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The London Hospital Computer Unit: Progress Report 1965

THE LONDON HOSPITAL COMPUTER UNIT

PROGRESS REPORT 1965

GENERAL CASE FOR THE COMPUTER

1. Early in 1964 the Board considered the installation of a digital computer at The London Hospital. This proposal was provoked by the immediate need to replace the existing 40-column punched card and keyboard accounting machines. However, it was clear from the efficient use already made of these machines that no major improvements could be achieved in our financial and medical records techniques without introducing some radically new type of facility. The Finance Department had taken part in a pilot scheme for using computers on payrolls. In addition, a number of staff in the hospital and its related bodies were using digital computers for their medical and scientific work, and had clearly demonstrated the value of computer techniques.

2. The case made out for a computer rested on a demonstrable need for approximately 60% of a single shift on a small machine for financial and administrative procedures allied to the knowledge that a number of the medical and scientific staff already had projects in hand and would come forward with more research and development work for the machine. The demand for computing facilities in the medical field was just beginning to be felt, and it was considered that the installation of a small machine which could be economically justified by existing and reasonably certain future demands, would allow the hospital staff to gain experience in this field. This would be invaluable in the future when much larger computing facilities might be expected to be available either on site or connected via a data link.

3. These arguments were carefully investigated by a firm of Management and Computer Consultants, with particular reference to the proposed financial system and the economic basis of the installation. Following their recommendations the National Elliott 803 computer was obtained on hired terms, comprising the following equipment:-

Computer

1. Basic Elliott 803 machine with 8K immediate access store (including 2 readers, 2 punches and an on-line teleprinter) equipped for 5-hole tape operation.

2. Automatic floating point unit.

3. 3 magnetic film handlers and their controller.

Peripheral Equipment

4. 2 Creed punches and 2 verifiers.

5. Creed editor-reproducer set and Creed reproducer.

6. Flexowriter editor-reproducer set and flexowriter reproducer.

4. A computer manager with extensive experience of the financial system already in operation was appointed to supervise the installation of the equipment and the subsequent organisation of the Computer Unit. Further, he was to complete the detailed analysis of the financial system and, with the assistance of a machine code programmer, to write the resulting suites of programs. The Computer Unit took over the existing punched card section together with the responsibilities of maintaining the old financial system whilst implementing the new computer-orientated system.

5. The staff of the existing punched card installation was gradually retrained to cope with the paper tape equipment as card punching was replaced by tape punching. The punch room supervisor and, later, her deputy were trained as computer operators to cope with the routine program running.

6. In addition, the Acting Chief Physicist was encouraged to spend a large proportion of his time stimulating interest in the machine, encouraging and assisting staff with the techniques of Autocode programming for scientific and medical problems and writing ad hoc programs in Autocode and Algol for specific problems.

GENERAL MATTERS ARISING

7. Since it was expected that the Finance Department programs would form the economic basis for the installation, these were given a high priority. A slow start was caused by late delivery of peripheral equipment, and the necessity to provide some immediate relief to the Wages section required some late changes of plans. Another setback was the loss of the assistant programmer at the point where he might have been considered to have finished his training. However, considerable progress was made with the Goods Inwards and Wages suites of programs so that a great deal of practical experience has been gained by the computer unit and other staff concerned. These programs involved the setting up of many basic routines which will be of considerable value when further suites of programs are written for Stores control, financial and cost ledgers, Private Ward accounts and other procedures, so that the preparation time for the additional programs will be reduced. It is expected that during 1966/67 the principal elements of the financial programming will be complete. A high degree of co-operation with the departments concerned in financial data processing has been reached and the disciplines of a computer system readily accepted.

8. One of the most significant facts arising from the experience of the first year is the tremendous demand for various types of computing facilities from all types of staff. The limitation on the use of the machine has been in terms of the programming and punching time available to get projects underway. A large number of staff have been on various types of Autocode course and many of them are routinely using the computer as a scientific tool in their daily work.

9. Initially, it was known that there would be a demand from certain departments for computer time on particular projects, but during the year it has been possible to obtain a broader picture of the demand and make provision for meeting it more effectively.

10. The original Patients' Surveys were written as one-off programs to the specific requirements of particular departments. However, with the experience gained on these surveys, a fast machine code 'General Survey Program' has been written to input data in a standard form and write it onto a magnetic film file in a packed form. It is anticipated that this will cope with the bulk of the hospital's computerised data recording in the immediate future. Although a general search program has been written for this type of recorded data, special Autocode programs can be written utilising these records as required by particular research projects.

11. From January 1st 1965 patients' records for the diagnostic index, together with bed state data on bed occupancy from the wards were punched on paper tape and a comprehensive Autocode program was devised to obtain the appropriate statistics for the SH3 returns, the routine reports to the Board of Governors etc. The program was based on the existing punched card system, but it is now being rewritten as a suite of interlocking machine code programs to implement the requirements of Hospital Activity Analysis and take the opportunity of providing a more complete picture of bed usage in the hospital, using a different type of ward return.

12. Probably the most significant lesson of the year is the realisation of the extent of the need for computer education within the hospital. Until there is a general understanding of the capabilities and requirements of computer based systems of data processing, many of the more exciting prospects in the medical computing field are unattainable. This lack of computer orientation makes the arguments over the optimum size of computer somewhat academic, since one of the main objects of the present phase of computerisation in the medical field is education and in many senses this is as easily (possibly more easily) done with a small machine as a large remote one. The experience gained in this phase will enable us to specify the real machine needs of the next phase leading to systems capable of doing the bulk of the hospital's information recording and providing immediate access to information of clinical and administrative interest.

CHANGES FOR THE SECOND YEAR

13. During the first year there was a drastic shortage of machine code programmers (as stated previously, the trainee programmer left six months

after the start of his training and, in addition, his replacement was away due to illness for four months). However, this has now been rectified and there are now four trainee machine code programmers, one of whom is employed by the Medical College to facilitate the application of the computer to laboratory research and educational problems. In addition, the Acting Chief Physicist will shortly be relieved of his responsibilities in the Physics Department and will be concerned solely with the application of Operational Research and Computing Science Techniques within the hospital.

14. The existing punched card and keyboard accounting machines will gradually be eliminated, and this will save the considerable effort needed by the Computer Unit to keep functioning that part of the financial system still dependent on these machines.

15. With so much work depending on a "do-it-yourself" approach, more tape editing equipment was needed, and a Westrex tape editor-reproducer was bought by the Medical College. The other limitation was one of tape punching facilities; the data for the Obstetric Survey and the Diagnostic X-ray Investigation had to be punched by a tape-punching service. It is hoped to overcome this by the use of a data input machine in the Finance Department, and eventually it might be possible to use a document reading machine to handle the bulk of the survey data. Also, the departments making considerable use of the machine have tended to use their own typing or clerical staff to assist them with small quantities of data punching.

DETAILED DISCUSSION OF COMPUTER USAGE DURING THE YEAR

16. Brief details of the computer usage during the 53 weeks from 2nd November 1964 to 6th November 1965 are noted below:

(1) Finance

(a) Wages

On 1st April 1965 the first departmental payroll was put onto the computer and subsequently successive departments have been taken over. By 1st April 1966 the last of the weekly wages will be on and the monthly salaries will then be added, thus completing this phase of the work. An Information Report gives details of gross cost analyses, employees leaving, increment and other standard information required. Further requirements for such items as Tax Returns and National Insurance schedules are provided for on request. The construction of these programs is such that changed or new needs can be dealt with relatively easily.

(b) Goods Inwards
This suite of programs provides the analyses of direct expenditure, subjectively and objectively, together with various analyses for internal use. It has been designed to allow for the expansion of the system by the inclusion of further programs using the common data basis.

(c) Remittance Advices
This suite of programs is operational, providing from an invoice file (mainly derived from the Goods Inwards program above) the remittance advice notes, credite transfer documents, cheque list, and a cash analysis.

(2) Patient Statistics

The basic patients' data and ward returns are analysed to provide statistics on the patients attending each hospital clinic, the duration of stay in hospital of In-patients categorised by consultant, as well as information on bed occupancy and other administrative data. In addition, the basic patients' data are filed for inclusion in the diagnostic index. The data for the annual SH3 returns is provided by the program.

(3) Patients' Surveys

The pilot survey was conducted in conjunction with the Obstetric Department. It contains 175 items of information relating to each case, and has proved rather time-consuming in operation. This was due to the difficulties in obtaining accurate information and lack of experience in dealing with this type of operation. As a result, techniques have been evolved to deal with these problems, and faster and simpler programs have now been written, providing the bases for the General Survey Program. Similar surveys have been carried out for the E.E.G. and Physiotherapy Department, and many others are now under-way.

(4) Operational Research

The major project was the detailed analysis of timings of patients' progress through various sections of the Diagnostic X-ray Department. A week's pilot study in the In-Patient X-ray Department was followed by a detailed investigation in the various sections of the department. These data are now available on magnetic film. The initial computer analysis was concerned with the flow of patients through the department, the utilisation of the X-ray rooms and the Patients' waiting times. The work has been the subject of a series of departmental reports which are now being examined with a view to further analysis or implementation. In addition, a preliminary statistical analysis of the functioning of the Laundry and the Linen Room has been carried out.

(5) Physics Department

The computer is now used as a routine tool for research work as well as a means of relieving the graduate staff of tedious calculations for the Radiotherapy Department. Detailed information on the exposure times for various field sizes for the two kilocurie cobalt units is now regularly provided from a computer program in a more comprehensive fashion than was previously possible. Decay factors for radioactive isotopes have been tabulated conveniently and a theoretical study of the behaviour of multi-channel collimators has been carried out. Some investigations have involved using the Elliott Treatment Planning Program, and work is still in progress on the adaptation of an exponential curve fitting program.

(6) Sundry Statistics

A number of staff have used the various available statistical programs to analyse the results of experiments or to find correlation coefficients etc. Although the amount of time involved is small, in terms of users this category includes a large number of persons who have obtained useful results from the machine and who may be expected to return with larger projects in due course.

(7) Other Users (Medical College, M.R.C., Research etc.)

(a) Dental Research
Data on the dental health of 4500 Nigerians were written onto magnetic film using a specially written survey program. These were then analysed in various groups according to age and sex to provide the initial statistical analysis. Further surveys are in progress.

(b) Department of Pharmacology
A number of studies were carried out using the computer, including a theoretical investigation of membrane behaviour, psychometric tests on students and various clinical trials of drugs.

(c) M.R.C. Social Medicine Unit
The Unit was already using computers elsewhere but the availability of a computer on site, the use of data on film rather than punched cards, and the ease of programming in Autocode have all combined to make the Unit a substantial and enthusiastic user of the computer. This work includes a major study on the epidemiology of coronary disease, studies of delinquency in the local area and of the outcome of prostatectomy, various dietary trials and surveys and some life table work.

(d) M.R.C. Neonatal Unit
The computer has been used for the analysis of their experimental data.

(8) Computer Unit

Some time was used for tape copying and writing compilers to film (mostly during the installation period) and an average of 4.2 hours per week was spent on scheduled maintenance and routine tests. "Engineers down time" has been approximately 4% of the total time that the computer has been switched on. The bulk of this time was required to track down faults on the peripheral equipment (especially the film handlers) and was in general carried out at off-peak periods, leaving the computer itself operational during normal hours.

CONCLUSION

17. At the end of the first year we have demonstrated that the Hospital can make good use of a computer on site. The demand from the Medical and Scientific Staff has outstripped our rather tentative previous estimates, and we have made provision to cope with this in future. The demands of the medical and scientific programs on the machine have been complementary to the developing financial programs, and we have had virtually full single shift working since the computer was installed. It must be appreciated too, that a large proportion of computer time has been spent on developing programs, and as production from routine programs occupies a greater proportion of the computer time, double shift working will inevitably have to be considered. Much of the initial work has been somewhat mundane, but the practical experience gained in carrying out this essential groundwork will be of enormous value as we progress to the more imaginative projects.

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