South Western Regional Health Authority

Report: Patient Administration Systems available to the N. H. S.

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1981.

SOUTH WESTERN REGIONAL HEALTH AUTHORITY

REPORT

Patient Administration systems available to the N.H.S

.....let use be preferred before uniformity,
except where both may be had."

FRANCIS BACON 1561 - 1626

Report prepared by the following members of the
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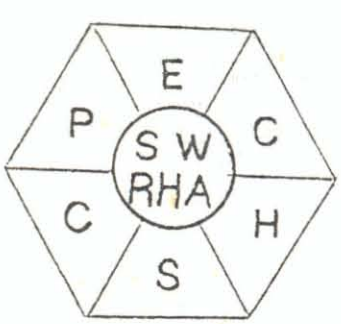

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FOREWORD

A survey of existing and potentially transferable patient administration systems was commissioned by the recently constituted Patient Administration Sponsor Group.

This first report addresses itself to the needs of the Sponsor Group but at the same time provides more detailed information for those Districts who are actively considering the implementation of patient administration systems.

It will be the first of a series of reports concerned with patient care systems. Later reports will include other systems appraisals and information obtained from the wider use of systems in the South Western Region.

The Region are actively considering the recommendations on patient administrative systems which arose from the study. The recommendation section has been removed from the body of the report pending the outcome of wider consultation in the Region to enable earlier circulation of the main text.

The investigating team, for this first report, was drawn largely from analysts at the Exeter Project all of whom have experience of designing, testing and implementing patient administration systems. In the course of their investigation a number of visits were made to user sites and manufacturers and I would like to thank all those individuals who gave their time willingly to help the investigation. All the sites visited expressed interest in the survey and copies of the report will be sent to all those participating from the NHS.

Although many of the systems investigated originated in the NHS it was most disappointing to learn first hand just how little had been done in coordinating the activities of the various computing groups within the NHS. Overall the lack of cooperation and wasted effort is the biggest lesson to be learnt by the NHS. Any future efforts devoted to patient care computing in the Region should attempt to remedy this situation.

Queries on the content of this report, more detailed information, suggestions, criticisms and comments should be addressed in the first instance to myself or R.H. Fisher at the above address. For those systems which are demonstrable in Exeter we would also be pleased to arrange demonstrations.

J. Sparrow.

J. Sparrow
Director of Computing

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INTRODUCTION

This report endeavours to balance the present necessity to spend very little money on patient care computing , with the desirability in the future of being able to expand these computer services with the minimum of cost and disruption and with the minimum of delay.

Most hospitals appear to run fairly smoothly. Sometimes, quite often for reasons outside the immediate control of the present hospital management, particular problems crop up which may be ameliorated by the introduction of computer systems. It is from this standpoint that most patient administration systems are examined by hospital managements.

The prime object of a computer system should be to improve overall performance rather than deal with individual and immediate problems. The systems analyst should take a wider view than perhaps is reasonable to expect from the manager of a department whose 'problems' the analyst has been called in to 'solve'. This 'wider outlook' may well cause antagonism between the user and the analyst but it is the responsibility of the analyst to produce both evidence and well reasoned arguments and then stick to his guns.

Users should be aware of the uncritical analyst whose main preoccupation is to provide immediate solutions to what appear to be immediate problems: equally they should beware of those who seem to be more excited by the technology than by the problems that the technology is being called upon to solve. It is , however, incumbent on the analyst to recognise the practical difficulties and to design solutions which satisfy the constraints within which the NHS is working.

Buying a computer system is an action fraught with risks. Some of the risk, being money, is measurable however most of the risk is imponderable involving as it does opportunities for future developments and efficiencies. Success in computer applications breeds desire for new applications. Thus a successful application with no expansion possibilites will be a major source of frustration. Approval to spend money on computing depends on the goodwill of all major disciplines in the hospital. That goodwill will be more forthcoming if the system provides services for a wider spectrum of personnel.

There are many criteria by which computer systems can be judged. However, the advent of increasingly cheaper and cheaper computing, particularly with micro computing, has tended to encourage the attitude that anything will do as long as it is cheap. It is essential to judge the quality and performance of the system before looking at the price.

This report assumes that its readers already have an understanding of the nature of the problems currently being experienced by Medical Records Departments. Therefore, it does not contain a description of manual medical records systems as such.

The survey has clearly shown that interactive real time, local systems with users inputting data via VDU are much preferred to the older style remote data collection with batch activity subsequently performed on a mainframe computer.

The report discusses the criteria involved in judging a system particularly from the viewpoint of those people who will be involved both in running the computer and operating the visual display units.

Recommendations are made about which systems the investigating team would prefer to see used as the basis for patient administration systems throughout the Region.

This report has been produced in an attempt to collate the available information on Patient Administration Systems. The speed with which this field is changing means that any facts presented in the report may not be relevant at a later date. Every attempt has been made to present an accurate assessment of the systems as perceived and where necessary to include any predictable developements.

A number of visits have been made in order to assess the systems considered and a great deal of supporting documentation and, in some cases, the actual system code has been obtained. This information is available for further investigation and demonstration at Exeter.

SUMMARY OF SYSTEMS CONSIDERED

The criteria by which a system should be judged are discussed in detail later in this report. Those criteria have been taken in to account in the summary of systems considered which follows. More detailed visit reports are included as a separate section. There are some major systems that have not been included in this report because they do not fall into the category of "imminently transferable". Such systems include inter alia those at The London, Charing Cross, St. Thomas and Queen Elizabeth (Birmingham).

No formal communications have taken place between this region and other regions with regard to determining regional policies as such but the following has emerged.

East Anglia have decided on CT1 equipment and are successfully pushing a master patient index module into the majority of their districts.

North East Thames are going two ways at once: they are standardising on DEC manufactured equipment and MUMPS, with a small system for District General Hospitals as at Southend, but the London Hospital have just bought a very large amount of equipment to do a full hospital system on DEC equipment but without using the DEC version of MUMPS. (Using an OEM for the supply of equipment and software.)

North West Thames seem to be standardising on the Plessey system although their own 1503 system at Barnet is being implemented in an additional hospital. That system also requires links to the mainframe.

The Oxford region are developing a policy of de-centralising all their computing processing to district level, they are currently involved in implementing MUMPS based systems on DEC equipment but may in the future be flirting with IBM.

Trent have a policy for developing standard MUMPS based systems for the whole of their region and are using a working party of district Medical Records Officers to provide the guidance.

Wessex currently appear to be standardising on NCR Chart. The investigating team had discussions with Wessex but in the end were unconvinced by Wessex reasons for sticking to CHART.

Some of West Midlands may be standardising on parts of the Stoke system.

WHTSO have a policy of implementing their system with ICL 1503 but this depends heavily on the presence of a large central

mainframe. They are looking at other systems especially that at Stoke when converted to the ME29.

Addenbrooke's Cambridge

A Master Patient Index system using CTL equipment and developed by East Anglia Region. The next planned extension is an outpatient module. This system was a surprise in that we had not appreciated how many districts in East Anglia had committed themselves to taking it. However CTL and CORAL and COBOL do not give the flexibility that are offered by DEC and MUMPS, and there was no inpatient system nor any plans for one in the immediate future. What Cambridge did have was an outline design for a radiology system which would be linked to the master patient index. This is based on experience they already have of a radiology system at Kings Lynn. While the program code will be of no use to this Region the system design ideas could be superimposed on top of a MUMPS based master patient index system with very little difficulty.

Barnet

The system provides MPI and Inpatients facilities. It is based on the use of a central large mainframe computer servicing local micros within two hospitals. This is a very ingenious system but using technology which is very much out of date. While it is claimed for micro computers that they can be run as an effective network the evidence so far is that when the network is under pressure response time slows very considerably. Systems effective only with a link to a Regional central mainframe for patient care activities will be increasingly irrelevant in the future. Therefore it is felt that this system is a technological blind alley. The fact that NWTRHA themselves are pursuing other solutions tends to confirm this view.

British Medical Data Systems

BMDS say that they can offer a master patient index module from as little as £40,000 to £50,000 and would expect to offer a full system for a 300,000 size district for £120,000 - £150,000. With the absorption of MCL, BMDS have acquired both useful experience and a problem in that trade union resentment against MCL may still be a factor in any relationship with BMDS.

The system offers more than was seen at any other demonstration of systems both inside and outside the health service but there could be severe practical difficulties involved in negotiations between the Region and BMDS in that some of the bargaining counters in these negotiations are the property of DHSS. The investigating team were not over impressed by the screen design in the system but screen design is something which can be fairly easily changed in MUMPS and the additional routines which were commissioned by Exeter for Primary Care would be extremely useful

in this respect.

Negotiating with an outside firm raises matters of principle which are outside the remit of this report but its readers should be aware that to take any health service system to the present state of the BMDS system would involve several hundred thousand pounds. Another factor which BMDS offers and none of the other demonstrated systems offer is the facility for costing at a detailed level. The report suggests elsewhere that this would be increasingly a requirement in the health service and if this is the case then all the other systems would be deficient in this respect.

CMC

This company are known to be implementing an FPC system in Avon. It was heard that they had also patient administration systems to offer. A visit to P.Talbot from a salesman showed that the system existed more in the mind than on the ground and no further dealings with the company are suggested at this stage. No visit report as such is written.

Doncaster (Nottingham/Hallamshire)

The Doncaster system can be demonstrated at Exeter. It is written in MUMPS and running on DEC equipment.

Currently there is only an inpatient system but when we saw the system it had been running for a few days and seemed to be working quite smoothly. A master patient index module is expected by the end of his year and the system specification will be available to us by the middle of September. The system was impressive and we would recommend its adoption as an inpatient module in the South West Region. Joint development of master patient index modules would have several advantages in that Trent are also developing the national standard FPC system also in MUMPS and on DEC equipment which would help ensure proper links between FPC and hospital indices as well as more joint development between the primary care team at Exeter on links between Primary Care systems and FPC.

Exeter

The last minute imposition of ICL equipment yet again and the lack of an opportunity to "package" the system means that while Exeter has implemented a range of facilities which is greater than any other covered by the survey (with the possible exception of BMDS whose facilities it complements) what Exeter can give is the experience of its staff, coupled with their knowledge of what might have been. It will provide the most complete system on ME29 equipment for some considerable time to come. In the long run when implementation is under way in all the other districts then the Exeter facilities should be added to the systems provided on the cheaper hardware that the other districts will use so that in the next round of replacements the

Exeter system as supplemented by the experience gained in other districts is available to all.

There is no visit report for Exeter but Appendix 2 contains a a description of the project that was written for the Regional Computer Consultative Committee.

IBM

At a very late stage in the investigation it was discovered that Oxford are having some discussions with IBM about the use of IBM's PCS system. A telephone call to the salesman elicited that while IBM feel that their full system is economically viable they have no low cost entry point in that to start the system in an average size District you would need to spend around £120,000 on software and hardware. The salesman expressed an interest in demonstrating the system but this could not be fitted in until after the middle of August. This offer will be taken up and if circumstances should change the above conclusion a visit report will be made and sent off as a supplement to this report.

NCR "CHART"

The investigating team feels that there has been a deliberate attempt by NCR to obscure the fact that so little of the system is usable.The approach by NCR to the health service seems to be remarkably half-hearted and at no stage are NCR committed to a plan which ensures continuation of the development. NCR strategy of only writing programs when somebody buys the application means that they have no real commitment for development in the future. This is the hazard which the health service is going to meet when dealing with any commercial firm which is unsure of the potential of the health service as a satisfactory customer base. The investigating team have moved from seeing NCR as a strong contender in the early stages of the investigation to being thoroughly disillusioned with NCR as a company and while those bits of the system which are implemented are quite good would not recommend NCR to any District.

Oxford

This MPI system can be demonstrated at Exeter.

The progenitor of this system was UCH, and it shows. The project would not recommend using this system as it stands as a master patient index module but it does have one or two ingenious index searching techniques which could be lifted. It is not clear how far Oxford are going to develop the system and no visit report has been written.

Plessey (The Middlesex and Northwick Park)

An MPI and inpatients system were developed at Northwick Park in cooperation with Plessey and recently implemented at the

Middlesex hospital. An outpatient module is being designed. At the Middlesex Hospital an ex programmer is in charge of day to day operation but can call in assistance quickly when necessary at Northwick Park. The system seems to need the permanent attention of a scale 4 analyst in addition to his project leader. But this may have been a function of the much greater number of terminals that the system supports including light pens in the pathology laboratories. The prices we have from Plessey indicate that the system might be much too expensive and the contractual arrangements whereby Plessey are prime contractor through whom one would have to negotiate for system changes with a secondary contractor (i.e. Leasco) could be both time consuming and extremely expensive (current prices for contract programmers are something around £800 per week).

Southend (UCH)

The Southend system can be demonstrated at the Exeter Project. It is an Inpatient System on DEC equipment. An MPI module is being developed with an outpatient module format. The team felt it is not yet in a sufficiently robust state for it to be recommended to the region nor is the design and implementation sufficiently modular to make transporting it elsewhere particularly easy. The system suffers from being an offspring of the UCH system where at the time that it was implemented the main virtue that MUMPS offered the team was that it enabled them to put a replacement system in very quickly. The system was untidy and still shows signs of the original lack of planning and lack of available time at the first implementation.

Stoke

Currently the system is working in a large group of hospitals and can show the only truly satisfactory example of an outpatients system. It is being rewritten for a large ICL mainframe 2960 from system 4 equipment. Except for the local data collection mode, given the availability of a central mainframe computer, the system does not offer a low cost entry, even when the system has been transferred to ME29 the book price of the machine necessary simply to do a master patient index will be around £100,000. Even though the Exeter Project in its own strange circumstances has been forced to go to ME29 equipment for Exeter district it has never regarded it as the most cost effective solution for systems in other districts. The system may require the presence of trained operators. Unless the regional 2960 were to be considered for similar real time tasks to that of the Stoke machine the Stoke project offers little future prospect until more complete systems are required by Districts.

WHTSO

This system is in widespread use in Wales and being implemented in the Wirral. It provides MPI, Inpatients and some outpatient facilities. It is based on the use of a central large mainframe

computer servicing local micros within hospitals in several Districts. This is a very ingenious system but using technology which is very much out of date. While it is claimed for micro computers that they can be run as an effective network the evidence so far is that when the network is under pressure response time slows very considerably. Systems effective only with a batch link to a Regional central mainframe for patient care activities will be increasingly irrelevant in the future. Therefore it is felt that this system is a technological blind alley. The fact that WHTSO themselves are actively pursuing other solutions tends to confirm this view.

CONCLUSIONS

The conclusions derived from this survey are as follows:-

1. There are very few, if any, fully "turn-key" systems available, and some degree of modification and support will be necessary with almost any system that might be implemented

2. There are no systems running anywhere based entirely on single micro or linked micros. They all involve mini or mainframe machines.

3. There has been an enormous waste of computer staff time developing in many different sites in the country patient adminstration systems in parallel. It is not in the interests of the N.H.S. for the situation to be perpetuated.

4. A byproduct of this dissipation of effort is that the majority of teams have little experience either of real time systems or of patient adminstration systems.

5. Judging from the reception of the investigating team at all the sites visited there is a considerable amount of goodwill at analyst and progammer level for the exchange of information and ideas in detail about the way in which the systems ought to work.

6. What is required is a strategy that allows flexibility. What this means is choosing a machine and a language both of which offer upgrading and flexibility and then checking to make sure that systems of a proper quality have been constructed with those tools. The tools that came best into those categories were DEC equipment and the MUMPS programming language. DEC offers other advantages in that their hardware range stretches from micro (PDP11/03) up to very large mainframe (VAX range) and MUMPS can be run on any of those machines. DEC also supply equipment to the specialist departments of the Health Service so that there is a greater choice of hardware compatibility with other systems in the district. DEC equipment is obtainable from several OEM suppliers so that a proper element of price competition can be maintained.

MUMPS is available on most of the PDP 11 and VAX range of equipment. Not only is it a 'programming language' in the ordinary sense of the word, it is also a Database handler and complete operating system. Real time programs can be written and tested very quickly. Batch programs do not always run very efficiently when writtten in MUMPS but they can be written in a way which allows them to run as background jobs and not interfere with real-time responses.

7. A MUMPS Phoenix system for Pathology systems on DEC equipment has just been completed at Oxford and will shortly be available for demonstration in Exeter.

8. Work Study should be asked to supplement any Hospital Administration Team in the Region, should the rate of implementation prove overwhelming. Discussions have already taken place between the managements of the Project and the Regional Work Study department; in addition several members of the Work Study department have spent time at the Project receiving practical experience in the use of patient administration systems.

9. There is a need for experienced computer staff with knowledge of the NHS to act as "cross pollinators" between the various Regional application teams.

10. This survey should be brought up to date at least every twelve months.

11. The information in this report is as up to date as possible but even during the three months of the investigation two additional systems became serious contenders from nowhere and one system became a serious contender having been regarded as unimportant at the time the investigation started. The ease with which programs can be developed with modern computer languages and the ease with which computers can be installed mean that the situation is changing elsewhere all the time.

12. The organisational impact on a District of a simple Patient Administration system will be relatively slight. However when a District is trying to manage several computers some of which are linked and all of which are involved in the day to day running of hospitals and other departments the organisational structure both to cope with and take most advantage from computers will be increasingly complex. The Exeter District will in the very near future have to deal with such a situation and a formal study should be undertaken so that other Districts may profit from the experience.

RECOMMENDATIONS

The systems which fit a MUMPS and DEC strategy are (1) the Oxford master patient index which needs some development, (2) Southend inpatient system which the team do not recommend, (3) the Doncaster inpatient system which the team were impressed by and (4) British Medical Data Systems who of the commercial firms have most to offer.

Doncaster (Trent) will have a master patient index written in MUMPS on DEC equipment by December. They have offered a copy of their system specification by the middle of September but the investigating team have no doubt that if the MPI is designed and programmed to the same standard as he inpatient system it will perform very satisfactorily.

1. A two pronged attack should be made on the problem:-

(i) The SWRHA collaborate with Trent RHA in order to use their system in MUMPS on DEC equipment for District by District implementation.

(ii) The Region negotiate further with BMDS to see if a deal can be worked out in which our bargaining conditions are the Exeter Nursing System, Information and GP systems, plus improvements already made in MUMPS by the Exeter team. BMDS already offer a wide range of Hospital systems including a costing facility. By introducing some of the Exeter modifications the applications could be made even more acceptable to potential users in the District (i.e. better VDU screen handling, recovery procedures etc.) In the event of a deal being agreed the equipment bought to do (i) can be used for (ii).

(iii) In the event of (ii) proving fruitless then there should be a regional development in collaboration with Trent on outpatient systems which would offer both "Clinic Diary" and "Real-Time" booking systems.

(iv) In view of the necessity for computer staff to be involved in the early stages of new developments regional support teams should be based at or close to the hospitals where the service is to be implemented.

2. Exeter staff, who are knowledgeable in both FPC and Hospital Systems, be permitted to investigate and estimate the cost of linking the Trent FPC system to various hospital systems which include an MPI module.

3. That a formal study of the problems of a District i.e. Exeter, in managing a large computer installation be undertaken. This should provide guidance to other Districts.

CRITERIA

Long Term Considerations

The installation of computer systems is to satisfy perceived organisational needs. If there is a major capital planning decision in the next ten years, say a hospital extension, then the new computer system should be designed to contribute data to the planning process. The computer could pay for itself by ensuring the correct distribution of resources in which case the administrative assistance, which is the day to day effect of the computer, is a bonus. Match the systems which the computer offers to the stated objectives of the District so that the implementation of the various applications follows a logical and relevant path. Specialty costing will be a factor in District management in the not too distant future. Such costing should be a direct by-product of patient systems rather than a superimposition from a batch accounting system.

Many of the benefits of computerisation are obtainable with a well designed, run and monitored manual system and the staff savings of implementing a computer system are unlikely, singly, ever to outweigh the capital and revenue costs incurred. The proper implementation of a computer system can, given the will, allow a complete reappraisal of existing procedures. The benefits which accrue to this exercise can often justify the expense and effort involved in implementation.

The areas where a computer system can substantially benefit a hospital and District are those where it is totally impractical, under a manual system, to provide the quality and precision of information which is necessary to best utilise the limited resources available. The management information currently required to be produced by NHS sectors is directly related, not to what is best but to what is possible. This is typified in SH3 statistics which crudely relate efficiency to numbers of patients treated and beds occupied. Little attempt is made to relate this to cost of treatment or to the ailments being treated.

All of the computer systems considered in this report, with the exception of the American originated BMDS system, go only as far as is necessary, in the provision of information, to duplicate the SH3 manual returns and feed the Regional HAA systems. The report of the Korner Committee may provide the impetus for the production of information which will allow accurate, local costing of treatment and give District Administration the ability to allocate their resources to the best advantage of the patient.

In order to ascertain the cost of treatment it is necessary to be able to correlate all aspects of a patient's contact with the NHS. To limit consideration to inpatients' stay, outpatients seen etc. whilst ignoring consequential costs of nursing, drugs, other specialist units etc. will lead inevitably to lack of

control. It is therefore necessary not to look only at the short term expediency of PMI, Inpatient and Outpatient modules in a computer system but to consider future developments of additional systems.

What do you do first?

The team started their investigation firmly convinced that the most obvious place to start implementing the patient administration system was actually with the master patient index. In fact this supposition was so "obvious" that it had never been questioned. During the course of the investigation it became apparent that for many hospitals the fastest and most central place to start was the inpatient system, and that the only justificaton for starting with the master patient index was where it was in such a mess that only a computer could be used to sort it out. In the latter stages of the investigation this argument changed yet again. In that it became obvious that if your master patient index was in such a mess that you needed a computer to sort it out then you had a considerable job tidying it by hand before you started to put the data on the computer. For instance Tunbridge Wells, in the course of a year, have only input 29,000 patients onto their MPI system.

This provides a very light load for the computer and if Districts are faced with this particular sort of problem it seemed fairly obvious that while the index sorting out was taking place the computer should also be running an inpatient system. The evidence we have from Doncaster is that a good inpatient system can be implemented fairly quickly and painlessly. The reasons for this seem to be that the clerks inputting the data in the inpatient system all tend to be specialists and therefore have a greater understanding of their job.

The inpatient system affects a lot of people concerned with the running of the hospital, District Management and consultants can get better and more immediate statistics, nurses get bedstates; porters and the like get inpatient directories. The right strategy therefore is either to implement the master patient index doing a full take-on for which additional money will be required (roughly the cost is 10-12p per patient), or to do a prospective take-on of the index and implement the inpatient module at the same time.

Consideration of outpatient systems is much more complicated. Only one site visited has successfully implemented a real time outpatients booking system. Most sites however have ambitions to implement such a system. It seems obvious that the actual selection of an appointment should be done using the visual display unit and for a long time the plans of the Exeter project included development of a facility of this sort. However only one site visited has such a system i.e. Stoke. One other site i.e. Cambridge has an outpatient appointment system which has put a load on the computer such that 30 second response times are frequent. The investigating team have come to the conclusion

that the clinic diary system, with a delayed real time input of the appointment may be a more cost effective solution to the problem of booking appointments for clinics. The reasons for this are as follows:

1. It does away with the need for standby print for booking appointments - (prints are obtained daily as part of the system).

2. It makes the breakdown of the computer much less critically interruptive of an outpatient clinic.

3. It is actually faster for a clerk to book an appointment using a diary than it would be using a computer system whatever the response time. With slower response times then the frustration of the clerk and of the patient would increase and hospitals might be forced to buy more computer power than was necessary simply to deal with the peak load of the outpatient booking.

How do you run the system?

Most of the installations visited found it necessary to select or recruit somebody at scale of HCO or GAA whose responsibility was to run the computer and to train new users, change terminals and so on. The one installation where this was not true was the Chart system at Tunbridge Wells, where the Medical Records Officer who was running the system and supervising the take on was working considerable amounts of overtime and was in the process of establishing an HCO post to take over the day to day running of the computer and the supervision of take-on.

There is no doubt that the presence of properly trained computer operators reduces the risk of systems being mis-operated and failing, and increases the speed and urgency with which manufacturers support can be called upon. On the other hand the problems of running a system using say just master patient index with perhaps a microfiche back-up are so small that "professional" computer operation is almost certainly unnecessary and the difference between being off the air for half an hour or off the air for three hours is relatively uncritical. As Districts begin to build systems up and have requirements for, say,more than fifteen terminals with inpatient and outpatient modules as well, then the consequences of not having the computer available can be quite serious and the quality and quantity of the support staff will need to be improved. It has become apparent that such simple things as security dumping and start and restart can be achieved by non-computer staff with the minimum difficulty.

It is not at all clear when a computer should stop being the responsibility of, say, a District Medical Records Officer and start to be managed by professional computer staff. The consequences of this may mean that the computer and its operation should become the responsibility of a second tier District

officer and combined with other responsibilities for Information and Planning. If, within a District, computing is not energetically coordinated then an inferior service will result. Increasingly D.M.T.s will find it necessary to be knowledgeable about the problems of running a computer and to resist the temptation to shuffle the problem to a junior member of staff. Perhaps in the end computer services within a District should be organised along the same lines as other specialist District services.

Running a computer for 24 hours is much safer than switching it on and off at the start and end of each day as it is at the time of switching on and off that the computer is most vulnerable. Districts should assume that they will run their computer 24 hours a day and site it either somewhere where there are staff around or in a very secure area. Modern computers frequently run in what are termed "normal office conditions" however, the modern mini running a small medical records system will be generating between 5 and 8 kilowatts and will very quickly turn what was a normal office into a hot-house. It is unrealistic to expect to run a computer in a small room without some sort of air conditioning, it is unreasonable to run a computer which has its own noise and internal fans in an office shared by other people. The one site we visited where this happened had produced working conditions which were very unpopular and rather belatedly a sound proof partition was going to be put between the computer and the staff.

Where there are non-specialist computer operators the diagnosis of faults will be quite difficult. Districts that are a long way from an engineer or from a spares depot will quite often find that when an engineer has been called in it will be discovered that the fault is not hardware but software; a software person will have to be called in and may then prove the opposite and when finally the diagnosis is firm the spare part will have to be brought from some other part of the country. DEC offers a remote diagnostic service in which an additional "black box" is attached to the computer which can be then dialled into by an engineer at his stores. Thus the diagnosis can often be made remotely so that the engineer arrives on site with the correct spares. While districts may be running only a master patient index system they may find such a requirement unnecessary. Should their ambitions expand they may find the lack of such a capability a considerable disadvantage.

To the uninitiated computer processing and updates appear to take place instantly. In fact all computer processes take some period of time and when a computer system breaks for whatever reason the break can occur while a process is taking place. Occasionally when this happens data is lost i.e. some of it has been written to a file but other parts have not. The problems of recovering such data can be considerable and require a great deal of technical knowledge almost certainly beyond the knowledge of the people running the installation. It is necessary therefore that the software supplied by the computer manufacturer can

recover such partial updates and restore a clean data base.This restoration is called 'stripback'

Early computer systems required a lot of batch processing in order to maintain the computer system and in order to do all the various analyses required. Increasingly analysis jobs can be input from a visual display unit and then assigned a printer so that at some stage later when the analysis is finished the resultant output either goes onto a spool file or directly out to a printer. The ease with which this can be done and the checks that the programs make as to whether there is actually a printer available and whether the printer has sufficient paper and is properly operable are an important part of the system.

It is important to be absolutely sure what support is available, whether there are people manning a telephone answering service for queries, whether that answering service is available 24 hours a day and at what cost.

What do you believe?

In all your dealings with computer salesmen remember the following:

1. His interests are the interests of his employer and not the interests of the NHS.

2. His personal interest may simply be the filling of this year's quota and it is most unlikely that he will have any real feeling for, or identification with, the problems which you are trying to solve.

3. A buyer's credulity is the salesman's biggest asset. When the salesman is earning his next commission extolling the virtues of whichever company he has moved onto, the inefficient system performing badly on the wrongly configured computer will be your mistake.

4. It is in the interests of a computer salesman to flatter you into believing you do not need the benefit of expert advice.

5. When you buy a computer you are also starting a long term relationship with the computer company. It is a relationship, profitable to the company, from which it will be increasingly difficult to extract yourself viz the Exeter Project and ICL.

6. The precepts you have to bear in mind are as follows:

    a) Always question what you are told.

    b) If you see the system working in somebody else's hospital without difficulties then that system is worth further discussion.

computer system which does not fit you are stuck with it, or you have to pay a high price for all the modifications necessary to make it a better fit.

Buyers of turnkey systems need a much greater understanding of the problems that they are trying to solve. They must give the supplier of the system a much more detailed specification of what the system is expected to do and how it is expected to do it. In other words to buy in a ready made solution requires greater effort at the purchasing stage than the commissioning of a new soluton.

The following precepts should be borne in mind:

1. A company which has only delivered one or two systems does not have enough experience to describe those systems as turnkey.

2. Conversely a company which may have delivered a hundred or more can only afford to support a hundred or more systems if those systems are genuinely turnkey and highly modular and driven by individual hospital parameters.

3. A proper turnkey system emerges after years of experience and while the initial design can help the development to turnkey it is fallacious to believe that the turnkey system can be immediately developed from scratch.

4. One of the hazards of looking for a turnkey system, if you have not clearly thought out in detail your own requirements beforehand, is that a system which superficially appears to suit what you think your requirements may be may cause you not to think about the detail; in which case you may well be bending your perception of your problem to suit the salesman's selling of his system. Some degree of compromise will always be necessary and may well be profitable but compromise should only be sought from a secure intellectual base and not from a position of vagueness.

5. The more complex your requirements and therefore the more detailed the study you have put into your requirements the less likely it is that you will find a turnkey system which matches your needs.

6. But, however limited your immediated ambition, success breeds desire for more applications and while the small simple preparatory turnkey module which you may buy now suits your immediate limited needs you have no guarantee at all that future modules will actually match your later requirements. It is a mistake to buy a turnkey system from a company who cannot demonstrate now how additional systems will be integrated, for in the future you may well have a requirement for them.

7. In the purchase of turnkey systems expert technical advice is even more essential than in the commissioning of new or modified systems. Any mistakes you make at this stage will be costly or

c) If a manufacturer says to you he would like you to help him develop the system what he is really saying is that he, the manufacturer, is very inexperienced in the implementation of hospital systems and that he is going to use you to gain that experience at the Health Service's expense.

d) If you see a demonstration of the system ask to use the visual display unit and printers yourself. Spend a long time, several hours if necessary, going through all the facets of the system. If working instructions are available use them to make sure that the system behaves accordingly.

e) Whilst on one hand it is important to be sure that the system works in the way it should, it is equally important to make sure that the system is robust and won't break under the strain of people doing unorthodox things to the keyboard or people typing unexpected data into the computer. In every organisation there is somebody with the urge to test the computer systems to destruction. The computer system you buy must be robust enough to frustrate such a person.

It is the opinion of the team who have investigated the patient administration systems commented on in this report that no system for patient administration or any of the other substantial areas of computing should be bought without considerable involvement of professional computer staff in the purchase procedure. Those professional computer staff should have the same interests as the would be purchasers of the computer i.e. the better operation of the NHS rather than the profits of a computer company.

Turn key systems

An insistence on "turnkey" system does not reduce the need for careful planning and technical involvement as described in the previous sections in this part of the report in fact it will increase the need.

It may be useful to draw an analogy with buying clothes. In this analogy "off the peg" equals "turnkey". Off the peg gives you the advantage of mass production but gives you the disadvantage that the garment may only fit where it touches. Made to measure on the other hand is expensive, may in the long run produce a garment which is intrinsically less well made but it is at least designed round the body that it is meant to fit. The analogy can continue further. If you wish to buy clothes made to measure you turn up at the tailors and he measures you if the thing does not fit then it is his job to re-tailor it so that it does fit. If however you buy clothes off the peg in a chain store you need to know precisely what your own measurements are in order to make the closest guess at to which garment is the best fit. At this point the analogy falls apart because while one can return and replace a garment which turns out not to fit, if you buy a

impossible to remedy at a later date.

Effects on Users

Effects can be beneficial or detrimental. Users can be anybody from the DMT with up to date and previously unobtainable statistics, to the VDU operator in an ill lit work station struggling with an over complicated keyboard, frustrated by an inflexible system.

The introduction of change involves consideration not only of the needs of the organisation but also of the fallibility and fears of the people within it. Some Areas have a policy of consultation with staff organisations at all stages of the introduction of computer technology. Trade Unions have an interest both in the possibilities of redundancy and the possibility that long term continued use of a visual display unit could be a health hazard. (See Association of Optical Practioners Report on VDU Operation. (S.Rosenthal, J.Grundy))

Many aspects of screen design seem to take little account of the potential problems of eye strain. Some screens have data which moves up the screen each time a line of data is entered. This must increase eye strain. Some screens have both headings and data in upper case which leads to lack of clarity. We discovered at Exeter that flashing cursors annoy users. However the effect of the computer system on the VDU operator is not all risk, the system can put at her fingertips all the information necessary to deal with patients' queries or the demands of the administrators. The job of the medical records clerk can be made more variable, more interesting, she can perform her tasks to a higher standard and gain more job satisfaction.

Usability

The installation of a computer system in a hospital department will bring changed methods of working. Staff who will be using the system should be made aware of the potential if the maximum benefits are to be obtained. Details of implementation should be planned well in advance and existing working procedures should be reviewed so that there is no increase in the workload and unnecessary duplication of effort. Information which has previously been difficult to obtain - by virtue of centralisation of files - can be made much more readily available at many different sites. The ability to control access to data should be a feature of the computer system but a re-appraisal of different levels of access will be necessary if the new situation is to be exploited to its fullest advantage.

From the users' point of view, the basic requirements of a real time computer system are equipment that is simple and easy to use; a consistently good response (2 seconds av - 5 seconds max.), a flexible system that allows staff to do their work quickly, efficiently, without constraint and that provides the

fullest possible benefits to the maximum number of people. Other factors to be considered are:- which features are necessary or merely desirable; is a 'fixed path' approach using a 'Menu' going to be limiting/time consuming or frustrating to the user? Both styles can be demonstrated at Exeter. Can all the terminals be used for all tasks under the control of passwords and monitoring? If information systems are required as well as data processing more terminals will be needed.

The VDUs should have good sized screens with clear well defined characters, preferably upper and lower case. Variable intensity and inverse video may not be a preliminary requirement but could be a useful feature in future systems. Screen displays should be well structured for easy reading (particularly for answering telephone enquiries). Information from file should be displayed in 'protected' style to prevent accidental corruption by the user. There should be comprehensive program vetting of all data input with clear indication of error conditions. Validation of data in a 'prompt/response' situation might not be as acceptable as a full screen send which checks several fields of data at the same time and the user can directly select the field to be corrected where two or more are in conflict.

It will be necessary to be able to change tables - add new consultants/clinics etc. - at short notice. Printing at a central point may incur problems in distribution which could be avoided by using local printers . It is essential that printing can be initiated from the VDU and produced on a printer in close proximity to the user. Standard and ad hoc enquiries should be possible.

Printers should have a clear font and be fast and quiet. They should be easy to load with various types of stationery and have automatic cut-off when stationery runs out. Standard stock size stationery (not pre-printed) is economically advisable. It is useful to be able to monitor the quantities of different types of output awaiting printing so that the user departments can assess work load, particularly during take-on. Standby systems should be adequate to cover break down of the system. There should be provision to add new systems and/or link with others. User manuals should be concise and unambiguous. Ensure that there are an adequate number of spare terminals to cover in the event of breakdown.

Adaptability to Local Requirements

What is meant by "Local Requirements"?

1. Does it fit within an overall District computing policy? (If there is not an overall District computing policy shouldn't that question be tackled first?) In a situation where finance greatly restricts the speed with which people can implement decisions a clearly expressed District strategy which shows the most practical options open at any particular point in development, is an essential prerequisite to the sensible purchase of computers.

2. How does the geography of your District affect the computer requirements? Where you have perhaps two or three large hospitals within one District it may well be cheaper to link those via terminals rather than to send paper through the messenger service to a central point. 3 or 4 extra terminals even with no additional message load on the system may critically affect the size of computer processor that you have.

3. How easily does the system cope with terminals linked locally through direct lines and remotely through GPO telephone lines?

4. How many index numbers can a patient have? Must the system cope with them all?

5. Which systems do you want to put on first, which do you want to put on next and how easily and how quickly can you change your mind?

6. How easily can the rules appertaining to the waiting lists and outpatient systems be modified to the needs of individual consultants?

7. Will the label formats exactly fit your requirements? Can they be modified by you as the user after implementation?

8. How easily can it be linked to other extant systems such as Path Lab, Radiology etc?

9. How quickly can you generate ad hoc reports from the data in the system? Is a specially trained computer person needed or can any trained user manage?

10. Having reviewed your existing manual procedures how well does the proposed computer system fit with your other operational policies?

11. etc.etc.

Installation

The installation of computer equipment will require special consideration regarding not only where to site the computer but the comfort of the staff who will be using it. It is advisable to locate the computer in a room on its own and not in a general office, as the equipment will undoubtedly generate heat and a certain amount of noise which will not be conducive to the daily work routine of Medical Records staff. The heat generation will almost certainly require some form of air conditioning even though the manufacturers might say otherwise. It is not a good idea to position a computer in direct sunlight. Printers will also add to the general noise level and this should be taken into account when planning the location, but still bearing in mind

that printed output will probably need to be quickly available. There should be adequate working space round the Visual Display units to allow for clerical work. It is an advantage to have VDUs that can be tilted and rotated and with non reflective screens. VDUs collect a certain amount of static so there must be protection from this too. There may be a requirement to have a movable keyboard but in any case the keys should be clearly marked. The main consideration for positioning the equipment must be for the comfort of the users as this will affect the work potential, but it could mean that special wiring may be necessary which will increase the cost. Works departments should be consulted at the earliest opportunity to advise on the practicalities of plans.

Implementation

Implementation of the computer system will require very detailed advance planning in consultation with all members of staff who will be affected. Job definitions will be required so that there is clear provision for all requirements. The decision about initial take-on is of paramount importance and should be fully investigated from the practical point of view. Is it necessary to do a fully retrospective take-on of the Master Patient Index? Alternative considerations might be given to take-on of current patients only or for patients who have attended within a given time. Is it necessary or useful to change the numbering system? Make sure that there is a feature for cross reference with other hospital numbers. Can the take-on be done from index cards e.g.is the information sufficiently good? Will there be some support available during this critical time or will it be necessary to employ extra help either using a bureau to do the full exercise or employ temporary staff? If the take-on is to be done on site will there be enough VDUs to cope with the extra workload? If more VDUs are needed for the take-on will the computer cope with the extra load? Whilst it is important to implement systems gradually to allow staff to get used to the equipment and the system, it is equally important that take-on is achieved in the shortest possible time. Estimate a time scale for take-on and use any information that the computer can give for a day to day assessment. Try to keep disruption to the minimum during take-on and phase in the other users with care.

Try to intermix clerical and computer work so that staff do not have to stare at VDU screens for too long. Some reorganisaton may be necessary due to the implementation of a computer system. Consider the benefits of staff interchangability and rotation of duties. This becomes much more viable with a computer system and not only makes for more interesting work for records staff but means that staff cover during holidays etc. is more readily available. Keep all staff fully informed particularly during the early stages of implementation so that they are aware of their own role in the exercise. Ensure that there is an adequate standby system - your computer system will break down on occasions!

Training

All aspects of training and implementation should be planned well in advance so that staff are well informed what the computer system is all about, the benefits of the system and how to use the equipment to the best advantage. The reasons for implementing a computer system should be clearly stated so that the people who are to be involved will be enthusiastic. Initially support may be required from the supplier to train key personnel. Subsequently training should be a designated role for selcted hospital staff. It is important that the people who are given training responsibilities should be able to identify with all local variations in the methods of working and also that they should stimulate enthusiasm.

Training should preferably be given on an individual basis in several short sessions with a 'follow-up' refresher soon after the trainee has actually been using the system in a real working environment. It is a considerable advantage to have training files using 'dummy' records so that there is no danger of corrupting real records. Training files have the advantage of allowing trainees to practice at their own time and pace, as well as being useful for demonstration purposes. The tutor should use clear simple language, avoiding computer jargon and should dispel completely any mystique about computers and any apprehensions that pupils might have about using the equipment. All aspects of the system should be covered with special emphasis on the procedures which are the pupil's immediate concern. A user manual should be provided for reference during and after training. The manual should be succinct and well structured to allow for quick reference by experienced users and a more detailed level for new users. Error recognition on the VDU could also refer the user to a specific section of the manual. If it is possible for the computer system to monitor error messages this might be a useful indication of further training requirements. Training should include the use of standby system and information when to revert to its use. Changing/reloading stationery and print ribbons should also be included in training sessions

Whilst it is hoped that the computer system will require the minimum amount of typing it is well to remember that a fair number of users will be unfamiliar with typewriter keyboards so this must be catered for in training. On-going training will also be required for new staff.

Costs

The costs detailed in Appendix 1 are intended only as a guide. The final cost to be paid by each individual District should be the subject of a careful survey specifically for that District and then formal quotations from whichever computer manufacturers are decided upon.

The policy considerations involved in costing are fairly simple. It is virtually certain that Regional purchasing would produce hardware at a cheaper cost than hardware bought separately by each District. However where a single District goes ahead on its own it may well be able to extract a very advantageous deal from a manufacturer in order for that manufacturer to get a foothold in the Region. At least two of the bids made to Plymouth recently may come into this category.

It is important to look further than the immediate costs for hardware and software. Systems will require support, modification and development within the Region. Other Regions cooperating with the SWRHA may ask for contributions for work done which the SWRHA will use. This is why the choice of the most appropriate programming language i.e. MUMPS should figure significantly amongst all the other considerations.

WHAT SHOULD PATIENT ADMINISTRATION SYSTEMS CONTAIN

Master Patient Index and Registration

A Master Patient Index (MPI) is a historical file of all patients registered with the hospital itself or with any of the other health care units participating in the system. Each patient record on the MPI should be accessible by one or more unit numbers, or by selected patient identity details using appropriate search techniques.

The index record itself, once located, should contain identity details and summary information relating to a patient's previous contacts, be able to assist in locating the patient's case notes, and also allow convenient entry to other application modules where these exist (e.g. Inpatients, Outpatients).

The search of the index using selected identity details (name, address, DOB, sex, etc) should provide a rapid method of determining whether a particular patient is registered. The possibility of finding a particular registration when only incomplete or inaccurate information has been given should be as high as possible and may be provided for in various ways. For example, by the immediate display of a page of the index in telephone directory style allowing the user to vary the search according to his experience, or by the use of sophisticated cross-references and other techniques, some of which may possibly be long and tedious and could even pre-empt the user's freedom of action.

Once it has been decided that a patient is not registered, a simple registration procedure should create an appropriate index record, and print suitable identity labels for case note front sheets, appointment cards etc. (repeat labels should also be available on request). A unit number may be allocated either manually or by the computer, but it should preferably contain a check digit.

Any update of the index should be immediately available to all users of the system and should be immediately reflected in any other application module linked to the MPI.

As a security back-up to the computer-held MPI, and also for those users who do not have access to an appropriate terminal, the MPI should be held on microfiche, which is regularly updated.

Episode details in summary form should be capable of being added to the patient's index record, both directly and also automatically from other modules where these exist (e.g. Inpatients, Outpatients). A specific case note location facility maintained on the index record would be an advantage, but summary

contact information might possibly be seen as an acceptable alternative for this purpose.

Various other facilities that would be desirable in a comprehensive MPI include regular checking of the index for potential duplicates, culling non-current patients for microfilming of case notes (where a patient has had no contact for a specified period), allocation of temporary registration numbers in emergency cases and appropriate links with FPC files.

Links to FPC systems

For planning purposes District Health Authorities will need population indices as well as hospital indices. The FPC index is the only source, under the control of the Health Service, of proper demographic information about the population which the Health Service is intended to serve. The difference between a hospital index and an FPC index may represent an as yet unsatisfied need within the Health Service. The populaton is mobile, roughly 10% move each year, and quite a large proportion of that 10% move within a locality. Not only do they change address they change names and marital status.

The identity details of a patient should be checked each time the patient is seen by a health service agency. If a change of identity detail manifests itself then that change should be fed into a central computer system from which each of the health service agencies can profit from the latest up to date informaton. The sharing of common data leads to an improvement in its quality and a reduction in cost of its storage.

FPC register details should be kept up to date by patient contacts with GP's. Any change notified to GP's should in turn be notified to the FPC. With the increasing likelihood of GP's getting age/sex registers direct from FPC's (via computerised registration systems) the exchange of data between GP and FPC is likely to improve. Patients have much more contact with their GP's than the hospital so that improved links between hospital indexes and FPC registers will be beneficial to the accuracy and content of the hospital index.

The long term perspective of computer systems for patient care must admit the necessity to link both hospital and health centre records to some degree, and a shared index between the FPC and the hospital would be the first essential link in such a sharing of information for the benefit of the patients.

There are however hazards in such a link, FPC's and hospital Medical Records Departments have very little understanding of each others working procedures and an essential part of introducing a shared index would be a better understanding of the way each others department actually functions. This will require extra effort and a real determination to provide understanding.

There may be an initial unwillingness by both FPCs and hospital to have heir "sacrosanct" data violated by some organisation outside their immediate control and there may well be the need for a "referee" to sort out the details of complaints about wrongly corrected or changed data. This process which was gone through at Exeter, where the antagonists were hospital medical records officers and health centre receptionists, will disappear after a year or two on the achievement of the proper understanding of each others functions.

In addition to the tactical and clerical problems of running a shared index between an FPC and a hospital there are also certain ethical problems as well. The technology of medical record linkage has been a much debated subject since the mid-fifties. Discussion about how to achieve a link has ranged from the imposition of unique and standard identification numbers which a patient should use in all his encounters with the Health Service to the use of multiple computer indices which all link back to a central record file. Fundamentally the use of a common number is difficult to achieve across all health care agencies whereas multiple indices occupy much more computer file space. As the cost of computer file storage decreases then the use of multiple indices, which are themselves intrinsically more efficient in the use of people's time, becomes more cost advantageous. To be consistent it seems important that a patient record should be accessible by any of the numbers by which the patient is known and by the patient's name, forenames, date of birth etc.

The only system available which has attempted to do this is the Tayside system in Scotland. Various attempts have been made to transfer this system as an MPI but not as a linked FPC/hospital system.

Trent RHA who are developing the national FPC system using DEC equipment and MUMPS also have hospital systems (Doncaster) but appear to have no plans to link them. Provided proper documentation can be supplied by Trent this is something which could be done by Exeter.

The cost of equipment to do both master patient index and FPC systems on one machine will be considerably less than the cost to do it on two separate machines.

Inpatient Administration

The basis of an Inpatient System is the input and storage of appropriate information relating to a patient's inpatient episode, including Admission/Transfer/Discharge details, additional identity and clinical information (for HAA data cellection) and other administrative details that might assist in providing more efficient management of the facilities available.

An effective and comprehensive system should be capable of allowing inpatient information to be captured as close to source as possible and immediately used to update files of bed states,

ward movements, patient location, etc., so that up to date details of inpatient situations may be available on display or as printouts.

A comprehensive range of printed information and statistics should be provided, both regularly and in response to ad hoc enquiries, including Patient Location, Bed Management and Consultant/Specialty statistics

The Inpatient Module should include, or be linked to, an HAA coding and data collection system, providing automatic extraction of the necessary data, and storage or transmission in a form acceptable to the RHA central computer. The diagnostic information should be retained in a suitable format for local analysis and displayed with appropriate episode details from the patient's record.

Episode details should be automatically retained in a summarised format on the patient's index/summary record for the purpose of identification and enquiry.

Waiting Lists

A consultant should be able to maintain separate waiting lists by specialty and within a specialty define the structure of the list or lists he requires. A list could be for an operation type, urgency or any other criteria. Within a list patients should be able to be categorised by priority and into males, females, adults, boys, girls, children, infants or any selection of these.

Details of patients on a list should be displayable on the VDU but selection for admission is normally best done from an up to date print, requested at the VDU and printed locally, when required. The patients' details held on the waiting list must, at all times, be in step with details in other parts of the system and a record of the waiting lists a patient is on, displayed, where appropriate with other episode details.

Non availability of the patient should be recorded so that, if required, this patient will not be presented for selection on the list. If a patient is called for admission but cannot attend this must also be recorded. In addition clinical criteria affecting the wait such as "do not admit for 6 months" should be held in such a way as not to present the patient for selection until necessary.

Since it is often expedient to communicate with the patient by telephone details of forenames and telephone numbers should be displayed and printed with the list.

Letters to the patient for changes, TCI, reminders etc. should be available on request at the VDU. Details of any transport required is also necessary to be processed for admission.

Statistics produced from the system for display and regular purposes should reflect the state of the list at the moment including how many patients have been waiting for how long. In addition the computer can calculate the waiting time to admission in a fairly precise manner taking into consideration clinical restraints and non-availability of patients.

Outpatient Administration

An effective outpatient system should provide for the rapid selection, booking and amendment of clinic appointments and the consequent production of clinic lists, tracer labels, amendment and cancellation lists, standard letters to patients, special lists (transport, X-Ray etc.) and appropriate statistics, both regular (e.g. SH3) and ad hoc.

A flexible approach is essential, so that too many restrictions are not placed on medical staff. For example, the system should allow for variable booking rules, different requirements for clinic constitution (mixed or separate lists of new patients, follow-up appointments, ward referrals etc.) and flexible definitions of clinic occurrence. These variables, and also the details of printed output (e.g. numbers of copies, when printed, samples, reprints etc.) should be easily changeable by the user and any additions or amendments made should be immediately reflected and available in all other parts of the system. A simple method of rescheduling clinics, involving the minimum disruption to other clinic appointments, and providing all the necessary letters etc. automatically, would be desirable.

Diagnostic and test information should be able, with appropriate security, to be added to follow-up appointments to aid doctors.

Statistics

In general the presentation of statistical information is abysmal. Reporting systems should have the option to present data as histograms and graphs. Comparison with similar periods in previous years should be possible, as should the establishment of trends. The facility to compare the performance of individuals against the performance of other members of the same group is an essential prerequisite of any reporting system.

VISIT REPORTS

Method of investigation

All of the sites discussed were visited by at least one, usually two or three members of the investigating team. Where those sites had test or training programs available then the investigating team were able to get "hands on" experience. Where such programs were not available then the investigating team had a live system demonstrated to them. Where a live system was demonstrated it was usually possible to visit the users of the system and watch it actually in use. Before the visits started a questionnaire was concocted to act as an aide memoire and as a result of each visit a completed questionnaire is held at the project. There is a sample of an uncompleted questionnaire much reduced in size enclosed as Appendix 7.

Where possible copies of user manuals and documentation were also brought back. A list of the available documentation is included as Appendix 6. A list of visits and participants is included as Appendix 5. The documentation not included in this report can be seen on request at Exeter. Visit reports are essentially working documents so that less attention is paid to the niceties of english grammar than some might prefer. There is at Exeter a completed questionaire for each site visited.

Addenbrookes (Cambridge)

So far the Cambridge system consists only of a Master Patient Index module based on CTL equipment. An outpatient module will be available by the end of 1982. The system is currently in use at King's Lynn where it was implemented on 9 February 1980. By the end of the year Ipswich, Peterborough, Bury St. Edmunds and Norwich should also have implemented the system, with Yarmouth perhaps coming on next year. At the end of 1982 the present Addenbrookes system on the Sigma 6 will be replaced by CTL system with both master patient index and the outpatient system.

The system was originally implemented with a back-up copy of the file kept on a regional mainframe computer, however this arrangement will not continue and in future all the systems will provide their own back-up locally. The computer is a CTL 8046 with 256 Kbytes. This handles 17 visual display units and 6 label printers slaved to the visual display units. Currently their printers are made by Anadex but they expect shortly to standardise on Tally, 200 characters per second, printers. The backing storage is 2 x 80 mega bytes although the usable area on these is 2 x 64 mega bytes, They use Cifer 2603 visual display units which have the advantage of being extremely cheap, i.e. around £760 including VAT. The central computer equipment seems to be extremely resilient in that it works only with an air

cooling unit and has worked in temperatures of between 60F and 90F.

The software works on a foreground enquiry and vetting system with a middle ground updating program which single threads. The foreground system is known as TADS which basically is a very flexible and very powerful screen generator which works well in situations where the formatting of the screen is not driven by the contents of the data. Thus it is appropriate for such things as patient administration systems but would become increasingly inappropriate the more widely one had variable presence and variable length data. In TADS you could enter your own routines written in CORAL while the middle ground updating was written in COBOL, the disadvantage of this is that one would have to support two languages, one of which is not very frequently used. It was interesting that in spite of the fact that TAD gives them powerful screen generating facility it was going to take them from June '81 until the end of 1982 to convert their outpatient system from the Sigma computer at present in use in Addenbrookes.

Access to the system was through individual passwords. When a user was introduced to the system they were given a password by the computer team; that password then allowed the user to change his password so that thereafter the issue of his own password was entirely under his own control. The operation of the system was by medical records staff but two HCOs from each location were sent on a 3 day operations course. The time to do the security dumps was about 40 minutes a day. The file structure of the system was such that each new set of applications demanded a new set of files all keyed by the patient number. There was a terminal control program which put out statistics at the end of the day on how many messages each terminal had generated but there were no statistical utilities in the software to give other information about the use of the hardware.

The system is basically menu driven although within a menu it is possible to go from one function to another without going back to the menu. However each change of function loses the patient number. This means that the patient number has to be re-input and a short identity displayed before the function can be continued with. This seemed unnecessarily long-winded. When any error was made the error message had to be cancelled by depressing one of the keys in the keyboard before the input could be proceeded with.

The files could be referenced in different ways, the most common reference being the hospital number but patients could also be accessed using Soundex and sex plus 3 letters of he forenames, day and month of birth. There was a facility in the system to set up alias type records if the patients were known by different names. New numbers are allocated by the registration staff not by the computer and in order to check that the number has been correctly allocated it is first input without being displayed and it has to be input correctly with the two inputs being compared by the computer. The data stored for master patient index had

surprising omissions; there was no space for postcode or telephone number or occupation or NHS number. The real time indices were kept up to date at the time of input of changes of data on the master patient index.

The full identity label is produced using, at the moment, Anadex matrix printers this enables them to print the patients case note number in much larger figures that the rest of the printing on the label. This is a very useful facility which ought to be copied elsewhere. It is not possible to add episode details, they do not deal with temporary numbers, duplicate registrations are checked for at the time of registration but there are no facilities for checking at a later stage. There are facilities for producing microfiche.

The Cambridge computer team supplied an outline description of their system and their proposed systems including a Radiology registration system which would be linked with their master index. They also supplied a copy of an evaluation of the manufacturers hardware proposals which showed DEC being slightly cheaper than CTL. The reasons that CTL was chosen were that CCTA seemed highly to favour that equipment. (The same was true when we were evaluating proposals for the general practice systems in Exeter).

While the Cambridge team were impressed by MUMPS they already had experience of Cobol and prefered to capitalise on that, and it was felt that CTL would be more robust in environmentally difficult conditions than the DEC equipment (see note re Doncaster machine).

Barnet

The Barnet ICL system runs on 1 x 1503, 1 x 1502, 4 x 1501. The 1503 acted as controller of the overall system and controller of disc drive. The 1502 acted as controller of the line printer. The equipment was operated satisfactorily by medical records staff although there was on site usually at least one programmer working on future developments who could be called upon in cases of emergency. The Regional Health Authority computer at New Southgate had one disc drive permanently loaded and running with the full index for Barnet General so that where a patient was known to be on the index but the details were not available locally they could be called via the telephone line and incorporated in the current index on the Barnet system. The visual display unit screens were very small (256 characters) which meant that to register and admit a new inpatient one had to go through eleven screens. The visual display units were not easy to read but the system was extremely ingenious in the way in which the limitations of the screen and keyboard had been tackled. The computer equipment appeared to be extremely reliable and they thought they had about one failure per month.

Access to the system was by a four character password; some of these passwords were extremely easy to deduce and were less a means of security and more a way of telling the computer what programs were wanted. Security was maintained with an update log and daily file copies were done at lunch time. This entailed the computer being down for about three quarters of an hour.

The systems covered are Master Patient Index and Inpatients. The fuller retrospective take-on of the Master Patient Index is being done as a background job having taken on a full index of the current patients. The system provides a service for Barnet General and three small local hospitals and is being adapted to use at Queen Elizabeth Hospital, Welwyn Garden City.

There is little flexibility in the file design although it was fairly easy to change formats on the visual display units. The only key to the patient record was the patient's number.

The main copies of the index at the hospital consisted of microfiche plus a real time addendum. The system produced stub labels, full identity labels and GP address labels. Episode details are not stored. Duplicates can only be checked for on microfiche before registration or by the mainframe some time after registration. Microfiche is produced weekly.

The microfiche viewer which was a MICRON 785 was particularly impressive. Following the distribution of this report the team will take steps to find out more about it.

The inpatient system really existed to give daily lists of occupied beds, hospital census and so on; so that the system automatically produced a number of permutations of the same sort of information such as daily discharge reports, daily transfer reports, daily admissions reports. There were specialty bed states showing the number of beds allocated, the maximum number occupied, the number empty. This information was given both by ward and in total. Any more complex analysis of the information had to be done on the mainframe where copies of the data were held. There are ambitions for an outpatient system and the first thoughts are they may use the WHTSO system.

Response time was either exceedingly fast when all the processing and the data were local to the 1501 or quite noticeably slow when access to the disc was required. The system comes into the category of 'technological blind alley' and is not recommended.

British Medical Data Systems

British Medical Data Systems are a new company 51% owned by BOC Datasolve, 49% owned by Shared Medical Systems International which is itself a company of Shared Medical Systems (SMS). SMS have a long history of implementing patient administration and costing and billing systems in the USA with over 500 hospitals using their system. They were not originally in the survey as a

previous marketing exercise in this country had resulted in them quoting prices of around £300,000 for patient administration systems.

Recently however, Shared Medical Systems have changed their hardware philosophy and this has resulted in a subset of their American system being offered on much cheaper equipment. It is this latest development which has brought their prices into line with prices offered elsewhere in the health service. The visit was as a result of a fairly impromptu meeting in Exeter where it became apparent that the price reductions mentioned above had taken place and where it had also become apparent that the Exeter project had facilities and experience which could be used as bargaining counters with BMDS.

The visit took the form of a fairly wide ranging discussion about BMDS's and SMS's activities and organisation followed by the start of a demonstration. In the afternoon R.H. Fisher spent three and a half hours working with the system and D.J. Clarke spent some of the time looking at the system and some of the time talking about software developments. The demonstration took place on a PDP 11/34 with only test files and a test program.

The software structure of the BMDS programs is very impressive. The claim that they can sit down with potential users and within fairly broad limitations design a system entirely personal to that particular hospital is substantiated. BMDS probaly have ten times more applications in use and available to be used than any of the other sites visited with the exception of Stoke or Exeter. The programs are written in MUMPS and run on DEC equipment.

The system is basically menu driven on a prompt and response philosophy. Within a menu the request can be changed by the use of function keys and it is possible in an application to change patients. It is also possible , having changed menus ,to bring back the last patient dealt with by the use of other function keys. This gives a good degree of flexibility.

Describing the system is difficult as it is so flexible. The following points will illustrate this flexibility.

1. Hospital Numbers can be of any format. They can be allocated either from pre-printed case notes or from the computer. Check digits can be added if required and the patient can be known by any number of case note numbers.

2. Patients Record can be accessed either singly or in combination by patient number, surname, forenames, date of birth, sex, soundex, previous name, alias, X-Ray number or even from a diagnostic number.

3. All the indices are kept in step with the data files.

4. The format(s) of labels can be specified by users and if additional label types are required they can be added into

the system after implementation.

5. The system allows for the use of temporary numbers which may subsequently be changed to proper formatted patient numbers.

6. Hospital can have multiple indices, equally, multiple hospitals can be covered by one index.

This same flexibility is apparent through all stages of the system which offer inpatients, outpatients, waiting lists. There are many other departmental systems incorporated into the BMDS functions such as Pharmacy, Nursing station systems and so on. These were not investigated.

After a short time it was possible to use all the facilities without assistance as whenever it was not clear what to do next on the system, pressing a button marked "HELP" produced instructions. These instructions are free-text and could be rephrased for individual hospitals.

The system used DEC normal journalling for security. The project have additional routines to cope with "stripback" which we would want to see incorporated into any system that BMDS might deliver to the Region. In addition there were some aspects of screen design which judging by the standards that operate in Exeter could do with tidying up. Again we have routines written in MUMPs in Exeter which could be easily incorporated into BMDS system which make it a better product than it is now.

Doncaster

The system seen at the Doncaster Royal Infirmary was concerned with inpatient management of waiting lists, inpatients and recent discharges. It provided a good service for these areas but there is no HAA coding. An MPI module is planned to be available late '81 but this was not considered. No outpatients facilities were available except for label printing.

The system had been running for 10 days so it was not possible to gauge true user reaction or the accuracy of statistics provided.

The system is a copy of a program developed for the Hallamshire Hospital. It has been taken by Nottingham University Hospital (replacing an earlier ICL system based on 2900 equipment) and modified to give clearer input screens and more flexible parameters for implementation. A team of 3 were involved in the implementation at Doncaster, on loan from Nottingham. They had been on site during the implementation but were due to lower the level of support.

The computer is a DEC PDP 11/34 with 2 x 10.4 MB discs, 5 VDUs and 5 printers. The machine was sited at one end of the HAA office with no sound proofing, air conditioning or other special features. Some staff resistance to the noise was noted, however

a partition is now planned. VDUs and printers were sited in the HAA office, Medical Records, Casualty and Maternity admissions and in the Outpatients Department for label printing.

Patients could be registered on the system either on going onto a waiting list or pre-admission for routine cases or as casualty admissions. ID labels were printed on request, the number produced routinely being dependent on the specialty at admission.

The patients' details are held on the computer for 45 days after discharge, this time being dependent upon the disc space available. The inpatient waiting list system provided for up to 36 separate lists for a consultant/specialty. Within each list the patients can be categorised as urgent, soon or routine. The selection of patients for admission is done from a printed list. No TCI letters etc. are printed but a list of expected admissions could be requested. The details recorded specifically for the waiting list are diagnosis, TCI date, date added to waiting list and comments.

On admission extra details are entered of next of kin etc., required for printing on HMR1 form. These details are held for 2 days only allowing for reprint of the HMR1 if necessary.

The system maintains and will display and print a complete range of bedstate information by ward, specialty and hospital.

The details of current patients can be accessed at any time by name, for enquiry purposes.

Statistics are maintained by day with counts of adults and children by hospital and specialty. Counts of available beds, occupied beds, admissions, discharges and day cases etc. are held for each bed type - NHS, private etc. These totals can be printed on request for any range of dates or accumulated quarterly and monthly.

Labels for outpatients can be set up and printed using a special function. The details entered for printing of the label are not retained for possible later admisson. In addition special label designs may be set up and printed and if required stored for later reprints. This could be used for any special function including return address labels, GP name, address labels or notification of special action e.g. X-Rays.

Passwords can be allocated on a VDU to give a user access to specific functions only.

Data security is maintained by a journal of all changes made during the day. The data base is copied daily on a prompt from the computer itself. This takes roughly 20 minutes during which time the system is not available. The computer also prompts the users when it is ready to print bedstates daily. The times of these functions are alterable.

All the variables used within the system, i.e. ward names, consultants, waiting list details, specialties etc. are easily amended at a VDU with access limited to a supervisor's password.

One of the most interesting facets of this visit was the way that it demonstrated how using MUMPS a system could be taken from an untidy prototype, i.e. Hallamshire, to a neat production system in 12 months.

Trent Region now have a policy of developing transferable systems in MUMPS. The systems requirements are based on the deliberations of a Committee of District Records Officers.

NCR(Chart)

More time has been devoted to this than to any other system. Two identical demonstrations, a visit to Tunbridge Wells, a slide presentation and a session of practical trial along with question and answer sessions have given the investigating team a fair insight into the system.

Having been replaced at the Middlesex Hospital by the Plessey system the CHART system is currently only being used by Tunbridge Wells for an MPI take-on. Dartford has just completed a take-on and is due to start using the MPI shortly. South Warwick are in the process of having their index punched prior to starting MPI in August. Wessex Region have purchased development rights to the system and are planning implmentation of MPI and outpatients at Southampton with Bath and Swindon Districts interested.

The MPI modules being used by Tunbridge Wells are version 1 of CHART. This version was used for demonstration and consists of MPI, Registration, Inpatients, HAA, Outpatients and case note location modules. Other modules such as Waiting List have not yet been programmed. Version 2 consists of MPI and Registration as a single module and does not interface with Version 1 Inpatients/Outpatients. These modules are currently being reprogrammed. South Warwick et al will be using Version 2.

The demonstrations given by NCR to the investigating team have entailed a simple, cued pass through parts of the system. When requests to try other routes were made it was usually found to be impossible for various unexplained technical reasons.

It was clear from the visit to Tunbridge Wells that NCR regarded it their function simply to sell the computer systems and to get them running but not to offer any real advice about the sort of problems which might be undertaken during the course of implementation and take-on. Tunbridge Wells, Dartford and South Warwick were bought without much assistance or no assistance from professional computer staff. The odd man out is Wessex Region who have bought an MPI module for Southampton and if successful plan further modules for other districts in the region.

On 20th July 3 members of the investigation team visited NCR's headquarters in London for a session of practical use of the system. Prior to this session we requested that we should be able to observe performance of the product when, in addition to the normal conversations at VDUs, background tasks are run. We also asked for a printer to be linked in for the online production of hard copy prints of patient letters, labels etc. A demonstration of the NCR Screen Processor facility was also requested.

The actual session consisted of a demonstration of the Screen Processor followed by the use of he Version 1 system on an NCR 8430. This is not the 9000 series equipment which is being marketed for CHART, although we believe the software can run on either machine with no discernible difference in performance. No background tasks were available so no assessment of their effects could be made. Despite our insistence on seeing the printing in operation and our requesting, at the VDUs a considerable volume of printed material, none was produced.

Three VDUs were used during the session accessing a file of about 300 patients. Enquiry type conversations produced good responses but the processing time for update procedures was noticeable and some displays, such as clinic appointments, were lengthy. A lot of time was lost due to one user locking out others. We feel there is a basic flaw in the NCR approach to locking which can allow one user to call up some information, walk away from his VDU and deny others the use of the system for almost any length of time.

In our opinion the Version 1 software, which we were using, is technically unsound. With the possible exception of Master index, it contains errors and incomplete functions and without the assistance of a systems designer it would not have been possible to progress through the session.

Although we have only been able to investigate Version 1 software we feel that the following criticisms may apply to Version 2 unless that has been radically re-designed.

a) The screen layouts suffer from a general lack of headings, comprehensible field names and information on the current state of the system.

b) Carrying out a function necessitates following too rigid a path.

c) Without skilful manipulations of the Master Patient Index search techniques, duplicate registrations will occur.

d) Outpatient appointment selection is unwieldy and the allowable booking rules are inadequate.

e) HAA coding is cumbersome.

f) Passwords are not suppressed.

We are left with the conclusion that at present NCR offer a system that may allow the user to begin the transfer of the manual index onto a computer file. Since we have to reserve our judgement about the availability of online printing, or of its quality if it is available, we must have doubts whether this system can satisfy the operational demands of a typical hospital. These doubts are further compounded by the omission of microfiche from present NCR thinking, which will not only make the problem of standby more serious but could also preclude those indexes which cover a multitude of sites from considering this system.

Plessey (Middlesex/Northwick Park)

This system is designed to run on a Perkin-Elmer mini computer with software produced by Leasco Software House. The software is NHS copyright and can be amended, updated by NHS staff (this facility had not been used). The equipment and software is marketed by Plessey as a turn-key system. It was developed at Northwick Park hospital over the last 4 years in conjunction with NHS staff and has been installed recently at the Middlesex hospital. One other site, Bedford, is negotiating for its installation.

The software is designed to provide Master Patient Index, Registration, Labels, Case Note tracing, recording of events, discharge, an HAA module. An outpatient module is at an outline design stage along with inpatient waiting list. The system also interfaces with laboratory system for Microbiology and Haematology, to provide patient ID information for these systems.

The basic screen handling is "full screen" with an ability to change function/patient easily. The screens seen were Bunker Ramo and have a very small display - difficult to read, but larger screens will soon be available.

Sign on, accomplished with user code and password, allows access to selected functions on user code with further limit by VDU Identity. When system goes down there is just "Sign on required" displayed and no indication when system returns.

MPI search is started by completing a screen with Surname/Forename 1/Forename 2 (3 chs only)/DOB/Sex using ? to complete an unknown field or partial field. The minimum requirement is surname. This request resulted in a list of 10 patients names and details including address which fitted. A selection from this can be made with access to patient details or, if present, the next page requested.

Registration is accomplished on one blank screen and patient

number must be entered. The errors are noted by cursor position. Patient number 6 digits with check digit. Use of this has been disabled at Middlesex but an * must be put in its place.

Events can be recorded on events screen. Unlimited number consisting of number, date and text (13 chs). They are sorted into date order. These are automatically updated from admission/discharge to include admission event, transfer event, discharge event.

Registration labels are produced automatically on defined printer when registration complete. The set has been amended to Middlesex local requirements from that used at Northwick Park. This was done by Plessey. Subsequent labels of only a selected short type may be requested for any patient.

A case note location may be recorded on the patient record and, with bar code labels printed and kept in and on case notes, the current location can be maintained by use of light pens. This field may also be maintained manually on VDU.

Admission is accomplished similarly to registration with the usual fields. Discharge similarly; transfers are able to be recorded but not home leave.

Displays are available of patients on a ward and numbers of patients currently in each ward with the number of available beds. To obtain the last ward return, though, can involve paging through - no direct access.

Bed states, statistics, IP list etc. are printed on the central printer by request to run a background task on the central console. Fairly simple.

HAA coding of address details etc. done by special function which displays patient by patient the name/address details for coding. The HAA information is then put onto magnetic tape. The recorded details are OK for N.W. Thames RHA but not all details as required by SWRHA including no serial number.

HAA diagnosis coding is done by calling up HAA screen and completing details. Middlesex have not yet implemented IP system. Northwick Park have only just been able to pass last year's tapes to RHA so system not yet functioning smoothly.

The lab systems linking into the MPI, access patient details by patient number so that every patient must be registered.

There is no Wl or OP system yet. In outline planning stage.

Microfiche index is produced quarterly with planned weekly microfiche supplements.

No facilities exist currently to produce other listings than those already programmed. A report generator is awaited from

Plessey, which should allow simple reports to be produced relating information from any of the files used within the system. This may also be able to do simple arithmetic. The runs will need to be requested from a specialist who will initiate the computer job from the central console.

System security. Weekly dumps and log tapes for the week. Recovery using log, 1 hour. No stripback of incomplete updates. Vulnerable to loss of log and disc crash.

Southend (UCH)

The UCH system is a MUMPS based system designed to run on DEC PDP 11 mini computers. It was originally developed and implemented by NHS staff at University College Hospital, London, serving both the main hospital complex and several peripheral hospitals within a one mile radius.

A packaged version of the basic hospital inpatient system was introduced at Southend and, with some modifications and enhancements carried out by NHS staff, was implemented in March 1981. The system now runs on a PDP 11/60 at Southend General Hospital, serving also one other main hospital (Rochford) and two peripheral hospitals (Westcliff and Shoeburyness).

At the moment the Southend system only provides Inpatient Administration in any degree of comprehensiveness, but this includes Registration (with index search/duplicate check carried out on a skeleton index) and basic Waiting List management. A full MPI system is currently being developed and an Outpatient system is planned.

The terminal equipment is a mixture of Texas Instruments Hard Copy Terminals and DEC VDUs. The basic screen handling is typically menu driven, with no fixed screen formats, using scrolled prompt and response methods. To judge only from the screen used in the demonstration, the display is not very easy or pleasant to read (green on matt black).

Log on to the system is accomplished with a personal password. There is no location ID. "Time Out" is used as an additonal security measure. Passwords are maintained by the system operator.

An optional Index Search and Registration facility is built into the Inpatient System, so that these may be carried out when adding a patient to a waiting list or admitting a patient. An index record contains basic identity details (Surname, Forename(s), Title, DOB or Age, Sex, Address and Postcode) and coded contact information (up to 30 x 6ch codes, e.g. S80WKS means Southend, 1980, Consultant = WKS). A first index search is made on Surname plus optional forename(s), year of birth (+/- 4) and sex. Up to 5 matches are displayed on the screen with option to choose one of these, continue the search, or register a new

The system can be run in fully interactive mode, data collection or batch mode or any combination of these. This flexibility allows a new user to start with little capital expenditure (given an available central mainframe) to build up an index and then expand the use of the system when necessary for a fuller service. IDMS data base software is central to the design and the licence charges for use of his software, for a user only site, are under negotation with ICL.

The MPI module provides for normal registration of patients (excluding patient's telephone number) with GP details brought in from a file of GPs. Labels are printed on request. Normal index search procedures using Surname/Forenames and DOB are used to ascertain current registration. Temporary registrations may be made and a list of outstanding temporary registrations produced. The records can then subsequently be checked and either full registration done or the details merged with an existing record. The patient's number can be any string of up to 15 characters or digits with no check digit. Microfiche and supplements are produced of the index including contact information. Contacts with any point of health care can be entered and maintained independently of other modules but when other modules are used they automatically update the contacts of a patient.

The inpatient module provides a complete system for the management of inpatients including planned admission documentation, bed state and free bed information. Administrative data for HAA data collection is automatically extracted onto tape for transmission to the RHA with clinical data being encoded onto punching documents from the case notes. This is currently punched by project staff and added to tapes for transmissions. Very little SH3 type statistical accumulation is performed. The system provided a daily record of occupied/available beds by ward from which the SH3 returns are generated manually. At Stoke each ward has a terminal which is used to enter details of patients arriving and departing from the ward and make follow up appointments and enquiries.

The waiting list system is used for approximately a third of all waiting list admissions. The system provides for the recording of urgency, diagnosis, comments and special requirements for patients and a list for the consultant is printed weekly. Selections made are given a TCI date and 10 days before this date standard or special letters are produced to notify the patients. For urgent notifications, a 'telegram' list is produced. Review and cancellation letters can also be produced.

The outpatients module provides a fast, flexible method of booking appointments, clinic preparation, management and completion and clinic rescheduling. An extensive range of possibilities of clinic booking rules allows for most requirements to be simply met. All of the required documentation and patient letters are produced as an automatic by-product of each action regarding an appointment. A range of statistical

information is produced to fulfil the needs of national returns and to enable assessment of the effect of booking rules on patient waiting times. Due to the immediate nature of follow up appointment booking a considerable volume of print is produced daily for back up in case of a computer failure.

A password system is not used to guard against unauthorised access to patients details on VDUs. The way the system has been designed ensures that only those parts of a patient's record necessary to carry out a particular expected function are available at any VDU. Therefore it is necessary to inform the computer of the location and function of each VDU so that, for example, the pertinent parts of the records of patients booked to a particular clinic are only available on the terminals designated for managing that clinic whilst the clinic is running. This system is under review and a password system may be incorporated in the re-written system. Badges are used on the ward light pens to restrict access to authorised users and, since these are being replaced, a new system is being devised.

Due to the nature of the project and the hospitals it is serving and the amount of work currently processed in batch mode, it is very difficult to ascertain how the system would perform in an isolated location where skilled, experienced operations staff would not be available to provide day to day support. The presence of terminals on each ward has influenced the design of the inpatients module but it should be possible to run the system with only the minimum of terminals in, say, an admissions office.

W.H.T.S.O.(Patient Administration Systems (PAS))

The system is designed to run on hospital-based mini computers (ICL 1500 series), linked to the Region's central mainframe computer (ICL 1904). Data is entered and validated on the hospital computer, captured on to cartridge tape, and spooled on to maxi tape for later transmission to the host computer (by GPO line), where it is used for batch bulk processing. Data is received from the host computer and recorded on maxi tape.

The system was developed and implemented at the University Hospital of Wales, Cardiff (UHW) by NHS staff and has since been implemented at two further main hospitals (Cardiff Royal Infirmary and Llandough Hospital) and three peripheral hospitals (Merthyr General, Aberdare General and Mountain Ash Hospital). The peripheral hospitals use a courier service link with the mini computer installed at Prince Charles District General Hospital. Other sites in Wales have implemented the system (e.g. Bodwelyddam, Haverfordwest) and Wirral Region are currently implementing.

The software is designed to provide Master Patient Index, Registration, Recording of Events, Label and Microfiche

production, Waiting List management for both Inpatients and Outpatients, Inpatient Administration and some Outpatient Administration (see description for systems existing and under development), plus statistical analysis for SH3 returns and a range of management informaton.

The basic screen handling is single line entry, field by field, (using prompt and response) in the same position on the screen, with simple validation and cross checking. The menu has to be used to change both function and patient, and it is also sometimes necessary to load a new program when changing function. The 1501 screens are small and difficult to read (256ch, 5 x 8 matrix), but the 1503 screens are larger and easier to read (1920ch, 5 x 10 matrix).

There is no restriction of access to the system apart from the physical location of the computer terminals and the knowledge required for operation. There is no password system of security.

All non-current patients are on microfiche only, which includes past episode details (up to 99). There is no automatic checking for duplicate entries. All index searching is done from microfiche. Current patient registration can be stored on local disc and a surname only search performed on this listing, but such a search is slow and tedious. A list is printed daily of current patients showing the current status of each. Microfiche is produced fortnightly with daily supplements.

Registration is carried out by inputting identity details in prompt and response mode and supplying a 6 digit patient number with hospital code (1 character) and check digit. There is no automatic checking for duplicate entries. Previous contact information can be added to the patient's index record (up to 99 episodes). Episode summaries are not added from other modules (e.g. inpatients and outpatients).

Identification labels are produced automatically and immediately on registration, but if repeat labels are required this is done by batch processing and takes some time.

There is no case note location system as such, although the previous contact information recorded on the index record can be used for this purpose. The system is based on a District index with a single case note, but some Districts file centrally, while others file at the last contact hospital.

Outpatient Waiting Lists are produced in order of urgency and waiting time to enable the selection of patients for first appointments. Inpatient Waiting Lists are produced in order of urgency, waiting time, and sex or type of operation if required (up to 9 different categories of waiting list may be maintained).

A patient may be admitted, transferred or discharged by inputting data via the screen in the same way as for registration. In this way a hospital-based inpatients' file is maintained on disc, and

used to produce TCI letters, Identification Labels, Admission Diary (patients due for admission the next day). Ward Returns, and various other information listings relating to inpatient situations, without the need for links to the mainframe computer. Additional information is serviced by the computer centre.

On first referral a standard letter is sent to the patient asking if there are any corrections to the ID or address details. The patient is then added to the appropriate WL, which is printed automatically on the day of the clinic allowing the consultant to make selections for the next clinic. Bulk input of selected patients causes printing next day of Appt. Letters and Clinic lists with interspersed Tracer Labels (long thin labels with the central character missing) in time order only. Separate lists are produced for new and old patients.

Clinics are only booked 2 weeks ahead, which allows an easy method of rescheduling - the whole clinic is moved en bloc into the next clinic space. An automatic "cull" can be made of the WL to identify those patients who have been waiting longer than a specified period; a standard letter may then be sent asking if the appointment is still required.

A follow-up booking system is "imminent". This will involve the automatic selection of appointments from a diary held on the local computer, utilising simple booking rules (Bank Holidays stored 2 years ahead; clinic period; slots every x minutes, n patients in each slot, overbooking allowed; weekly, fortnightly or irregular clinics; up to 9 assistants' rules for each firm). Cancellation of a F.U. clinic will cause cancellation letters and a list of patients to be printed next day, allowing appointments to be rebooked and details entered on the cancellation letters.

SH3 statistics for outpatients are incorporated with those for inpatients. There is no diagnostic index but a provisional diagnosis can be put on a patient's record on the OP WL. A zoned transport list is planned.

The security and resilience of the system are low: although an input log is maintained, there is no update log and no duplicates of main files are held. There is no stripback facility for system recovery in the event of file failure and it is unlikely that a degraded system could function with failed disc drives (data entry only might be possible).

COSTS

ASSUMPTIONS

		Hospital Size		
		Small	Medium	Large
Index size		100,000	200,000	300,000
Inpatient throughput p.a.		5,000	12,000	25,000
Outpatient attendances p.a.		15,000	40,000	75,000
Backing storage (MB)	IP	6	14	30
	MPI	42	84	125
	MPI,IP,WL,OP	44	89	135
VDUs	IP	2	3	4
	MPI	3	5	6
	MPI,IP,WL,OP	5	9	13
Printers	IP	1	2	2
	MPI	1	2	2
	MPI,IP,WL,OP	2	3 + LP	4 + LP

Costs (£)

		Small			Medium			Large		
		MPI	IP only	The lot	MPI	IP only	The lot	MPI	IP only	The lot
NCR	Capital	37,000	35,700	50,500	45,700	40,400	90,000	47,000	41,700	98,600
	Revenue	6,220	6,050	8,850	7,350	6,660	13,980	7,520	6,830	15,100
DEC	Capital	40,100	29,120	45,950	61,070	32,120	73,270	82,190	43,100	101,040
	Revenue	8,960	7,640	9,660	11,480	8,000	12,940	14,010	9,320	16,270
ICL	Capital	61,100	59,650	66,380	70,720	63,480	86,610	88,710	64,930	115,740
	Revenue	7,210	7,070	7,760	7,920	7,460	9,800	9,060	7,610	11,800

Revenue costs exclude salaries and consumables.

Capital costs exclude installation, cabling, delivery charges, building costs.

NCR EQUIPMENT

	Small	Medium	Large
IP	A - 1 VDU	A + 1 printer	A + 1 VDU + 1 printer
MPI	A*	B - 1 VDU	B*
MPI,IP,WL,OP	A + 2 VDUs + 1 printer	C* - 1 VDU + 2 printers	C + 3 VDUs + 3 printers

Hardware costs (£)

IP only	32,700	37,400	38,700
MPI only	34,000	42,700	44,000
MPI,IP,OP,WL	40,000	79,500	88,100

Software

IP	£3,000	
MPI	£3,000	
MPI,IP,OP	£10,500	(WL?)

Revenue costs (£ p.a.)

Hardware maintenance (at 13% capital p.a.)

IP	4,250	4,860	5,830
MPI	4,420	5,550	5,720
MPI,IP,WL,OP	5,200	10,330	11,450

Software

IP	£1,800	(£2,900 if enquiry package included)
MPI	£1,800	(£2,900 if enquiry package included)
MPI,IP,WL,OP	£3,650	(including enquiry package)

N.B. no magnetic tape (£5,500 A
£12,000 B,C)

* Package A includes NCR 9020 with 256 kB of memory, 2 x 54 MB discs (13.5MB on each being removable), a 70 lpm matrix printer, 3 VDUs and 8 disc packs.

Package B includes NCR 9020 with 512 kB of memory, 2 x 81 MB discs (13.5 MB on each being removable), 2 x 70 lpm matrix printers, 6 VDUs and disc packs.

Package C includes NCR 9040 with 768 kB of memory, 2 x 81 MB discs a 300 lpm line printer, a 70 lpm matrix printer, 10 VDUs and disc packs.

DEC EQUIPMENT

	Small	Medium	Large
IP	D*	D	A
MPI	A*	B*	C*
MPI,IP,WL,OP	A	B	C

Hardware costs (£)

IP	29,120	32,120	43,100
MPI	40,100	61,070	82,190
MPI,IP,WL.OP	45,950	73,270	101,040

Revenue costs (£ p.a.)

Hardware maintenance (at 12%)

IP	3,490	3,850	5,170
MPI	4,810	7,330	9,860
MPI,IP,WL,OP	5,510	8,790	12,120

Software

DSM 11 : £4,150 p.a.

DEC prices can be further reduced by:-

(i) Standard 8% S.W. Region bulk purchase discount

or (ii) buying the computer equipment or some part of it from OEM suppliers. (This is not true for the other two suppliers).

N.B. Magnetic tape = £9,000

* Package A includes PDP 11/34 with 2 x 28 MB discs
Package B includes PDP 11/34 with 4 x 28 MB discs
Package C includes PDP 11/44 with 3 x 67 MB discs
Package D includes PDP 11/34 with 2 x 10 MB discs

ICL EQUIPMENT

	Small	Medium	Large
IP	A*	A	A
MPI	A	B*	C*
MPI,IP,WL,OP	A	B	D*

Hardware costs (£)

IP	59,650	63,480	64,930
MPI	61,100	70,720	88,710
MPI,IP,WL,OP	61,380	86,610	115,740

Revenue costs (£ p.a.)

Hardware maintenance

IP	3,770	4,160	4,310
MPI	3,910	4,620	5,760
MPI,IP,WL,OP	4,460	6,500	8,500

Software

TME : £3,300 p.a.

N.B. Magnetic tape = £11,000

* Configuration A consists of ME29/35 with 256 kB memory and 1 MDS 20/40 disc.
Configuration B consists of ME29/35 with 512 kB memory and 1 MDS 20/40 disc.
Configuration C consists of ME29/35 with 512 kB memory and two MDS 20/40 discs.
Configuration D consists of ME29/35 with 768 kB memory and two MDS 20/40 discs.

Notes on the

EXETER PROJECT

for meeting of RCCC on 11 June 1981.

1. History
2. Equipment
3. Staffing
4. Applications
5. Education & Training
6. Conversion
7. Future Role
8. References

J. Sparrow
6 May 1981

THE EXETER PROJECT

1. History

The Exeter Project, concerned with the full integration of patient records using computer techniques, was conceived in the late 1960's. Detailed proposals to the DHSS supported by the SWRHB in 1971 enabled buildings, equipment and staff to be obtained. Until 1976 the full cost of the project was borne entirely by DHSS R & D funds. Since 1976 the funding has been a joint affair between DHSS, SWRHA and Exeter Health Care District. This situation continues with Exeter District taking full financial responsibility for hospital operational systems, the DHSS taking full financial responsibility for primary care development and operational systems and the RHA only the remaining development resources which are to be made available to all Districts in the Region. The RHA still receives funds as a consequence of the Exeter Project. In 1976 this amounted to £295,000 p.a. and by 1980 this had risen to £427,000 p.a. It is this resource which can now be used generally throughout the Region.

2. Equipment

In 1973 an ICL 1904A main frame computer was purchased complete with a substantial terminal communications network. Since that time it has had enhancements to its core store, discs and terminal network. The present configuration consists of:-

1904A CPU with 128KW core store

- 11 EDS 60 Disc Drives
- 3 Disc Controllers
- 6 Magnetic Tape Decks
- 2 Magnetic Tape Controllers
- 1 Card Reader
- 1 Paper Tape Reader

7903 Communications Controller

- 2 Direct Connection VDU controllers
- 22 Remote VDU's
- 25 Hard Copy Printers (Termiprinters)
- 46 Local VDU's
- 8 GPO lines (Private leased lines)
- 1 GPO line (Dial up line)
- 6 Slow modems (300 baud)
- 2 GPO modems for dial up (2400 baud)
- 14 Fast modems (4800 baud)

Figure 1 shows diagramatically the configuration,
Figure 2 the layout of the computer room and
Figure 3 the location of the terminals.

The above equipment is operated 24 hours per day on a 7 day week basis. The terminal system is available to users 21 hours per day. Batch systems and development work run in parallel with the real time and during the 3 hours when the terminal system is unavailable due to security dumping and essential batch runs associated with real time files.

Since the above equipment is nearing the end of its life consideration has been given to replacing it with more modern and cheaper equipment. Agreement with the DHSS has already been reached for the purchase of three mini computers from DEC to enable the primary care activities to continue. The first machine for development has already been delivered and installed at the project. It consists of:

PDP 11/34 CPU with 256K bytes core
- 2 RK07 28M bytes disc drives
- 1 Disc Controller
- 2 Magnetic Tape Units
- 1 Magnetic Tape Control
- 6 VDU's
- 3 Hard Copy Printers
- plus a full MUMPs development licence.

The second and third machines for operational use have been delivered to the project for temporary storage. They will subsequently be installed and commissioned at Ottery St. Mary Health Centre and Mount Pleasant Health Centre later in 1981. The configurations consist of:

Ottery St. Mary

PDP 11/34 CPU with 256KB core
- 2 RK07 disc drives
- 1 Disc Controller
- 1 Mag tape drive
- 1 Mag tape controller
- 6 VDU's
- 2 Hard Copy Printers
- plus an object licence for MUMPs

Mount Pleasant

PDP 11/34 CPU with 256KB core
- 2 RK07 disc drives
- 1 Disc Controller
- 1 Mag tape drive
- 1 Mag tape controller
- 12 VDU's
- 2 Hard Copy Printers
- plus an object licence for MUMPs

The Health Centre at Exmouth will share the OSM machine and the group practice at Pinhoe the Mount Pleasant machine.

Exeter District have already decided to have the existing hospital administration systems converted for use on an ICL ME29 computer. A decision still has to be made concerning ward systems but if it is decided to continue them a second ME29 will be required.

The first ME29 already delivered to the project consists of:

ME29 CPU with 768 Mb core

2 EDS 80 Mbyte discs
2 FDS 160 Mbyte discs
1 Disc Controller
2 Magnetic tapes
1 Magnetic tape controller
1 Line Printer
1 7502 Communications Controller
4 VDU's
3 Hard Copy Printers
2 VDU Workstations

Later this year it will be transferred to a site in Wonford Hospital and enhanced by further communications equipment as follows:

5 7502 Communications Contollers
24 VDU's
12 Hard Copy Printers
2 Leased GPO lines
4 Fast Modems

This hospital administration system will then provide a service at:

R D & E Hospital (Wonford)
R D & E Hospital (Heavitree)
Princess Elizabeth Orthopaedic Hospital
West of England Eye Infirmary
and five smaller acute hospitals in the District.

If a decision is made to obtain the second ME29 for ward systems then the following additional equipment will be necessary:

ME29 CPU with 768 Mb core

2 EDS 80 Mb disc drives
1 FDS 160 Mb disc drive
1 Disc Controller
3 7502 Communications Controllers
18 VDU's
8 Hard Copy Printers

The magnetic tapes and line printer on the first machine will be shared.

3. Staffing

The total staff complement at Exeter is currently 48½ WTE. This comprises

1	Director
1	Chief Systems Analyst
1	Chief Programmer
1	Operations Manager
½	Administrator
5	Senior Analysts
5	Analysts
4	Senior Programmers
9	Programmers
5	Shift Leaders
5	Senior Operators
5	Operators
4½	Clerical and Secretarial Staff
1	Driver
½	Punch Operator

Figure 4 shows a staff structure chart and the current team assignment.

4. Applications

Although the systems in operation at present on the ICL 1904A are fully integrated it is convenient to break them down into specific application areas to describe the activities carried out by the system.

A. Primary Care

This is a total system for primary care record keeping which can and is used to eliminate all manual record keeping by General Practitioners.

a. Real Time Terminal Transactions

Home Keys - A selection of all facilities presented on request to user (Menu).

Display Registration - Basic screen for patient identity use for initial creation and amendment.

Display Summary - Main screen for clinical summary containing separate sections of variable size and presence for

i. priority medical details
ii. medical history
iii. current problems.

Display Extension - Less important clinical data with separate sections for

i. Vaccination and immunisation
ii. Family History
iii. Obstetric History
iv. Social History
v. Attendance summary

Display Medication - Complete list of medication over life of patient.

i. Summary
ii. Repeat medication used for complete record and for initiating repeat prescriptions.

Document Archives - Record of long episodes by GP, or hospital correspondence.

Control Hypertension - Graphical control for hypertension with built in check list of questions to patient and the patient's answers.

Anti-coagulation - As above for the control of anti-coagulants.

Display Consultant - Clinical data input by hospital doctors immediately available to GP.

Surname Index	- Complete list of all patients registered with the system in alphabetic order for identification of record when only surname is known.
Reassessments due	- List of all patients marked by GP for some form of reassessment. Held in date order.
Referral signals	- List of all patients referred by GP to himself or another person for follow up treatment. Enables individual record to be accessed by other than GP but under GP control.
Leaving list	- List of all patients leaving practice. Automatically initiates a print of patient record for the next doctor.
Log Report	- List of accesses to the system by user of this password for the last 20 occasions.
Hospital Summary	- List of all outstanding inpatient and outpatient appointments for this patient and a summary of previous episodes. /Entries created by hospital/.
Image Print	- Allows the printing of any individual screen on a local printer.
Complete Print	- Allows a print of all medical data on local printer.
Leaving Print	- Allows print of entire record for onward transmission to next GP.
Printer Keys	- Allows inspection of the print queues, in some cases amendment to them, for all types of requested printing.
Abbreviations Table	- Alphabetic list of all abbreviations used in the system.
Drug Table	- Code for the regularly used drugs to enable repeat prescribing to be effected more easily.
Locality Table	- Alphabetic code for entering address and used in batch searches.
Register Addendum	- List of all patients registered in alphabetic order since last microfiche of index produced.
Typewriter	- Blank screen facility for creating text to output on local printer.

Previous Episode - Means of storing old clinical data in an immediately retrievable fashion.

b. Batch Systems

Monthly Statistics

Quarterly Statistics

Archiving changed or out of date data

Retrieval of archived data for research

Microfiche production
i. Index
ii. Clinic Summary
iii. Archive Data
iv. Deceased patient data.

Household Grouping - List of patients all at the same address.

Removal of dead patients

Ad hoc enquiries on administrative and clinical data

Create and amend health centre files.

B. Hospital Administration

The hospital administration system is designed to be used throughout the MRD of the hospital eliminating the need in most cases to write or type information relating to patients attendance at hospital. It covers all the major activities of the MRD concerned with master patient index, inpatients and outpatients.

a. Real Time Transactions

Identification Details - Create or amend patients records. Ability to link to three possible patient numbers.

Patient Summary - Record of all current inpatient and outpatient activity.

All Attendances - Fuller list of previous episodes of care.

Extension Details
- i. Further information concerning inpatient activity and outpatient appointments.
- ii. Used to generate sticky labels for use in case notes, on appointment cards and ad hoc.

Printing - Ability to monitor the printing done and outstanding for individual local printers.

Query Index - Full community index held in alphabetic order. Ability to page through 38 patients at a time or singly for more detailed information.

Admission	- All details necessary when patient admitted to hospital.
Transfer	- All details required when patients transferred between wards or between hospitals.
Discharge	- i. All details required when patient discharged ii. Automatic production of discharge notification on sticky labels for despatch to GP.
Associated Consultant	- List of all consultants involved in a single patient episode.
Addition to Waiting List	- Used to add patient to a wating list.
Waiting List Update	- Used to check and add or modify details of a patient already on a Waiting List.
Waiting List Page	- View of page of patients on a particular waiting list.
Guardian and Postal Address	- Additional information required when patient is to be admitted.
Diagnostic Index	- Covers inpatients and outpatients.

b. Batch Systems

HAA prints

SH3 statistics

Surname Index production

Monthly statistics for individual consultants

Inpatient lists

Archiving of old data

Microfiche Production
- i. Community Index
- ii. Dead Patients
- iii. Old v New numbers

Unallocated hospital numbers check

Duplication of records check

Ad hoc analysis runs

Clinic Lists

Clinic Diaries

Waiting list prints by category

Print of Diagnostic Index

Analysis of Diagnostic Index

Tracer Card Labels

C. Ward Systems

The major reason for installing terminals on the wards was for nursing systems but other uses can and are made of them. For nurses the old nursing orders record for patients has been completely replaced by the computer system whilst nursing reports have been partially replaced.

a. Real Time Transactions

Nursing Orders - i. Create and amend all orders for patients.
ii. Initial selection by patient care profiles or individual orders.

Nursing Reports - Signature (via user password) to indicate order has been carried out at appropriate time.

Position in Ward - Movement of patient from one bed position to another.

Admission to Ward - i. Linked to hospital administration hospital admissions.
ii. Direct ward admission for emergencies.

Ward Transfer - Movement of patient between wards.

Ward Discharge - Discharge of patient to another hospital or home.

Ward Home - List of all patients on ward in appropriate bed position.

Patient Home - List of all orders/reports for individual patients.

Area Home - One of many pages containing phrases from which nursing orders are compiled.

Printing - Output on local printer in ward for

i. Current orders for today
ii. Orders applicable after midnight
iii. Care plan
iv. Deleted orders
v. List of patients on ward
vi. All orders
vii. Future orders

Urgent Path. Lab. Results - Results of tests by ward

Unexpected Path. Lab. Results - Results of tests by ward

Consultant Data - Clinical Data for patients by specialty

Nurse Personnel System - Use of GP screens for nursing personnel records.

b. Batch Systems

Back up printing

Bedstate - derived direct from ward admission, transfer and discharge.

Nursing Workload - based on orders issued for individual patients.

Creation of Care Profiles

Creation of Area Homes

Changes to Phraseology

Archiving of nursing orders and reports

Retrieval and analysis of archived data

Analysis of Clinical data by specialty

Analysis of nurse personnel records

D. Enquiry Systems

General information is available to all VDU users.

a. Real Time enquiries

Name and address of all GP's in Devon

Local Activities

Drug Information - Full details on 600 drugs accessed by both pharmacological and trade names.

How to use a VDU terminal

How to use a termiprinter hard copy terminal

System availability

SH3 statistics for previous year

Nursing Procedures - Up to date record of 120 procedures carried out by nurses.

b. Batch Systems

Printout of GP List

Microfiche of Drug Information

Paper print of Drug Information

Sticky labels - i. GP name and address
ii. General

Print out of Nursing Procedures

Microfiche of Nursing Procedures

E. Other Systems

a. Real Time Transactions

Histology Results
Cytology Results
Nurse Allocation
Anti-body Research

b. Batch Systems

Microfiche of Histology results
Microfiche of Cytology results
Microfiche of Anti-body research
Hip displacement Analysis
General Literature Research Register
Nurse Change Lists
List of trainee nurses in different specialities
Ward assignment of trainees
Special Care Baby Unit - monitoring of results.

F. General Support

All the systems described above are available every day of the year on a 21 hours (real time) or 24 hours (batch) a day basis. In order to support this level of complexity and to ensure maximum availability of the system to users an operational and support organisation is required.

Operations staff man the computer suite at all times on a regular shift rota basis. Under normal circumstances they can cope with day to day problems and restart the application should troubles occur.

Because of the sensitive and critical nature of much of the data it is essential to ensure that there are adequate security and confidentiality facilities. Planning and organising this type of activity, along with general maintenance of the systems programs and incorporating new developments etc falls to the support team. This team and members of the other applications teams have to be available at any time to effect repairs should the need arise. These times are of course minimised by thorough testing during the development stages. In a real time transaction environment with many simultaneous users employing many different transactions it is impossible to test all possible combinations prior to systems going live.

5. Education and Training

Due to the nature of the Exeter Project, a large and innovative venture into the uses of computers in patient care, a considerable effort has been devoted to the education and training of potential users both within the Region and outside.

Many visitors have come to the project for demonstrations of live operational systems. Many lectures and demonstrations have been given off site to NHS organisations who have requested them. This has been aided enormously by the ability to take a VDU terminal around the country and, with the aid of a GPO modem and a standard GPO telephone jack-plug, connect the terminal directly to the Exeter computer. A full range of demonstration facilities exist and can be used to show how all the systems at Exeter operate without the need to use any real patient data.

As a result of these lectures and demonstrations a very large number of NHS personnel have been acquainted with the possibilities that are available to them in the use of computers. Within the Region all the medical record departments have had the opportunity of seeing the system and partially as a result are now keen to have facilities of their own. Doctors and nurses who have also seen the benefits that can accrue to them will be in a position to actively support and recommend to their own authorities ways to proceed in the future.

A continuing role of this nature will be essential if the major benefits obtainable from computerisation in patient care are to be realised over the next few decades.

6. Conversion

A. General

The systems at Exeter have been running operationally progressively since 1974. During this time most of the original objectives of integration and individual departmental systems have been realised (see Fig. 5). Extension of the full system to the whole of the Exeter District incorporating both primary and hospital activities has been considered. Whilst this approach is in the best interest of the patients, funding does not permit its implementation at this stage. Unfortunately the lack of understanding both in the DHSS and NHS of the full benefits of full integration has limited the funds available for such extensive computerisation.

The conversion programme has thus had to take account of the current financial position and the continued lack of integration of services within the NHS despite reorganisation.

Primary care activities are still under the direction and financial control of the DHSS whilst hospital care activities are under the control of SWRHA.

The programs written for the ICL1904A had at the time of initiating them to be written in low level language only available to ICL equipment users. An extensive investment in such programs has been made by the project fully supported by DHSS, SWRHA and Exeter District. The ideal situation would thus have been to preserve the systems design which has been tested over a long period but to rewrite the programs in a modern high level language suitable for real time transaction processing.

B. Primary Care

The decision to rewrite has been made in the case of primary care computing where the original systems are being rewritten in the language called MUMPs. The decision is the result of a growing awareness amongst GPs generally that computer assistance is necessary and the full commitments and support not only of the existing users but a growing number of other local GP's who wish for a similar service. MUMPs is a high level language originally developed in the USA at Massachusetts General Hospital specifically for use in the medical sphere. It is becoming widely accepted in the UK and already is taking a considerable hold on health care computing in the NHS.

In a programme agreed in 1978 with the DHSS the primary care activities are to be taken off the mainframe ICL 1904A computer and transferred to three mini DEC PDP 11/34 computers. This work will be completed by the end of this financial year with a full year of evaluation to follow. The mini computers are to be located in primary care premises and are to be operated entirely by primary care staff.

Maintenance, wider implementation and further development of the systems are likely to fall to the Exeter Project and continue to be funded via DHSS sources. These tasks may thus provide one of the few remaining Nationally coordinated computer activities.

A development machine has already been put into active use at the project and the two operational machines have been delivered to the project and will be installed and commissioned at the health centres in the last quarter of this year.

MUMPS is proving a very suitable language for rapid development with the advantages that changes can be made easily in the light of operational knowledge or changes requested by the users.

C. Hospital Administration

Estimates were made for a similar rewrite of the hospital administration programs. The prime consideration however was felt to be to preserve the existing operational systems in Exeter District and to transfer these activities using minimal staff resource.

The programs are thus to be transferred using the low level language selected in 1970. This meant that the choice of equipment was limited to that from ICL. The larger 2900 systems were felt to be too large and expensive for hospital administration alone. Sharing the Bristol machine was not viable for the local transaction system required especially since the programs were not to be rewritten. The smaller 2900 systems were inadequate for the task so the final choice was limited to the new ICL ME29 computer.

A joint decision between RHA, AHA and Exeter HCD was then taken to replace that part of the ICL 1904A computer and associated terminal network used for hospital administration with an ICL ME29 with a new communication network. The central part of this machine has been delivered to the project and programs are in the

process/

process of transfer. To assist with this task and again to minimise the staff resource necessary some additional transaction processing software from Telecomputing (TPS) has been acquired.

Once the programs have been validated on the new equipment the computer will be moved to Wonford Hospital. Here it will be reinstalled and commissioned, the network enhanced and operational systems transferred from the 1904A. By the end of 1981 it is expected that hospital administrative systems will be operational on the ME29 and under the control of the District who will be financially responsible for all operational costs.

In the mean time and in parallel with the transfer investigations of other possible patient administrative systems is to be made so that advice and guidance can be provided to those Districts who wish to proceed in this area. Hopefully a system, or systems, can be installed in all Districts of the Region which can be implemented, maintained and developed using the Regional Computer Staff resources at Exeter.

D. Ward Systems

Although ward systems have been part of the overall Exeter Project from the outset the development has been slower and they have not been used operationally in the whole hospital for much over a year. Several wards have been experimenting successfully for several years but the full impact on the hospital has only been realised since mid 1980.

For this reason the RHA, AHA and Exeter District decided to run the systems for a further year on the ICL 1904A before making a final decision on machine replacement. In the likelihood that a similar decision to that of hospital administration will be made later this year plans to install a second ICL ME29 have been made. This machine would share the magnetic tapes and line printer facilities of the first but would have its own disc storage and terminal network. The machines will be linked so that activities initiated on one machine can be run on the other.

The same situation pertains to transfer of programs. They will not be rewritten but transferred with the minimum of staff resource necessary.

Ward systems, although potentially very beneficial, are still very much in their infancy in the NHS generally. For this reason there is considerable interest in the Exeter work not only from within the Region but from other Regions and from the DHSS.

Terminals on the wards not only provide a means for nurses to create, update and maintain accurate and up to date records on their patients but provide doctors, administrative and technical staff with material to enable them to perform more efficiently and effectively.

Since the problems of transfer are similar to those for hospital administration many of the problems and difficulties will have been overcome before transfer of ward systems need start at the end of this year.

7. Future Role

The ultimate role for the Exeter Project is to be finalised later this year in discussion concerning the merging of the computer departments in Bristol and Exeter.

Increasing demand for computer systems within the Region at all levels indicates a strong need for a central service for the maintenance of existing systems, design and implementation of new systems and general advice on computing. This by no means implies continued reliance only on a central regional computer since patient care computing is essentially a District based activity.

The valuable expertise gained by Exeter in the areas of patient care computing is thus to be used not only to provide continuing service in the Exeter District but also to provide assistance with other activities as and when they are defined by Districts.

Already the RCCC has decided that patient care computing should be high on the priority list for future developments and a sponsor group has been set up. The first task being undertaken by Exeter Staff on a Regional basis is an investigation and comparative study of computer operational systems in patient administration which might prove suitable for wider implementation in the Region. As well as advice on the suitability of systems to meet user requirements assistance will be given in defining and writing operational requirements, assessing and evaluating tenders, implementing and maintaining operational systems. In this way the experience gained in each District in the Region can be channelled and used to make the best use of limited computer resources within the Region.

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COMPUTER CONFIGURATION

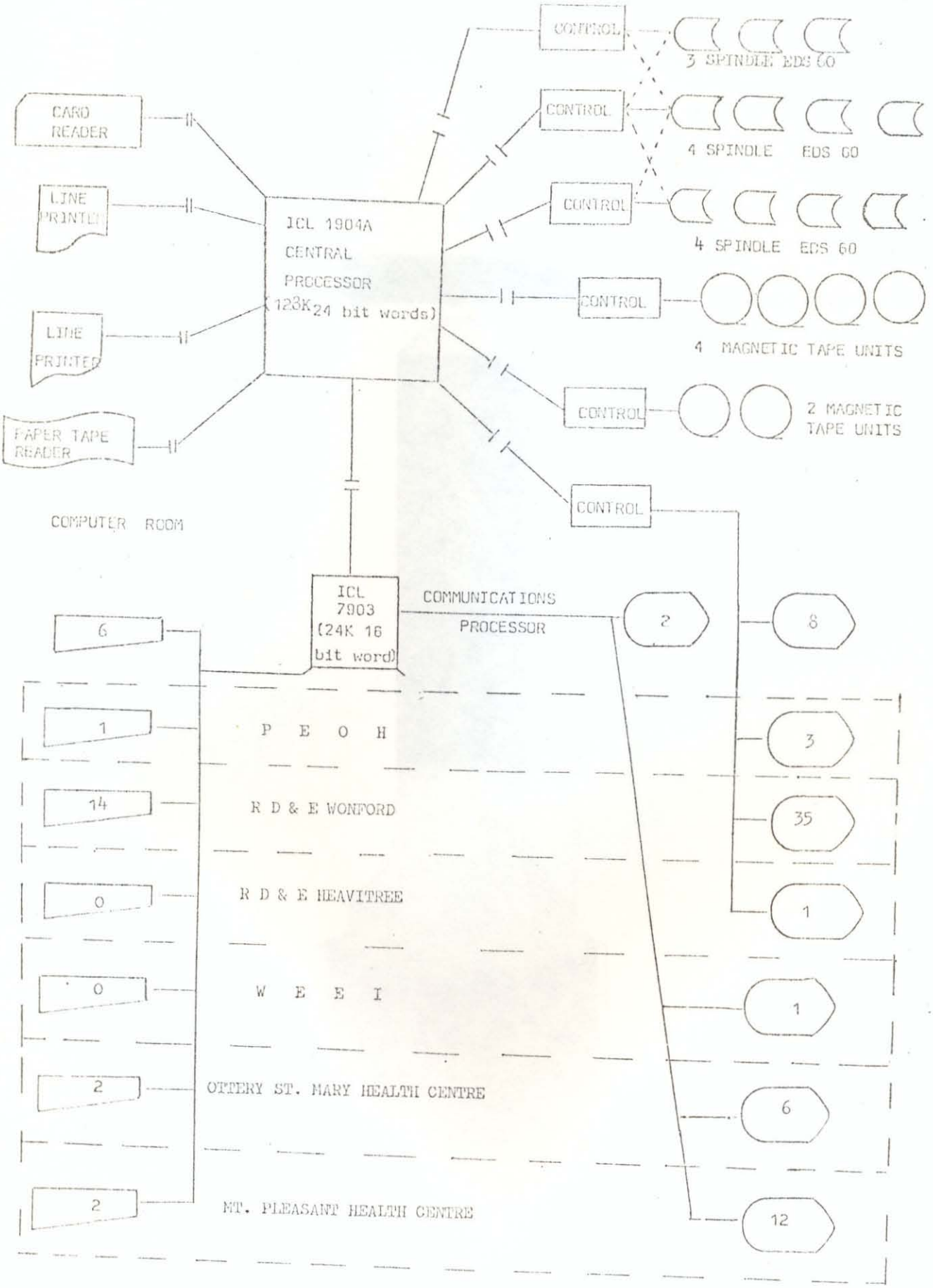
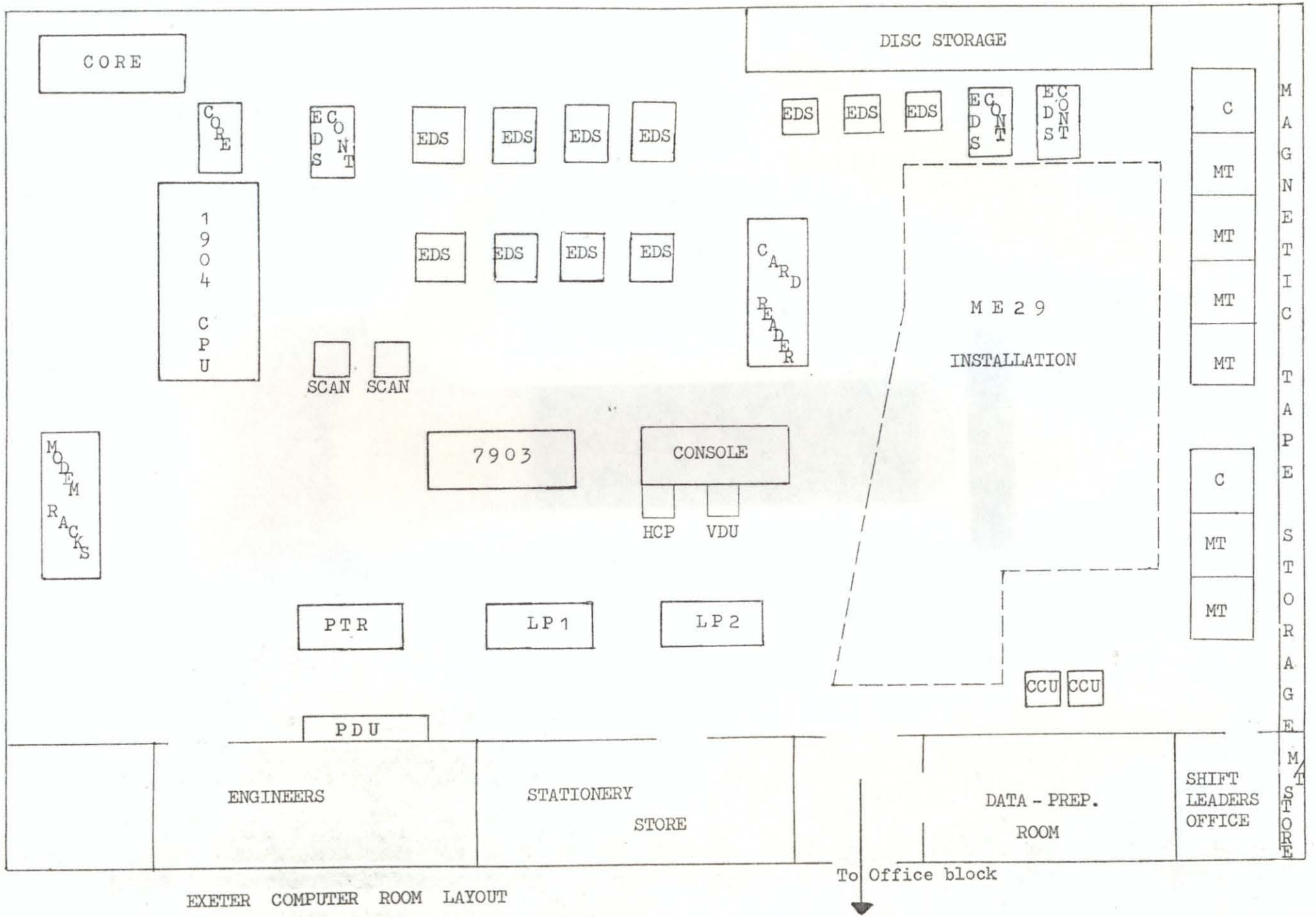


FIGURE 1



EXETER COMPUTER ROOM LAYOUT

Figure 2

LOCATION OF TERMINALS ON 1904A

	VDU's	TERMIPRINTERS
ROYAL DEVON & EXETER HOSPITAL, WONFORD		
	Locals	
Conversion Office	2	1
Medical Records Department	2	1
Outpatient Reception	3	1
Outpatient Appointments	2	
Inpatient Admission	1	1
Fracture	1	1
HAA	1	
Wards	15	8
Pathology Laboratory	3	
Intensive Therapy Unit	1	
Radiotherapy	1	
Pharmacy	1	
Nursing School	1	
Accident & Emergency	1	1
PRINCESS ELIZABETH ORTHOPAEDIC HOSPITAL		
	Locals	
Medical Records Department	2	1
Reception	1	
WEST OF ENGLAND EYE INFIRMARY		
	Remotes	
Medical Records	1	
ROYAL DEVON & EXETER HOSPITAL, HEAVITREE		
	Remotes	
Medical Records	1	
OTTERY ST. MARY HEALTH CENTRE		
	Remotes	
Consulting Rooms (G.P.)	2	
Reception	2	1
Other Health Care Team	1	
General Office	1	1
MOUNT PLEASANT HEALTH CENTRE		
	Remotes	
Consulting Rooms (G.P.)	7	
Trainee GP	1	
Reception	2	1
Other Health Care Team	1	1
Practice Nurses	1	
COMPUTER CENTRE		
Console		1
Data Preparation/Developement Room (Spares)	2 Local 1 Remote	2
Seminar Room (Spares)	2	2
Demonstration Room (Spares)	2	1
Monitor Consoles	2	
	68	25

Fig. 3

EXETER COMMUNITY HEALTH SERVICES COMPUTER PROJECT

STAFF ASSIGNMENT AS AT 1 MAY 1981

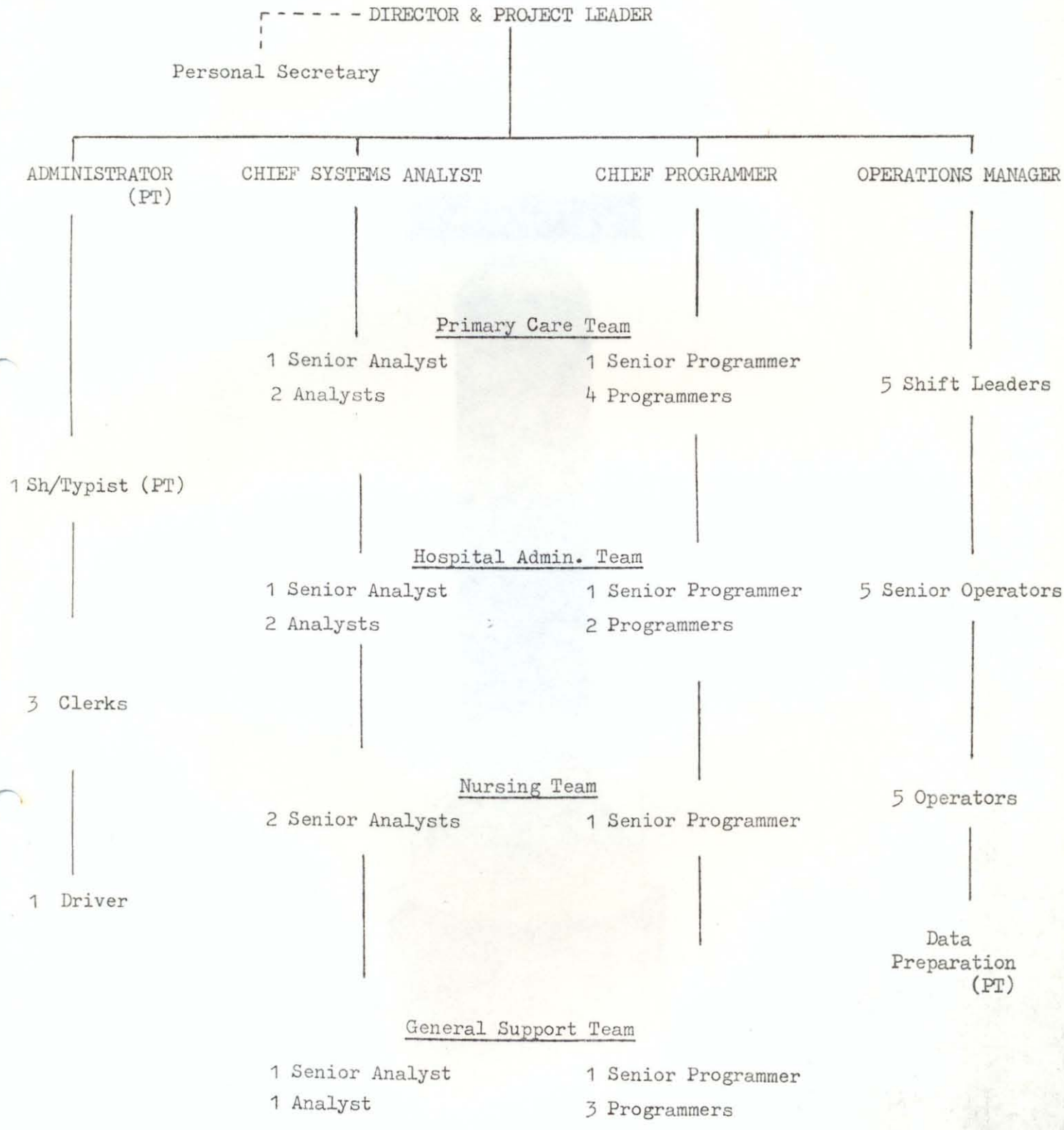


Figure 4

REAL TIME SYSTEMS INVOLVING

THE INTEGRATED PATIENT RECORD

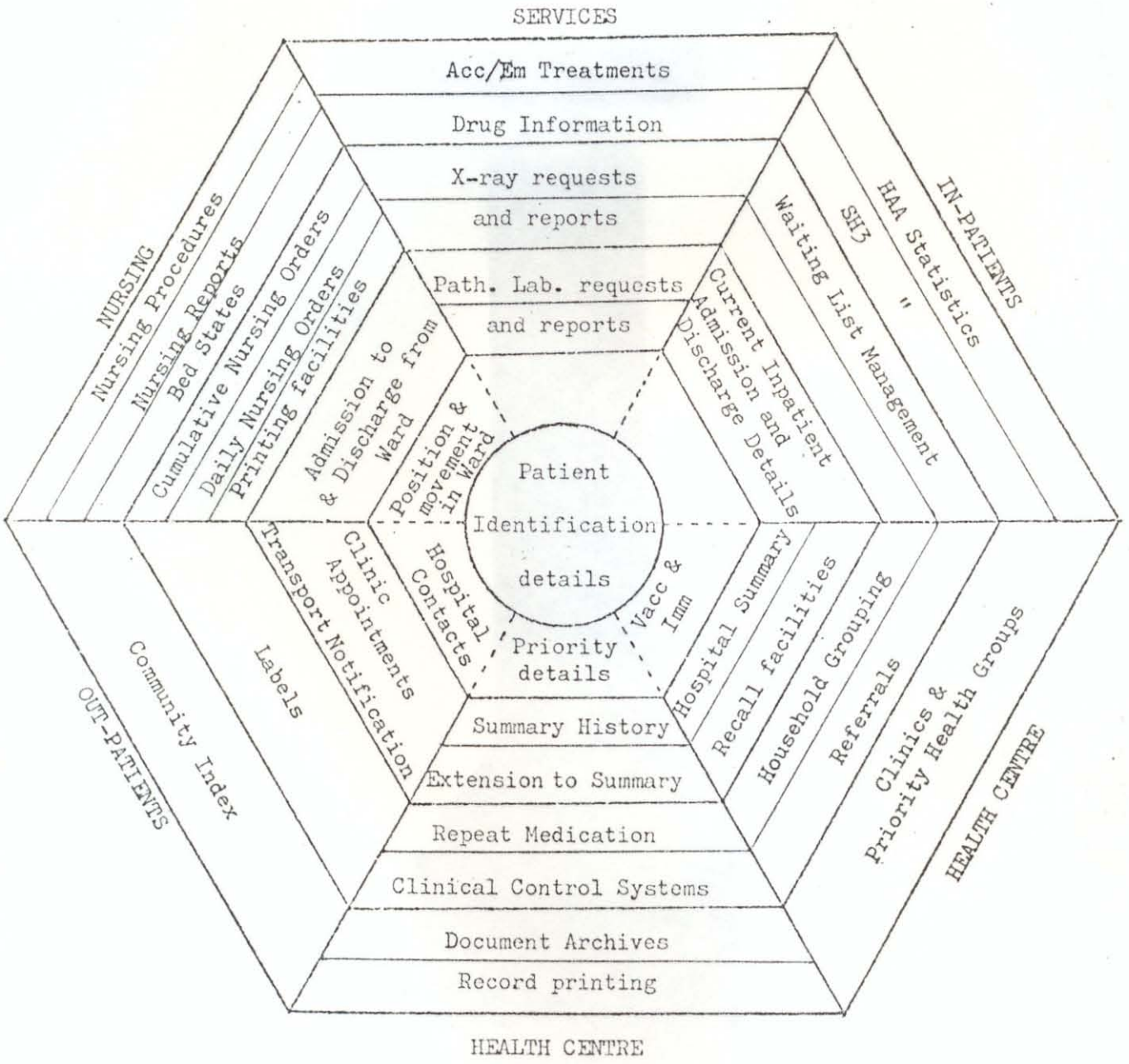


Fig 5

SYSTEMS CONSIDERED	EQUIPMENT USED
ADDENBROOKE'S (CAMBRIDGE)	CTL
BARNET	ICL
BRITISH MEDICAL DATA SYSTEMS (B.M.D.S.)	DEC
C.M.C. (INVERCLYDE)	CMC
DONCASTER (TRENT)	DEC
EXETER	ICL
I.B.M. PATIENT CARE SYSTEMS (PCS)	IBM
N.C.R. CHART (TUNBRIDGE WELLS)	NCR
OXFORD	DEC
PLESSEY (MIDDLESEX/NORTHWICK PARK)	PERKIN-ELMER
SOUTHEND (UCH)	DEC
STOKE	ICL
W.H.T.S.O. PATIENT ADMINISTRATION SYSTEMS (PAS)	ICL

PERSONNEL

Investigating Team from Exeter Community Health Services Computer Project

RHF	Mr. R.H. Fisher	Chief Systems Analyst
GRG	Mr. G.R. Greenslade	Senior Systems Analyst
ZK	Dr. Z. Kumpel	Senior Systems Analyst
HDE	Mr. H.D. Eades	Systems Analyst
JAR	Mr. J.A. Rafferty	Systems Analyst

Help from Exeter Community Health Services Computer Project

DJC	Mr. D.J. Clarke
JS	Mr. J. Sparrow

Help from Exeter Health Care District

MS	Mrs. M. Stringer	District Medical Records Officer

Help from South Western Regional Health Authority Computer Department

PT	Mr. P. Talbot	Regional Systems Development Officer

Help from Cornwall & Isles of Scilly Area Health Authority

NC	Mr. N. Campion	Area Medical Records Officer

VISITS

HOSPITAL/COMPANY	DATE(S)	ATTENDEES
University Hospital of Wales, Cardiff, S. Glam	6 May 1981	RHF,GRG,JAR
Barnet General Hospital, Barnet, Herts.	14 May 1981	RHF,HDE
Southend Hospital, Westcliff, Essex.	27 May 1981	RHF,ZK,JAR
Middlesex Hospital, London W1	1 June 1981	RHF,GRG,HDE
Northwick Park Hospital, Harrow, Middlesex.	2 June 1981	RHF,GRG,HDE
North Staffordshire Royal	10/11 June 1981	PT,GRG,ZK

Infirmary, Stoke-on-Trent.		
Addenbrooke's Hospital, Cambridge.	18 June 1981	RHF
Doncaster Royal Infirmary, Doncaster, Yorks.	25 June 1981	RHF,GRG
British Medical Data Systems, Walton-on-Thames.	6 July 1981	RHF,DJC
NCR Limited London NW1	7 July 1981	RHF,MS,GRG, HDE,NC
Pembury Hospital, Tunbridge Wells, Kent.	8 July 1981	RHF,MS,GRG, HDE,NC
NCR Limited London NW1	20 July 1981	GRG,HDE,ZK

DOCUMENTATION/LITERATURE AVAILABLE

N.B A completed questionnaire is held at Exeter for each of the sources listed below with the exception of IBM

Addenbrooke's (Cambridge)

The selection of a mini computer for Patient Administration Systems

Master Index and Radiology -Outline System Description

An overview of the computer system for management of hospital outpatient appointments

Barnet

B.M.D.S.

General Introduction to Systems Available.

The Economic Analysis and Justification of Computer Systems for NHS Hospitals.

Proposal to Plymouth Health District for a Computerised Master Patient Index by British Medical Data Systems Ltd.

Patient Administration, Pathology and Pharmacy.

Reply to Comprehensive PAS Questions proposed by E.C.H.S.C.P.

Doncaster (Trent) (Can be demonstrated at Exeter)

Doncaster Inpatient System User Manual.

IBM

Outline System description (Glossy)

Technical description of PCS as a programming language.

NCR (Chart)

Outline Systems Brochure

Introduction/OMI

Detailed Systems Description

X-Ray Management

Costs/Benefits for a District General Hospital

System Proposal

NCR 8400 Series General Description

Detailed Specification of Equipment

Software Costs

Operational Software

I-9000 Seriess

I-9000 Series Screen Processor

1979 Annual Report

"CRITERION" Virtual Storage Software

NCR 8230/50 System Technical Summary

NCR Multiprocessing Systems

NCR Tran-Pro

NCR 2950 Nursing Station Terminal

NCR 8270

Plessey

Brief Introduction to Applications plus Information on Plessey's Relationship to Health Computers.

The Middlesex Hospital User Handbook Issue 1 (March 1980).

Southend (UCH) (Can be demonstrated at Exeter)

User Manual.

Stoke

A Description of the Computer System at the North Staffordshire Hospital Centre (Stoke) (June 1980).

Basic Health Care Register - System Overview (Jan. 1981).

The Evaluation of the Experimental Computer Project at the North Staffordsire Hospital Centre as measured by the use of Performance Criteria.

Outline Specification for Master Population Index.

W.H.T.S.O.

Report on a Survey of Computing Facilities Required for the Health Services of Wales in the 1980's (May 1978).

PAS User Manual and Detailed System Description.

Description of 1900 Program Suite.

PAS Operatonal Requirements.

PAS Outline Systems Description.

HA SYSTEMS CHECK LIST

1. SYSTEM DESCRIPTION.

1.1 Producer.

Name of system.
Writer.
When was system started?
When did it first go into production?
Is system complete
What developments are underway currently?
What developments are planned?
Who is doing developments?
Who to contact with enquiries.
Notes.

1.2 Demonstration.

Where was system demonstrated?
User site?
Demonstrators name/title.
Quality of demo.
What sales literature was given?
What back up material was supplied.
What is available?
Who can it be obtained from?
Who can be contacted for further information?
Notes.

1.3 System Marketer.

Name.
Address.
Notes.

1.4 System Software Supplier.

Name and address if different from system marketer.

1.5 Other User Sites.

What other sites have implemented system?
When
What is their reaction to it.

1.6 System Documentation.

Quality of documentation seen.
What is available.
Is there a charge for it?

1.7 Training.

What training can be provided to users?
By whom?
Cost.

1.8 Implementation.

How is system implemented?
By whom?
Cost.

1.9 Take On.

How is existing index taken on?
By whom?
Where?
Are extra facilities available for take on?
Cost.

1.10 Contractual Undertakings.

Will prime supplier be solely responsible for system?
Is there more than one software supplier involved?
Details.
Notes.

2. TECHNICAL DETAILS OF SYSTEM.

2.1 Demonstration Equipment.

Computer.
Size of index.
Number of vdus.
Responses.
How long to register a patient.

2.2 Cost Of Equipment and software.

Machine.
Discs.
Tape.
Line printer.
Terminal vdus.
Terminal printers.
Software.
Estimated cost of mpi/admission/op system for 300,000 patients(10 vdu).

2.3 Computer Equipment.

Supplier.
Computer make.
- Model.
- Range.
- Core.
- Expandable.

Disc type.
- Number.
- Unit capacity.
- Total capacity.
- Maximum capacity.

Magnetic tape drive?
Industry compatible 9 track?

2.4 Terminal Equipment.

Vdu make.
- Type.
- Full screen send?
- Maximum distance from computer locally.
- Are they good quality?

Printer type.
- Speed.
- Upper and lower case.
- Quality of print.
- Quiet.

2.5 Operating System.

What OS is used.
Who maintains it.
What data base software is used.

2.6 Environmental requirements.

'normal office' environment?
How much room required?
What special requirements?

2.7 Maintenance.

What regular preventive maint.
When?
What call out procedure for failures?
How long before engineer arrives?
What escalation procedure?

3. TECHNICAL DETAILS OF APPLICATION SOFTWARE.

3.1 Application Software.

Language.
Modular.
Amendable on site?
Easy to amend?
Who provides diagnostic aid?
Under what circumstances?
Who is responsible for error correction?
Are error corrections made by new release or on site amend?
By whom?
Is it possible for local changes to be incorporated?
Are enhancements going to be available?
Who from?
When and what?

3.2 File Structures.

Description.

3.3 Security.

Are main files maintained in duplicate?
Is an update log maintained?
Is an input log maintained.

3.4 Resilience.

Is system capable of recovery from file failure by stripback?
Can a degraded system function with failed disc drives.

3.5 Operational running time.

Can system be run 24 hours a day?
What is total down time necessary?
What batch work is necessary in support of r/t?

3.6 System Back Up.

What back up system is available in case of machine failure?

3.7 Operating requirements.

Are any specially trained operators required?
Can system be run by hospital staff?
Is it being operated by hospital staff?

3.8 System Expansion.

Is there any limit on file sizes.
Can new files be added.
Can data items be added to existing files?
Can screen layouts be amended?
Can new screens be added?

3.9 System Management Information.

Message rates by terminal/password?
Message contents by time?
Other.

3.10 Multiple Updates.

What protection is there against two people updating the same record simultaneously?

4. GENERAL SYSTEM PHILOSOPHY.

4.1 Brief System Description.

4.2 Type of System.

Fully interactive?
Interactive and batch?
All batch?

4.3 Security of Access.

Passwords?
Personal passwords?
Identification badges?
Terminal restriction?
How are new passwords allocated/set up?

4.4 System Coverage.

Multiple hospitals?
Multiple main indexes?
May patient be accessed by more than 1 case note number?

4.5 Function Access.

Is it necessary to use menu to change function?
Is it necessary to use menu to change patient?
Is input line by line?
Is input full screen?
Is a single screen sufficient for most functions?
Is a blank screen displayed before data can be displayed?
Brief description of conversation mode.

4.6 Printing.

Is all print requested locally by user?
Is all print available at local printers?
How is print requested and where?
Is print also available on a line printer?
Can print files be amended?
Can print files be interrogated/edited?
Description of print system.

5. MASTER PATIENT INDEX.

5.1 Module Description.

5.2 Module History.

5.3 Case Note Numbers.

Which formats of numbers are used?
Are these normal casenote numbers or special computer numbers?
Are numbers computer allocated?
Sequential numbers?
With check digit?
How many case note numbers may a patient be known by?

5.4 Contents Of Index/Summary Information.

Surname/forenames/dob.
Previous names.
Alias.
Patient numbers.
Sex/title/marital status.
Postal address.
Postcode.
Alternative address.
Locality code.
Tel No.
Occupation.
Gp name/address.
Gp number.
Are gp details called in from file?
By fpc code or local number?
Date of registration.
Nhs number.

5.5 Keys to Patient record.

Patient number.
Surname/forenames.
Date of birth.
Sex.
Soundex.
Previous name.
Alias.
X-ray number.
Diagnosis.
Other.

5.6 Index displays and Search Technique.

Description.

5.7 Maintenance Of Indexes.

Are all indexes kept in step with data files?
Details of any batch index updates.

5.8 Vetting.

Is all registration input validated?

5.9 Identification Labels.

Stub labels.
Full id labels.
Patient address labels.
Gp address labels.
Notes.

5.10 Episode details.

Can episode details be added without other modules e.g. inpatients?
Any maximum on record.

What is recorded.
Can free text be input?
Are episode summaries added from other modules?

5.11 Temporary Numbers.

Description of emergency admission registration procedures.

5.12 Duplicate Checking.

Are duplicate entries detected on registration?
Can duplicates be searched for after registration.

5.13 Case Note Weeding.

Is date of last update retained?
Can lists of selected patients be produced in filing sequence?
Can record be marked for microfiching of casenotes.
Can a library location be indicated.

5.14 Computer Record Weeding.

Can parameters be specified to cause removal of selected patients computer records?
And data?
By vdu.
How is removal done.
Is data retained for investigations.

5.15 Microfiche.

Can microfiche be obtained.
Master index.
Is it produced regularly.
Does it include episode details.
Other?

5.16 Archiving Of Data.

Is deleted data archived.
Is any data removed without being archived and/or microfiched?

5.17 Tracer system.

Is there a tracer system.
Description.

5.18 Links with FPC.

6. OUTPATIENTS.

6.1 Module Description.

How many VDU's are used?.

6.2 Module History.

6.3 Appointment Bookings.

6.4 Displays.

6.5 Vettings.

6.6 Bookings Rules.

6.7 Clinic Diaries.

6.8 Clinic Lists and Pullings Lists.

6.9 Standard Letters to Patients.

6.10 Transport Lists.

6.11 Clinic Cancellation/Rescheduling.

6.12 Outpatient Waiting Lists.

6.13 Statistics.

6.14 Diagnostic Index.

Displays?
Printing.

7. INPATIENTS.

7.1 Module Description.

How many VDU's are used?

7.2 Module History.

7.3 Displays.

7.4 Vetting.

7.5 Planned Admissions.

7.6 Emergency Admissions.

7.7 Transfers And Discharges.

7.8 Bed Bureau.

7.9 Bed States.

7.10 Ward Census, Porters List etc.

7.11 Discharge Ledger.

7.12 HAA.

7.13 SH3 Statistics.

7.14 Consultant Statistics.

7.15 Ad Hoc Statistics.

7.16 Discharge Notification.

7.17 Discharge Summaries.

7.18 Diagnostic Index.

7.19 Clinical Data.

7.20 Maintenance of Inventory of Hospital Resources.

7.21 Catering.

8. WAITING LISTS.

8.1 Groups And Catesories.

8.2 Planned Admissions.

8.3 TCI Letters.

8.4 Selection Of Patients TCI.

8.5 Theatre Loadins.

8.6 Ward Loadins.

8.7 Statistics.

8.8 TRANSPORT.

8.9 Requests.

Where from?
Automatic or printed?

8.10 Schedulins And Bookins.

Description of transport schedulins system.

8.11 Milesse Claims.

8.12 X-RAY SYSTEM.

8.13 Index.

8.14 Appointments (Includins Equipment Schedulins).

8.15 Requests.

8.16 Reports.

8.17 Film Library.

8.18 CLINICAL DATA.

8.19 Research Facilities.

8.20 Diagnostic Index.

8.21 Records.

8.22 Recall and Review.

8.23 Diagnostic Assistance.

8.24 Patient Questionaire.

8.25 NURSING SYSTEMS.

8.26 Personnel.

8.27 Allocation.

8.28 Orders.

8.29 Reports.

8.30 Rotas.

8.31 Workload/Dependency.

8.32 Record of Training.

8.33 Links with Patient Administration Systems.

8.34 PHARMACY.

8.35 Stock Control.

8.36 Information.

8.37 Issues.

8.38 Costing.

8.39 Prescribing.

8.40 INFORMATION SYSTEMS.

8.41 Hospital Notice Board.

8.42 Telephone Directory.

8.43 Who's Who.

8.44 What's On.

8.45 Procedures.

8.46 PATHOLOGY.

8.47 Haematology.

Requests.
Requests from Wards.
Links with MPI.
Urgent Results.
Results.
Quality Control.
Day Book.

8.48 Chemistry.

Requests.
Requests from Wards.
Links with MPI.
Urgent Results.
Results.
Quality Control.
Day Book.

8.49 Histology.

Requests.
Requests from Wards.
Links with MPI.
Urgent Results.
Results.
Quality Control.
Day Book.

8.50 Microbiology.

Requests.
Requests from Wards.
Links with MPI.
Urgent Results.
Results.
Quality Control.
Day Book.

8.51 PERSONNEL RECORDS.

8.52 Other than Nursing.

8.53 OTHER FACILITIES.