DESIGN OF A CLINICAL WORKSTATION FOR PRIMARY HEALTH CARE
B.G. Celler¹, N.H. Lovell², E. Ilsar¹ and Kagay Lim¹
¹Biomedical Systems Laboratory, School of Electrical Engineering, University of N.S.W., Sydney 2052, N.S.W. Australia
²Centre for Biomedical Technology, School of Biomedical Sciences, University of Technology Sydney, Broadway, 2007, N.S.W., Australia

Abstract - In this paper we report on the design and development of an Integrated Clinical Workstation for Primary Health Care. The Workstation is Windows based, has a sophisticated user interface and supports a wide range of computing platforms from desktop to laptop to handheld notebook computers. The Workstation is modular and expandable both in its software and hardware components so that users may select only those modules appropriate to their own roles, clinical practice and levels of expertise. The design focuses on the provision of clinical services and integrates the following key components:

- Patient records and basic practice management.
- Clinical records. Based on ICD10, IPCE or Read Code classifications
- Clinical Measurements. Blood pressure, spirometry, ecg and basic haematology and biochemistry.
- Clinical Decision Support. Based on epidemiological data, protocols and medical expert systems.
- Domiciliary care and evaluation of functional health status of the elderly
- Communications and Networks. Wireless LAN, ISDN, Modem and fax.
- Clinical Reporting. Morbidity profiles, prescribing profiles and laboratory services and procedures

INTRODUCTION

The primary health care sector in Australia represents the base of the health care pyramid, and is formed by over 20,000 general practitioners, nurses, local area health services, community domiciliary nurses and community hospitals. This sector has a predominant role in the delivery of preventive health care and in the triaging of patients needing more expensive specialist or hospital services. Developments in health care world wide are increasingly recognising the importance of this sector, and have defined major themes, (i) efficiency in the production of health care services and the management of health care resources, and (ii) effectiveness in the selection of appropriate care services for delivery to the patient, and in the quality of these services.

The role of information management and communications technology in achieving these objectives and ensuring an effective and efficient delivery of health care is now widely acknowledged, but despite quite widespread use of computers for patient billing and practice management, less that 5% of doctors use computers during the consultation for purposes related to clinical management of the patient. Computers are still most commonly used by reception staff and practice nurses. There is no doubt however that with the impetus of the IM&T strategies in both the UK and Australia to computerise the majority of GP practices by 1995 and promote universal use of the Read codes as a national thesaurus of clinical terms, medical use of computers during consultations will increase.

METHODS

We began by analysing the IM&T needs of the Medical Practitioner. Analysis of the workload patterns of the average GP (1989/90) revealed the following distribution of hours:

- surgery 44%
- Home visits 24%
- Patient Case discussion and paperwork 14%
- Practice administration 7%
- Reading and study 4%
- Clinics 3%
- Other 3%
- Teaching 1%

A review of activity associated directly with patient care at the surgery or during home visits (82% of workload!), identifies the following key activities:

- The taking and reviewing of patient clinical notes and their maintenance in a historical or longitudinal setting
- The taking of clinical measurements. The majority of those which can be carried out in the surgery include,
  - blood pressure
  - temperature
  - ecg
  - spirometry - measurements of lung function
  - audiometry
  - simple blood test - glucose and haemoglobin
  - simple blood and urine biochemistries
  - simple neurological tests

More complex procedures which are required to be carried out and/or analysed in hospitals or specialised laboratories include;

- pap (cervical) smears
- complex bacterial and viral cultures
- complex haematology
- complex biochemistry
- complex cardiovascular function tests
- radiology and other imaging studies

bgs94_1.chp

0-7803-2050-6/94 $4.00 ©1994 IEEE 1398
• Integration of clinical notes, patient histories, clinical measurements and laboratory tests in the diagnostic decision making process
• Prescribing of drugs and remedies. Referral to specialist or hospital based services. Counselling and referral to community health and social services. Preventive health care counselling on dietary, psychological and life style issues. Family planning services and contraception.
• Follow up and management of the chronic degenerative patterns of morbidity associated with advancing age.
• Communications and follow up associated with referrals to specialist and hospital services. Liaison with community health and home care services.

The Clinical Workstation for Primary Health Care has been designed to support the activities of the primary care practitioner in the delivery of primary health care [1,2,3,4]. It integrates Clinical Records, Clinical Measurement, Clinical Decision Support and Communications and Network support with a sophisticated yet easy to use interface which requires little learning time and makes few demands on keyboard skills.

The design is being implemented using the Government Open Systems Interconnection Standards (GOSIP), incorporating the OSI Basic Reference Model. Communications between internal modules and between different users will follow either EDIFACT or HL-7 standards for electronic communications. Database design will be transaction oriented and based on the concept of Information Objects or Tokens for maximum flexibility. A key element of the design is that design standards will be freely available to allow third parties to develop value-added modules which can be immediately and simply integrated with an existing system. Thus for example, modules incorporating computerised patient education leaflets or consumer product information on prescribed drugs could be installed as add-ons to the existing base system and can transparently access the patient master index and other database resources.

ENGINEERING OBJECTIVES

A key objective of the project is the development of number of low cost modular components. These include,
- Electrocardiography
- Spirometry (Lung function analysis)
- Basic haematology, blood and urine analysis
- Non invasive measurements of blood pressure, heart rate, weight, temperature and circulatory function
- Audiology and auditory evoked responses

Combinations of these functions cover the clinical measurement needs of most primary care practitioners. The physician would pick and chose modules according to the needs of his practice. All measurements are recorded and displayed in real time on the computer monitor using advanced graphics and a sophisticated user interface for ease of operation. Clinical measurements are fully integrated with a patient and medical records database for storage and retrieval.

REFERENCES

1. Celler B. G. Implementing information and communications technology in general practice: Why has it been so difficult? Proceedings of the 7th Computer Conference of the RACGP, 3-5 June, 4 pages., 1992


RESULTS

Progress on the development of a Clinical Workstation for Primary Health Care is well advanced. The Workstation provides full standalone capability for clinical data capture, retrieval and transfer according to national and international standards for semantics, classification and coding. As the availability of longitudinal data is an increasingly important component of managing screening tests and immunisation status and for patients with chronic or degenerative diseases, all clinical measurement records are available for visual comparison and graphical trend analysis.

Graphics based communication using FAX and modem technology are integrated with the clinical measurement system and permit either automatic or user controlled sending and receiving of all clinical and measurement data. An expert system shell for medical decision support in primary health care is being developed to provide clinical decision making support for patient management and for the automated interpretation of data obtained by the GP in his own surgery or communicated from external pathology services.

The workstation incorporates security systems consistent with all current legislation on privacy, freedom of information, data integrity and ethics of use.

CONCLUSION

The Clinical Workstation is a prototype for a new generation of modular integrated software and hardware tools designed to support the clinical role of the primary health care physician. Implementation of all the specifications outlined will ultimately take the form of an unethered, portable notepad computer supporting a communications link via modem, LAN or wireless LAN, and removable instrumentation and clinical measurement modules.