and is available for fast retrieval, resulting in immediate access to patients' demographic, historical and clinical information. The systems will subsequently provide detailed cost analyses and computerised methods and facilities to provide health managers and researchers with the information needed to understand and explain the population health conditions. There will also be opportunities for improvement whilst containing public expenditure within optimal limits. Direct cost savings are expected, most notably from the clinical modules such as Laboratory, Radiology and Pharmacy. At least 25% of Laboratory tests will be saved, otherwise wasted because of unnecessary repetition due to misfiling or multiple health facility attendance. Similar savings would be expected from Radiology and Pharmacy Departments.

Each patient attending any of the national health facilities is registered at the point of first encounter, in the Patient Master Index. At the time of registration, a logical record is created. The record contains the patient demographic data which is brought on line from the Central Population Registry database residing on CSO mainframe

* Head of Occupational Health Services
Ministry of Health
Assistant Professor
College of Medicine & Medical Sciences
Arabian Gulf University
State of Bahrain

computer. Health data such as diagnosis, therapy, laboratory tests, imaging results, etc. is attached to the record. During the subsequent visits to the same or different health facility, the same record is updated. Information relating to a particular visit or all visits to a particular health facility or all health facilities can be accessed by the authorised attending health staff.

The total integration of the various components of Bahrain Health Information System provides excellent opportunity and facility for the health managers and researchers to obtain valuable information and data relating to individuals or groups. Data needed for clinical costing, for example, could be generated from the transactions captured by the different systems such as length and type of hospital stay, cost of laboratory tests, cost of drug, etc. The same is also true with regard to epidemiological studies such as average weight of children at birth, occurrence of communicable diseases, the demographic characteristics of patients suffering from cardiovascular diseases, cancer cases diagnosed by the pathology laboratory, etc. Design of additional systems is simple and easy. The Birth Registration system, for example, could be expanded into a system for the follow up of childhood development and immunisation.

The BHIS supermini computer is located at Salmaniya Medical Centre; it also connects directly with wards and departments within the SMC. For example, laboratory auto-analyzers are connected directly to the computer via on-line interfaces thus allowing for direct capturing of results. The facility can view results or obtain hard copies at both the laboratory and the ward. Modems and telephone lines are used to connect the remote sites. High speed modems and telephone lines are used to connect BHIS computer with the mainframe system at CSO. The link is heavily utilised for obtaining demographic data from the Central Population Registry. The link is flexible enough to accommodate future requirements such as an on-line link to other databases residing on the CSO system or other ministries eg. budgetary information held by the Ministry of Finance.

IMPLEMENTATION

Implementation began with a user requirement study conducted by a private firm in late 1982. System specifications were identified and several ready-made commercial packages were considered. A decision was made favouring in-house development which began in 1985 on IBM 4381 mainframe computer at CSO. In 1988, a more

comprehensive user requirement study was conducted by BHIC staff. The aim was to study the overall requirements of national health service. The outcome of the study was compiled and published in January 1989 in a report entitled "Bahrain Health Information System: Objectives, Key Applications & User Requirements"¹. The study identified the need to implement the following systems:

1. Admission, transfer and discharge of patients
2. Medical records
3. On-line ordering of material and diagnostic resources
4. Laboratory
5. Radiology and imaging
6. Blood bank
7. Pharmacy and drug information
8. Operation theatre management
9. Nursing services
10. Outpatient appointment
11. Catering and dietetics
12. Patient billing
13. Patient progress notes
14. Personnel management
15. Materials management
16. Engineering management
17. Financial management
18. Transport services
19. Training information
20. Public health information
21. Linen and laundry supply
22. Security and safety
23. Housing
24. Licensing and registration of health practitioners
25. Medical commission
26. Electronic mail

The effort needed to develop the above systems was estimated at approximately 200 Man Years Full Time Equivalent. Subsequently a decision was made to reconsider a ready-made package. The study report was made public and more than 20 national and international software/hardware firms were invited to submit their proposals subject to an evaluation committee from the Ministry of Finance and National Economy, Central Statistics Organization and the Ministry of Health. A total solution proposed by one of the private software/ hardware firms was selected in 1989. The selected solution offered the following advantages:

- totally integrated modular system allowing phased approach with application modules added and integrated into existing system as and when required.

- over 60 modules currently available which could be customised to meet the Ministry of Health's specific needs; of which 45 live modules were demonstrated to an evaluation committee in operation at Austin Hospital, Melbourne, Australia.
- currently available and operational in over 200 installations worldwide. Ready for immediate delivery with no development risk.
- all modules written in one common language thus reducing maintenance cost.
- supports Arabic language
- modular hardware with upward compatibility up to 750 devices on one computer. Up to 16 computers could be networked if needed. Latest hardware release can support up to 4000 devices on one box.
- relational database with variable length data fields, thus reducing storage requirements considerably.
- guaranteed communication support with IBM main-frame installation at Central Statistics Organisation and Ministry of Finance and National Economy.
- designed to meet national health care concepts and requirements.
- very reasonably priced and supported by a stable company.

Approval by the Ministry of Health, Central Statistics Organisation, Ministry of Finance and National Economy, and the Computer Licensing Committee was given to Bahrain Health Information Centre to proceed with the implementation of the selected solution. A contract was signed in April 1990 for a phased implementation of the following systems:

1. Patient Master Index
2. Inpatient admission/transfer/discharge
3. Birth registration
4. Outpatient appointment
5. Medical Records Morbidity including ICD9 coding
6. Accident and Emergency
7. Medical File Tracking

8. Waiting-list and maternity booking
9. Pharmacy dispensing, drug supply and management
10. Radiology and imaging, radiology supplies
11. Biochemistry
12. Haematology
13. Microbiology
14. Histology and cytology
15. Blood bank
16. Theatre management
17. Order entry
18. Inpatient billing
19. Diagnostic billing
20. General ledger and creditors
21. Invoice matching
22. Accounts receivable
23. Health manpower management
24. Material management

Hardware installation and commissioning was completed in October 1990 but because of the Gulf war, software customisation did not start until May 1991. As of February 8, 1992, the following systems have been implemented live at Salmaniya Maternity and Psychiatric hospitals, and Ministry headquarters:

1. Patient Master Index
2. Inpatient admission/transfer/discharge
3. Birth registration
4. Outpatient appointment
5. Medical Records Morbidity including ICD9 coding
6. Radiology and imaging, radiology supplies
7. Biochemistry
8. Haematology
9. Microbiology
10. Inpatient billing
11. Diagnostic billing
12. General ledger and creditors
13. Invoice matching
14. Accounts receivable
15. Health manpower management

It is hoped that the implementation of the remaining systems will be accomplished before the end of 1994.

REFERENCES

1. Bahrain Health Information System. Objectives, Key Applications & User Requirements. Report submitted to Ministry of Health, 1989.