The London Hospital Computer and Operational Research Unit

The London Hospital Computer and Operational Research Unit: Progress Report 1966

THE LONDON HOSPITAL COMPUTER AND OPERATIONAL RESEARCH UNITS

PROGRESS REPORT 1966

1. Computer Science and Operational Research in Hospitals

Even at the close of 1966 the number of computers installed in hospitals in this country is still incredibly low. An I.B.M. 1440 has been installed in the United Birmingham Hospital Group while Elliott Medical Automation Limited has extended its activities from the 803 at University College Hospital to another 803 near the Royal Infirmary, Edinburgh, and a 4120 at the Hammersmith Post Graduate Medical School. It would appear that we are still the only hospital to have completely financed a machine for its own exclusive use. However, there has been noticeable activity in the field of medical computing during the year. Meetings have been more frequent, and there is now a growing appreciation that useful experience can only be obtained by implementing an actual computer project.

The value of Operational Research techniques as applied to the peculiar problems of hospitals is gradually being realised. Although there are few people active in this field at the hospital level attempts are being made to share their ideas and experience.

2. Computer Usage

A graph of the average weekly running time of the computer since its installation is given in Appendix 1. There has been a steady increase in the demand for computer time and the services of computer staff. The overall mean weekly running time for the year is 74.4 hours per week - almost a 50% increase on last year's figure. During the last quarter of the year the average rose as high as 102 hours per week. In order to cope with this demand without stepping up the operating staff to the level required for full double shift working, normal working hours are being used for the operation of routine data processing systems and for short sessions for scientific staff. Evening sessions have been used by the Computer and Operational Research staff for program testing and for longer scientific sessions. Very long operating sessions have only been available during the weekends. The pressure on time has led to the development of various programming techniques which make maximum use of the possibilities of unattended all-night computer runs for sorting and merging data, for analysing it and for simulation programs. A table of the actual computer usage is given in Appendix 2 and brief details of the various projects are given in Appendix 3.

3. Problems Carried Over from the First Year

During the first year the programming staff was very limited. This has been corrected and there is now a total of three fully trained programmers. In addition, the Medical College also has a programmer although at the present time she is a trainee. On the machine side, the keyboard machines in the Finance Department have now been completely dispensed with and an input machine has been installed there to originate data at source, and the punch card installation has been steadily run down. These developments have meant that the punch operators have not been so heavily overloaded as they were in the first year and this has made it possible to put in hand some of the computer systems mentioned below.

At the beginning of the year the Operational Research Unit was set up to explore the implications of current techniques in management science and to provide scientific backing for the Computer Unit.

4. Interaction and Integration of Computing Needs

Although we believed originally that it was logical to combine all the diverse computing needs of the hospital and college in formulating our plans, this approach has been much more compelling in practice than we had anticipated. It has been extremely valuable to have the various computer projects handled side by side in the same installation. There have been clear advantages to the medical records systems as various control techniques developed in connection with financial

systems have been implemented. Correspondingly, as various computer systems are implemented more powerful methods of mathematical analysis and control are being provided to detect important features amongst the detail of the data collected. The interaction between operational research studies and the system analysis for related computer systems has been similarly fruitful.

With so many staff using the computer on a "do-it-yourself" basis the scientific work on the computer has tended to become fragmented. The logic of the situation points clearly in the direction of standardisation and a fairly straight appraisal of priorities before programming or systems resources are allocated to any project.

5. Development of Systems

As the programmers have become fully trained and experienced it has been possible to allocate a programmer to each major project, not only for the development of the program but also for it's subsequent maintenance. This procedure has facilitated the up-dating of systems that have already been implemented.

During the first year it was possible to generalise the approach to patient surveys by providing a general survey program. This generalisation has been achieved during the current year on the rather higher plane of computer systems. The current technique is to provide fast machine code input programs in conjunction with powerful but necessarily slower Autocode analysis programs. The latter can be written in the form of a general framework into which the detailed calculations required for particular systems may be written. Modifications to the output and analysis may be effected simply, and irrelevant output can be suppressed as experience indicates.

The difficulties of implementing systems in departments having no previous experience of the discipline required to obtain and transmit accurate data are more widely appreciated, as is the realisation that there is often no precise knowledge of the information required to control many aspects of the hospital's activity.

6. Operational Research Studies

Although it is difficult to classify and separate activities, one of the major concerns of the Operational Research Unit has been to assist in the establishment of suitable data collection systems in order to assess and potentially improve the hospital's performance. Much of the data required for relatively simple calculations is not available and the current requirement is not so much for mathematical sophistication as for the crude control of basic factors onto which later sophistication can be built. During the year efforts have been made in three key areas of hospital activity, out-patients clinics, admissions and theatres. Each of these activities appears to run on a self-regulating basis using a standard allocation of resources and the minimum of external regulation.

More detailed control of these activities, on the basis of detailed knowledge, would enable the hospital to make better use of its resources.

The various statistical returns required by the Ministry of Health and the House Governor's Office have provided some indication of the trend of events. Usually, this has been after any action was appropriate, and as a result, the staff have gained the impression that statistics are collected in order to fill in various forms rather than for operational use. Much experiment will be needed to establish what constitutes the most informative material and how it may best be used.

The data collection for the control of Out-Patient Clinics, devised in conjunction with the North East Metropolitan Regional Board Operational Research staff, is being implemented from 1st January 1967 together with the new bed-state

section for Medical Records, the latter being part of the process of computerising the hospital's statistical returns. Preliminary work is in hand for the creation of a Theatre Computer System but this is being held back until the other two systems are well established. It is hoped that these embryonic schemes will in due course form the basis of the complete system for the Integrated Hospital Information Service. In addition, the data files will provide material from which realistic computer models of various aspects of the hospital's operation can be built and examined by simulation techniques and otherwise.

7. Current Developments

There has been a tendency for a number of projects requiring statistical analysis to be passed to the Computer and Operational Research Units for analysis. Although it was not originally intended that we should provide this type of service, it would now seem desirable to strengthen the statistical resources of the Operational Research Unit to cope with these problems - particularly in view of the impending move of the M.R.C. Unit of Social Medicine. We have assisted with the education of staff and students in computer techniques and is now co-operating with some staff from the College in a course for selected medical students involving the application of the computer to particular problems.

Various statistics are collected throughout the hospital for routine purposes, and it is apparent that a great deal of additional information can be extracted from these data. This information should be provided as part of a continuing process of examination and evaluation aimed at throwing fresh light on the functioning of the hospital. The problem of integrating these statistics into a total information system is under review.

8. Conclusions

The practical experience gained over the past two years has enabled The London Hospital to be in the forefront of medical computing in this country. The personnel of the units have endeavoured to keep abreast of current developments in this specialised field. As a result of these activities the advantages of moving from batch processing to real time computer techniques have become evident. Many of the systems for patient administration currently being devised are arranged to provide the closest approach to real time working possible on our computer. As a result of these efforts, the specification of the computer required for the next phase of the hospital's development is beginning to crystallise. Some of these ideas have been summarised in the paper reprinted as Appendix 4.

Publications

W. Abbott, "A Year's Experience of a Hospital Computer", British Hospital Journal and Social Service Review, May 1966.

W. Abbott, "The London Hospital Computer Unit", The Hospital, 1966, 62, 265.

Barry Barber and W. Abbott, "Computers in the Hospital Service", The Hospital, 1966, 62, 521.

Papers Presented

Barry Barber, "Operational Research", Regional Staff Training Centre, March 1966.

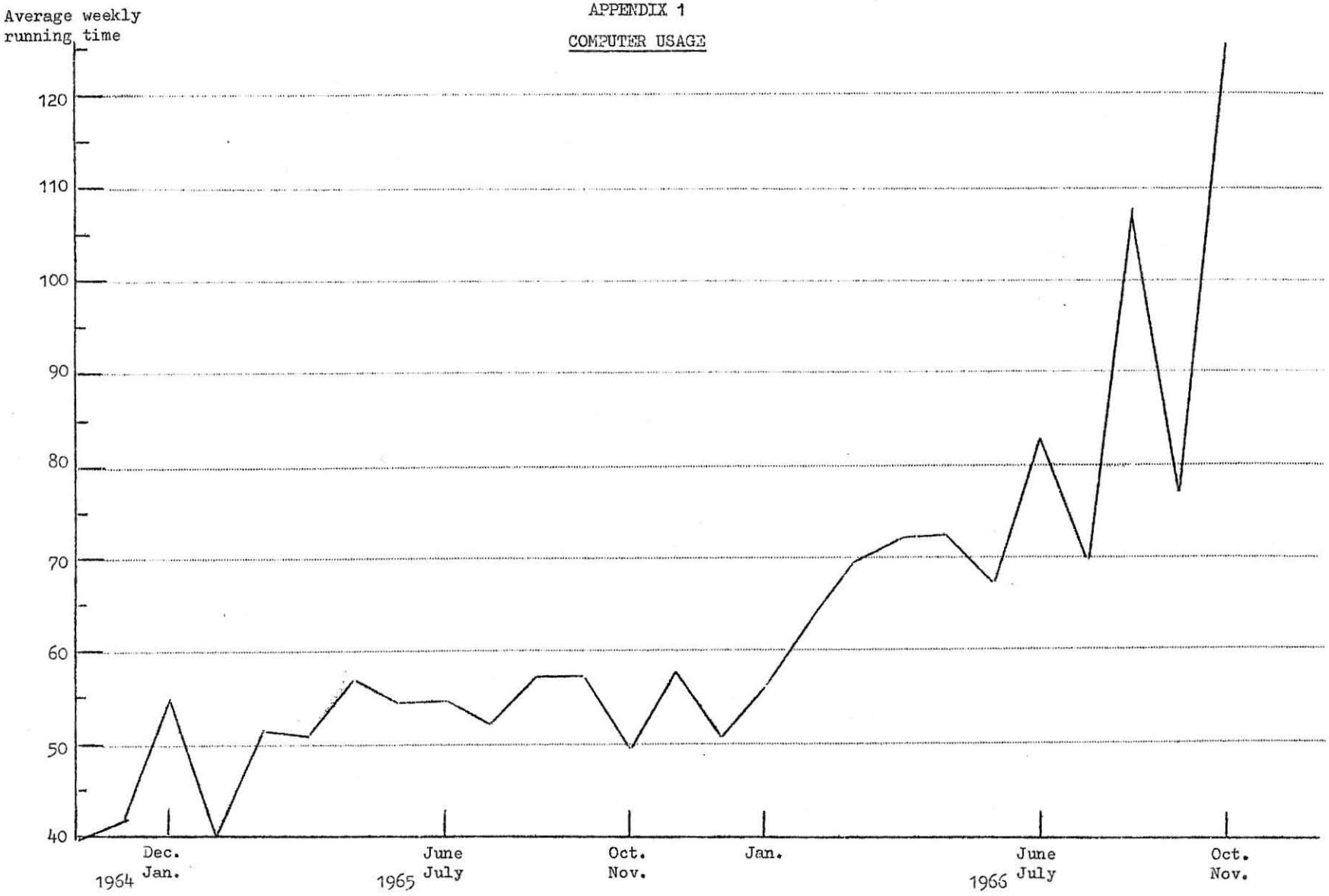
Barry Barber, Society of Radiographers Annual Conference, Brighton, June 1966.

Barry Barber, Symposium on Computers in Medicine, July 1966.

Barry Barber, British Computer Society, Medical Data Processing Group, November 1966.

APPENDIX 1

COMPUTER USAGE



Appendix 2

Comparative Table of Computer Usage

	1964-5		1965-6	
	Hours	Percentage	Hours	Percentage
A. Systems				
1. Financial System	592.9	22.1	1261.5	32.6
2. Patient Administration System	272.5	10.1	599.1	15.5
3. Other	-	-	2.5	0.1
B. Research and other usage				
4. Operational Research	118.9	4.4	439.2	11.3
5. Patient Surveys*	313.9	11.7	164.1	4.2
6. E.E.G. Department	14.9	0.6	271.1	7.0
7. Sundry Statistics	12.2	0.5	18.4	0.5
8. Mathematical Analysis**	112.2	4.2	59.5	1.5
9. Other (a) Dept. of Pharmacology	145.9	5.4	184.9	4.8
(b) M.R.C. Units	143.0	5.3	253.8	6.6
(c) Miscellaneous	595.8	22.2	218.4	5.6
10. Computer Unit	363.5	13.5	399.2	10.3
	2685.7	100.0	3871.7	100.0
Average weekly running time	50.7 hours/week		74.4 hours/week	

*Includes Dental Research but excludes E.E.G. survey

**Includes Physics Department

Appendix 3

Brief Details of Computer Projects

A. Systems

1. Financial System. The transfer of various elements of the financial system has continued throughout the year, and the time required on the machine has been increasing. The work on the financial system accounts for about $\frac{1}{3}$ of the total computer usage; the time quoted in Appendix 2 includes program development.

During the year the salaries and wages suite of programs has been fully implemented for all staff. The effects of the many and various changes in such things as salary scales, National Insurance contributions, Graduated Pension Scheme, have all been dealt with as part of the routine maintenance of the programs. These programs provide all the required analyses of Salaries and Wages expenditure, and are interlocking with full internal financial controls. Other associated programs to deal with such items as end of year returns are also fully operational.

As with salaries and wages the full suite of Goods Inwards programs has been implemented; payments to suppliers and the various analyses required are now routine production. Some revision of these programs is being undertaken to provide within the suite of programs the full financial control at present being carried out manually.

The suite of programs for stores accounting has been written and is now being tested.

2. Patient Administration System. With the progressive implementation of the financial system, attention has been turned to the ad hoc patients and statistics programs with a view to creating an integrated Medical Records System. This is a continuing process, involving not only a detailed systems analysis of a rather dispersed system, but also an attempt to understand precisely what information is most useful for management control purposes. The patients statistics program has been split in order to bring it into line with current systems philosophy and render the data input faster and more efficient. The Bed-State return from the ward has been completely revised and separated from the basic patient discharge record. This change will enable management data to be made available more rapidly and more accurately - the original technique of analysing discharge information inevitably meant that one could only provide average information retrospectively. Also, the statistical records of the Whitechapel Clinic have been taken over during the year.

3. Other Systems. A filing system for Matron's records of student nurses is being developed, with the intention of developing programs to assist with the student nurses duty rota. The basic input program is substantially written.

B. Research and other usage

4. Operational Research. The computer has proved an indispensable tool in handling a number of problems during the year. As part of a continuing interest in out-patient clinics - and other queueing situations - the parameters of a particular mathematical model of a queue have been tabulated exhaustively. In addition the first of a suite of simulation programs has been written to examine the behaviour of transient queues. These will not only provide a useful means of clinic analysis but they will be even more important in demonstrating the expected behaviour of the clinic when rearrangements are being contemplated. Work has also continued in connection with the further study and implementation of various matters arising from the study of the Diagnostic X-ray Departments. The analysis of the Attitude Survey results involved a suite of programs for tabulating the data and testing the results statistically. Also, an examination of the patients file for 1965 was carried out to provide information as part of the study of hospital admissions. Finally, there has been a flow of small statistical problems requiring computer assistance.

5. Patient Surveys. The departments now running surveys are Obstetric, E.E.G., Physiotherapy, Dental, Physiology and Urology. As foreshadowed in the last report the development of more efficient programs for handling these surveys has in fact enabled us to reduce the overall time required in spite of increasing the amount of work handled.

6. E.E.G. Department. One of the problems of E.E.G. analysis is that of handling the vast quantity of data generated by their equipment. During the year the department has constructed an analogue to digital converter with paper tape output for use with their 24-channel analyser. Various methods of analysis have been adopted to obtain meaningful results and some promise to be useful adjuncts to the visual inspection of the standard E.E.G. tracing. In a short time this department has become a major user of the computer and its requirements will soon outstrip the capabilities of our present computer.

7. Statistics. Apart from the major users of statistical techniques there is a steady demand for the statistical analysis of data collected in the course of various research projects. The computer removes the labour that previously restricted the use of even standard techniques and enables the research staff to handle their data more effectively.

8. Mathematical Analysis. This includes the various projects carried out by the Physics Department together with some analysis for the Medical Unit.

9. Other users etc.

(a) Department of Pharmacology. This department has continued to expand their use of the computer during the year and has acted as the liaison department for other departments of the Medical College.

(b) M.R.C. Social Medicine and Neo-Natal Units. In spite of having free access to an Elliott 803 at King's College this department has almost doubled its use of computer time on The London Hospital machine.

(c) Others. Emergency facilities have also been provided for a number of Elliott 803 installations during the year.

10. Computer Unit. Although there has been a substantial increase in the use of the computer the time required by the Unit for maintenance, tape copying and demonstrations has been kept down to a figure of about 10% more than that required last year.