INFORMATION SYSTEMS DESIGN FOR THE COMMUNITY HEALTH SERVICES

Volume 1

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This thesis is concerned with the design and implementation of a community health information system which fulfils some of the local needs of fourteen nursing and para-medical professions in a district health authority, whilst satisfying the statutory requirements of the NHS Korner steering group for those professions. A national survey of community health computer applications, documented in the form of an applications register, shows the need for such a system.

A series of general requirements for an information systems design methodology are identified, together with specific requirements for this problem situation. A number of existing methodologies are reviewed, but none of these were appropriate for this application. Some existing approaches, tools and techniques are used to define a more suitable methodology. It is unreasonable to rely on one single general methodology for all types of application development. There is a need for pragmatism, adaption and flexibility.

In this research, participation in the development stages by those who will eventually use the system was thought desirable. This was achieved by forming a representative design group. Results would seem to show a highly favourable response from users to this participation which contributed to the overall success of the system implemented.

A prototype was developed for the chiropody and school nursing staff groups of Darlington health authority, and evaluations show that a significant number of the problems and objectives of those groups have been successfully addressed; the value of community health information has been increased; and information has been successfully fed back to staff and better utilised.

INFORMATION SYSTEMS; COMMUNITY HEALTH SERVICE; KORNER;

INFORMATION SYSTEMS DESIGN METHODOLOGY; PARTICIPATION

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CONTENTS

<u>Volume 2</u> <u>Page</u>

TABLES

1. INTRODUCTION

1.1 The Nature of the Research Problem

In an average health district, the normal health care activity of the community (non-hospital) health services, creates tens of thousands of health care interactions annually. These take place across a whole spectrum of the population in services provided for the new born by the domiciliary midwifery service, to domiciliary care of the terminally ill elderly patient. Current information about these interactions is stored in several discrete and often very separate manual record systems.

Surprisingly there is almost a complete absence of any comprehensively organised information about the reasons why these services are 'requisitioned' by the community and how effective they actually are. National Health Service (NHS) management recognises the need for systematic collection, collation and analysis of information of a 'service' nature (type, duration and frequency of interactions) and 'clinical' nature (patient's details and their reasons for requiring care). This would provide a valuable information base for planning and organising health care activities.

This need was also recognised by government departments and the steering group on health service information, chaired by Mrs. Edith Korner, was set up to make recommendations to the Secretary of State for Health on the future collection of information. Their recommendations about community services need to be implemented in all health districts by April 1988. The recommendations cover a minimum amount of data which must be recorded to provide the statistics required by the Department of Health and Social Security (DHSS).

In current discrete information systems which have operated for many years, data has been collected on forms relating to the provision of services in the community. Individual practitioners submit data on their activities to managers usually on a monthly basis.

A characteristic of this data is that it is of a high volume, which means that it is impossible to process manually into meaningful information. Often, the returns made by staff would be stored away for many years without any use ever being made of them. Yet the recording of such data is often necessary to fulfil statutory requirements. The under use of information, together with the lack of feedback to operational staff originally collecting the source data, has lead to problems of frustration.

Further, as new items of data for collection have been identified, forms have been amended by managers with little or no training in forms design. This has led to a situation where a large number of poorly designed, cluttered or incomprehensible forms are in use. These forms are open to misinterpretation and are difficult to understand and complete correctly.

Despite these problems, the potential of community information is large, but it needs to be processed adequately. For example, in

Darlington health authority, the information about clients at any one time in the district general hospital is limited to 750 occupied beds, however for the community school nursing service, the current number of clients registered is some 20,000. The processing of this data would allow valuable epidemiological and demographic information to be obtained. This opportunity is presently lost.

The development of an integrated community health information system would allow many of the needs and problems identified above to be addressed.

1.2 The Research Problem Area

The national health service in the United Kingdom is divided into some 220 district health authorities for administrative convenience. A number of these districts are geographically grouped together and administered by a regional health authority. There are sixteen regional authorities in the United Kingdom.

A district health authority provides both hospital and community based services. A community health service within a district will be responsible for providing domiciliary services to the catchment population of that district. Community services are also provided from health centres and clinics. Today, an increasing emphasis is being placed on caring for clients in the community situation.

A number of professional staff groups are involved in the provision of community services including nursing and para-medical staff, who provide domiciliary and clinic based treatments. Services provided to the catchment population include health promotion and education, provision of professional advice and support, health surveillance and screening, vaccination and immunisation, and treatment for specific diseases. The community health service is also responsible for the provision of certain statutory services, for example, to school children.

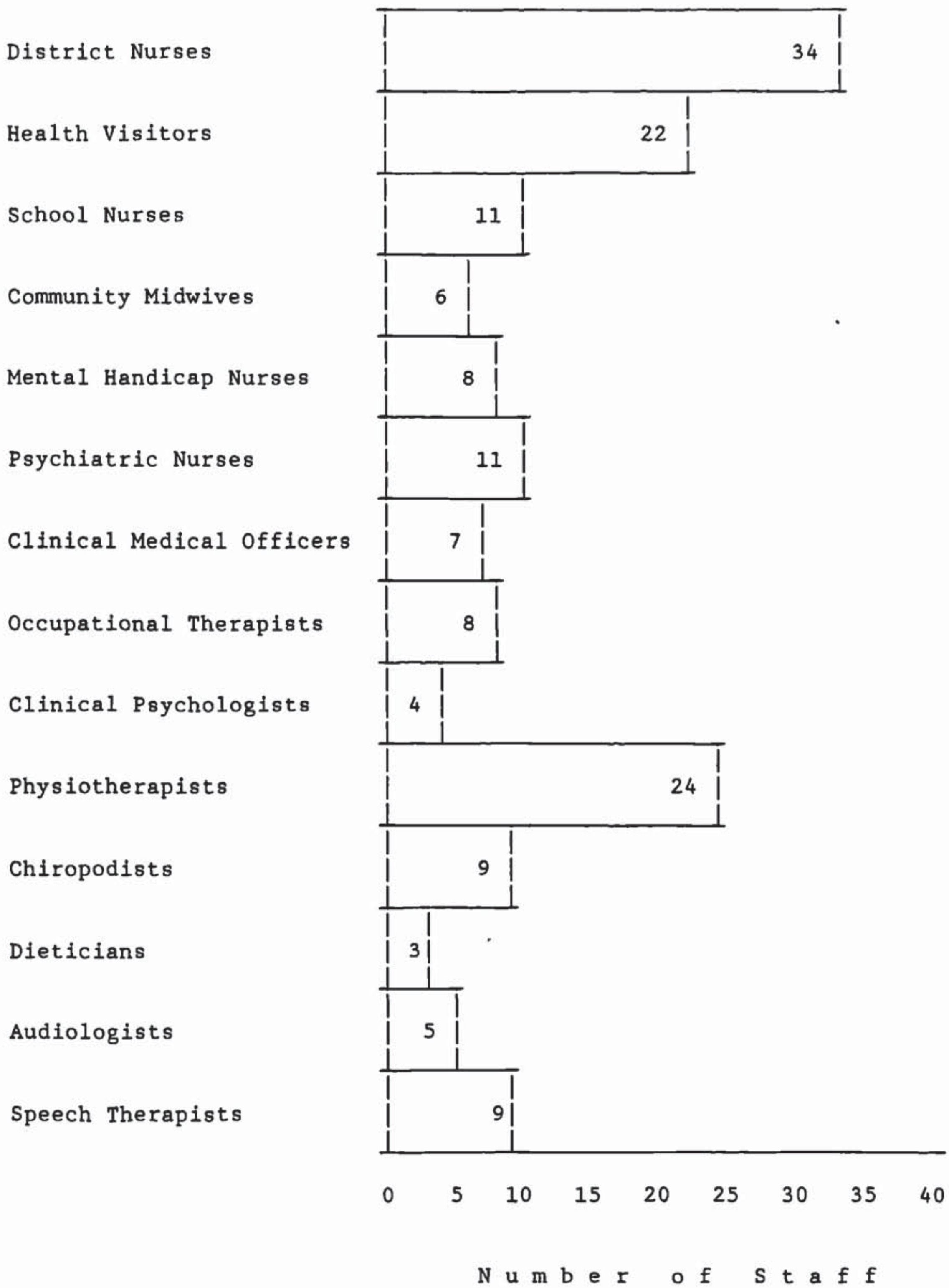
All the practical work involved with this research programme was carried out in the community services of a district health authority who agreed to take part in the programme. A profile of this district is presented below.

The northern regional health authority, with its administrative centre in Newcastle-upon-Tyne, provides support for sixteen district health authorities. The most southern of these is Darlington health authority, situated in the county of Durham and serving a population of some 121,000.

Darlington health authority operates with an annual budget of some £29m and employs 2,700 staff. In the community services some £3m is allocated from the district budget and some 220 staff are employed. The distribution of professional nursing and para-medical staff in the community is shown in table 1.1.

Fourteen professional groups are based at various locations throughout the district and at the general hospital. The Archer street health department is the administrative centre for the

Table 1.1 Distribution of Professional Community Staff



community services where most community nursing staff groups work from, supported by a number of clerical, administrative and ancillary staff.

1.3 Reasons for Developing an Information System

From a study of the research problem, this research programme is justifiable because the development of a community health information system may offer benefits in the following areas:

Integration: A single system could provide management information for a wide range of professional nursing and para-medical staff groups which has previously not been available. Both service and clinical information may be brought together in a single system.

Reduced duplication: At present, many staff groups record duplicate information. For example, the community midwives and health visitors record identical information about children in separate manual record systems. Such duplication may be reduced by using an information system.

Fulfilment of Korner recommendations: An information system could provide a means of meeting the recommendations of the NHS/DHSS steering group on health service information.

Feedback of information: The professional staff who collect data would be able to have information fed back to them for their own use. This may reduce the frustration felt at present because of the under use of information.

Data collection costs: The costs associated with data collection and presentation in terms of time and resources could be reduced. This will allow more time to be allocated by staff to direct patient care. Mundane clerical effort should be reduced.

Electronic processing: As data will be stored and processed electronically, it will be possible to generate statistical information very rapidly. The transfer of data to other NHS computer systems, such as a hospital based patient administration system, may be possible. The security of data will be enhanced.

Value of information: If information can be made more timely, accurate, readily accessible and appropriate, its value to the organisation will increase.

Health care planning: Health is a product of many influences: genetic characteristics; environment; wealth or poverty; employment; personal behaviour and direct medical care. Donaldson (1983) defines health care planning as being concerned with all of these factors and the social and economic policies giving rise to them. The starting point for such planning is to decide on the health needs of the population and this is done using descriptive epidemiology. These needs are relative to the levels of expectation of the population, to cost, and to the ability of medical policies to relieve the needs. A community information system could provide valuable information for rational and incremental planning cycles, based on studying needs, provisions and outcomes.

Epidemiology: This is the study of health and disease in the population and is based upon aspects of social science and statistics. The provision of a community client register in an information system could allow valuable epidemiological information to be extracted. Barker and Rose (1975) and Morris (1975) describe how the techniques available in epidemiology can be used to discover the causes of certain diseases and provide guidance on methods of treatment, future prevention of disease and health care planning. *Ad hoc* research projects could be supported with such a client register.

1.4 Objectives for the Research Programme

The primary practical objective of this research programme is to help fulfil the needs and address the problems described in section 1.1, whilst achieving some of the benefits outlined in section 1.3. This objective is summarised as follows:

> **'Design and implement a prototype version of a community health information system, which has as its strategic objectives:**
>
> **1. Fulfilment of the local needs of all community health service staff groups, and**
>
> **2. Fulfilment of the statutory requirements of the Korner steering group concerning community and para-medical information'**

In order to achieve this objective, four other areas are also addressed in the research. These concern the current state of computer applications in the community health services; the identification of the requirements of an appropriate information systems design methodology; the identification or modification of a suitable methodology; and the involvement of community health service staff in the development of the prototype. The reasons for requiring these 'sub-objectives' are given below.

In many large organisations, identical developments concerning information technology are being carried out in different parts of those organisations. In the NHS for example, many district health authorities are developing, in parallel, the same types of computer applications. In an attempt to keep a check on applications development, East Anglian regional health authority maintain on behalf of the NHS as a whole, a register of all computer applications in use within the service. A community health section is included. It is up to individual districts to submit to East Anglia on a regular basis details of their applications. One concern of this research was to ascertain whether the register was accurate and also whether local developments did take place within districts which were unknown outside of those districts.

It is vital to be aware of current computer applications in the community health service, in order to verify that there are no other systems of a similar type to that proposed for this research programme. This leads to the following sub-objective:

> **'Identify and document the current state of computer applications in the community health services'**

To develop an information system, it is necessary to select or define an information systems design methodology. Before this can be achieved, it is essential to derive a set of requirements for the methodology so that it is appropriate. This leads to the second sub-objective:

> 'Identify the requirements of a successful design methodology suitable for producing a community health information system'

Information systems development is an area where certain principles, tools and techniques may be appropriate in some situations and not in others. Avison and Wood-Harper (1986) suggest that it is unreasonable to rely on a single methodology to develop all types of application. Tools and techniques appropriate in some circumstances may be inappropriate in others.

Benyon and Skidmore (1987) in their proposal of a 'tool kit' for the systems analyst, conclude that one single methodology cannot cover the whole range of system tasks. The diversity of information systems, and those who develop them, means that one methodology cannot tackle all situations which are encountered during information systems development.

It may therefore be the case that there is not a methodology which is suitable. For example, it may be difficult to incorporate the statutory requirements of Korner and also the local needs of community staff. This leads to the third sub-objective:

> 'By using the requirements, identify, or define instead, a methodology suitable for producing a community health information system'

The application of any methodology needs to involve those who will use the operational system produced. People should have a right to influence the design of systems which will affect them. The expertise that users have about their application area will be useful in the development process. This should lead to the production of a better system than would otherwise be the case. The final sub-objective is therefore defined as:

'To involve members of the community health service in the design and implementation of a new system'

The fulfilment of these sub-objectives will help achieve the primary objective defined earlier.

1.5 Selection of a Research Methodology

In order to select the best research methodology to use in a project, it is necessary to recognise those available and understand their relative strengths and weaknesses. A comparative analysis of methodologies has been carried out by Milton-Jenkins (1985). Research methodologies in information systems are described in Mumford, Hirschheim, Fitzgerald and Wood-Harper (1985). A brief description of the alternatives available is given below:

Mathematical modelling: This attempts to model the 'real world' by using mathematical equations. All independent and dependant variables are known and included in the model.

Experimental simulation: In this methodology, a simulation model is produced to mirror parts of the 'real world'. Human subjects can be exposed to the model and responses recorded.

Laboratory experiment: Here, the researcher can manipulate the independent variables, control intervening variables, and then measure the effect of the independent variables on the dependant variables.

Free simulation: In this form of simulation, a closed setting to mirror a part of the 'real world' is set up and the responses of human subjects measured as they react with the system. In free simulation, events and timings are determined by the researcher and the behaviour of the human subject.

Field experiment: This research takes place in a 'natural setting'. Systematic observations are then made of the effects of the independent variables on the dependant ones. Independent variables are manipulated whilst the intervening variables are controlled.

Adaptive methodology: A control group and non-random assignment of human subjects is used in this methodology. Measurements are taken before and after the introduction of independent variables.

Field study: This type of study is conducted in a 'natural setting' with human subjects. No independent variables are manipulated, but dependant variables are systematically measured.

Group feedback analysis: Human subjects are used to test out a hypothesis, and the data gathered is statistically analysed, and fed back to the participants for their subjective comments.

Opinion research: Data is gathered from human subjects on attitudes, opinions and beliefs via questionnaires and interviews.

Participative or action research: Human subjects are used in this methodology to provide creative potential. A particular approach will be investigated in a real life environment.

Case study: A particular subject or organisation will be observed by the researcher without any intervention taking place. No control is exercised over the subjects, but attempts are made to capture the nature of a certain environment at some point in time.

Archival research: Historical documents are examined and recorded data studied.

Philosophical research: This is a mental pursuit whereby the researcher reasons using flows of logic which are explicit, replicable and verifiable by others.

From the comparative analysis of research methodologies, action research was selected. This allows the researcher great potential to utilise the ideas of users and change ideas as the work develops. Researchers and subjects co-operate in solving a real life problem. A sub-objective of this particular research programme was to involve members of the community health service in the development of a new system. This research methodology was therefore thought appropriate.

Elements of other research methodologies, in particular opinion research, were also used in the project.

Action research allows work to take place in a natural setting and is particularly appropriate in order to gain an insight into real life practical areas. Feedback from the practical application of techniques can be used to refine and improve those techniques based on the experience gained. The results of action research are of a qualitative nature, however they do offer a degree of external validity because the results might be applicable to different populations, for example another district health authority.

Some disadvantages of action research however, include the problem of repeatability of results versus the uniqueness of an information systems development; the impartiality or otherwise of the researcher; and difficulties in determining the cause of a particular effect, which could be due to environment, researcher, or methodology.

Action research is described in Checkland (1981) and defined by Sandberg (1985) as a close interaction between action and research, between practice and theory, in a process of continual change. Action research in the information systems development environment is discussed by Wood-Harper and Flynn (1983) and Antill (1985) who outline the methodology as follows:

Data collection: Data will be amassed through literature and case studies, through previous experience and continuous observations.

Design methodology: The approach to be used for the research will be formulated. This practice can be continuously refined through ongoing application.

Application of practice: By working with those people who will be affected by the system being developed, the researcher and others involved will learn from the activities carried out.

New theories: Application of this methodology may lead to ideas for new work or modifications to the techniques being used. These new theories may be developed further by a current research project, or they may identify the need for application of other research methodologies such as case studies or field experiments.

1.6 Scope of the Thesis

This introductory chapter has described the research problem to be addressed and the problem area in which it is found. The reasons for pursuing the research programme were presented. The primary objective of this research was then stated along with four sub-objectives. Finally, a research methodology was selected. The scope of the remaining thesis chapters is outlined as follows:

Chapter 2: A Survey of Community Health Computer Applications

The need for a survey is described, followed by an outline of the survey method applied. A description of the types of application discovered is then presented together with details of some actual systems which were of particular interest to this research programme. A series of results are presented from an analysis of the questionnaire responses obtained.

Chapter 3: Selection of a Design Methodology

The nature of information systems and information system design methodologies are presented. A number of both general and specific requirements are then identified which a design methodology should meet if it is to be applicable in the problem situation. A series of approaches to information systems development are described and then an overview of a number of existing methodologies given in order to facilitate the selection or definition of a suitable methodology.

Chapter 4: A Community Health Information Systems Design Methodology

A methodology for use in the problem situation is described. The framework of the methodology is outlined, followed by detailed descriptions of the tasks in each stage. The tools and techniques selected for use in the methodology are presented.

Chapter 5: Application of Methodology

A description of the design group which applied the methodology is given. Participation by members of the community health service was thereby exercised in the development process. The tasks carried out in each stage are described in detail.

Chapter 6: Implementation

A description is given of the application generator used to produce a prototype system. Details are then given showing how the data schema, file maintenance, reporting functions and security sub-systems were developed. A trial of hand held data recorder equipment is described and compared to an equivalent paper method of data collection. A description of the implementation stage is provided.

Chapter 7: Conclusions

A number of issues concerning the evaluation of information systems are described and a method for evaluating the prototype outlined. The results of the evaluation are presented and conclusions drawn from those results. A series of general conclusions are then made by referring to the original objectives of the research programme. Finally, some areas for possible future research are outlined.

2. A SURVEY OF COMMUNITY HEALTH COMPUTER APPLICATIONS

2.1 The Need for a Survey

It is essential to be aware of information systems already developed in the community health services. The starting point for this study was to examine the NHS national register of computer applications maintained by East Anglian regional health authority.

This register is grouped into sections, based around type of application, although other groupings are available. A community health section is included. Copies of the register are provided on a regular basis to all regional health authorities and, through representatives, made available to individual districts.

It was also necessary to ascertain whether districts always submit details of their applications to East Anglia. This is necessary to keep the register up-to-date, otherwise it will not provide a reliable view of developments. In order to obtain an accurate picture, it was decided to carry out an independent national questionnaire-based survey across all health districts.

No survey has ever been attempted in the past which produced a definitive report on community health applications. This chapter presents such a report and also analyses the responses made.

2.2 The Survey Method

A questionnaire was devised to collect information on computer systems which were either operational or under development in the community services. In November 1984, these questionnaires were circulated on a national basis and responses collected over a two month period. A standard accompanying letter was sent with the questionnaire giving instructions for completion. Copies of the questionnaire and accompanying letter are given in appendix 1. Follow-up letters were sent to non-respondents after one month. The final response rate was very high (94%). All responses were analysed by computer using the dBASE II data management package.

The survey results indicated that many new systems were to be introduced over the next few years and therefore the survey was repeated in November 1986 to review these developments. The results from this second survey were used to update the register of community applications contained in appendix 2. Catchpole (1985b) discusses the survey method further.

2.3 A Description of Community Health Applications

The common types of community applications discovered are described below, and examples used to show the nature of each application type. Summaries of these are recorded in Catchpole (1985b, 1985c and 1986a).

2.3.1 Child Health Record Systems

Child health records are of importance in any community health department. It is vital that vaccination and immunisation as well as medical examination records are effectively stored and maintained. This is emphasised by Norman (1984).

The Welsh Health Technical Services Organisation (WHTSO) have developed a child health system which is described in section 2.3.1.1. This system has been well documented by Walker (1980 and 1982), Rigby (1982a, 1982b and 1983), Cottrell (1983) and Ford (1978). Several districts have developed their own projects however, using alternative hardware and software systems. These are described further in section 2.3.1.2.

The national standard system is undergoing continual enhancement, and any development of a community health information system should seek to complement, rather than replace it.

2.3.1.1 National Standard System

This system is designed to run on ICL mainframe series equipment. The total package consists of five modules which can be taken over a period of time, with the first module being mandatory. The modules comprise of:

The child register: Records the name, date of birth, address, general practitioner and other details for each child resident within a catchment area. The birth notification document is used to generate an entry on the child register.

<u>The immunisation module</u>: Provides an appointments system for ensuring all pre-school children receive immunisation appointments. The schedule to be used for immunisation is decided by each district and sessions can be set up in community health clinics or in general practitioners surgeries. This is the most frequently used module.

<u>The pre-school health module</u>: Enables districts to issue regular appointments to all children for developmental surveillance, based on the same system used for immunisation appointments. The module allows storage of the results of each examination, using the International Classification of Disease (ICD) codes, on each child's medical record. A chronological history of progress and development is built up for all children allowing epidemiological studies to be carried out.

<u>The school health module</u>: Maintains a scheduling service for the three services of surveillance, immunisation and examination of school children. The scheduling algorithm can be specified locally. Integration with education authority records is provided for, and an interchange of information on new school starters and leavers is possible.

<u>The statistical module</u>: Allows access to the information base to provide statistical information for demographic and epidemiological purposes.

2.3.1.2 Other Child Health Systems

Alternatives to the national standard include the Cheshire child health system running on IBM equipment, the North Warwickshire Health Authority (HA) system also on IBM, and a system in North Derbyshire HA running on an Apricot micro-computer. Hampstead HA use the Minstrel micro-computer to run a package which provides a birth register on all children born after January 1984. A recall facility is available to produce labels, print-outs and appointment letters.

A system produced in Nottingham HA entitled 'ChildFile' runs on a Commodore micro-computer and records and analyses data obtained from the routine screening of pre-school and school children. The system can provide information about a child's progress, initiate screening and follow-up appointments and analyse demographic data. Medical data recorded by the system is held in a simple coded format. One feature of this system is that it is operated directly by the health visitors who generate source data. 'ChildFile' is described further by Holland (1984).

2.3.2 Loan of Equipment Systems

Although stock control has always been a prime target for computerisation, only a small number of districts reported having community stock or loan of equipment systems. Leeds Eastern HA, East Yorkshire HA and Islington HA operate typical systems.

The Leeds Eastern HA system is a generalised package, allowing issues, receipts and amendments to be applied to a stock master file and routine monthly and annual reporting. This package has been in use since May 1981, operating on a Tandy micro-computer with floppy disc storage and a daisy wheel printer.

In Islington HA, a package running on a Minstrel micro-computer since April 1984, assists in the control of various aids loaned or delivered to disabled patients. Three types of record are maintained, namely:

Patient records: Personal details are held together with references to equipment on loan or delivered. Each patient can be linked into a regular delivery schedule so that items are not overlooked.

Equipment records: For each item type, maximum, minimum and reorder levels are held together with reorder quantities, lead time, stock in hand and on loan.

Supplier records: Names and addresses of suppliers are held together with outstanding order details.

Reports produced include overdue order lists, reminder lists or labels, delivery lists and statistical summaries of items issued.

The above systems are all stand-alone packages, performing the single function of stock control. A major community information system produced for district nurses integrates loan of equipment with a workload recording system. The Financial Information Project community system is described in section 2.4.4.

2.3.3 Community Health Registers

Many tasks carried out in a community health department involve the maintenance of registers of clients which are analysed regularly by particular categories for recall and analysis purposes. Clearly, this is an ideal application for automation, and many districts now have access to some form of community health registration system. Often, family practitioner committee (FPC) computer systems can be used to download data to set up these registers. One such project in Gloucester HA downloaded FPC data from a DEC PDP 11 mini-computer to a Tandy micro-computer system. This project is described by Henderson (1984).

The remainder of this section describes several of the most common types of automated client indexing applications. A community health information system should seek to provide such registers for recall and analysis.

2.3.3.1 Mental Handicap Registers

Many districts maintain mental handicap registers using computers. Islington HA maintain on a Rair micro-computer, a register of persons with learning difficulties and various other disabilities.

A similar system known as 'MenIndex' running in Croydon HA is available to all members of the community mental handicap team and stores personal and medical details of each client. The system collates data for analysis purposes.

2.3.3.2 Cervical Cytology Recall Registers

For the last five years, Harrogate HA have operated a recall register which records individual test results for cervical examinations and arranges postal recall of clients for further examinations. All women between the ages of sixteen and seventy are covered by the system. Data entered can be analysed and a wide variety of statistics produced.

A similar package runs on an ICL ME29 computer in West Glamorgan HA. Smear test results are recorded from the pathology department and personal details from the FPC or general practitioner. Recall schedules are generated by date band and letters are produced by a micro-computer for postal distribution. Neumann (1979) describes a cervical cytology recall system implemented in the district of Rostock in West Germany.

2.3.3.3 Other Community Health Registers

Numerous other computerised registers are available, including appointment lists for audiology (West Suffolk HA), observation registers for children at risk from non-accidental injury (West Suffolk HA), death registers for morbidity analysis (Hillingdon HA) and elderly registers (North Warwickshire HA).

2.3.4 Community Nursing Statistical Reporting Systems

A number of systems are available for collecting statistical information on activities and services provided by community nursing staff. Canterbury and Thanet HA operate a nursing activity analysis package which collates data for disease, visit type and age group analysis for several groups of community staff. This package runs on an Alpha micro-computer system. Clwyd HA operate a package which records activity data. The system is designed to allow ad hoc enquiries and also to produce quarterly statistical summaries. This package is constructed using the Condor data management system on a Hewlett-Packard computer.

The provision of statistics from workload should be an essential function of a community health information system.

2.3.5 Chiropody Record Systems

An Apple 2e micro-computer, in operation since July 1984 provides a centralised chiropody information system for Shropshire HA. Each chiropodist receives appointment lists. Reports concerning treatments given, types of case treated, and performance indicators are provided on a daily, weekly and monthly basis. The system produces reports for the DHSS and calculates payment details.

2.3.6 Other Computer Applications

The survey highlighted some systems which were used by only a small number of districts throughout the country:

- Dental Workload Analysis (5 districts)
- Communicable Disease Management (1 district)
- District Nurse Allocation (2 districts)
- Electronic Mail Services (4 districts)
- Epidemiological Data Analysis (1 district)
- Family Planning Records (3 districts)
- Health Education Records (1 district)
- Community Psychiatric Nurse Management (1 district)
- Speech Therapy Records (6 districts)
- Nurse Personnel Systems (6 districts)
- Physiotherapy Contact System (1 district)

2.4 Community Health Information Systems

This report has so far highlighted stand-alone, single function applications, but the survey also revealed several major systems which could be of relevance to this particular project. These are larger scale systems which attempt to provide information for a multiplicity of staff groups, more in line with the requirements of this research programme.

2.4.1 The Wessex Regional Community Nursing System

This is a comprehensive package running on ICL 2966 equipment at the Wessex regional computer centre since January 1983. Data capture facilities are provided at each district, consisting of Hytec Prelude micro-computers connected by telephone line to the mainframe. The majority of the ten districts in the Wessex region use this system. Community nurses collect task orientated data relating to the patients they visit and the time spent on various other activities. This data is processed, and monthly, yearly and ad hoc reports are produced giving details of the workload of each community staff group. Data is collected relating to number of visits by age group, dependency, and disease classification for district nurses and by visit reason for health visitors. This is entered by clerical officers on a daily basis in each district.

This system was not designed to meet the Korner requirements for community services and is not used by any para-medical staff groups.

2.4.2 The Leicestershire Community Nursing System

In 1971, a feasibility study was initiated to assess the possibility of using a computer system for the storage of community patient records and to schedule the work of district nurses. By 1973, a computer system had been developed for the city sector of the Leicestershire Area HA.

The system stores patient information covering personal, nursing and hospital details, and sociological and medical conditions using a coding system. By using codes, the possibility of transcription errors is reduced. The amount of written work to be done by nurses is also reduced. On a first contact with a patient, the nurse completes a coded form which then generates a record on the computer. By recording the frequency of visits required to a patient, the computer can schedule further visits. Schedules for all nurses are produced daily and these show the names and addresses of patients to visit. Space on these schedules is reserved for nurses to indicate the type and duration of each visit and the activities carried out. These are then used as prime input documents. Group sessions held in general practitioner's surgeries or health centres are recorded on a separate form, where the types of treatment given, time spent, and number of patients seen can be recorded. Data is entered weekly in batches.

Management information is provided both for individual nurses and for managers. One of the aims of the reporting is to increase the continuity of care by enabling better communication between staff groups. This is described further by Eccles (1977).

The Leicester system is unique because it is the only system which provides visit schedules for nurses automatically. A health centre in Glasgow is using a system, described by Tannahill (1981), which goes some way towards scheduling, by prompting health visitors with the names of clients who may need visiting, based on the allocation of priorities.

This system does not meet the Korner requirements or handle para-medical staff groups. It is now more than ten years old and is very much the 'grandfather' of more recent developments. In particular, the Financial Information Project community system appears to be based on some of the concepts of this system.

2.4.3 Management Information Pilot Project Community System

The objective of the Management Information Pilot Project (MIPP) was to design and implement systems which would allow the requirements of the six reports of the Korner Steering Group on Health Service Information to be met using computers. Each system would provide accurate and timely information about the use of resources and the delivery of care. The Bromsgrove and Redditch Health Authority was chosen to pilot the systems which would be implemented using ICL DRS 20 micro-computers. All the systems are based on the manual collection of data which is then processed by computer to provide management information reports. Originally, the MIPP systems were intended to provide Korner solutions for those districts who had no alternative operational systems which could provide the Korner minimum data sets. MIPP is described more fully in DHSS (1984a, 1984b, 1985a and 1986).

The objectives of the community project were to provide a single patient based system which would provide information for planning, monitoring and operational control, give rapid turnaround of data, and meet the recommendations of Korner (1984a).

Two versions of the system have now been produced, the first meeting the above objectives for community nursing staff only, and the second, an enhanced version released in May 1986, catering additionally for para-medical staff groups and meeting the recommendations of Korner (1984b). This system is known as 'ComCare' and is described fully by Dorey (1986).

Detailed information on patient care services in the community is provided for community nursing and para-medical staff. A patient register is maintained together with a detailed breakdown of staff activity.

Outputs from the system include monthly and quarterly management information reports, patient details which include recent contacts, and ad hoc analyses. Management reports available include an analysis of patient contacts under various categories, analysis by health care programmes, time analysis on activities, mileage summaries, discharge analyses and group session attendances by location and programme. Ad hoc analyses are provided using a commercial report writer package.

Many districts are committing themselves to 'ComCare' as a solution to Korner for community nursing and para-medical services. This system does meet the Korner requirements and handle all community and para-medical staff groups, however the data processed is only the Korner minimum data set. It does not meet the local requirements of NHS managers, which is a strategic objective for the development of an information system in this research programme.

2.4.4 The Financial Information Project Community System

Set up in 1979, and funded jointly by the DHSS and the West Midlands regional health authority, the aim of the Financial Information Project (FIP) was to improve methods of costing patient care which were at the time thought to be inadequate. The research group produced operational systems which formed part of an integrated tool to link systems for clinical and management budgeting. An important aspect of the systems is that they collect data down to the level of the individual patient.

A trial set up in South Birmingham HA showed that the collection of activity data relating to specialty, age, sex and diagnosis of patients was feasible. This trial is described in Financial Information Project (1984).

Once this trial was completed, a system was designed and implemented using the Mumps programming language. Mumps was developed to allow the rapid production of medical applications, originally at the Massachusetts General Hospital in the United States.

The FIP package consists of four modules which may be implemented separately or combined to form an integrated system. Each module is described below:

Home nursing module: Provides workload information which is compatible with Korner and other DHSS information requirements. Data is collected by means of patient registration forms and daily diary sheets. Codes are used to record locations, reasons for discharge, treatment types and activities. Outputs from the module include reports which summarise data, but only at the staff team level.

Loan of equipment: Functions as a stock control system and provides management information. The system maintains two lists, a delivery list of items available to be sent to clients and a waiting list of clients for whom equipment is not yet available. Outputs from the system include delivery dockets for drivers and analyses of the waiting lists.

Domiciliary incontinence: Records details of patients either awaiting or receiving the supply of incontinence aids. Input comes from either manually completed forms or direct from the home nursing module. Outputs are similar to the loan of equipment reports.

This system does meet the Korner requirements for community services, but was originally produced as a district nursing system. It has since been extended for health visitors and other staff groups associated with district nursing only.

2.4.5 The Community Health Information Project

In 1984, the NHS Computer Policy Committee (CPC) commissioned an enquiry into the future development of the national standard child health system. One of the recommendations of this enquiry was that any further development work should take place within the framework of a comprehensive community health information project (CHIP). In response to this, the CPC initiated a project to develop and implement a comprehensive information system for the community services containing the national standard child health system, a full patient index based on those maintained by family practitioner committees, and other applications, identified from a study of community information requirements. This project has three phases:

A general appraisal of information needs: which produced an outline, hardware independent, functional specification for a system, and identified plans for the detailed development of this specification. This phase is described in NHS (1985a).

Development of a detailed functional specification: which will also be hardware independent and will cover priority areas identified in the previous phase.

Development of specific application systems: which will take place from the detailed specifications. These systems will be hardware dependant and will be funded by a consortia of districts who wish to participate in the project.

This is a major NHS project which will not be completed until the next decade. Phase one of the project has been completed and the findings are described in NHS (1985b and 1985c). One of the priority areas identified for development was that of electronic mail services, and since this application is unrelated to the development of other parts of the system, the implementation of a pilot within Bolton HA is already underway.

CHIP is an ambitious project based on the national standard child health system. It will not be available until the next decade, which will be too late to meet the Korner deadlines of April 1988.

2.5 Community Health Systems in the United States

The first use of computers in community health agencies in the United States was made in the late sixties. For example, in New Jersey around that time, a client based statistical reporting system was implemented, but fell into disuse because of its slow turnaround time. Many other projects, such as the Rockland County Health Department system described by Saba and Levine (1978), were also unsuccessful due to the primitive nature of the computing facilities available at the time. Levine (1975) describes the use of community health agency computer systems further. In the late 'Seventies, three types of information system became prominent, see Saba (1982). These are described below:

Financial records and billing systems: These are used mainly by large visiting nurse associations who administer home health nursing care. The systems are often geared for providing data for the MediCare and MedicAid services for third party settlement of payments.

Statistical information systems: These collect, aggregate and summarise data which is collected on school, clinic and home visits in the community.

Patient care information systems: These are generally large systems, collecting information based on individual patient contacts. They are usually operated by large community health agencies. Numerous school health records systems have been developed such as that described by Johansen and Orthoefer (1975).

A survey described by Saba (1982) showed that in 1979 up to 26 states were using computer systems in their community services, and almost all of these were developed by 1974, during the five year period up to 1979, only another five implementations were recorded. Some example community systems in the USA include the following:

The Omaha visiting nurse association project: This was concerned with the production of a financially based statistical reporting and patient care information system, designed from a problem classification scheme suitable for computerisation. This is described further by Martin (1982).

Computer stored ambulatory record system (Costar): This was implemented by the Indian Health Authority and produced using the Harvard Community Health Plan. The system was written in the Mumps language, and allows the storage of patient details and contacts, and provides for the scheduling of appointments. Both clinical and financial information is provided. Costar has been brought to England, and is in partial use at several sites on DEC equipment. Saba describes this system further.

The Livingston community health services data system: This is described by Hersley and Moore (1975) and is used for planning, resource allocation and monitoring performance with regard to target population and financial services. The system integrates health service, demographic and financial information taking as input community health service, household survey and financial data. Comprehensive reporting facilities are provided by a general purpose file management and report writing system used by managers and researchers.

Patient care information system (PCIS): This system allows community nurses to access data over the telephone on-line, from devices held in their cars and homes. It provides full medical care data on all residents of the Papago Indian Reservation in Tuscon, Arizona.

2.6 Results of Survey

Out of a total of 219 districts surveyed, responses were obtained from 206 districts, giving a response rate of 94%. Many districts returned multiple questionnaires and the final number of returns was 307. After the first survey, 266 responses were made, and a further 41 new responses obtained from the second survey. Applications which provided data compatible with the Korner recommendations for the community, amounted to 55 separate systems.

The results of the survey are documented in an unpublished report and the following represent some of the more interesting results from that report. In some of these results, data from both the first and second survey is given. In histograms, the lower figure indicates a result from the first survey, and the higher,

Table 2.1 Breakdown of Application Types

Application Type	N	%
Audiology Records	2	1
Cervical Cytology Recall	14	5
Child Health Records	74	28
Chiropody Records	11	4
Communicable Diseases	1	1
Community Workload Statistics	31	12
Community Client Registers	22	9
Dental Workload Analysis	5	1
District Nurse Allocation	2	1
Electronic Mail Services	4	2
Epidemiological Data Analysis	1	1
Family Planning Records	3	1
FIP Community System	14	5
Health Education Records	1	1
Loan of Equipment Records	13	5
Mental Handicap Registers	16	6
MIPP 'ComCare' System	9	4
Nursing Personnel Systems	6	2
Others / Miscellaneous	16	5
Primary Health Care Systems	4	2
Physiotherapy Contacts System	1	1
Psychiatric Nurse Management	1	1
Speech Therapy System	6	2

Table 2.2 Authorship of Applications

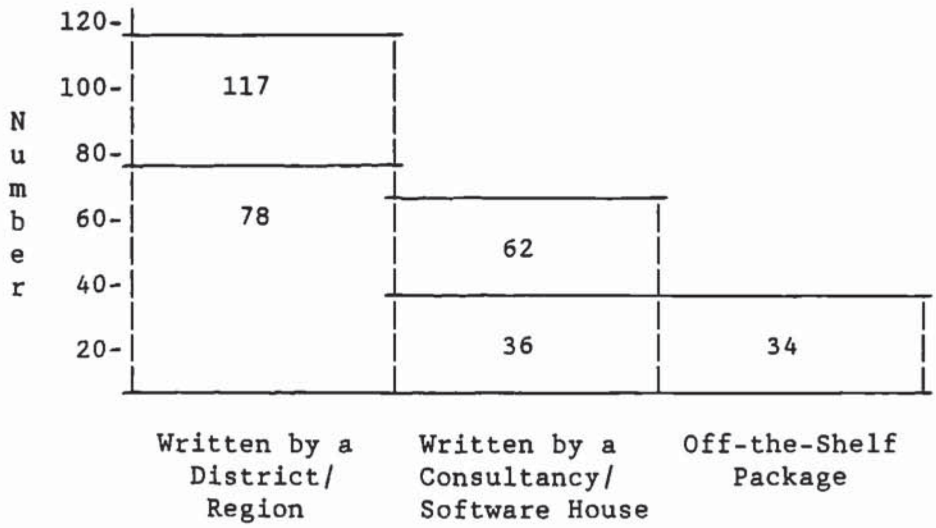


Table 2.3 Availability of Applications

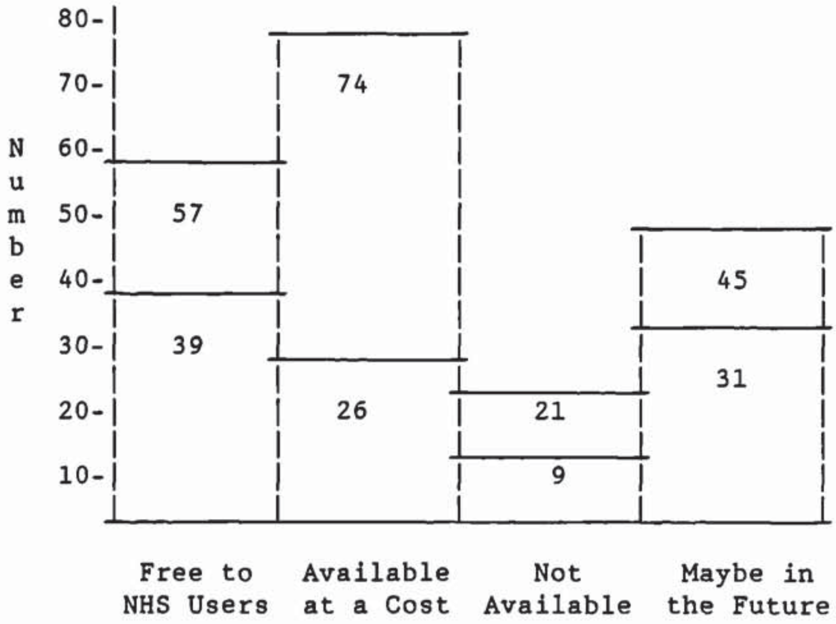


Table 2.4 Operational Status of Applications

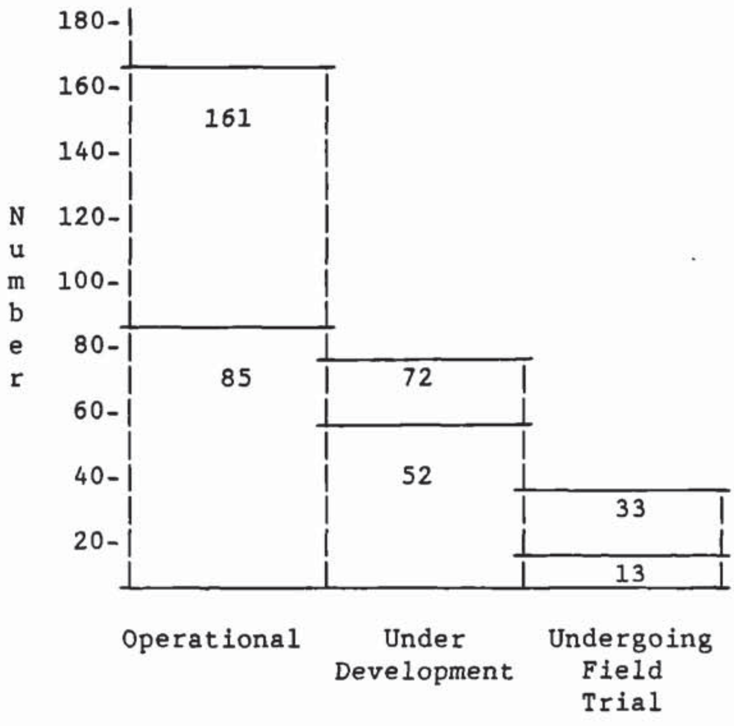


Table 2.5 Breakdown of Hardware in Use

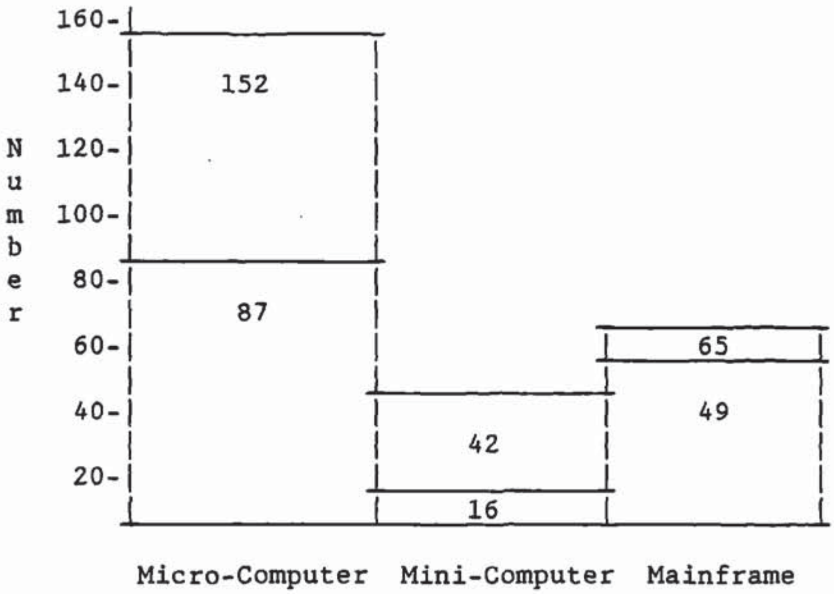


Table 2.6 Micro-computer Usage in the Community

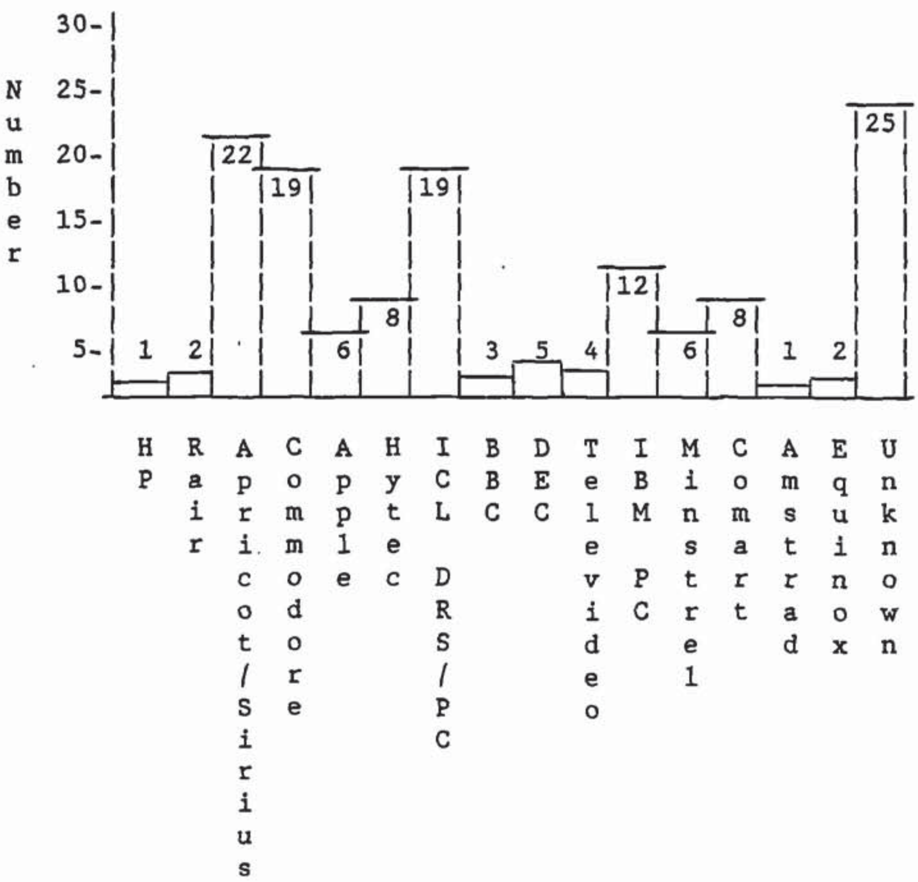


Table 2.7 Mini-computer Usage in the Community

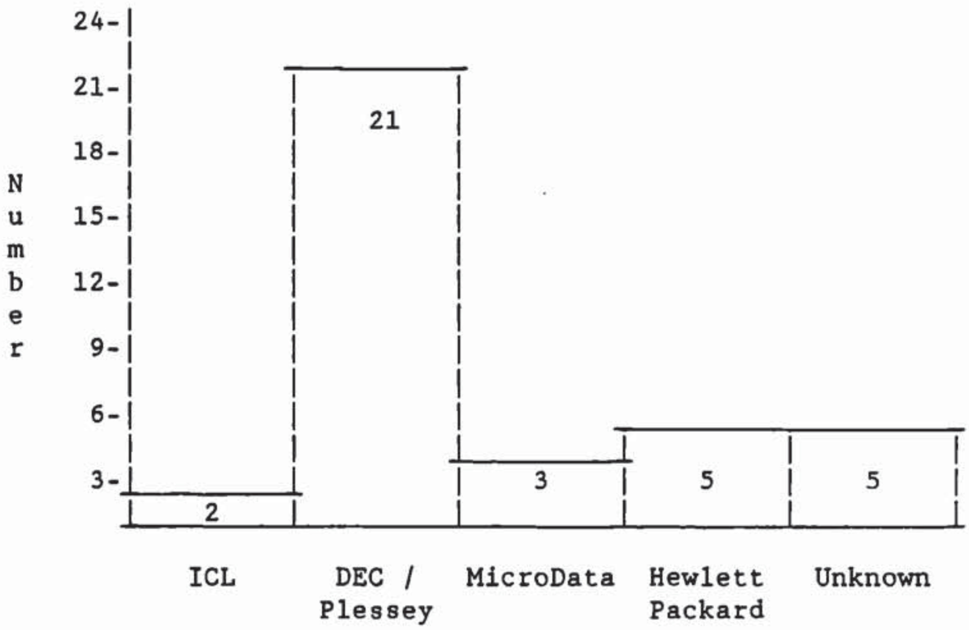


Table 2.8 Languages used for Community Applications

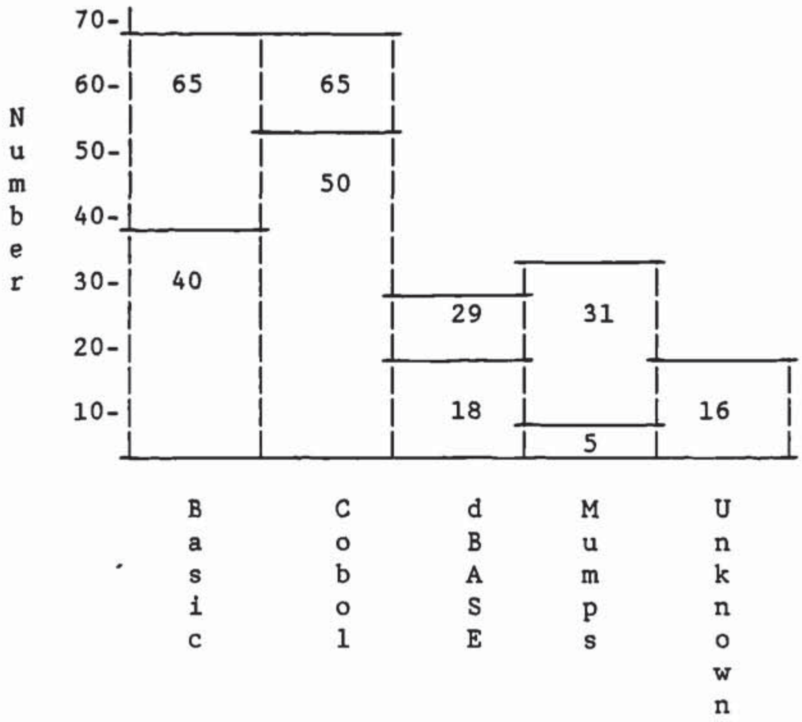
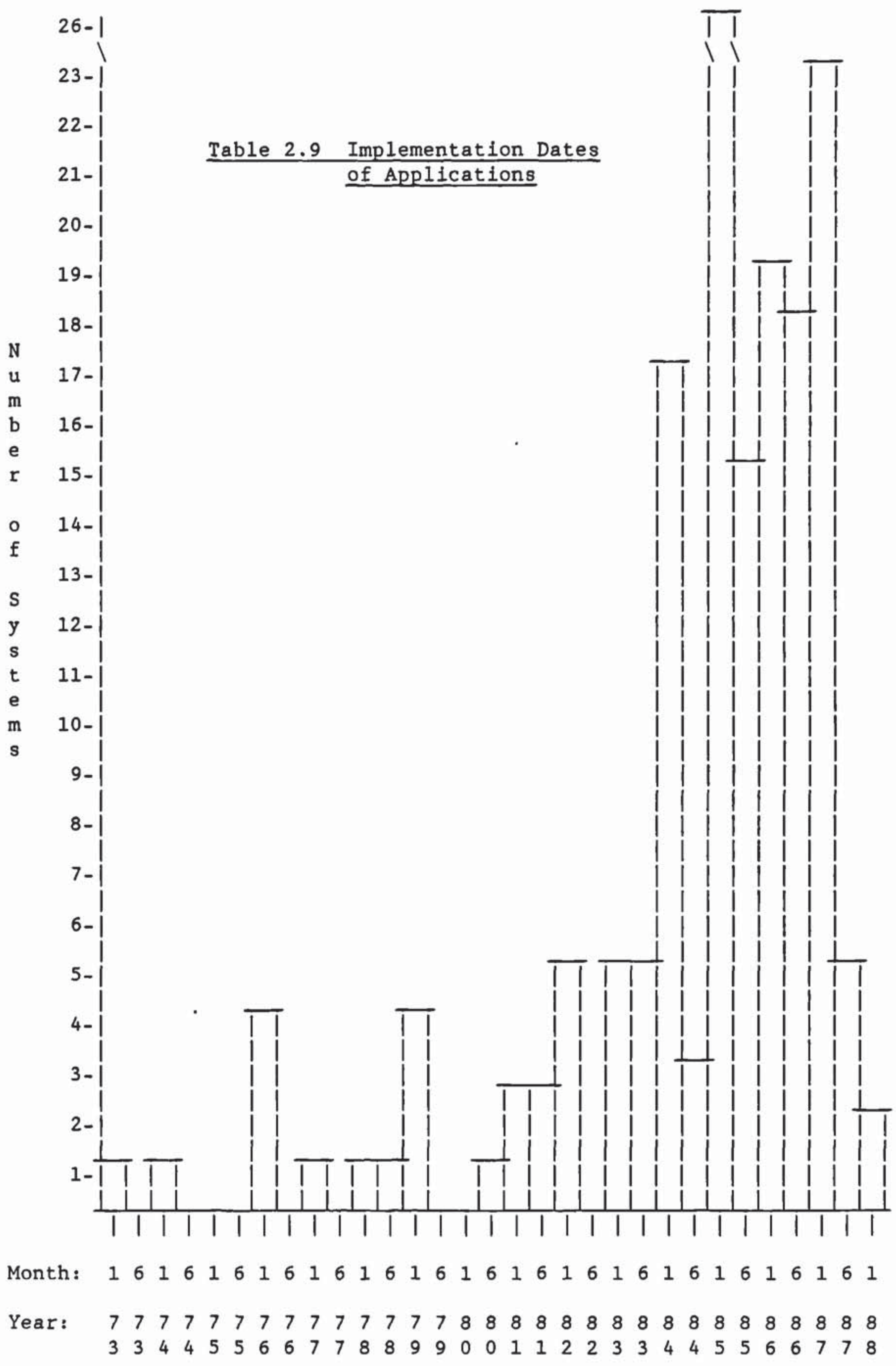


Table 2.9 Implementation Dates of Applications



a combination of the results from both.

2.7 Conclusion

The results of this survey have confirmed that the NHS national register of computer applications is inaccurate with regard to community health systems. There was a particularly large number of micro-computer applications highlighted in this survey, which were not recorded in the register. It appears that districts are failing to notify the East Anglian regional health authority of new developments.

At the present time, the register produced from this survey is the most definitive, up-to-date representation of community health computer applications. East Anglian regional health authority are presently updating their national register using the results of this survey.

The reason why so many micro-computer applications remain unknown outside of the districts they are used in, might be due to the way that these systems are being purchased and installed. The availability of micro-computer systems is now very high because of their low cost, small size and robust nature. Many health districts have purchased systems which have been acquired by managers in the community health services and funded from their own budgets. This was recognised by Grummit (1980). In many cases these purchases have taken place with little or no guidance from computer professionals within districts. This is evidenced in Catchpole (1985a). Systems are often specified and designed by community health service personnel with little or no previous computing experience. Both packaged and internally developed software is in use. This phenomena resulting in a new mode of participation in information systems development when departmental managers instigate the purchase and implementation of systems, is noted by Land (1982). This practice has been widespread, not just in community health, but in many other areas of the NHS. These local developments are often unknown outside of the districts, and occasionally even outside of the units in which they are developed.

From the results, it can be seen that there is a wide range of both hardware and software used to implement a multiplicity of community applications. Such a diverse range of systems indicates little or no attempt to apply a procurement strategy for standard equipment although most districts do now possess one. This again suggests that many purchases and developments have been made from local budgets in community health departments, independently of any external influences outside of community units.

The survey revealed the following types of application. Child health records are held by a number of districts on the national standard system, although several variations exist. This is the only nationally supported community system. Numerous other applications are available covering loan of equipment and stock control, patient registers, and statistical reporting systems on workload. Wiseman (1982) identifies the development of these systems, as managers start to recognise the potential of accurate and timely activity data. Many other applications are in use in a smaller number of districts.

There are a number of major community health systems in operation. The Wessex system provides statistical information on nursing activity, but does not provide Korner compatible information and covers only nursing staff groups. A system in Leicester HA provides comprehensive information on district nursing activity, but this is again incompatible with Korner.

The FIP community system also started life suitable only for district nursing staff, and has gradually been amended to take into consideration the Korner requirements and the needs of the health visiting staff group. The MIPP 'ComCare' system whilst meeting the Korner requirements does not take into consideration local needs, and has again been amended over a period of time to provide Korner data for other staff groups. Finally, the large scale centrally funded CHIP project will be completed too late to offer a solution to Korner. Immediate reactions to CHIP from many districts are that the project will be too expensive to implement and time scales are too lengthy.

Only 55 districts so far have systems which provide Korner compatible data. It appears that many districts are making a commitment to the MIPP 'ComCare' or FIP Community system to meet the Korner deadlines.

The main conclusion of this survey is that there is no community health information system which covers all staff groups, and has fulfilled the strategic objectives of meeting local needs of community health service staff and the statutory recommendations of the Korner steering group. This research programme could therefore proceed with the development of such a system, confident that this is a unique and novel information systems development.

3. SELECTION OF A DESIGN METHODOLOGY

Before attempting the selection of an information systems design methodology, it is necessary to understand the nature of both information and information systems.

3.1 The Nature of Information and Information Systems

Information can take many forms, have many values and be expressed in a number of different ways. Tully (1985) describes information as being 'that which is constructed from symbols, using a set of conventions, to convey meaning'. Symbols in this case either alone or by combination relate a particular state to the receiver of them.

It is possible to differentiate between raw 'data' and processed 'information'. Un-processed raw data may however be information to some, depending on its context. Information can be regarded as a subset of data. Land and Kennedy-McGregor (1981) propose five classifications for information. These are descriptive, probabilistic, explanatory (or evaluative), unexpected and propaganda. All information can be classified into one of these categories. Additionally, the nature of information can be described as formal (official) or informal (unofficial). Formal information includes hard facts and figures, whereas informal or soft information is often more intuitive or qualitative. Information processing in organisations is carried out by a combination of formal and informal systems which are closely linked. Informal systems may not necessarily process information but may simply store and communicate it in a passive manner.

Information is often regarded as a resource, with great emphasis being placed on the 'corporate data base' in an organisation. It is difficult however to place a value on or identify any 'transfer' value for information, as one can for other types of company resource such as capital or labour. The value of a piece of information may depend upon its accuracy, timeliness, consistency and on whether it changes the user's expectations about a situation. Information bonds the components of an organisation together by controlling the actions of individuals and groups. Scarrot (1985) classifies some uses of information as follows:

Accumulation of experience: Information can be represented in symbols and recorded permanently for future use.

Exploration of possible actions: Information in thought processes can be used to evaluate the consequences of taking various actions.

Adaption and operation of human groups: In a constantly changing environment, information is used to control the actions of people.

All organisations need to have information systems to operate effectively. The components of an information system might include computers, word processors, manual records, or the telephone system, all of which are operated by people who construct and work with them. Raw data is processed by information systems to transform the data into meaningful information. Most information systems are concerned with processing descriptive information such as sales or production figures and are of a formal nature. Descriptive information tends to be objective and verifiable. Information systems exist to generate, record, manipulate and communicate the information necessary to allow an organisation to carry out the activities which allow it to meet its objectives. They provide the different functions within an organisation with information necessary for rational decision making.

Land and Kennedy-McGregor (1981) suggest that anyone who develops an information system must acknowledge and take account of the existence of both formal and informal types of information. Advancements in information technology usually enhance the development of only formal information systems. Care needs to be taken to ensure that new systems do not destruct valuable informal systems without offering a suitable alternative. Earl and Hopwood (1980) suggest that replacing an informal system with a formal one may lead to a reduction in organisational performance. They suggest that this is because the spontaneity, flexibility and unofficial nature on which informal systems are based may well be lost in a formal system.

Five components of an information system are identified by Land and Kennedy-McGregor (1981) who suggest that interactions are required between all five components if an organisation is to operate effectively. There is a need for system designers to be aware of all of these components:

<u>Informal human system</u>: comprising interactions between groups and individuals in the area of discourse.

Formal human system: comprising a system of rules and regulations, departmental boundaries and roles for members of staff.

Formal computer system: comprising those activities removed from the original human system because they are automatable. A computer system works only by interacting with the human system.

Informal computer system: comprising the un-structured and informal information which is obtained from the formal systems often by means of personal computer work-stations.

External Systems: comprising the formal and informal links into the 'outside world'. No systems operate in a completely closed environment.

Land (1985) identifies three sources from where an information system may obtain its data. These are the 'real world' itself, other formal information systems which model the 'real world' and finally other informal information systems which often provide qualitative information about the 'real world'.

Vetter and Maddison (1981) suggest an information system should serve many applications, be easily expandable, and store and present information in a number of appropriate ways. Above all, a system should meet the needs of the users or otherwise it may be rejected by them. This research programme will attempt to produce such a system for the particular problem situation.

3.2 Information Systems Design Methodologies

An information systems design methodology is a collection of philosophies, stages, techniques, tools, documentation, rules, and training for practitioners who develop information systems. A methodology contains identified stages and each of these may contain sub-stages within them. Recommendations on the tools and techniques to be used in a stage, and how to plan, manage and control that stage may also be given.

Different methodologies have different boundaries, some may cover all stages of systems development, others may cover analysis and design only. Many do not cover system implementation but instead interface with a further implementation methodology. Fitzgerald, Stokes and Wood (1985) show that many methodologies cover the complete development life-cycle, whereas others are more restrictive. Similarly, some methodologies may claim to be generic in their applicability, others may be specific to hardware, software or type of application. A large number of methodologies for developing information systems are available. Many are similar but have different names associated with particular consultancy firms.

A number of assumptions may govern the underlying principles in a methodology. For example, a computer system may always be assumed to offer the best solution to a problem. As they compete for a share of the information systems development market, vendors claim that their methodologies are more logical than their competitors; more complete; produce documentation for both technical and user personnel; or are able to deal with complex problems and changing user requirements.

Maddison (1983) identifies the following framework for a methodology:

> Business Strategy: To decide the overall objectives of the business.
>
> Information Systems Strategy: To decide organisation wide guidelines on the requirements for information systems.
>
> Information System Strategic Planning: To decide on an overall plan for information systems development.
>
> Feasibility Studies: To assess the costs and benefits of various alternatives.
>
> Analysis: To understand and document the problems and needs of the business, and model information and processes.
>
> Design (Use): To specify external interfaces and design aspects of the information system, such as the functions to be performed by the information system as seen by the users. The design of inputs, outputs, screen layouts and reports for the new system will be considered.
>
> Design (Technical): To specify the internal architecture, logical and physical structures and data flows.
>
> Implementation: To carry out the processes necessary before the system is brought into operation.
>
> Transition: To bring the system into an operational state.
>
> Evolution: To maintain and fine tune the system.

Two major stages in development are concerned with analysis and design. These are described below:

Analysis stage: The meaning placed on the term 'analysis' varies between methodologies. Fundamental aims of all analysis procedures however are to understand the scope, the functions, and the building blocks for a system in order that it can be designed and implemented. In many early methodologies, analysis depended very much on the skills and ideas of the analyst, but in today's methodologies more formal approaches are used by identifying guidelines, procedures and techniques which reduce the chances of error or omission. A conceptual model of a system will often be produced during analysis. This is often pictorial and shows what a system does rather than how it does it. Data analysis will often be carried out as part of a systems analysis exercise.

Design stage: In this stage the system requirements are translated into logical and physical specifications. A logical specification may identify schema, sub-schema, file layouts and program specifications. A physical specification may identify data base descriptions, file descriptions and screen template designs.

Many early information systems implemented in the 1970s failed in their early stages. Often the requirements for a system changed between the system being specified and actually implemented or perhaps inaccurate models were produced of the 'real world' upon which the design was based. Many systems did not meet the needs of users. More recent development methodologies try to overcome these problems by using approaches such as participation, prototyping or powerful data analysis techniques. These are described in section 3.4.

Episkopou and Wood-Harper (1986) suggest the different methodologies available for designing systems provide different ways of viewing the same world. They suggest that there is no 'best way' to carry out the development of an information system, since the above approaches are not mutually exclusive and the approach to be used will depend upon the circumstances of a particular situation. Certain principles, tools and techniques may be relevant in some situations but not in others.

3.3 Requirements for a Successful Design Methodology

In order to select or define a methodology for producing a community health information system, it is necessary to identify the requirements for such a methodology. This section describes a series of general requirements which any methodology should seek to address and then identifies some specific requirements for this problem situation.

Two important issues which will effect the design of a community system are the recommendations of the NHS/DHSS Korner steering group on health service information, and the requirements of the UK Data Protection Act. These are described in detail before the specific requirements, which incorporate these issues, are presented. Each requirement has a unique identification used for cross referencing purposes.

Examples are given to show how one design methodology meets some of these requirements. Learmonth and Burchett Management Systems Ltd. (LBMS) market this methodology, known as the LBMS System Development Methodology (LSDM) which is described by Hall (1983) and Burchett (1985).

3.3.1 General Design Requirements

In this section, traditional thinking on requirements analysis is given early on, and more current thinking follows later. Some of the early ideas on requirements are summarised by Catchpole (1986b).

R1 Rules: Tozer (1985) identifies the need for formal guidelines in a methodology to cover phases, tasks and deliverables; tools and techniques; documentation and development aids; and guidelines for estimating time and resource requirements. More current thinking asserts that rules must not be too restrictive and need to be flexible, otherwise the wrong solution may be produced at the right time.

The six phases in LSDM all have extremely well defined tasks. Tools and techniques for use in each stage are defined, together with the outputs expected from that stage.

R2 Total coverage: A methodology should cover the entire systems development process from initial analysis stages through to transition, implementation and maintenance. This is stressed by both Bantleman (1984) and Tozer (1985).

R3 Understanding the information resource: MacDonald (1983) suggests the aim of a methodology is to ensure effective utilisation of the corporate information resource. The requirement to achieve this involves understanding the resource in terms of the data available and the processes which need to make use of the data. LSDM for example, does this by producing three separate views of data in an organisation, which together form a comprehensive and verifiable data model of the information resource. A separate phase then documents the functions required and their data requirements.

R4 Documentation standards: All output from a methodology should be easily understandable by both users and analysts. Jargon free text is essential. There is a need to move away from the 'Victorian novel' type of specification associated with many early systems. Well presented documentation leads to easier systems maintenance and evolution. Documentation which is easily comprehensible can be transferred between projects. Bantleman (1984) suggests that standards once specified should be adhered to. Examples of standards might include the specification of symbols to be used for rich pictures or entity models, and the definition of standard forms on which to record design decisions. In more current thinking, a flexible approach to standards is suggested, to suit particular circumstances.

R5 Separation of logical and physical designs: A methodology should ensure total separation of logical descriptions and requirements for a system, from any specific technical or physical design solutions to meet these requirements. There should be no physical design connotations derivable from any of the logical design documentation. This is essential because design requirements are more stable than the technical solutions to meet them. Tozer (1980) describes this further. For example, technical solutions may need frequent modifications to provide hardware or software performance 'trade offs' in a data base.

R6 Validity of design: A means is required to check for inconsistencies, inaccuracies and incompleteness in outputs produced. Each stage of a methodology should incorporate verification procedures to check on the correctness of the analysis and design work. [Bantleman (1984)]. Many methodologies achieve this by means of structured walkthrough sessions held with users. Forms of user participation are to be encouraged. The provision of quality assurance activities is also advisable. It may be beneficial to construct multiple views of a system using different techniques, and these could be compared for consistency. LSDM incorporates three techniques for viewing an organisation's data which are comparable for consistency checking.

R7 Early changes essential: Any changes to a system design should be identified as early as possible in the development life cycle. This is because of the rapid increase in cost and time associated with progression along the development curve. A need is therefore implied for verification procedures.

R8 Inter-stage communication: The full extent of work carried out at each stage must be communicable. [Bantleman (1984)]. Output from one stage should form the input to the next. Yao (1985) suggests that for successful systems design, input from the analysis to the design stages must be consistent, complete and useable.

R9 Effective problem analysis: A methodology should support problem analysis by providing suitable means for expressing and documenting the problems and objectives of an organisation. [Bantleman (1984)].

R10 Planning and control: Careful monitoring of an information systems project is required. A methodology must support development in a planned and controlled manner. This will help ensure systems are developed within a sensible time scale and at an acceptable cost. [MacDonald (1983)]. A methodology could aid project planning by incorporating a project control technique, although this does not necessarily need to be integral to the methodology. [Bantleman (1984)]. Accountability, monitoring and control will allow the user to see the true costs associated with the development of systems, and cause them to consider future design requests carefully.

The six phases of LSDM for example, each with their own sub-divisions, ensure that a series of checkpoints can be identified for development staff to work to. It is these checkpoints that can provide an interface with a project control technique.

R11 Performance evaluation: A methodology should support a means of evaluating the performance of operational applications developed using it. The methodology should facilitate the inclusion of implementation and performance constraints as necessary for an information system. [Wasserman and Freeman (1976)].

R12 Increased productivity: Often the only justification for adopting a new methodology is that of increased productivity in systems design. This can then be sold to management in financial terms. [Bantleman (1984)].

R13 Improved quality: A methodology should improve the quality of analysis, design and programming products and hence the overall quality of an information system. [Bantleman (1984)].

R14 Visibility of the product: A methodology should maintain the visibility of the emerging and evolving information system as it develops. [Wasserman and Freeman (1976)].

R15 Emphasis on data over functions: A methodology should place emphasis on producing verified data models on which to base the design of a system. This is because data is more stable than the processes which access the data. Avison (1985) describes this stability of data over time. LSDM incorporates techniques for analysing the data and processes of an organisation separately. Tagg (1980) emphasises the need for both data and functional analysis for successful systems development.

R16 Teachable: Wasserman and Freeman (1976) stress the need for a methodology to be teachable. Users themselves should appreciate the various techniques in a methodology in order that they can verify analysis and design work. They need to understand the work that has been carried out in order to be able to identify corrections.

R17 Information systems boundary: A methodology should allow definition of the areas of the organisation to be covered by the information system. These will not necessarily be areas for computerisation, since the information system may have manual aspects. This is described by Avison (1985).

R18 Designing for change: Technical design should allow easy modifications or additions to be made to physical file structures or data bases. All systems need to change over time if they are to survive, and a methodology should support this evolution.

R19 Effective communication: A methodology should provide an effective communication medium between analysts and users. [Bantleman (1984)]. All members of a project team need to communicate effectively through the methodology. Yao (1985) suggests that if technical and user personnel do not interact and communicate effectively, it is unlikely that a successful system will be produced.

R20 Simplicity: A methodology should aim for this, even as systems become more complex in terms of hardware and software developments. [Bantleman (1984)]. If a methodology is misunderstood then it will be misapplied. [Tozer (1985)].

R21 Ongoing relevance: Bantleman (1984) suggests that a methodology should be extensible so that new tools and techniques can be incorporated as they are developed. A methodology needs to be 'open ended' but still retain its overall consistency and framework. It will then remain relevant to current thinking and not become outdated. Avison and Wood-Harper (1986) describe new developments in tools and techniques, along with new technology itself, as a 'moving target' to be addressed by information systems methodologies.

R22 Automated development aids: Where possible automated development aids such as data dictionaries and modelling tools should be used since they can enhance productivity and reduce development time in the application of a methodology. [Bantleman (1984)]. A good automated data dictionary would allow the storage of meta-data about both data and functions at the logical and physical level. Use of new technology must be made in a balanced way. There are numerous automated analysis and design aids available to support existing methodologies such as Auto-Mate and Data-Mate for LSDM.

R23 Consideration of user goals and objectives: The goals and objectives of potential users of a system should be noted, so that when an information system is designed, it can be made to satisfy these users and assist them in meeting their goals and objectives. [Land (1976) and MacDonald (1983)].

R24 Flexibility: Tools and techniques should be available in a methodology which can be selected as required to fit particular circumstances in the problem situation. A variety of different approaches to systems analysis and design should be available within a methodology framework. It should be possible to omit and adjust aspects of a methodology as required.

R25 Participation: There is a need for those people in an organisation who will eventually use an information system to take part in its design. Firstly, this is because people have a right to control their own destinies and their interests need to be protected. Secondly, the understanding and knowledge of the organisation they will be able to impart, will lead to a much better understanding of the requirements for an information system. These views are described by Land (1982) and Mumford (1983). It is essential that user management become involved in both the definition of business needs and the identification of priorities and solutions to meet these needs. This will ensure commitment from management to an information systems project.

R26 Relevance to practitioner: It is important that a methodology is appropriate for the practitioner applying it. Level of technical knowledge, experience with computers, systems analysis and design, and organisational change, will vary with different types of practitioner. Similarly, social and communication skills will vary. Episkopou and Wood-Harper (1986) describe a framework for selecting an appropriate information systems design strategy based on assessing the characteristics of the problem solver (system designer) and the problem owner (system user).

R27 Relevance to application: The methodology used must be appropriate for the type of system being developed. [Tozer (1985) and MacDonald (1983)]. Types of application may include scientific, commercial, real-time or distributed. LSDM and many similar packaged methodologies have proved inappropriate for many classes of application because of their inflexibility. Features of one methodology may be appropriate in certain circumstances, but not in others.

3.3.2 The Korner Steering Group on NHS Information

In 1974, it was recognised that existing health service information systems would not be able to support the management functions required after the reorganisation of the NHS which took place at that time. Shortly afterwards, criticism was directed at the NHS Resource

Allocation Working Party (RAWP) claiming that very little was known about activity in the community services, and important information was lacking about primary care and patients in hospital. The report of the Royal Commission on the NHS (1979) again criticised the information systems of the service as being inappropriate and having poor definitions and classifications for data. It was suggested that data being collected and processed was not relevant to modern methods of health care and was neither accurate nor timely. Jones (1984) identifies a vicious circle of lack of timeliness, accuracy and subsequent under-use of information. The cause of these problems was thought to be the DHSS, who, since the inception of the NHS, made their information needs take precedence, often at the expense of NHS management.

In response to these criticisms the then Secretary of State, Mr. Patrick Jenkin, set up the NHS/DHSS steering group on health service information. This group had the following terms of reference:

' 1. To agree, implement, and keep under review, principles and procedures to guide the future development of health service information systems.

2. To identify and resolve health service information issues requiring a co-ordinated approach.

3. To review existing health service information systems.

4. To consider proposals for changes to, or developments in health service information systems. '

which are described by Korner (1982). The composition of this group was noteworthy since the majority of members came from the NHS, including its chairwoman Mrs. Edith Korner.

To decide what data to collect and process, the group looked at the needs of various tiers of information user. Precedence was given to the needs of district managers and health authorities. Statistical information for planning and accountability at district and regional level was then given careful thought, as were the requirements of the DHSS itself in collating information for decision making.

Three criteria were applied in selecting data for collection. Firstly, was it desirable to collect a certain data item, secondly, was it feasible to collect that data item accurately, and thirdly, was it affordable to collect it within current financial constraints. Data which fitted this criteria was assembled into minimum data sets and presented in six reports. These cover the activity areas of hospital, ambulance, laboratory and diagnostic, para-medical, and community health services. Manpower and financial accounting functions are also described.

In April 1984, the Secretary of State for Health instructed all health authorities to implement the recommendations of the Korner steering group by April 1987 for hospital services, and April 1988 for community and para-medical services.

The community health services have always provided a 'poor' quality of information in terms of accuracy and timeliness because of the complex nature of the service and high volume of data to be processed. Speakman (1984) observes that even though an increasing number of people who require care in the community are being discharged from hospital within a shorter space of time than ever before, it is difficult to support a case for more resources because current information systems have difficulty showing these increases. Webster (1984) and Davies (1984) both recognise that the implementation of the Korner recommendations in the community using computers will improve this situation.

The recommendations for community and para-medical services are described by Korner (1984a and 1984b) and Fairey (1985). Two minimum data sets are described for the community, one covering patient services provided to the community, and the other covering patient care in the community. Services to the community are divided into programmes of care such as immunisation, health surveillance and health education. Patient care in the community includes programmes such as general, mental illness and mental handicap services. By specifying care programmes, activity data can be related to services. Each programme will be described in terms of the type of service it is intended to provide, who should receive that service, and who is actually receiving it.

Each set of data items are the minimum required to satisfy district, regional and DHSS needs. No operational data items are specified. For example, to determine the day to day deployment of resources, a manager may need to know not only the type of service given, but also who delivers that service and in what way. In addition to recording the type of a visit, the content or duration of that visit may need to be recorded.

A key strategic objective for a community health information system is to meet the recommendations of the Korner steering group covering the community and para-medical service minimum data sets.

3.3.3 The UK Data Protection Act

Jones and Richards (1978) note that protecting confidential information has been an important ethical tradition of the health professions for many years. Further discussion of patient's rights and privacy concerning computer storage of medical data is found in Westin (1977) and Trute (1982). As much of the data to be stored by a community information system will be of a personal nature, that data will be subject to the regulations of the UK Data Protection Act.

The Act is based on proposals outlined in a government white paper about data protection on which comments from the health professions were sought in 1982. The Act establishes the post of data protection registrar, who will maintain a public register of data users, and have the power to ensure that personal data is used in accordance with the principles of the Act as described by the Office of the Data Protection Registrar (1985).

The NHS/DHSS steering group on health services information has also studied aspects of confidentiality of health data, and have made recommendations outlined in Korner (1984c).

Data items covered by the Act should be easily identifiable, together with necessary meta-data in order to provide the details required for the registration of the system. This could include, for example, access information which defines who is allowed to execute particular functions or access particular types of data. Definition of this meta-data at the design stage and possibly storing it within a data dictionary system will ensure that it will be easy to provide appropriate details of the information system to the local Data Protection Officer.

3.3.4 Specific Design Requirements

The following specific requirements have been identified for the particular problem situation:

R28 Fulfilment of Korner recommendations: It is necessary that a methodology is capable of analysing the minimum data set recommendations of the Korner steering group on health service information as described in section 3.3.2. In addition, operational data items need to be specified on top of the minimum data set.

R29 Data protection: A methodology should provide meta-data in the required format to the Data Protection Officer. This will ensure registration for the information system can be made and subsequently updated as required by the UK Data Protection Act as described in section 3.3.3.

R30 Design for integration: The community health service comprises of at least fourteen separate nursing and para-medical staff groups. A single system is required to satisfy the information processing requirements of each group. Many groups, such as health visitors and community midwives, currently process identical client information separately. A methodology must facilitate the identification of duplicate data items and functions and allow integration across all staff groups. A number of discrete views of community information will be required for each staff group and a means is required to identify where and how these views can be integrated.

R31 Expansion and linkage: Rapid developments are taking place in the areas of family practitioner committee (FPC) registration systems, hospital based patient administration systems, and community health records, and it is likely that interfaces into these applications will be required. A methodology should allow the production of a system which can easily be interfaced to other applications. This implies a need for suitably presented documentation.

There are numerous benefits associated with the integration of health records, such as increased accuracy, less duplication, and easier amendment and verification of data. Such a concept does pose problems with regard to privacy of data and restriction of access to those parts of a record that a user is authorised to view.

A patient record can be regarded as a tool for communicating and recording information, and for initiating actions and decisions. Often a single record structure cannot fulfil this purpose, and so temporary linkage to other records may be desirable to widen the range of information available. This concept is made feasible with electronically held records. Record linkage and integration is described by Rouse (1978) and Mikan (1984). The scope for linking community health records using computers is described by Davies (1984).

<u>R32 Variety of participants</u>: The motivation of the end users of an information system varies greatly. Some are highly enthusiastic about being able to participate in a re-design of their current manual information systems, and others less so. The communicative and social skills of each staff group and the skills associated with different management grades in each group, also vary greatly. A methodology must enable attention to be given to the personalities of the users and their abilities to specify requirements. Episkopou and Wood-Harper (1986) describe this further.

<u>R33 Non-technical user involvement</u>: Staff groups who work in the community services have had no exposure to the design or operation of computer systems. A methodology employed for use in the organisation must be capable of being taught to and applied by these users in order that they can record their needs accurately and then verify their correctness.

<u>R34 User interface</u>: In order to provide rapid retrieval of patient information, a terminal based on-line enquiry system may be required which is accessible by all staff groups. Attention will need to be given in a methodology to the man-machine interface and the most suitable ways of providing such an interface.

3.3.5 Conclusion

This section has defined requirements for a successful information systems design methodology. General requirements have been identified and more specific requirements defined for the particular problem situation. Two key issues connected with this problem situation are the recommendations of the NHS Korner steering group and the UK Data Protection Act. These have been described and appropriate requirements extrapolated.

These requirements will be used to justify the use of a design methodology in the problem situation.

3.4 Approaches to Information Systems Design

This section presents a number of approaches for developing information systems. These often form the basic philosophies on which methodologies are based. Four approaches are identified, but special emphasis is given to the participative approach because a sub-objective of this research programme is to involve members of the community health service in systems development using participation.

3.4.1 Participative Approach

Participative systems design involves users positively in the decisions about the design of information systems. Mumford (1983) suggests that any comprehensive discussion of participation needs to consider structure, content and process. Structure is concerned with how participation is enabled to take place. The content of the participation concerns the type of issues about which decisions are taken, in this case with regard to information systems design. Finally, the process of participation concerns how decisions are taken, knowledge acquired, how effective working relationships are formed over time, and how solutions are implemented. Mumford (1983) describes three participative structures:

Consultative participation: A systems design group will be set up which will take design decisions on the new system although there will be a large amount of consultation with staff at all levels in the user department. The bulk of the design decisions will be taken by traditional systems analysts although the needs of the user department will be a major concern of the group.

Representative participation: This involves a much higher level of user participation. A design group will be set up which is representative of all staff grades within the user department. Members of the group will probably be selected by management. Each member of the design group could make an equal contribution to decisions. A problem with this approach is that the selection of participants by management may lead to the branding of 'management favourites' or 'yes men'. The apparent generosity of management to allow participation in this form may be regarded with suspicion by other staff. Mumford and Henshall (1979) describe these problems further and Mumford (1981) describes a practical application of this approach.

Consensus participation: This is a democratic approach because it involves all the staff in a user department. A design group will be formed with representatives of the user department and technical staff. A feature of this approach is that representatives from the users will be elected by the users themselves. The role of the design group here will be one of decision making, but also receiving and feeding back information to the department as a whole, allowing it to make final decisions. Mumford (1980) describes an application of this approach in the purchase invoice department of a large engineering company. A problem with this approach can be the long time scales necessary for the extended decision making process.

The above structures rely on the formation of a design group for their successful operation. The constitution of this group is vital to the success of a project. Mumford, Bancroft and Sontag (1983) suggest that the group should comprise of representatives from each major department with an interest in the information system. These representatives should cover different levels of seniority, a 'diagonal slice' of the organisation. Group members should be people who are interested in the work; have the time available; are able to think broadly and creatively; and are good communicators. A consultant or technical facilitator may advise the design group to help them make informed decisions. They will not however take on the traditional systems analyst role by making decisions themselves. Participative projects sometimes have a long lead time while group members acquire the necessary skills they need for analysis and design tasks.

The benefits of participation are numerous and are described by

Land and Hirschheim (1983). By utilising the knowledge held by individuals about their systems, we can clearly obtain a more accurate picture as to what is required in a replacement system. There are more subtle benefits however. The increased commitment given by users and achieved through participation could mean the difference between the acceptance or rejection of a new system.

Rejection of a system by its users may occur because they resist the changes which a new system may bring to an organisation. People may resent change because they are inherently conservative and prefer to practice familiar skills in well established situations, rather than learn the new skills often associated with new technology. If a system is imposed on an unsuspecting user community, it is less likely to succeed than if collaboration was made with these users about its introduction.

To counteract any resistance to change, a suitable mechanism needs to be established. This may be done using a 'fix' to detect and counteract the 'games' that people play to frustrate the introduction of new systems. Alternatively, a 'prevention before cure' approach may try to gain the commitment of users before a system is implemented. Examples of these situations were given by Professor Land in a seminar presented at Aston University entitled 'Resistance to Change' in March 1987.

Participation is an approach which may be used to involve users throughout the development of any new system in which they will be ultimately involved. The resulting commitment may ensure that they are willing to learn new skills and respond positively to the introduction of the new system. It is known that people can and do respond rapidly to changes, and have a high capacity for learning new skills when a suitable climate exists. This research programme makes use of a participative approach to try and establish such a climate.

Mumford (1983) describes a methodology known as 'Ethics', which shifts responsibility for systems analysis and design on to those who will operate and use an information system. 'Ethics' differs from traditional methodologies in two ways. Firstly, it places emphasis on people's needs in an organisation and requires that they be taken into account in systems design. Secondly, it uses participative techniques to derive the specification for a system. In this way, individuals and groups who traditionally have taken no role in the design task are able to contribute. Whilst participation is important however, the technical aspects of system design must not be neglected and a balance needs to be achieved.

3.4.2 Structured Systems Analysis and Design Approach

De Marco (1980) defines structured analysis as the use of data flow diagrams, a data dictionary, structured English and decision trees and tables, to build a structured specification for an information system. These tools meet the two basic needs of systems analysis because they provide a communication mechanism between analyst and user, and allow precise recording of a specification suitable for translation into a system.

Dataflow diagrams are used as an analysis tool to show flows of data, irrespective of any physical or organisational boundaries and the medium of flow. A top level context diagram can be developed showing only inputs and outputs, and then a successive explosion of this can take place until 'functional primitives' are defined.

Yourdon and Constantine (1978) describe structured design as a way of designing the components of a system and their inter-relationships in the best possible way. Connor (1985) defines design as a strategy to convert a specification from structured analysis into an implementable computer system using certain design tools and principles. These include structure charts, transform and transaction analysis, and module packaging.

In this approach systems are designed for change. Structured development techniques allow changes to be made to one part of a system, which are non-destructive to other parts. A project is broken down into increasingly smaller units called modules, until a level is reached where each module can be adequately described using a number of available tools. This is known as functional decomposition and is a 'top down' approach to systems analysis and design. Complex problems are broken down into smaller subsets to make them more manageable and easier to control. This in turn makes the maintenance and evolution of a system much simpler.

3.4.3 Data-Centred Approach

This approach is used to analyse and document the data associated with an organisation. Formal methods are available for ensuring this is carried out both quickly and accurately.

Data analysis examines the data elements in an organisation and their relationships with one another. It assists in determining the fundamental data resources of an organisation by collecting together relevant facts about data, thereby providing a sound basis for data base design. Data models are application independent. They should be accurate and complete enough to satisfy most applications and end users in an organisation. Data items change less than the functions using them therefore the design of systems should be based on data rather than functions. This can be achieved using data analysis techniques, which in any case are desirable when a data base solution for an information system is being considered.

A conceptual analysis may be applied before data analysis. This provides a good understanding of the organisation and helps to minimise the cost of detailed data analysis by limiting the scope of such analysis. The methods used in conceptual analysis are similar to data analysis. The aim is to define entity and relationship types, without the detail of specifying attributes.

Most techniques in data analysis neglect to show flows of data, but only model a static representation, however more recent techniques such as entity life history analysis add a dynamic dimension to modelling. The approach is powerful in analysis, implementation independent and can be supported by a comprehensive data dictionary. Data analysis is well described by Davenport (1978), Hawryszkiewycz (1982) and Stephens and Martindale (1984).

3.4.4 Prototyping Approach

The use of a prototype allows the demonstration of a potential system to users, allowing comments and criticism to be made without any 'irreversible' work being done on a real system. Prototyping can be regarded as an extension of the systems development process. The philosophy behind the approach is that if users can see what the final version of a system will be like, and are able to agree on its acceptability, then there is a much less possibility of the final system being rejected.

A quick delivery of a skeletal working system can be made which will effectively test out the design principles of a system with users, who can then be involved participatively in the construction of the system. Changes suggested by them can be implemented immediately in an iterative cycle until, for example, screen and report layouts are considered satisfactory.

Often a prototype can be turned into the final system saving time and effort. Developing a prototype will typically take less than 10% of total development time. An experimental design can be implemented at comparatively little cost. Numerous packages are available to allow rapid development, and some systems allow prototypes to access data already stored in existing data bases. Prototypes are usually regarded as 'quick and dirty' systems, which may be less efficient and lack data validation when compared with a final system. However, if care is taken during their design, they can be turned into effective operational systems. A prototyping approach responds well to the complexity and uncertainty associated with the development of high risk information systems.

Fourth generation languages (4GLs) are particularly suited to developing prototypes. These are non-procedural, specification languages rather than programming languages, which describe what is to be done, rather than how it is to be done. The findings of the Institute of Data Processing Management (IDPM) Working Party on fourth generation languages, described by Stephenson (1986), indicate a continuum of fourth generation language products.

This continuum is based on a trade off, with 'technologist orientated' products at one end of the continuum and 'end user' products at the other. At the 'technologist orientated' end is found the application generator. These are products providing facilities for constructing the programming parts of a complete system. They are suitable for use by professional programmers. Increasing scope is offered by transaction processing system builders, decision support products and, at the extreme of the continuum, total end user products. These are pure 4GLs and require little or no programming skills.

Application generators provide programming facilities to generate systems. Generally, the code they generate makes less efficient use of computer hardware than traditional third generation language code produced by an experienced programmer. They do however improve productivity amongst development staff significantly. Their use is particularly appropriate to the production of prototypes because they allow the rapid development of systems.

3.4.5 Conclusion

The four approaches described each have benefits associated with their use. Participation clearly offers advantages to be gained by involving users, although the training required and tasks to be carried out in a design group may be time consuming. Nevertheless, a requirement for a methodology to be used in this problem situation is to involve users in system development **[R25 Participation]** and to consider their aspirations **[R23 Consideration of user goals and objectives]**.

Structured analysis and design approaches provide an effective way of analysing problems by their logical decomposition of systems, again an identified requirement **[R9 Effective problem analysis]**. Data-centred approaches clearly address specific requirements on data such as **[R3 Understanding the information resource]** and **[R15 Emphasis on data over functions]**. Whilst most techniques in a data-centred approach model static states only, newer techniques such as entity life history analysis can reflect the dynamic state of data.

Prototyping approaches offer a great potential for time saving, which could be used to counteract the extra time needed for participation and user involvement. They offer a much greater chance of success in terms of user acceptance, and can save a great deal of overall development time and effort. They allow flexibility and easy iteration of the development cycle. Human-computer interfaces can be easily evaluated using this approach **[R34 User interface]**.

The main conclusion drawn is that each approach evaluated has a great deal to offer information systems development and each addresses a wide range of the requirements identified earlier. A design methodology does not need to be based on an exclusive approach however, but could use as its underlying philosophies, some or all of the approaches identified. In this way, a methodology may meet a greater number of requirements than would otherwise be the case.

3.5 An Overview of some Current Methodologies

In 1982, an International Federation for Information Processing (IFIP) working group (WG 8.1) organised a conference to provide a comparative review of information systems design methodologies. A comparison of the facilities in various methodologies was attempted by specifying a standard case study. The study used was that of organising a conference. Thirteen methodologies were compared by being applied to the case study. The results are recorded in Olle, Sol and Verrijn-Stuart (1982). The test case however did not compare all the facilities of each methodology. Antill (1985) suggests that the conference discovered what a large number of confusing and diverse principles were apparent in information systems design, rather than identifying any common underlying principles.

A further IFIP conference on the same topic was held in 1983 and attempted to carry out a further comparative review of methodologies. The results of this review are described by Olle, Sol and Tully (1983). The third conference in this series was held in 1986 and entitled 'Improving the Practice'. A number of methodologies were reviewed, including many of those which were presented in the first conference and have since been developed further. Olle, Sol and Verrijn-Stuart (1986) present the proceedings of this conference. The work of IFIP in information systems research over the last ten years has been recorded by Verrijn-Stuart (1987).

A number of other feature analyses and reviews of methodologies have been carried out. Maddison (1983) describes one such analysis, Bemelmans (1984) and Wood (1984) also review a number of methodologies. Wood-Harper and Fitzgerald (1982) compare six approaches to systems development with respect to the objectives of each methodology and the models provided.

These reviews have provided a valuable record of the type of development methodology available, and many of those discovered in the literature presented are discussed below.

3.5.1 Data Analysis / Data Base Methodology

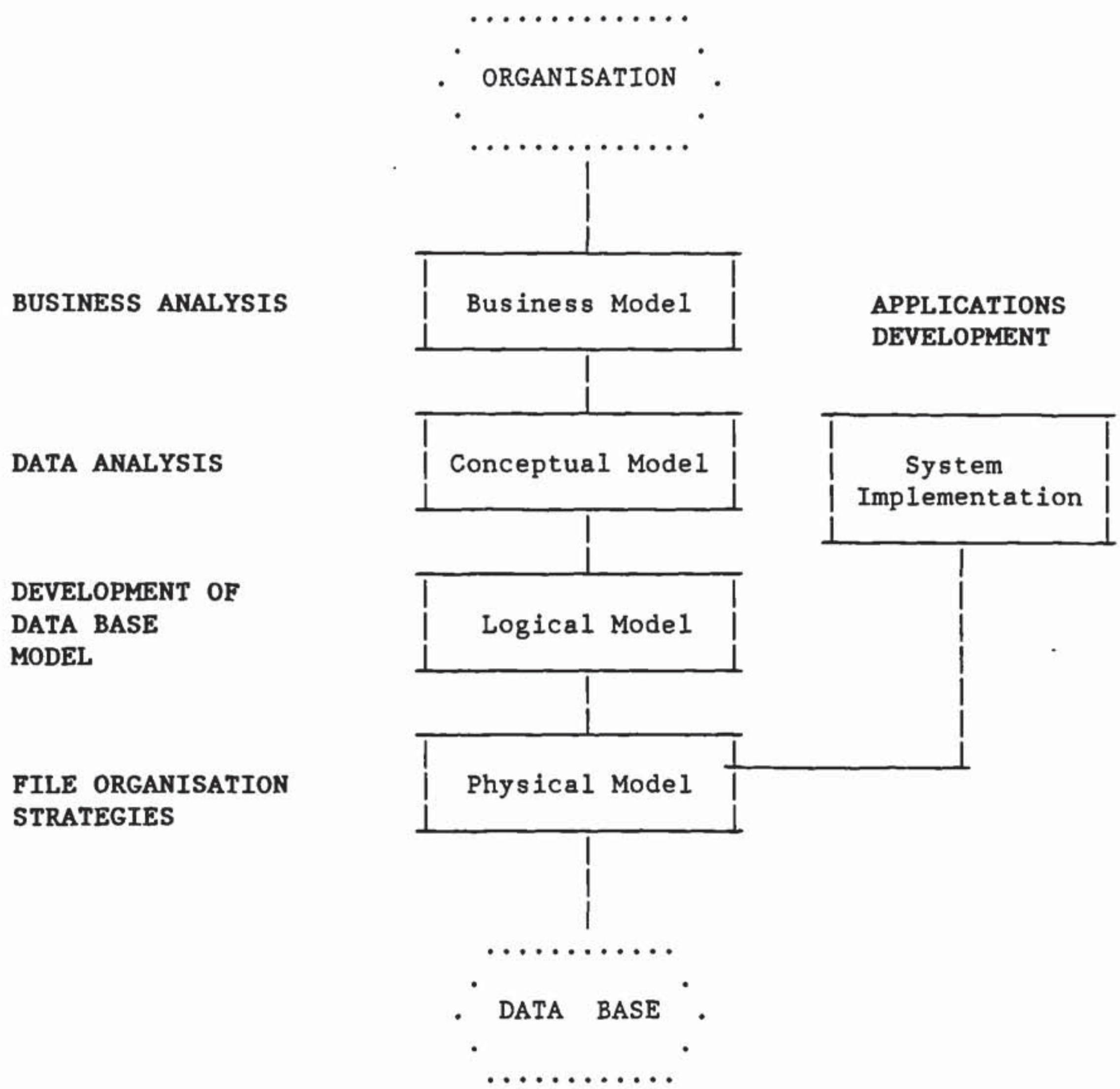
This methodology attempts to reflect aspects of research into data dictionaries, documentation techniques, the need to involve the user in systems development, and application generators. These are all covered by requirements for a methodology suitable for use in the problem situation for this research programme. The methodology consists of stages ranging from establishing an informal model of the organisation to the physical implementation of a system. A series of mappings take place which transform a conceptual model of the organisation into a physical model. Table 3.1 shows the stages in the methodology and the models produced. Avison (1985) describes these stages:

Business analysis: An overview of the organisation will be produced. The organisational structure will be studied together with the goals which will help determine the types of information required by management. Alternative strategies for system implementation will be evaluated and the best ways of approaching change investigated. An attempt is made to study the organisation as a whole to prevent any important relationships being lost if a breakdown occurred. It is particularly important to define boundaries and interfaces to the organisation. A systems planning team may be appointed to co-ordinate a project and advise on the strategy for development. Crowe and Avison (1981) discuss some alternative strategies for information systems development.

Data analysis: A formal conceptual model of the organisation will be produced. The entities in an organisation and their relationships will be documented together with items of interest about each entity. The entity relationship approach is one of the most widespread techniques of data analysis and is applicable in this stage. A number of alternative techniques could be considered such as a document driven technique which is a 'bottom up' means of performing data analysis.

Develop a data base model: Mapping of the conceptual model into a logical model is carried out. The form of this model will depend upon the data base management system (DBMS) in use. A hierarchical, network or relational DBMS may be used, and the logical model will reflect this. The conceptual model used for this is DBMS independent, but the logical model is not.

Table 3.1 Stages in Data Analysis / Data Base Methodology



File organisation strategies: The logical model will be mapped onto the DBMS in the form of relations, hierarchies or networks. File organisation and access will be considered depending on technical considerations and a physical model will be produced.

Application development: Application sub-systems will be developed and implemented. In practice, it is likely that applications will be developed before a total data base is implemented because management may require an earlier payoff. The data for one department may be analysed, a data base set up, and applications developed and implemented before moving on to study the next department and so on. Some applications may be implementable using a DBMS query language. In large operational systems, a method of systems analysis and design will need to be employed. The conventional approach may be used which could be enhanced by using participation, prototyping or fourth generation tools. Avison (1985) suggests that each application needs to be assessed to determine which approach to systems development will be most suitable.

Comment on Methodology

Advantages of this methodology include the emphasis placed on understanding the information resource in terms of the data available to the organisation, and the clear separation of logical and physical models, apparent in the stages defined. This methodology will produce a design for an integrated solution to information systems development within the organisation. A disadvantage with regard to this research is that it does not define in any detail how to produce applications, but only considers global data base design, assuming that applications sub-system development will follow on.

3.5.2 Development of Data Sharing Systems (DDSS) Methodology

DDSS consists of six stages which cover strategic planning, analysis, design, system construction, transition and production. DDSS is especially suitable for systems which will apply data base technology. About forty tasks are defined in the methodology and emphasis is placed on producing accurate diagrammatic models and a data dictionary. Some of the principles of DDSS are:

1. Interactive use of a data dictionary for all documentation and development work.
2. Emphasis on simple diagrams with standard specifications.
3. Decomposition of tasks into small, well defined and controllable units.
4. Orientation towards producing a strategy for systems development.
5. Complete separation of analysis and design tasks.
6. Clear distinctions between application and data orientated tasks.

The six phases of DDSS are described below:

Strategy: By starting with the needs, problems and priorities of the users, the main entities and processes are defined and a development strategy produced for each application area identified.

Analysis: The requirements of each area will be specified in detail, then analysed and documented. Models produced at this stage include a global entity model, detailed entity models, and functional entity models local to each application area. Access path analysis is shown on a functional logic model and an attribute usage matrix shows the grouping of attribute types against the information operations that retrieve or update them.

Design: All technical detail: files, data bases, transactions and dialogues are designed in this stage and documented. The facts gathered from analysis are used for this and eventually for program and operational procedure designs. Output from the stage includes logical and physical data models, transition control matrices, input forms and screen and report layouts.

Construction: Programs are developed, new data loaded and production documentation produced in this stage. Program testing is carried out. Acquisition of hardware and software including a data base management system is also part of this stage.

Transition: The system will go live either in parallel or with direct changeover. Tasks include training users, data preparation or conversion, and acceptance of the system by the users.

Production: Appropriate maintenance and tuning will take place until the system is satisfactory.

This methodology was produced in the early 1970s. In 1978, it was recommended by ICL. An enhanced version of DDSS was produced in 1980 by CACI-International known as D2S2. Many aspects of DDSS are included in the 'Information Engineering' methodology of James Martin. DDSS is described further by Palmer and Rock-Evans (1981) and MacDonald and Palmer (1982).

Comment on Methodology

Advantages include its comprehensive coverage of the development process, its emphasis on the importance of data, and again a clear separation of logical requirements from specific technical solutions. The methodology recognises the need for careful planning and control, and specifies documentation standards for effective communication. A disadvantage with regard to this research is the lack of opportunity to involve users in the development process to any great extent through participation.

3.5.3 Information Engineering Methodology

The term 'information engineering' (IE) suggested by Clive Finkelstein was adopted by James Martin to encompass a set of disciplines for developing information systems. Systems developed using this method are based on data and its relationships which are considered in terms of business policies. A major feature of IE is that users play a large part in the specification and design process. The logical data bases used in a system will be primarily produced by users, and this will improve the understanding and appreciation that the users have of a system. Martin and Finkelstein (1981) and MacDonald (1986) describe this methodology in detail. Mitchell (1985) describes the practical application of IE in one of the regions of the British Gas Corporation.

Some of the disciplines of IE include:

Strategic requirements planning: establishes long range plans based on the organisation's objectives and identifies present and future information needs.

Information analysis: defines operational objectives for the organisation and the information needed to meet these objectives. This information is presented as logical data models showing the entities and relationships in the organisation.

Procedure formation: allows the users to study the data models already constructed and identify events that change the state of entities and the conditions that precede or succeed these events. Business procedures are defined in terms of combinations of these events and conditions to allow the logic for computer and manual procedures to be defined.

Data use analysis: studies the data model in terms of the accesses required to support the procedures identified from the previous stage and considers volumes of data. This information is passed to the physical implementation stages.

Implementation strategies: implements and tests the system design and considers acquisition of hardware and software.

Distribution analysis: considers the corporate data requirements of the organisation as a whole to determine whether a centralised or distributed approach should be adopted, how the data bases or files should be structured, and what communications are required.

Physical data base design: by using the data model and output from data use analysis, the physical implementation of the data structures can be made.

Fourth generation languages: may be used to produce an implementation system and their use will be considered at this stage.

Program specification synthesis: Programs are coded in this stage. A data dictionary will be used to hold details of common modules which are based on pre-defined procedures. These modules are drawn upon to incorporate into necessary program code.

Comment on Methodology

IE is a highly sophisticated product which has been developed over a number of years. It is very comprehensive and has been used successfully by many organisations. Its application however, requires practitioners to be highly proficient in the tasks involved, which can also be lengthy and time consuming. A comprehensive set of standards are to be adhered to. A disadvantage of IE is that within this rigidity, it is unclear how some of the specific requirements for the problem situation would be handled, such as the statutory Korner steering group recommendations.

3.5.4 Information Systems Work and Analysis of Changes (ISAC) Methodology

This methodology was developed in 1971 by a Swedish research group, through close contact with practical applications development in several organisations. The approach is concerned with analysis, and finding out and solving aspects of users problems. ISAC consists of three phases:

Change analysis: which identifies, analyses and determines what changes are needed to overcome current problems.

Activity analysis: which delimits and describes future information systems in the activities of the organisation.

Information analysis: which describes exactly what the information system will contain and perform.

The resulting specification produced will be suitable for systems design. The methodology is process orientated and leads to the documentation of both activity and information models in the form of diagrams. The methodology extends from looking at the needs of users and the current problems that they have to the production of a detailed specification for an information system from both manual and automatable viewpoints.

ISAC involves all the people in an organisation, allowing them to describe their current activities and decide on how they can be improved. The use of descriptive techniques and method steps helps achieve this. ISAC allows the development of local information systems for local users. It assumes that solutions to problems for which sub-systems are implemented will give a solution for the organisation as a whole. The methodology aims to improve communications between people in the organisation through the use of a 'top down' approach.

An assumption of this methodology is that users will have needs to be fulfilled and problems to be solved, and therefore these needs will help determine the reasons for requiring an information system. ISAC does not fit into a typical framework but of its three phases, the first two could be regarded as analysis, and the final stage as design. The phases are described below in more detail:

Change analysis: Identifies and studies the changes needed to overcome problems. The phase is divided into analysing problems and current situations, studying the alternatives available for change, and then selecting the change approaches to be used.

Activity analysis: Is used to define the boundaries of future information systems which may be developed to fit the needs of users. The phase is divided into the partitioning of a system into information sub-systems, studying these information sub-systems, and finally co-ordinating the development of each sub-system. Each of these tasks is sequential because output documentation from one task is used as input to the next. Where several sub-systems exist, development may be done in parallel.

Information analysis: consists of precedence and component analysis, process analysis and finally property analysis.

Lundeburg (1982) and Maddison (1983) describe this methodology further.

Comment on Methodology

This methodology provides an effective way of analysing and solving the problems in an organisation. All the members of the organisation may become involved in this process. Difficult problems can be handled using ISAC because of the 'top down' approach used, and effective communication with users is achievable through extensive use of diagrammatic models. A disadvantage is that ISAC does not address the latter stages of system development, although it does prepare the way for physical implementation through its effective analysis procedures.

3.5.5 Jackson's System Development Methodology

Jackson's system development methodology (JSD) has been applied in many fields including finance, administration and communications. It can be used with any programming language, operating system or data base management system and is well proven.

JSD contains activities which cover requirement and functional specification; logical, application and physical system design; program specification, design and implementation; and system and program maintenance. These activities are carried out in six stages of which four are concerned with specification and two with implementation. Aspects of the Jackson structured programming technique (JSP) are evident throughout the methodology. JSD is applied iteratively and as increasing detail is considered, data items and functions will be discovered which were not apparent at the start of a project.

The modelling process of JSD attempts to simulate the real world and in doing so convey the scope of a system to the user in clear terms. Users then have the ability to add, delete or amend this scope. System functions are added to the model to provide required outputs. Implementation is then considered.

JSD distinguishes between static and dynamic models. A static model is one which represents a 'snapshot' view of one point in time, such as the data in a data base between updates. A dynamic model considers active flows of data. JSD emphasises the dynamic modelling component in an information system.

The six stages of JSD are described below:

Entity action step: Real world entities and the actions they perform (or are subject to) are described. A JSD entity must exist as part of the 'real world' outside of the system. Actions are described, linked to entities and then given attributes. Most methodologies link attributes to data entities, however JSD links them to actions because actions change the value of attributes.

Entity structure step: Entities are modelled for their entire life time. An abstract model of the 'real world' is defined from the elements identified in the previous step. Tools known as structure diagrams are used to do this. These follow a tree hierarchy and can convey the constructs of sequencing, selection and iteration.

Initial model step: The system to be built is specified by creating a model which reflects the abstraction of the 'real world' model previously produced. A system specification diagram will show the relationship between the 'real world' and the model. A notation known as 'structure text' is used to reflect the content of a structure diagram.

Function step: The functions which will provide the necessary outputs will be built into the model. The events in the real world that trigger the production of outputs will also be incorporated. Structure text will then be written for the detailed specification of the functions.

System timing step: Timing constraints are considered such as when information is required because this effects when processes will be run.

System implementation step: A series of system implementation diagrams will be produced showing how the specifications for the processes relating to each entity will be implemented on the available hardware.

JSD is described in detail by Jackson (1983). A description of a practical application of JSD is given by Wilson (1985).

Comment on Methodology

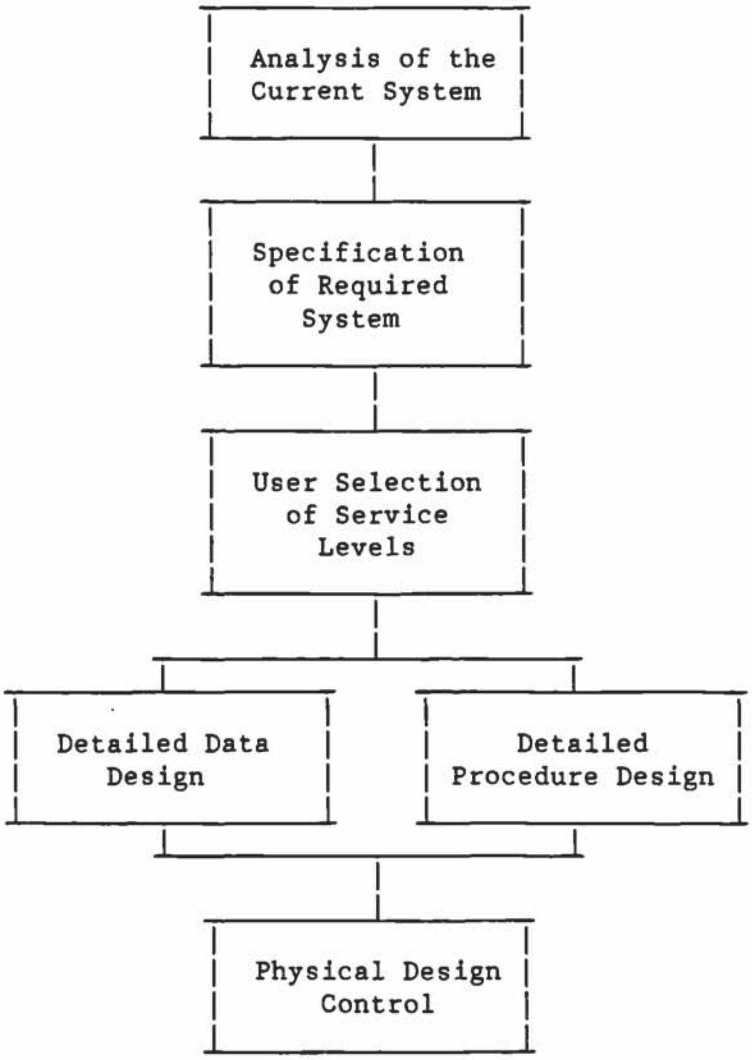
JSD offers the advantages of total coverage of systems development, a set of documentation standards, and a series of steps providing an effective means of problem analysis. JSD is detailed and comprehensive, however it can consume large amounts of development time and requires highly competent practitioners. Its reflection of JSP aspects makes it rather esoteric and jargon ridden, therefore limiting further the type of practitioner who could successfully apply it. Disadvantages with regard to this research include its complex and non-participative nature. It is unlikely that users could be involved in many tasks, and also unlikely that they would be able to understand the outputs produced. This leaves a number of the requirements for the particular problem situation unresolved.

3.5.6 LBMS Structured Development Methodology (LSDM)

This methodology contains a data driven means of systems analysis and design which takes as input an initial statement of requirements and produces as output program specifications, user clerical procedures, operating instructions, file or data base schema, and plans for testing and quality assurance. The methodology was first developed around 1979.

A revised version, known as the structured systems analysis and design methodology (SSADM) has been adopted by the Central Computer and Telecommunications Agency (CCTA) for use in all Government projects. LSDM is divided into six stages as shown in table 3.2.

Table 3.2 Stages in LSDM Methodology



Some basic principles of LSDM include the following:

1. Data structures are used to determine systems structures.

2. Project development staff have detailed rules and guidelines to work to.

3. Logical design is clearly separated from physical design.

4. As much design work as possible is done on paper before committing to implementation.

5. Development is an iterative process requiring the production of a series of partially correct views.

6. Design assumptions are clearly stated.

LSDM makes use of the techniques of third normal form data analysis to create logical data structures, entity life cycle analysis and structured walkthroughs. Tools available include data flow diagrams, a cross referencing system for documentation and a set of standard forms. A rigorous set of guidelines accompanies the use of these tools and techniques.

Three views of a system are produced in LSDM by using entity models, data flow diagrams, and entity life histories. Each of these views gives a partial description of a system. The views combined provide a comprehensive picture of a system and how it will organise and use data.

Bantleman (1984), Burchett (1985) and Hall (1983) describe this methodology in more detail.

Comment on Methodology

This methodology like IE, is a highly sophisticated and tuned product. Advantages include its coverage of all aspects of system development and its specification of rules, documentation standards and procedures across all stages. Equal, but separate emphasis is given to data and process analysis, and a complex network of models provides cross verification and allows validity checking. A disadvantage with regard to this research is its rigidity, which means it is unable to meet the specific requirements for the problem situation, such as involvement by users, and the need to address the Korner recommendations. LSDM does possess a number of desirable features however, covering validity checking, planning and control, and documentation standards, which would fulfil some of the requirements for a methodology for use in this research programme.

3.5.7 Multiview Methodology

This methodology described by Wood-Harper, Antill and Avison (1985) claims to address many problems associated with the analysis and design of information systems. It attempts to structure the tasks of both analysts and users. It brings together research from the areas of human activity analysis [Checkland (1981)], socio-technical systems design [Mumford (1981)], data analysis [Palmer and Rock-Evans (1981)], and structured analysis and design techniques [Gane and Sarson (1979)]. This ensures that the different views of all the people with an interest in an information system will be considered. Table 3.3 shows the stages in Multiview and the questions addressed by each stage.

Multiview consists of the following stages:

<u>Analysis of human activity system</u>: attempts to define views of an organisation. By studying the main purpose and problem situation of

the organisation, a world view upon which to base the definition of system requirements can be produced. A technique used concerns the formation of a rich picture of the problem situation. These can be used as a discussion aid between problem solver and problem owner and can show both subjective and objective views of a problem situation. A second technique involves the formulation of a root definition. From this, a conceptual model can be produced describing the necessary activities for the system defined in the root definition. This will show what the system will do. As much background information as possible will be collected from many sources, and all major parties will be interviewed.

Table 3.3 Stages in Multiview Methodology

How is the computer to further the aims of the organisation using it ?	Analyse Human Activity System
What information processing is required ?	Analyse Entities and Functions
How can it be fitted into the working lives of the people who will use it ?	Analyse and Design Socio-Technical System
How can individuals using the system best relate to it and use it's outputs effectively ?	Design Human-Computer Interface
What is the technical specification of a system to meet the identified requirements ?	Design Technical Sub-System

Analysis of entities and functions: A functional model will be developed by a process of decomposition and a data flow diagram is also constructed. Entity modelling will be carried out to document the data required and an entity model constructed. The events, functions, and other items collected in this stage are collectively known as an information model. Verification of this model will be carried out by interested parties.

Analysis and design of socio-technical system: Considers the social objectives of those who have an interest in the information system, and defines alternatives suitable to meet these objectives. A similar exercise is carried out for technical objectives. By ranking these alternatives in terms of how they meet both social and technical objectives, and considering costs and other constraints, a 'best fit' socio-technical solution can be selected. Both human and computer tasks can then be defined for the solution and these are then input to the technical design stage.

Design of human-computer interface: Considers the technical design of the interface including menus, command lines, forms, and other screen displays. Inputs to this stage include the entity model and human and computer tasks defined earlier. Once decisions have been made on the methods to be adopted, the technical requirements to provide them can be specified. Consideration is given to what information the user wishes to exchange with the machine, and how these interactions can then be implemented.

Design of technical sub-systems: The entity model and technical requirements form inputs to this stage. A number of tasks will be carried out including design of the 'application sub-system' which will implement the functions required, and a 'non-application sub-system'. This will consist of an information retrieval sub-system which will support informal enquiries perhaps through the use of a DBMS query language; a data base maintenance sub-system which will provide facilities for insertion, amendment and deletion of data; a control sub-system which will consider aspects of error detection; a recovery sub-system for restoration in the event of system failure; and a monitoring sub-system which will analyse the activities of users of the system.

Comment on Methodology

An advantage of Multiview is its consideration of the different views of those in an organisation because of the alternative approaches it takes. It also allows both technical and social objectives to be evaluated and selected. However, it is not clear how the outputs of one stage are transformed into inputs for the next stage. Further, a number of modifications would be necessary to accommodate the specific requirements of this research. It is thought that a number of the techniques used in Multiview such as rich pictures, might be applicable when using participation, perhaps in the form of a design group.

3.5.8 Nijssen's Information Analysis Methodology

Developed over the last 9 years, this methodology has been used on a number of projects. It was originally specified at Control Data Corporation in the Netherlands. It is an analysis method only, not covering design aspects, and is procedural. A number of development projects have made use of it.

The scope of NIAM excludes strategic, feasibility, implementation and maintenance stages. It does recognise the need for project planning. An objective of NIAM is to produce a specification for a system in terms of functional decompositions, information flow diagrams (IFDs), information structure diagrams (ISDs) and descriptions of functional performance.

Data analysis is included in the methodology, and entities, relationships and attributes are defined using diagrammatic representation. The analysis results are expressed using a grammar language called the referential idea language. This language can be compiled and used with a Codasyl or relational data base management system.

NIAM has the philosophy that the real world can be perceived in terms of:

1. An object system based on the observable reality at the present time.

2. An abstraction system which is a mental model of the object system.

3. A conceptual grammar used to describe the abstraction system in a form of structured English.

4. An information base of computer held data which describes the state of the object system.

5. The environment which represents the users who translate their observations about the system into messages for the information system.

The NIAM formal language allows results of the analysis phase to be specified. These specifications are then compiled using the appropriate software and stored in a data dictionary system. Each of the specifications can be maintained throughout the systems development cycle and used as documentation tools.

Maddison (1983) and Verheijen and Van Bekkum (1982) describe the methodology further.

Comment on Methodology

NIAM is practical only for certain types of application such as small to medium sized developments being constructed for the first time. NIAM offers advantages of effective problem analysis covering both data and functions by making use of a special language. This language can be translated into source program code automatically. Disadvantages with regard to this research include its limited coverage of the development process, and a difficulty of effectively communicating results to users for verification.

3.6 Conclusion

From the review of literature, it is apparent that there is a large number of methodologies available for information systems development, which use an equally large number of diverse approaches, tools and techniques. Many of the methodologies studied come close to meeting most of the general requirements identified in section 3.3.1 such as LSDM and IE. Although LSDM for example, is claimed to be suitable for all types of application development, it is unclear how it would meet the specific requirements for the problem situation described in section 3.3.4. A methodology cannot be identified which meets the majority of the requirements in section 3.3.

It is therefore proposed to define a methodology for the problem situation which will meet more closely the identified requirements. It is not intended to define a 'new' methodology with new approaches, tools and techniques, to add to the ever growing list of development methodologies. Instead, the ideas and approaches of the past which are well established and are proven to work well, will be combined in a novel way, thus building on an established 'rock' of knowledge, rather than laying foundations in what could turn out to be sand.

A number of different approaches, tools and techniques will be adapted and combined using a contingency approach for this particular situation. The Multiview methodology has proved that this is possible by bringing together a number of research ideas and well used tools and techniques into a contingency approach which supports the definition of different views of an organisation.

4. A COMMUNITY HEALTH INFORMATION SYSTEMS DESIGN METHODOLOGY

A methodology is defined which has been adapted from a number of other methodologies, approaches, tools and techniques which were reviewed in the previous chapter. This has been done by considering the requirements identified in section 3.3. The stages of the methodology are described, followed by an explanation of the tools and techniques which are integral to the methodology and also the use of a data dictionary.

4.1 A Framework for the Methodology

A framework upon which the methodology is based can be seen in table 4.1. From this framework, eleven stages were identified which are shown in table 4.2. Stages which can be carried out in parallel are shown at the same level in the structure. Maddison (1983) suggests a framework for a methodology which defines various stages. This framework has been mapped on to the methodology and is shown in table 4.3.

This methodology has been produced specifically for use in the community health services in order to meet requirement **[R27 Relevance to application]**. Three fundamental approaches which the methodology is based upon are participation, prototyping, and a data centered approach. These are described in section 3.4. One of the methods of participation will be used throughout application of the methodology in the form of a design group. This will fulfil requirement **[R25 Participation]**. A prototyping approach to development will be used

Table 4.1 Information Systems Design Methodology Framework

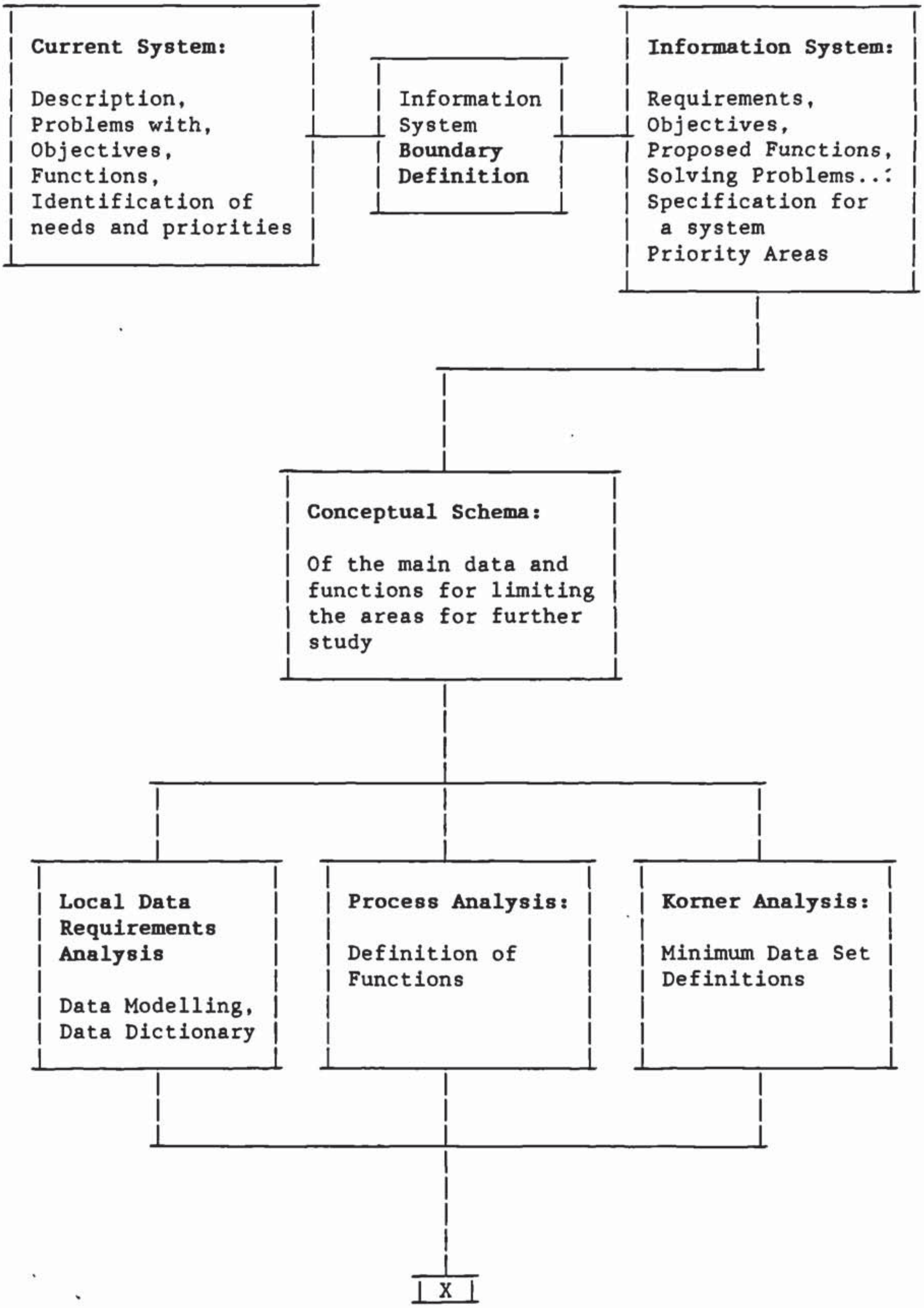


Table 4.1 Information Systems Design Methodology Framework (Continued)

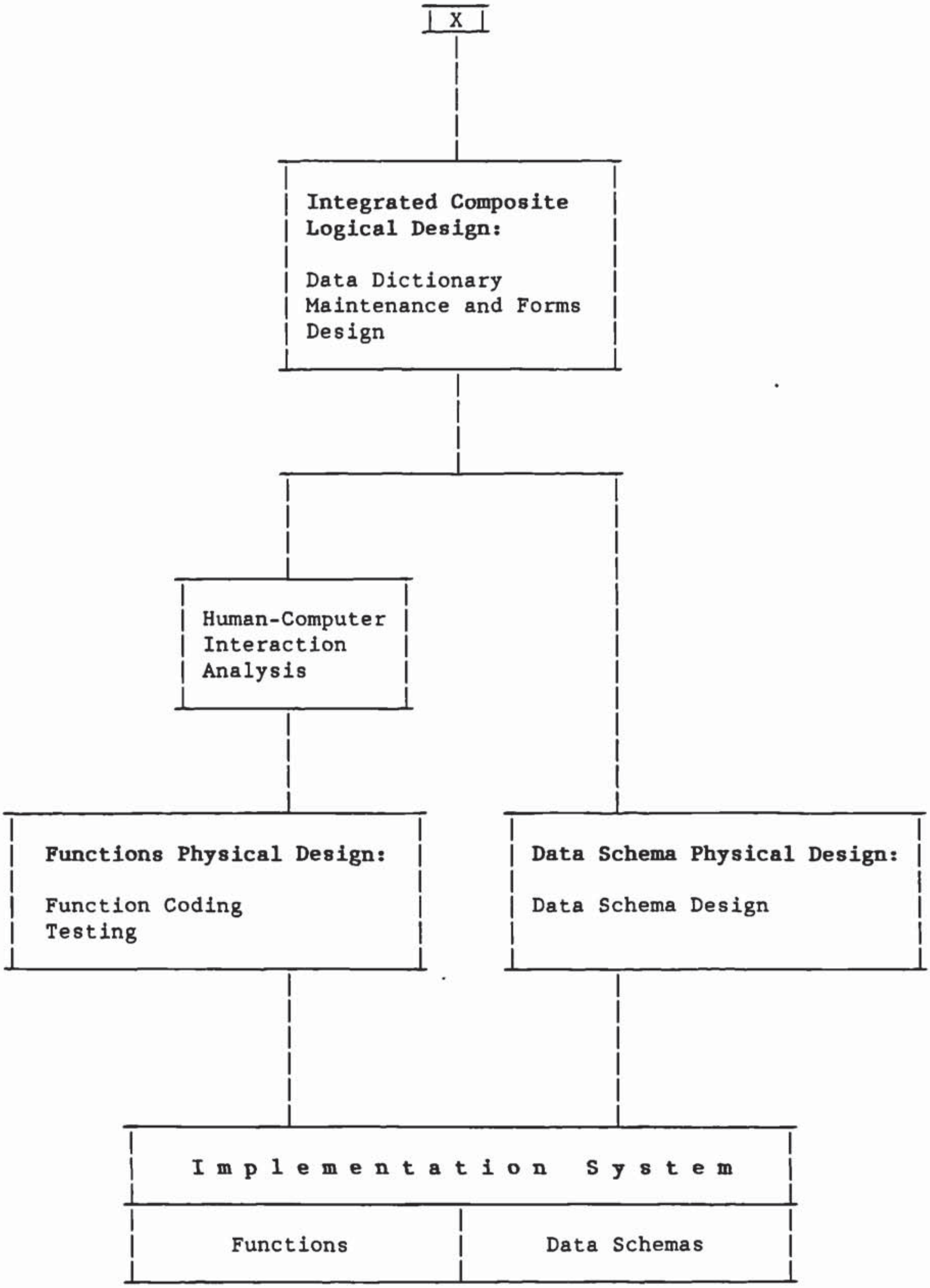


Table 4.2 Information Systems Design Methodology Outline Stages

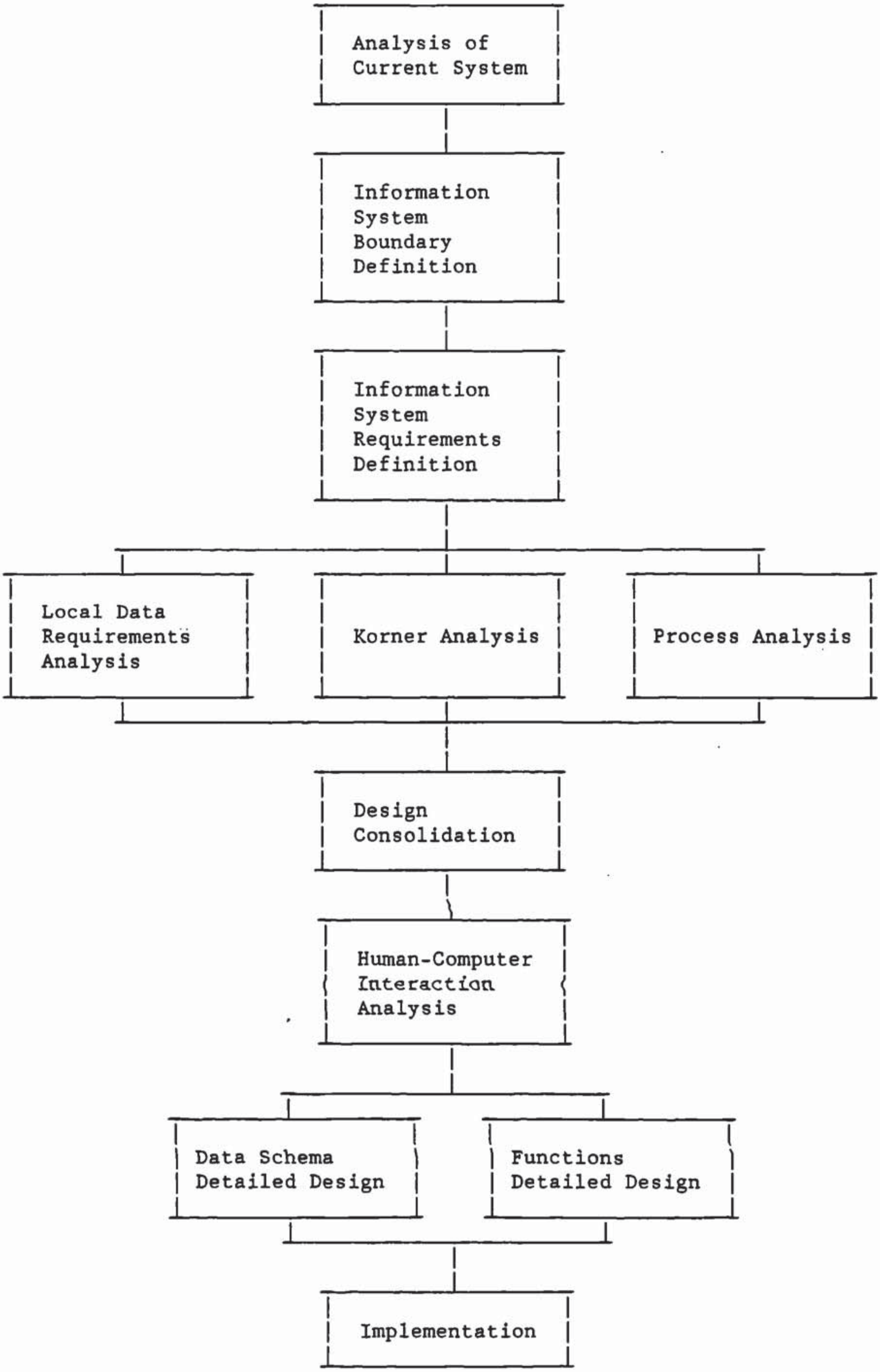
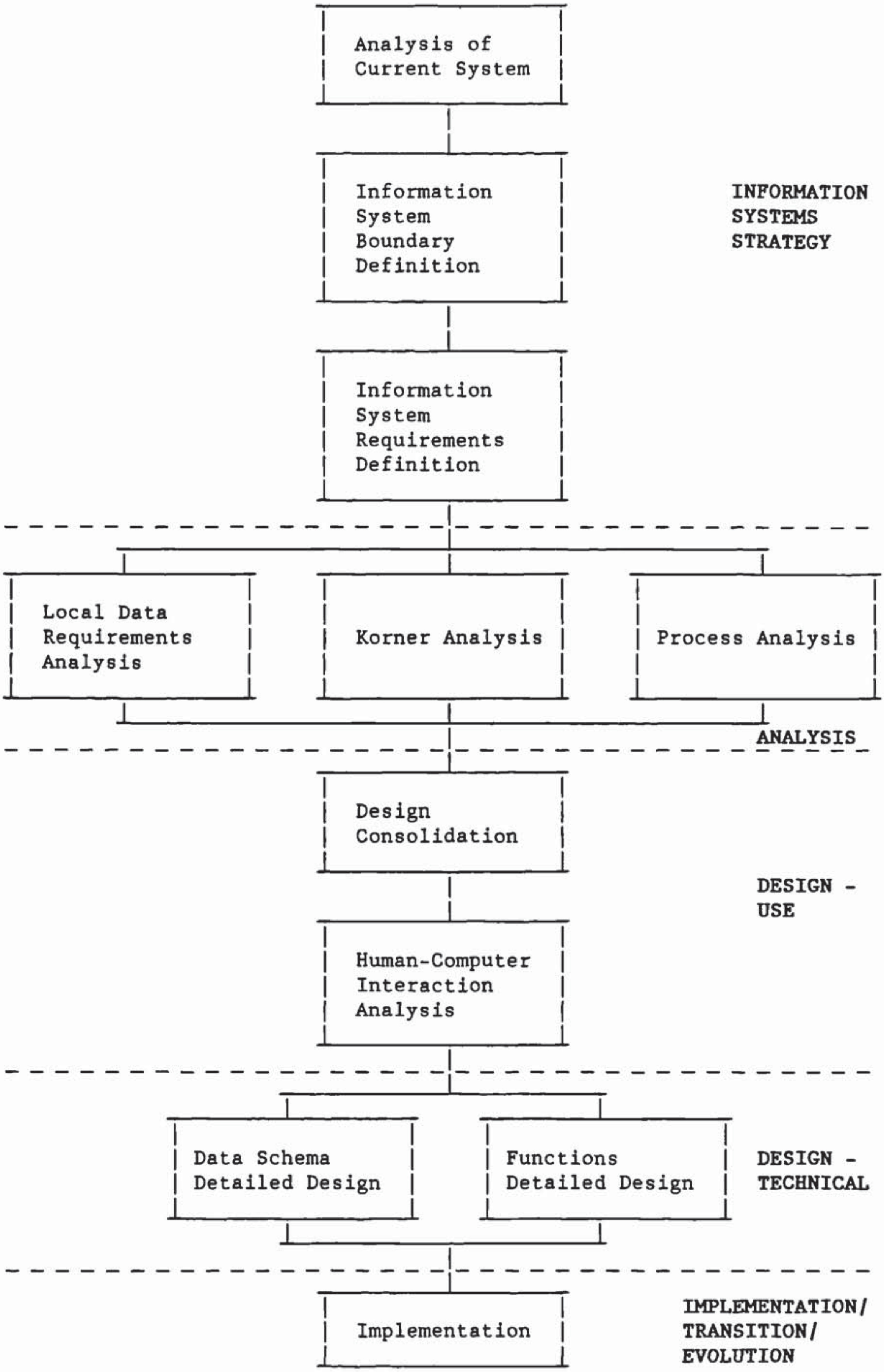


Table 4.3 Design Methodology Mapped onto Maddison's Framework



which will utilise an application generator. The use of a data-centred approach will address requirements such as **[R3 Understanding the information resource]**.

The design group will consist of a variety of users and a facilitator. Many of these users will be non-technical staff. The tasks that members of the group will be asked to perform will be considered by taking into account their various abilities. In this way, the methodology should address requirement **[R32 Variety of participants]** and **[R33 Non-technical user involvement]**.

Levels of training given to different types of user will vary according to their skill level. In this way the methodology will address requirement **[R26 Relevance to practitioner]**.

To meet requirement **[R2 Total coverage]**, the methodology begins with an analysis of the current system and is completed with an implementation stage. A series of rules are defined for carrying out each stage. This will ensure requirement **[R1 Rules]** is addressed. The outputs required from each stage are defined and the procedures for using the tools and techniques available. This further meets requirement **[R1 Rules]**, and ensures a series of checkpoints are provided for project control to meet requirement **[R10 Planning and Control]**.

Another requirement for the methodology is **[R20 Simplicity]**, in order to prevent misunderstandings in the application of the methodology. An aim of this chapter is to present the methodology in a simple and understandable way.

Tools and techniques which are appropriate to use at various stages in the methodology are shown in table 4.4. These are provided to give flexibility to suit varying circumstances.

It should be possible to meet requirement **[R21 Ongoing relevance]** by adding new tools and techniques into this 'box' of tools but still maintain the overall consistency of the methodology. Using this approach, requirement **[R24 Flexibility]** will be achieved. A variety of approaches to analysis and design will be available, and tuning or even omitting various aspects of the methodology in its application will make it 'open ended'.

Table 4.5 shows the expected outputs from each stage, indicating the flow of documentation through the methodology. Outputs from one stage form inputs to subsequent stages. This will ensure requirement **[R8 Inter-stage communication]** is achieved. In order to check the validity of output, a mechanism is provided at the end of each stage using structured walkthroughs or other participative sessions to verify documentation. This will ensure changes are identified early in the development life cycle, addressing requirement **[R7 Early changes essential]**. The expected outputs will ensure that requirement **[R14 Visibility of the product]** is met, however definitions are only 'loosely' made to maintain flexibility.

Table 4.4 Possible Tools and Techniques for Use in Methodology

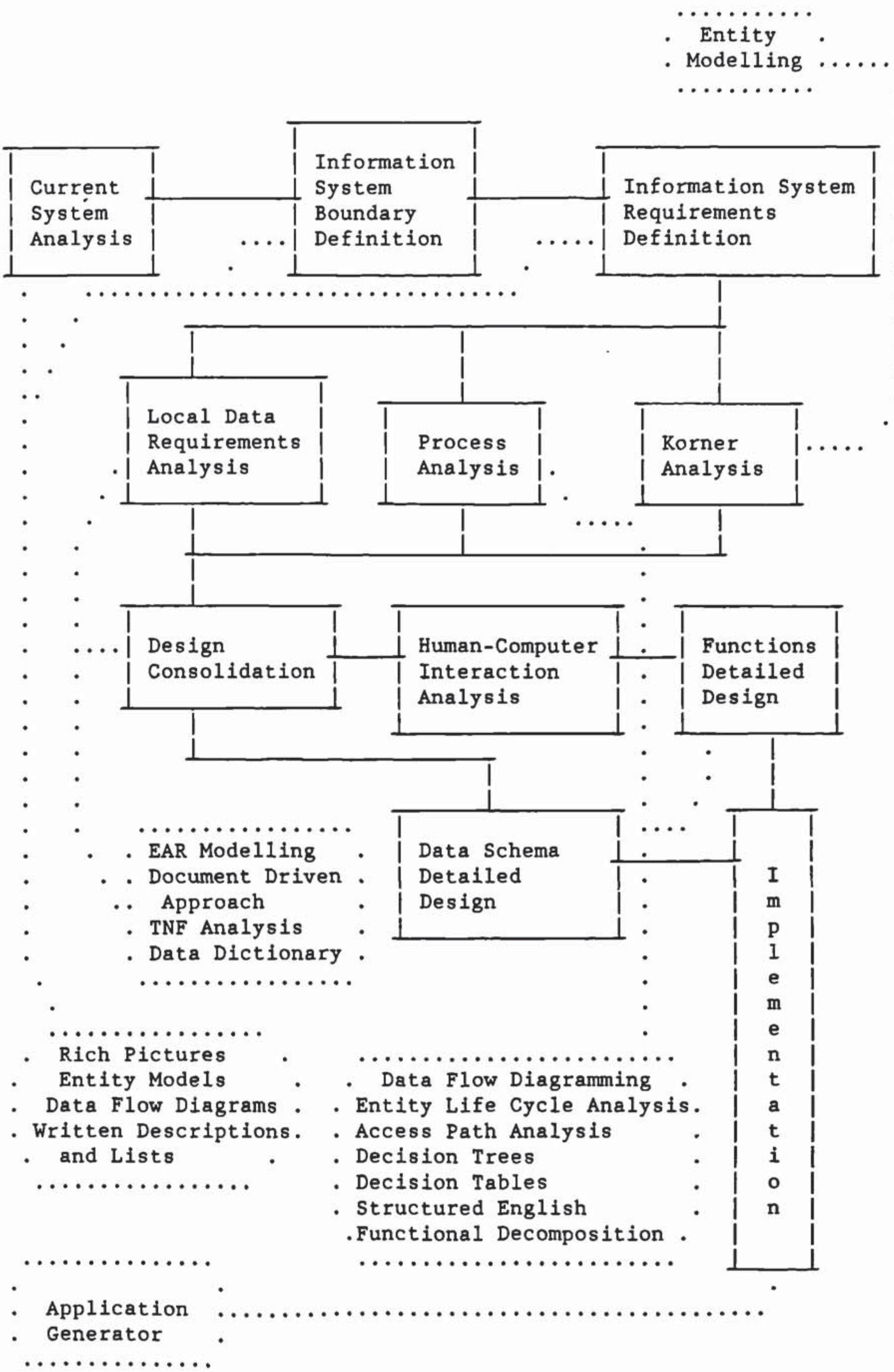
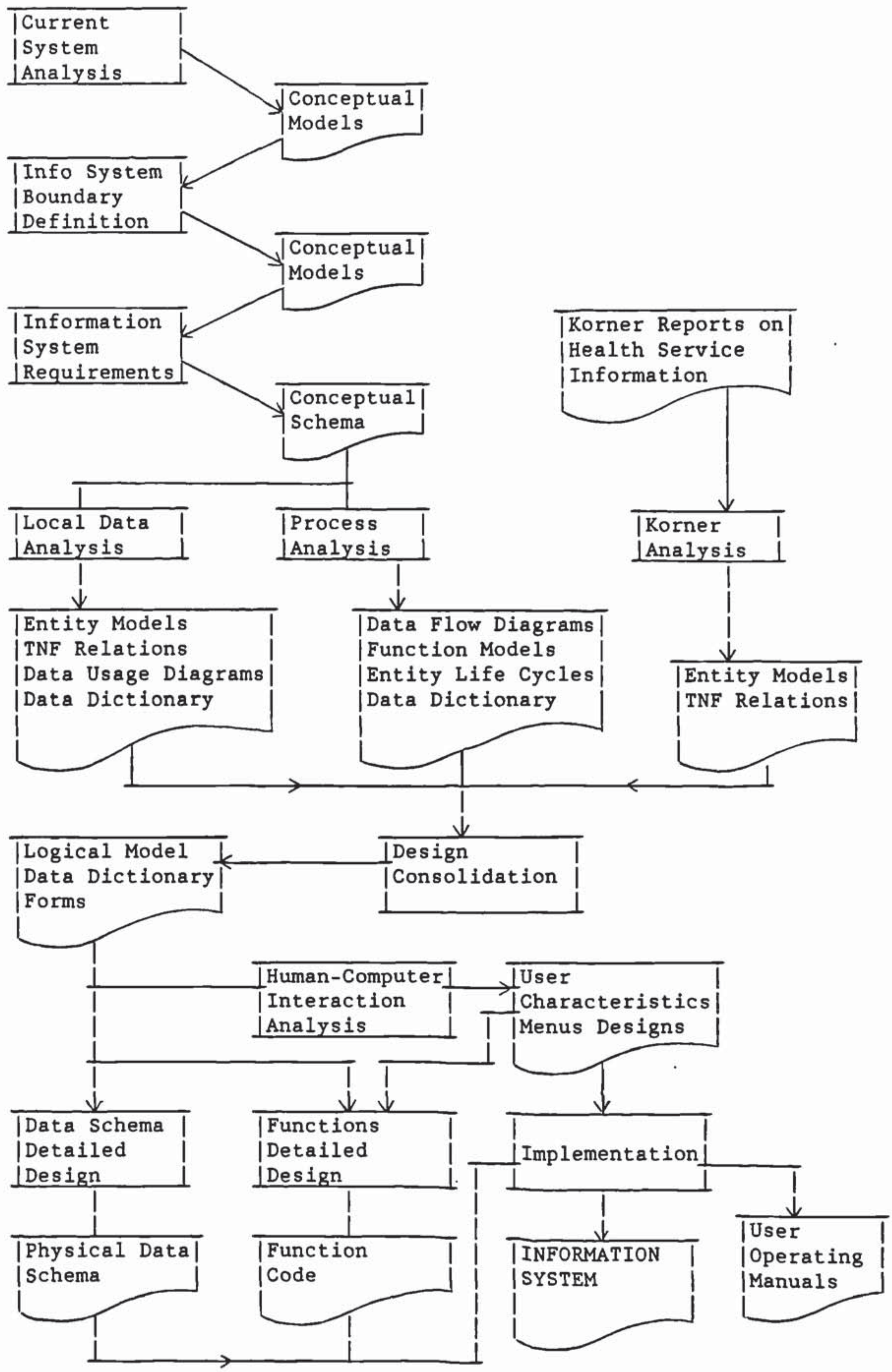


Table 4.5 Outputs from each Methodology Stage



To support the methodology, a set of 22 standard forms have been designed to record all documentation and these are shown in appendix 3. Diagramming and other conventions have been added at the foot of many forms to support their use by inexperienced practitioners. The use of these forms provides a standard control for all documentation, ensuring requirement **[R9 Effective communication]** is addressed. The conventions described for completing the forms address requirement **[R4 Documentation standards]**. For example, the symbols to be used for constructing a rich picture are given on the form used to record rich pictures.

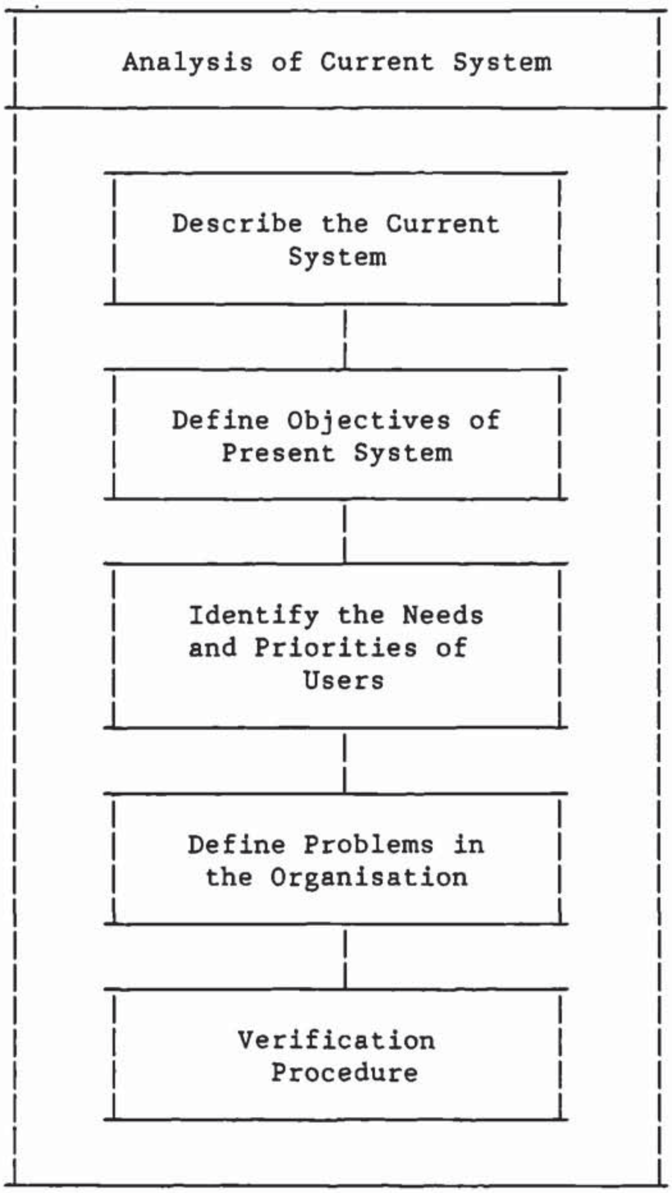
Formats for defining data items will be comprehensive and standardised and so it will be easy to provide information to address requirement **[R31 Expansion and Linkage]**. By applying standards, more effective communication should be achieved between technical and non-technical staff.

4.2 The Methodology Stages

4.2.1 Analysis of Current System

This stage will describe the present system. The objectives of the system need to be defined, along with the needs of users and the priorities these needs take. Problems with the present system need to be noted so that resolution can take place in the new information system. By documenting goals and objectives, requirement **[R23 Consideration of goals and objectives]** will be addressed. A verification procedure will check the accuracy of information gathered. Form ISD16 will be used to record the written documentation produced. Table 4.6 outlines the tasks involved in this stage.

<u>Table 4.6 Analysis of Current System Tasks</u>



<u>Describing the current system</u>: A series of interviews and group discussions with management and field staff; the studying of

existing documentation, forms and procedures; and the use of observation techniques will be used to gather information about the present system. Form ISD23 will be used to record observation and interview results. Rich pictures, simple entity models and data flow diagrams will be developed to describe the present system. These will be recorded on forms ISD20, ISD5 and ISD6 respectively.

Defining the objectives of the present system: The objectives of the organisation will be determined and recorded using form ISD16.

Identifying the users needs and priorities: A written list of the needs of users will be produced. These needs will be arranged in order of importance.

Problem definition in the organisation: A written list of problems will be constructed. Rich pictures allow the recording of problems and areas of potential conflict in an organisation and may be useful here.

Verification procedure: Feedback sessions with those who provided information for the above tasks will be held to verify the correctness of the descriptions of the present system.

4.2.2 Information System Boundary Definition

In this stage, aspects of the organisation that the information system will cover are to be identified. The entity models and data flow diagrams produced from the previous stage will be used to record these design decisions. These pictorial models are extremely useful as communication aids. Participants will be encouraged to indicate on the models areas for further study which will fall inside the boundary of the information system. This stage fulfils requirement **[R17 Information systems boundary]**. It is important to limit the area of study.

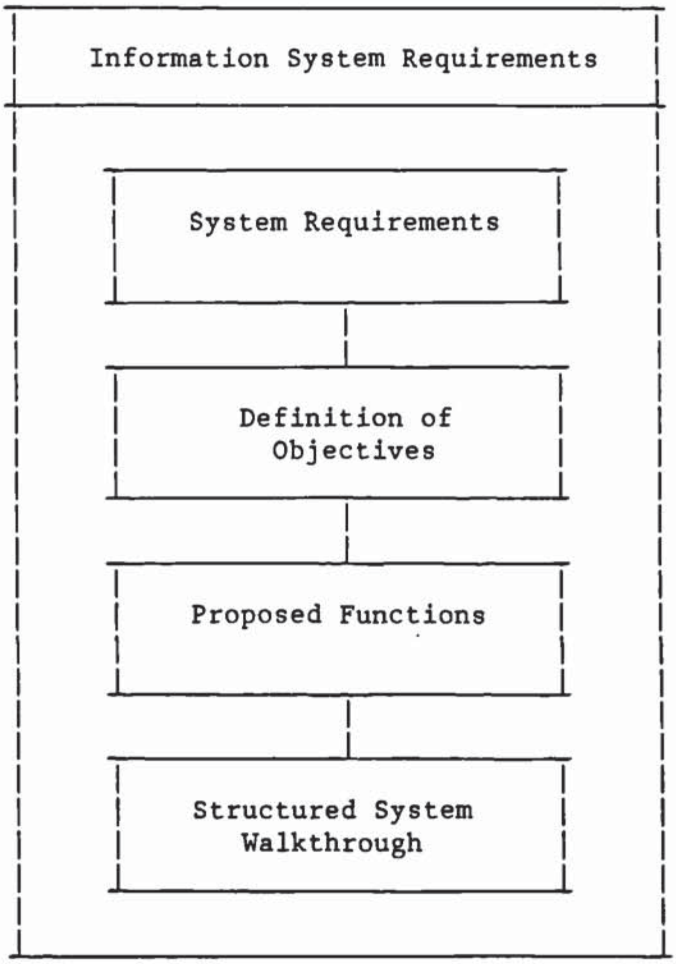
4.2.3 Information System Requirements

The objectives that the information system is required to meet will be defined. The description of the current system produced earlier will be used in this stage. Proposed functions that the system will perform will be identified, together with the priorities for developing these functions. The specification produced in this stage will define what the system will do, rather than how it will be done. This is the conceptual schema. Table 4.7 outlines the tasks in this stage.

System requirements: Participants will produce definitions of the requirements for the information system. Data flow diagrams and function charts will be used to record these requirements. The documentation produced from the previous stages will be used to help formulate these. Data flow diagrams and function charts are to be recorded on forms ISD6 and ISD11.

Definition of objectives: A list of objectives for the information system will be defined. These will be recorded on form ISD16.

Table 4.7 Information System Requirements Tasks



Proposed functions: Earlier documentation and group discussions will be used to provide information on the functions that the system is to perform. Function hierarchy charts will be used to describe each of the functions by exploding top-level descriptions into appropriate levels of detail. Form ISD16 will record any lists produced, ISD4 will record functional specifications, and ISD11, function hierarchies. The priority for developing functions will be ascertained and a list produced showing these priorities.

Structured system walkthrough: The final task in this stage is to hold a walkthrough to check the accuracy of the work carried out so far. Any inaccuracies, omissions or inconsistencies should be identifiable. A consolidation exercise will be carried out to check for total consistency in the documentation before this is input to the analysis stages which follow. A discussion of structured walkthroughs is given in section 4.3.6.

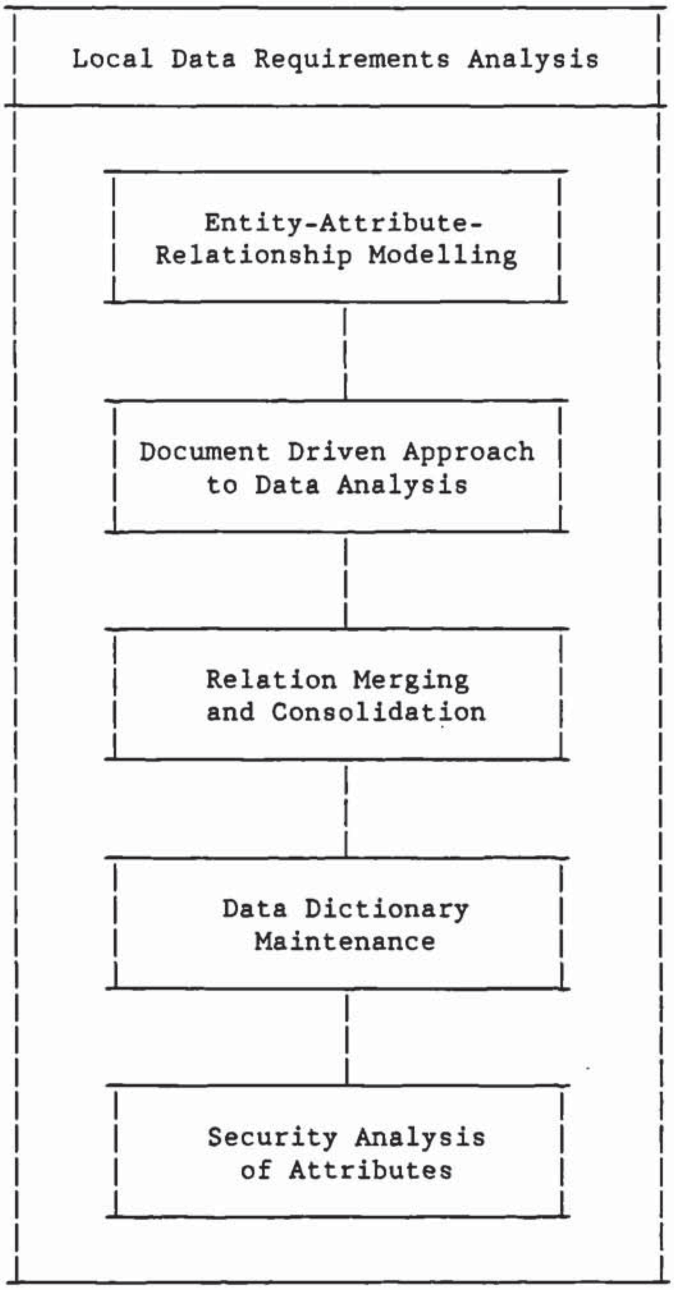
4.2.4 Local Data Requirements Analysis

This stage will produce output in the form of entity models and third normal form relations. Access information will be defined about individual data items, and a data dictionary will be constructed containing meta-data about each item. Separate views of data will ensure requirement **[R3 Understanding the information resource]** is met. The data modelling carried out will ensure major emphasis is given to this resource, addressing requirement **[R15 Emphasis of data over functions]**. Table 4.8 shows the tasks involved in this stage.

Entity-attribute-relationship (EAR) modelling: Information will be gathered for entity modelling by participants. Outputs from this stage will consist of entity models and third normal form relations recorded on forms ISD1, ISD2, ISD3 and ISD5. A series of walkthrough sessions will be held to verify these results. The techniques of entity modelling are described in section 4.3.1 and verification of entity models by structured walkthrough in section 4.3.6.

Document driven approach to data modelling: Major forms currently in use will be collected and analysed by the approach described in section 4.3.2. Outputs will include data usage diagrams and third normal form relations recorded on forms ISD19 and ISD16.

Table 4.8 Local Data Requirements Analysis Tasks



Relation merging and consolidation: The third normal form relations produced from the previous two tasks will be merged into a single set of relations and duplicate items removed.

Data dictionary maintenance: All data items defined will be entered into the data dictionary and appropriate meta-data described for each item. This data will then be in a form to pass on to the consolidation stage.

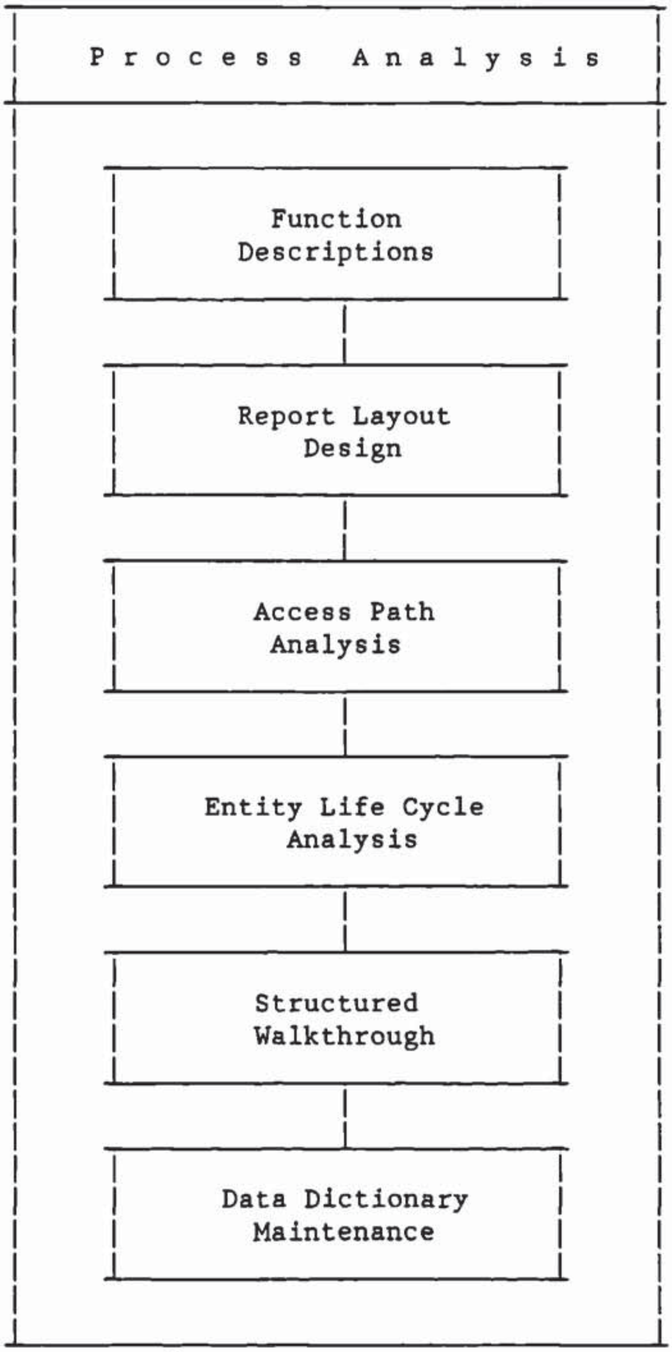
Security analysis of attributes: For each item in the dictionary, levels of access will be specified by the participants. This security meta-data will ensure requirement **[R29 Data protection]** is fulfilled.

4.2.5 Process Analysis

In parallel with local data requirements analysis, the functions outlined in the information system specification will be described using appropriate tools. The data requirements of each process will be identified by constructing functional models during access path and entity life cycle analysis. Details of functions will be added into the data dictionary. Report and screen layouts will be designed for each function. A walkthrough will verify the acceptability of the designs produced.

This stage will ensure that requirement **[R3 Understanding the information resource]** is fully addressed by the methodology. Table 4.9 describes the tasks in this stage.

Table 4.9 Process Analysis Tasks



Function descriptions: Each function defined in the requirements specification will be described in terms of the report layout needed and associated data requirements. One or more of the tools given in section 4.4 such as decision trees or structured English will be used to describe logic.

Report layout design: Report and screen layouts will be defined and agreed by participants for each of the functions described.

Access path analysis: This technique will be used to identify the data requirements of each function and the required access paths. The technique is described in section 4.3.4. Output will be in the form of functional models recorded on form ISD21.

Entity life cycle analysis: This technique will be used for entities specified during access path analysis. Forms ISD12, ISD13, ISD14 and ISD15 will be used to record results. The technique is described in section 4.3.3.

Structured walkthrough: The outputs from each of the tasks in this stage will be verified as acceptable by the users.

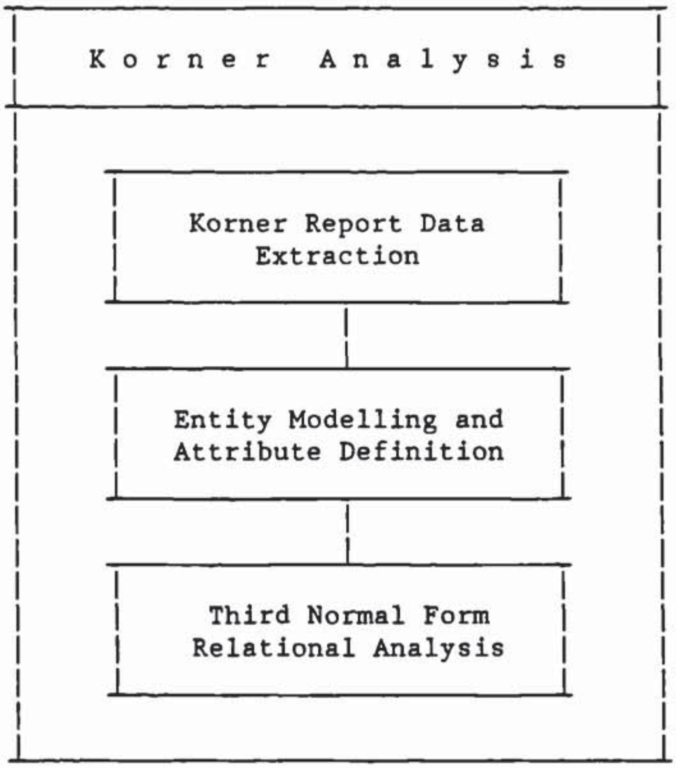
Data dictionary maintenance: Basic details about each function will be entered into the data dictionary.

4.2.6 Korner Analysis

The minimum data set descriptions for community and para-medical services will be converted into a form suitable for incorporation into the data models already defined, namely entity models and third normal form relations. This stage may proceed in parallel with the previous two stages. An essential requirement for the methodology is

[R28 Fulfilment of Korner recommendations] and the provision of this stage will ensure this requirement is achieved. Table 4.10 defines the tasks in this stage.

Table 4.10 Korner Analysis Tasks



Korner report data extraction: The Korner reports [Korner (1984a and 1984b)] will be studied in order to extract the recommendations made about data set items. A series of lists will be drawn up defining the data items to be stored and their possible values. Form ISD16 will be used to record this list.

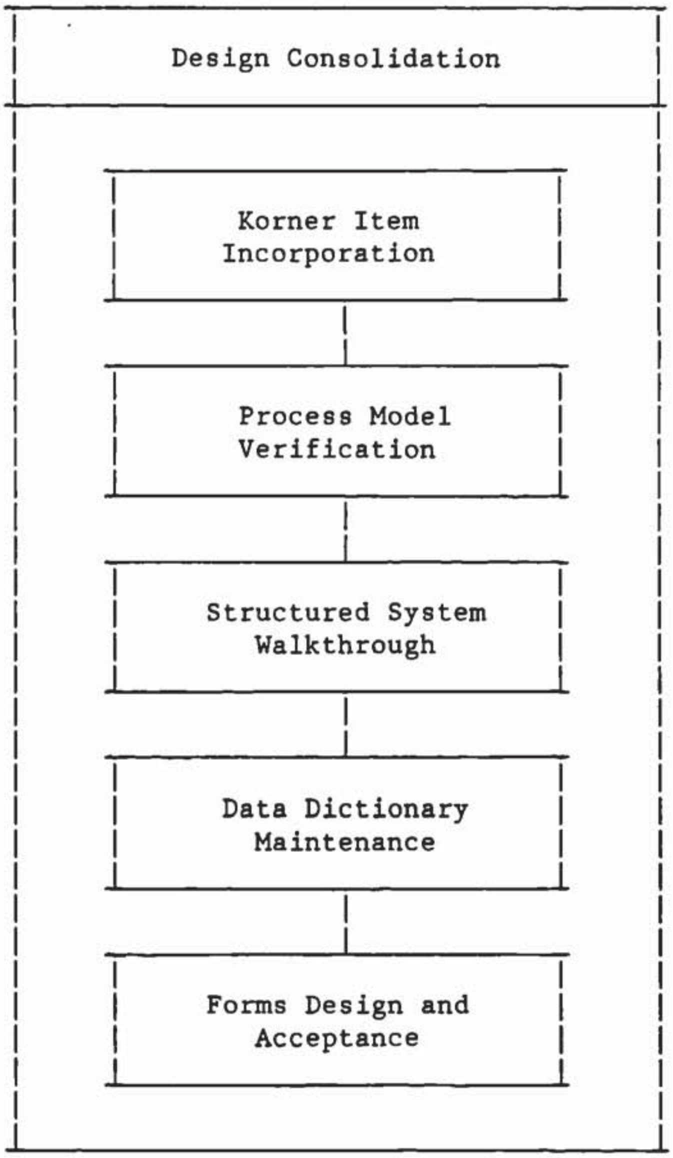
Entity modelling and attribute definition: The lists of data items will be used to construct entity models which will pictorially represent the Korner requirements. Relationships and attributes will be formally defined using the technique described in section 4.3.1.

Third normal form relational analysis: Attributes defined in the previous stage will be normalised according to the procedure set out in section 4.3.5. The relations produced will then be in a form suitable to pass on to design consolidation.

4.2.7 Design Consolidation

Outputs from the three previous stages of local data requirements analysis, process and Korner analysis will be integrated into a single model to be passed on to the detailed design stages. This ensures all documentation produced during analysis is effectively passed on to the design stages, thereby addressing requirement **[R8 Inter-stage communication]**. The models produced from Korner analysis will be merged with the data analysis models and any redundancy removed. Process models will be used to verify the correctness of the data models. Any items identified in the process models, which are not in the data models will be added, and any items not used in the process models but appearing in the data models will be removed. A structured walkthrough will be held to confirm the acceptability of the new logical design and any problems resolved. The data dictionary system will then be updated. Forms design and acceptance will be carried out by the design group after data requirements have been agreed. A single integrated design will be produced from the earlier views, thus fulfilling requirement **[R30 Design for integration]**. Table 4.11 shows the tasks involved with this stage.

Table 4.11 Design Consolidation Tasks



Korner item incorporation: The third normal form relations obtained from Korner analysis will be merged with the local data requirements analysis stage relations and any duplication removed. Entity models will be amended accordingly.

Process model verification: The function models defined during process analysis will be compared with the local data requirements analysis stage models. Any redundant data items not used by functions will be eliminated, and any items not in the data models but required by a function will be inserted into the design.

Structured system walkthrough: The consolidated design documentation will be presented to the design group for checking. All aspects of the design will be considered and any changes recommended will be agreed and implemented. This will be an iterative process.

Data dictionary maintenance: Korner analysis stage data items will be added into the data dictionary and amendments made so that the dictionary reflects the current state of the design.

Forms design and acceptance: The forms required to collect the data items to be held by the system will be designed. This will be an iterative process carried out until agreement is reached on the acceptability of the forms.

4.2.8 Human-Computer Interaction Analysis

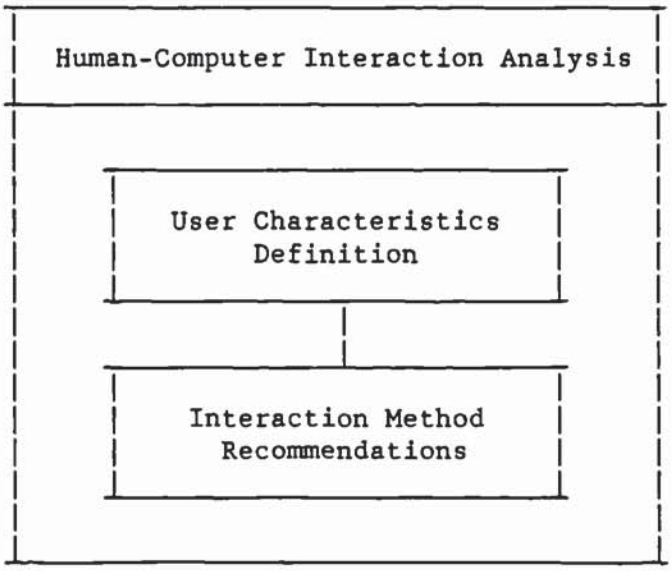
Recommendations can be made on the type of interaction methods to be used by studying the characteristics of the end users of the information system. Menu and screen templates will be designed. This stage will address requirement **[R34 User interface]** which considers the need to give attention to the user interface in a methodology. Table 4.12 outlines the tasks in this stage.

User characteristics definition: The levels of ability and computer experience of users will be identified and recorded. Form

ISD17 will be used to document these.

Interaction method recommendations: General screen and menu templates will be produced which can be used for constructing actual screens in the system which are based on the characteristics defined. Form ISD18 will record this information. The use of a screen painter can be made here to 'try out' various screen and report layouts on the design group. Various interaction methods are described by Monk (1985).

Table 4.12 Human-Computer Interaction Analysis Tasks



4.2.9 Data Schema Detailed Design

This stage, together with local data requirements analysis, ensures requirement **[R5 Separation of logical and physical design]** is met. The earlier data and Korner analysis stages consider conceptual and logical design, whilst this stage considers physical and technical design solutions. Data models will be redefined in a form suitable for the application generator which will be used to produce a prototype implementation. Schema definitions will be constructed on standard forms to be passed to the implementation stage. Any necessary meta-data will be defined for data items. Presenting the results in a standard format will ensure that requirement **[R18 Designing for change]** is addressed.

4.2.10 Functions Detailed Design

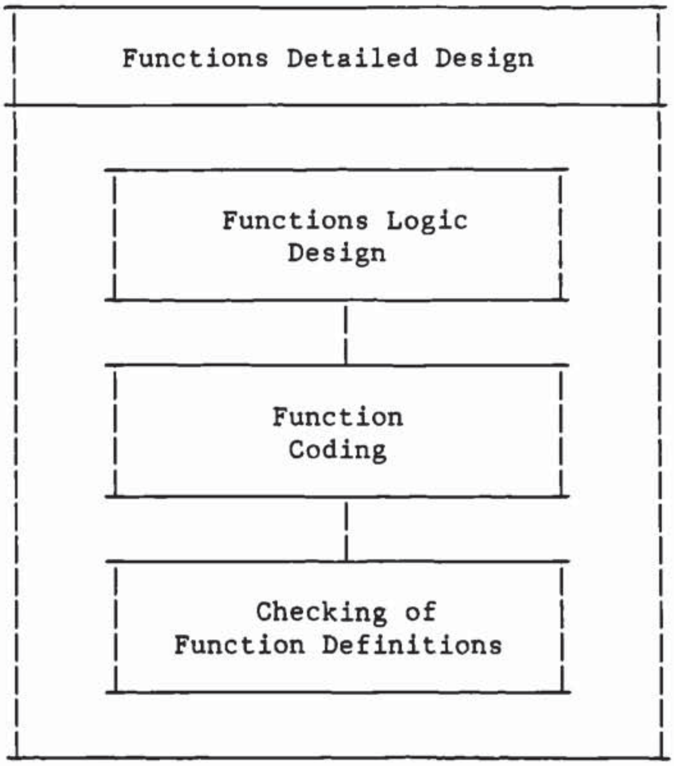
This stage, together with process analysis, ensures requirement **[R5 Separation of logical and physical design]** is accomplished. Outputs will include detailed descriptions of function logic produced using appropriate tools. Recommendations made on interaction methods will be taken into account in the design of screen layouts. Checking of functions will also be carried out. Table 4.13 describes the tasks in the stage. The detail of these tasks will be geared around the application generator used to produce the prototype system.

Functions logic design: The logic of functions will be exploded to a suitable level. The tools specified in section 4.4 can be used for this. Use of these tools will help meet requirement **[R9 Effective problem analysis]**.

Function coding: The required details will be defined in the form required by the application generator, in order to be able to implement functions. The use of a screen painter can be made here.

Checking of function definitions: The definitions made will be checked 'on paper' for correctness, before being entered into the application generator.

Table 4.13 Functions Detailed Design Tasks



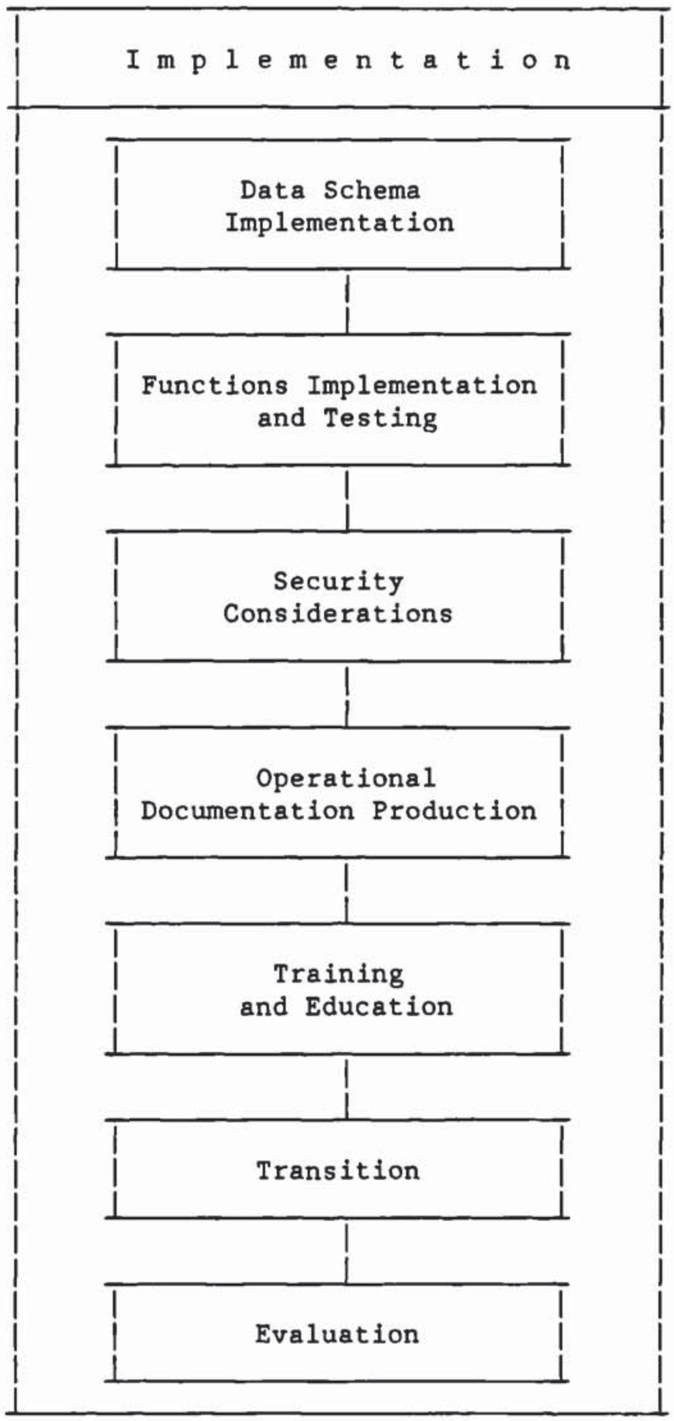
4.2.11 Implementation

This will be done using a prototyping approach to development. The data schema from the previous stage will be implemented on a prototype. Functions will be implemented and tested, and security measures specified. An iterative cycle of review and change can be operated with the design group in these tasks. This will ensure the validity of the implementation and acceptance of the end product by the users. Operational documentation will also be produced in this stage. Transition and evaluation are the final tasks. Table 4.14

shows all of the tasks in this stage. Frost (1984) describes aspects of implementing systems in some detail.

Data schema implementation: The data base schema will be set up using the application generator.

Table 4.14 Implementation Tasks



Functions implementation and testing: Functions will be implemented and tested using test data set up in the file structures.

Security considerations: Access restrictions to both data and functions will be built into the information system as specified in the design stages.

Operational documentation production: User manuals will be written detailing operating procedures for the information system.

Training and education: Training will be provided for the staff who will be using the system.

Transition: The information system will be implemented using one of the methods of take-on such as direct, pilot or parallel running.

Evaluation: The system will be evaluated for success using an appropriate method. This will meet requirement **[R11 Performance evaluation]**.

4.3 Techniques in the Methodology

Each of the techniques in this section are sufficiently well described to allow them to be taught to members of the design group. This will address requirement **[R16 Teachable]**.

4.3.1 Entity-Attribute-Relationship Modelling

Entity modelling involves producing pictorial views of the data in an organisation called entity models. This technique is well described by Davenport (1980), Shave (1981) and Hakim (1985).

Three concepts are involved in the technique. Firstly entities, which are defined as things of interest to the organisation that can be uniquely identified in the area under study. Secondly, relationships, which show logical connections between entities, and thirdly, attributes, which serve to describe entities and the relationships between them.

The first stage of modelling is to determine the entities in the organisation. This tends to be an iterative process because more entities will be discovered as the practitioner's understanding of the organisation increases. Major entities will be obtainable easily, and the more obscure ones discovered later on. One starting point for discovering entities is to obtain written descriptions of the organisation's operation such as annual reports, clerical system documentation or company operating procedures. Jukes (1983) suggests that three levels of entity can be obtained:

1. Concrete: such as a customer, product, or building
2. Tenuous: such as an order or booking
3. Doubtful: such as an invoice or goods received note

Having defined the entities involved, relationship types must be constructed showing associations between entities which are of interest to the organisation. This is done by pairing each entity type with each of the other entity types and asking the following questions. Positive responses will confirm the validity of a relationship:

a) Is the resultant pair sensible and can one ask a meaningful question about it ?

b) Could the relationship describe structure, sequence, content or any other association ?

c) What is the degree of the relationship ?

The degree of a relationship describes the number of the one entity type which may take part in a relationship with another entity type. Howe (1983) defines three types of degree:

a) <u>One-to-One (1:1)</u>: One entity of one type may have a relationship with one, and only one entity of another type.

b) <u>One-to-Many (1:m)</u>: One entity of one type may have a relationship with many occurrences of another entity type.

c) <u>Many-to-Many (m:n):</u> Many entities of one type may have a relationship with many occurrences of another entity type.

To determine the degree of a relationship, the following questions can be asked:

a) Can an entity of type A be related to more than one entity of type B ?

b) Can an entity of type B be related to more than one entity of type A ?

If the answer to both questions is 'no' there is a 1:1 relationship, if the answer is 'yes' to both, the relationship is m:n, and if the answer is 'yes' to one, and 'no' to the other, there is a 1:m relationship.

Once entities and relationships for a system have been defined, an entity model can be constructed. Table 4.15 gives conventions for entity models and these are illustrated by example in table 4.16. Apply the following rules:

a) An entity type is represented by a 'hard' box.

b) A relationship is represented by a line joining entity boxes together:

   1) A mandatory relationship where participation from both entities is required, is represented by a solid line.

   2) A fully optional relationship in which only one or the other entity occurrence need participate in the relationship is represented by a broken line.

   3) A contingent relationship in which just one of the two entity types need participate is represented by a broken and solid line. A broken line is shown from the entity type which need not participate in the relationship and a solid line from the entity type which must.

c) 'Many' relationships are indicated by placing a 'crows foot' at the end of the relationship line.

d) An involuted relationship occurs when one entity may have a relationship with itself and this is represented by a line which loops back to the originating entity.

e) When the exact degree of a relationship is known, e.g. 1:2 or 1:12, this is written onto the entity model itself and is known as a fixed degree relationship.

f) A description of a relationship will be written next to the line on all models.

g) There can be more than one relationship between the same two entity types if required.

<u>Attributes</u>: The next step in modelling, following completion of an entity model, is to assign attributes to the entities and

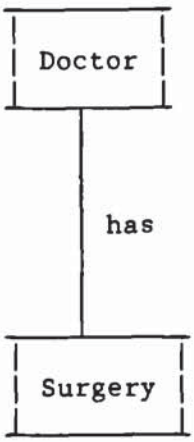
Table 4.15 Entity Modelling Conventions

[Entity]	- An Entity Type
________________	- A Relationship Type
________________	- A one-to-one (1:1) relationship
	- A one-to-many (1:m) relationship
	- A many-to-many (m:n) relationship
________________	- A mandatory or obligatory relationship
________--------	- A contingent relationship
----------------	- A fully optional relationship

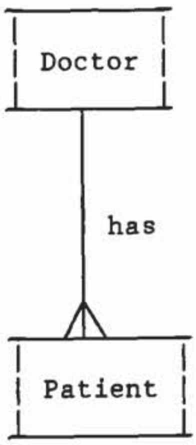
relationships. Palmer and Rock-Evans (1981) define attributes as being descriptive properties or values. Attributes can be primary, because they show the basic facts which must be collected for the organisation to function, or they can be secondary, which means they can be generated from other attributes as a result of the functions of the business. A key or identifying attribute must also be allocated to each entity. If a key cannot be identified, the entity is invalid. Keys can be formed from one or a number of attributes concatenated together. In notations, key fields will be underlined.

Table 4.16 Example Entity Model Structures

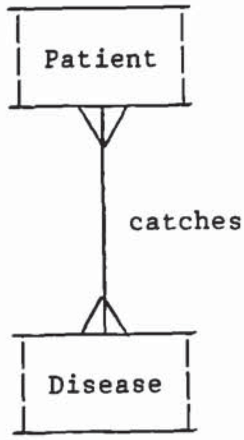
1:1



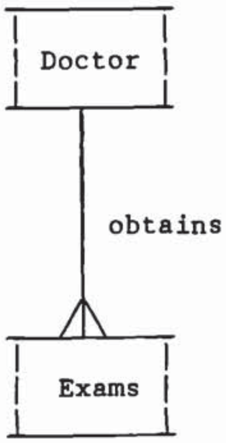
1:m



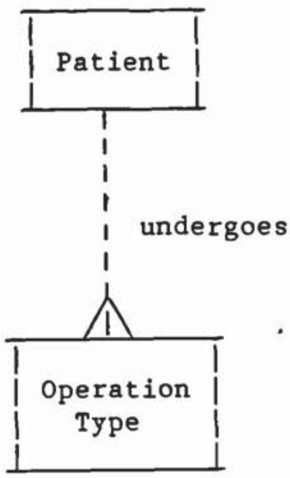
m:n



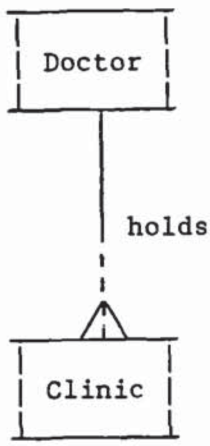
Obligatory



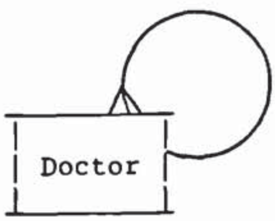
Fully Optional



Contingent

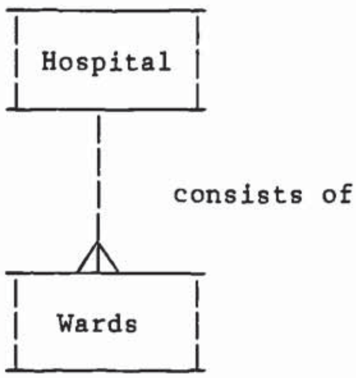


Involuted Relationship



The contents of files, forms, letters and reports can all be used to reveal relevant attributes. Tables will be produced containing these attributes, and once complete, normalisation into third normal form can take place using the technique described in section 4.3.5. For example:

Entity Model



Example Tables for Entity Model

hospital (name, description, no-of-beds, no-of-staff, date-opened)

wards (name, ward-no, name-of-ward, description, no-of-beds)

Form ISD5 will be used to record entity models, and forms ISD1, ISD2 and ISD3, entity, relationship and attribute specifications respectively.

4.3.2 Document Driven Approach to Data Analysis

The major forms used in the organisation will be collected together and sorted into order of importance. Documents carrying the most information are usually important. Each form will then be considered in turn as described below by Crowe and Avison (1981):

a) Identify each data element on the form and give the element a name, ensuring any synonyms or hononyms are detected. Give the form itself a title.

b) Construct a data usage diagram showing the relationships between data elements on the document. Diagrams are to be constructed in the same way described in the example at the end of this section.

c) Each level on the data usage diagram represents a relation, therefore construct relations from the diagram and select which elements will act as keys.

d) Normalise the relations into third normal form using the technique described in section 4.3.5.

e) Repeat the above steps for each form, but combine sets of relations with subsequent ones defined from previous forms.

As more forms are studied, the number of new relations which will need to be added will reduce. Attributes from a form may be added into existing relations where identifying keys are the same. As the process progresses, the model will become less likely to change.

The notation to be used for data usage diagrams will be as follows:

a) Data elements will be placed in 'hard' boxes.

b) The root box of each diagram will be a 'soft' box and will contain the name of the form.

c) An asterisk will be placed inside a box to indicate a repeating element.

d) The diagrams will be hierarchically structured with elements at lower levels being the components of the higher level element they are attached to.

e) Relation keys will be underlined.

Form ISD19 will be used to record both data usage diagrams and associated relations.

Consider the following example form:

<u>Waiting List and Booked Admissions</u>

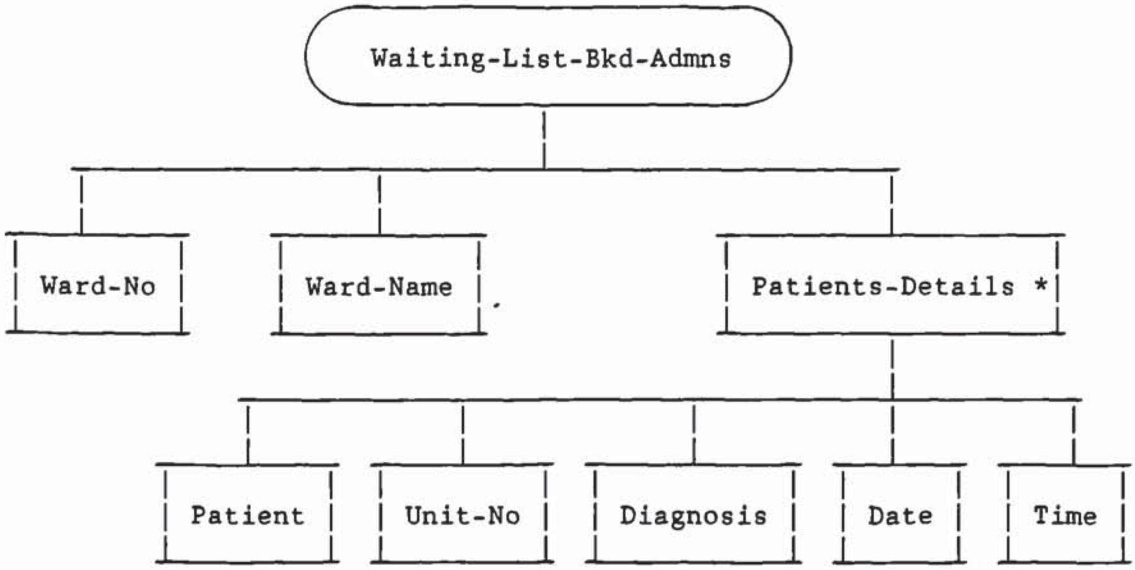
Ward No. [| |]   Ward Name [   ]

Patient	Unit No.	Diagnosis	Date	Time

The following elements can be taken from the form:

Waiting-List-Bkd-Admns		- Name of Form
Ward-No	}	
Ward-Name	}	
Patient	}	
Unit-No	}	- Data Elements
Diagnosis	}	
Date	}	
Time	}	

and the data usage diagram below produced:



The relations obtained from this diagram might be:

Waiting-List-Bkd-Admns (Ward-No, Ward-Name)

Patient-Details (Ward-No, Patient, Unit-No, Diagnosis, Date, Time)

4.3.3 Entity Life Cycle Analysis

This is a pictorial method of analysing the behaviour of entities by considering all events which may effect an entity during it's lifetime. When an entity is effected by an event it is because an elementary function will have been executed. Palmer and Rock-Evans (1981) and Rosenquist (1982) describe this technique. There are five tasks to be performed:

Summarise which functions use which entity types: This is done by constructing an entity/function usage chart on form ISD13. All the entities defined in data analysis, and the elementary functions defined in process analysis will be entered into such a chart and entity/function usages determined.

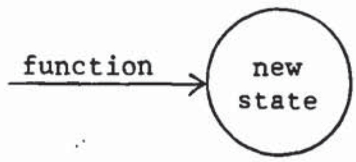
Decide which entity types merit further study: There is no need to produce life cycles for entities whose states do not change except for creation, deletion and archiving. Only the more interesting entities, whose life cycles are more complicated should be studied further.

Determine the valid states of the entity: By production of a valid state table, determine the valid states that an entity and its sub-types can exist in. Events which modify one or more attribute values of an entity or change the relationship an entity has with another entity are then studied. Form ISD15 will record this table.

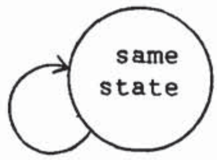
Draw an entity life cycle diagram: Using the information defined in the previous two stages, an entity life cycle diagram will be constructed according to the following conventions:

a) The initial event occurring causes an entity to go into an initial state

b) Elementary functions cause the state of the entity to change

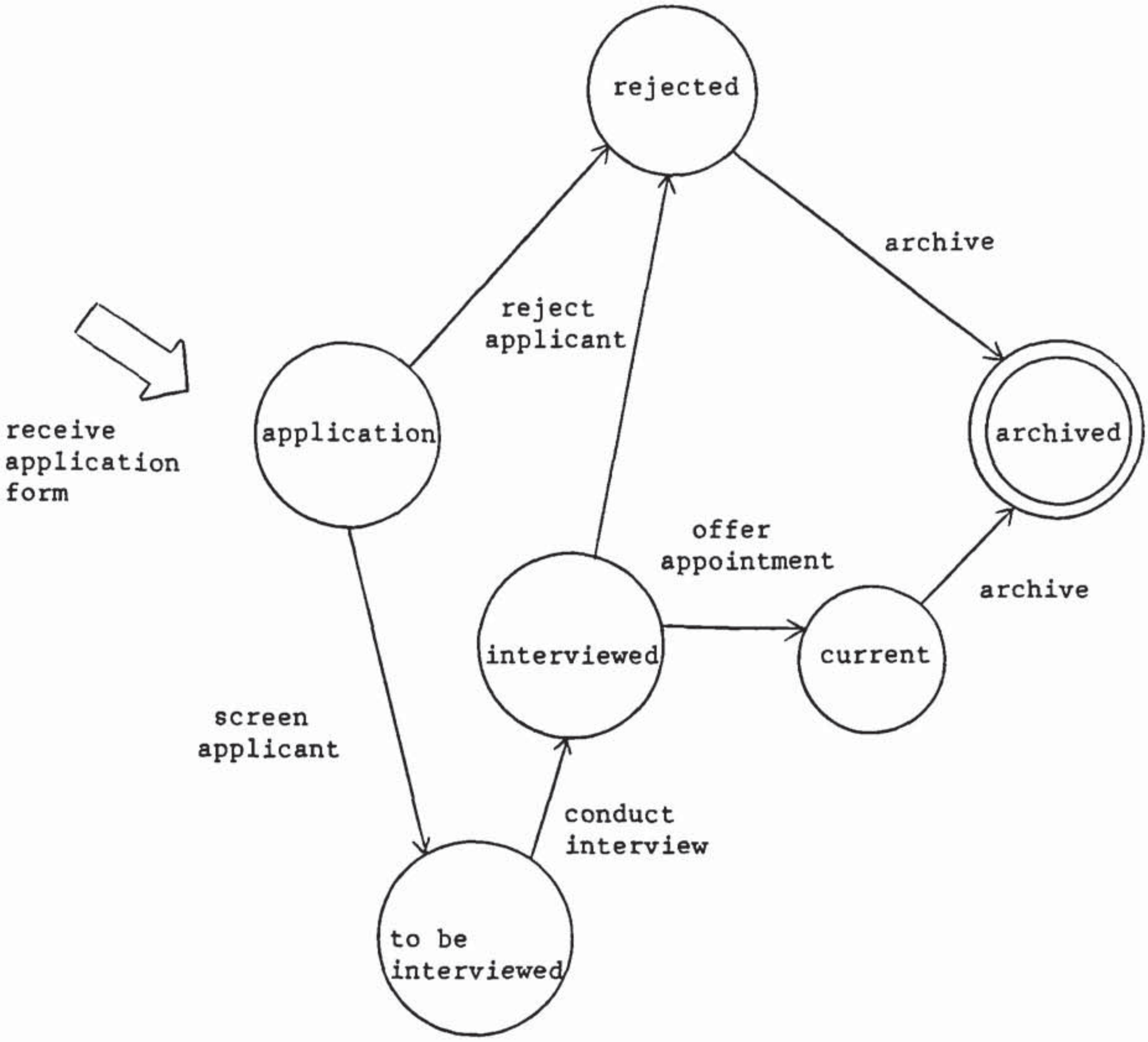


c) An elementary function may cause no change of state in the entity



d) The final state the entity reaches maybe an archive state

Table 4.17 Example Entity Life Cycle Diagram



Construct an entity life cycle matrix: The final stage involves constructing a matrix. In the left hand column of the matrix, list the valid states for the entity taken from the valid state diagram, the events (or elementary functions) are then placed along the top row of the matrix. Interaction points of the rows and columns show the resultant entity states after the functions shown in the column headings have been executed in the state described on that row. If a function is invalid for an entity in a particular state, an E is placed to denote an error. Form ISD14 records this table.

Example corresponding to life cycle diagram above

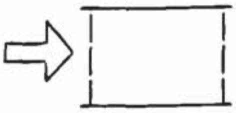
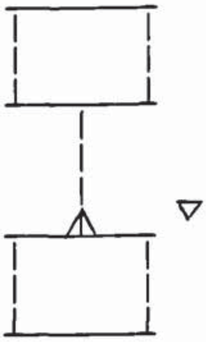
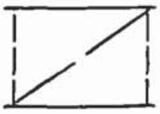
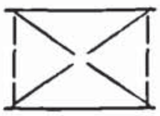
State/Event	Receive Application Form	Screen Applicant	Reject Applicant	Conduct Interview	Offer Appointment	Archive
Not known to system	Application	E	E	E	E	E
Application	E	To be interviewed	Rejected	E	E	E
Rejected	E	E	E	E	E	Archive
To be interviewed	E	E	E	Interview	E	E
Interviewed	E	E	Rejected	E	Current	E
Current	E	E	E	E	E	Archive
Archived	E	E	E	E	E	E

4.3.4 Access Path Analysis

The technique of access path analysis described by Rock-Evans (1981) is used to determine the data requirements of functions. This technique produces standard functional models which show the entities and relationships involved with a function and also impart additional usage information. Form ISD21 will record these models.

A function can be exploded down into sub-functions up to the point where individual transactions are specified. These transactions are known as elementary functions which can have functional models developed to show their data requirements. The models are constructed on the same basis as for entity models described in section 4.3.1, but using the conventions of table 4.18.

Table 4.18 Access Path Analysis Conventions

	- Means access one entity of the type specified directly
	- Process all or a range of entities
	- Process one or more entities of the one entity type related to one entity of another entity type
	- Modify an entity occurrence
	- Delete an entity occurrence
	- Create a new entity of the specified type

4.3.5 Normalisation Principles

Normalisation is well described by Bramhill and Taylor (1976), Date (1981) and Hannaford (1980). The objective of normalisation is to obtain the highest possible level of data independence to ensure that the work of creating, updating, retrieving and deleting attribute values is kept to a minimum. A further objective is to ensure that data structures are robust and consistent. The basic normalisation process is as follows:

a) Before normalisation can take place, ensure that each attribute only occurs once in a relation, each value of an attribute is consistent in its format, and attribute names are such that they do describe the values actually held in them.

b) To cast a relation into first normal form, any repeating groups in the data must be removed.

c) To progress onto second normal form, remove attributes into further relations so that data items in the relations are dependant on all the keys.

d) To obtain third normal form, ensure that all data items are dependant on the whole of the key of the relation, and not on each other. In other words split any relations up where data items are found to be transitively dependant on non-key data items.

The following example shows the normalisation process. The initial un-normalised relation can be constructed from tables of the form:

Doctor No	Doctor Name	Operation No	Operation Date	Patient-Name	Admission Date
14	Smith	9981	12/03/87	Carter	10/03/87
14	Smith	9982	13/03/87	Hunter	06/03/87
23	Jones	9985	13/03/87	Wright	09/03/87

Un-normalised Relation

doctors-operating-schedule (doctor-no, doctor-name, operation-no, operation-date, patient-name, admission-date)

By removing the repeating group apparent from studying the table, we can cast into first normal form:

doctor-details (doctor-no, doctor-name)

operation-details (doctor-no, operation-no, operation-date, patient-name, admission-date)

By observing the new relations it can be seen that 'operation-date' is not dependant on 'doctor-no', and so to obtain second normal form relations we must break the above down further:

doctor-details (doctor-no, doctor-name)

op-details (doctor-no, operation-no)

op-patient-details (operation-no, operation-date, patient-name, admission-date)

Finally to achieve third normal form we need to split '**op-patient-details**' down still further since 'patient-name' and 'admission-date' are related to each other, but not to the 'operation-no' key field:

doctor-details (doctor-no, doctor-name)

op-details (operation-no, doctor-no)

op-patient-details (operation-no, operation-date, patient-name)

patient-details (patient-name, admission-date)

The above series of relations are now in third normal form.

4.3.6 Structured Walkthroughs

The aim of a structured walkthrough or review, is to detect errors, omissions and inconsistencies in development work carried out. Collins and Blay (1982) describe structured walkthroughs further. The use of walkthroughs at each stage in the methodology should ensure requirement **[R6 Validity of Design]** is met.

The time allocated for reviews must be scheduled, together with an approximate idea of when they will be held. The length of a walkthrough should last for about an hour if necessary but no longer. Major sections of work which may take more than one hour to review should be split into logical parts and a series of intermediate reviews set up. The material to be reviewed should be circulated to those attending several days before the walkthrough, to allow them to peruse the work and detect any problems or errors. The following points must be borne in mind during a review:

a) Unnecessary discussion and 'side tracking' should be avoided.

The leader must ensure that participants focus their attentions on the objectives of the review only.

b) An accurate record of action points must be maintained on an action list which can then be used to correct documentation. Form ISD9 will record these action lists.

c) One member of the review team should take on the role of reader, and guide other members through the documentation to be discussed. The reader will normally be the author of the documentation being considered.

The review process operates as follows. Firstly, any problems or comments arising from the preparatory reading will be raised and answered by the author of the work. In cases where it is obvious that a misunderstanding has occurred, the review should be abandoned and scheduled for a later date when the documentation has been rewritten. After any preparatory points have been raised, the reader will go through the work and questions should be asked as points arise. Minor errors may be corrected as they are found but major errors should be added to the action list for further attention.

Finally, the location of the walkthrough is important. It must be held away from other people working in the office, if not, more timid members of the group may remain silent since others may be listening to their comments.

Structured walkthroughs and entity models: A significant part of a walkthrough may be used to explain and verify entity models. Ellis

(1985) suggests the following points to aid the understanding of entity models:

a) A model should always be introduced progressively, three or four entities at a time. As new entities are introduced, their significance should be explained. Care is needed to ensure all models presented are consistent with any master model.

2) For every entity, an explanation should be given in words of each of its relationships. This explanation should be a categoric statement which should be verified. The degree and optionality of relationships should also be explained.

3) In some cases, two or three attributes of an entity may be suggested to allow the user to visualise the sort of information which will be held for that entity. This might enable the significance of an entity to be seen more easily.

4.3.7 Interviewing Techniques

The design group may wish to interview other members of staff in the organisation as they collect information at each stage. Some guidelines are set out below for the design group to consider.

Lopez (1975) identifies that the main objective when conducting an interview is that of information seeking, and gives some basic guidelines to achieve this. Before an interview commences, the interviewer should have the topics to be discussed firmly in his mind. Many staff who may be interviewed will be extremely busy, and so direct and 'to the point' interviewing methods are needed.

Hakim (1985) suggests that at each interview, comprehensive notes must be taken which can then be directly translated into entity or function models. Form ISD22 will record interview notes. MacKay (1980) identifies some further issues for consideration by the design group:

Rapport: The idea of maintaining rapport during an interview is important. This is defined as the establishment of a comfortable and unconstrained relationship between interviewer and subject. Rapport skills are difficult to acquire, but attempts should be made at the start of the interview to establish a suitable climate. This can be done by informing the subject of the ground rules, acceptable norms, and standards of behaviour for the interview session. An amiable and sincere climate should be strived for to put subjects at their ease.

Releasing emotion and tension: The behaviour of some subjects may be marked by suppressed emotions or intensity of feelings. These should be released. It may be desirable to allow subjects to display their emotions because this may allow a deeper bond to be formed between interviewer and subject and allow better communication.

Gatekeeping: This is a technique for keeping communication flowing by asking open ended questions which become more and more specific and channel the subject's responses. Questions are built on previous answers.

4.4 Tools for use within the Methodology

Each of the tools in this section are sufficiently well described to allow them to be taught to members of the design group. This will again address requirement **[R16 Teachable]**.

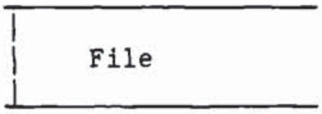
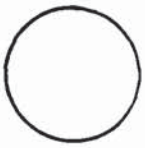
4.4.1 Data Flow Diagrams

Connor (1985) and Gane and Sarson (1979) describe the use of data flow diagrams. They are useful for describing processes and showing associated flows of data between these processes.

Data flow diagrams (DFDs) may be produced to any level of abstraction and top level or context diagrams can be exploded until the required level of detail is reached. On a high level DFD we do not record error conditions but only normal states. Error conditions are left until lower level diagrams are produced and this ensures top level diagrams are easy to understand and not too complex.

DFDs are useful as communication tools between analyst and user in the author's experience, but only in circumstances where a facilitator has been available to help interpret them, and advise on their construction. It is easy to mark boundaries on the diagrams to show the extent of a study. Users will be able to see the accuracy of system designs easily, and once accepted as a correct representation by users, the diagrams can rapidly be converted into detailed logic designs.

Table 4.19 Data Flow Diagram Conventions

	- An open ended rectangle to show a Data Store
	- An arrow to indicate a Data Flow
	- A circle to show a source or destination for data
	- A hard box to show a Process which can transform a Data Flow
	- Indicates a duplicate Data Store (used to prevent data flow lines crossing)

The following steps should be used to construct a data flow diagram, using the conventions shown in table 4.19 and form ISD6:

a) Identify the external entities involved in the organisation under consideration.

b) Identify the inputs and outputs which can be expected in the normal course of the operation of the organisation.

c) Identify enquiry situations and 'on demand' requests for information that could arise.

d) Produce a first cut data flow diagram showing the external entities, where the main input documents come from and the main output documents go to. Draw on the data flows that arise between the necessary logic processes and data stores thought to be required.

e) Check this first draft to ensure that all the inputs and outputs have been included and that only normal conditions are specified with no exception or error conditions.

f) Produce a clearer second draft, trying to ensure that all processes are unique, and that a minimum of data flow lines cross.

g) Conduct a walkthrough of the second draft and make any changes found to be necessary.

h) Explode each process to a lower level, as far down as required, bringing in error and exception conditions. Final versions of each diagram can then be produced as required.

4.4.2 Rich Pictures

Rich pictures are pictorial models, useful for explaining how an organisation operates. If drawn properly, the pictures should be self explanatory and easy to understand.

It should be possible to identify elements of structure in the problem area such as departmental boundaries, geographical layouts or product types. Elements of process should also be identifiable to show what is going on. Rich pictures help identify an organisation's primary tasks. These are the basic tasks which an organisation must carry out in order to survive and are usually central to the creation of an information system.

Both structure and process elements can be recorded on a rich picture. The relationship between structure and process is the climate of a situation. A rich picture can impart hard facts about the organisation, but may also show soft or subjective information. The limited space available for a rich picture means that its author will be forced into taking design decisions about what really is important enough to record on the picture. The use of rich pictures is described further by Wood-Harper, Antill and Avison (1985).

Rich pictures are to be recorded on form ISD20 according to the following conventions:

a) The main departments that are of interest can be placed on the rich picture at the start of construction.

b) Other symbols are sketched to show people and things that are relevant both inside and outside of the organisation.

c) Conflict areas are indicated by crossed swords () and 'think bubbles' can be placed to indicate the major worries of key people shown on the rich picture.

d) Layers of rich picture can be developed if a single picture cannot contain all details about an organisation.

e) Arrows will indicate relationships between things or people.

4.4.3 Decision Trees

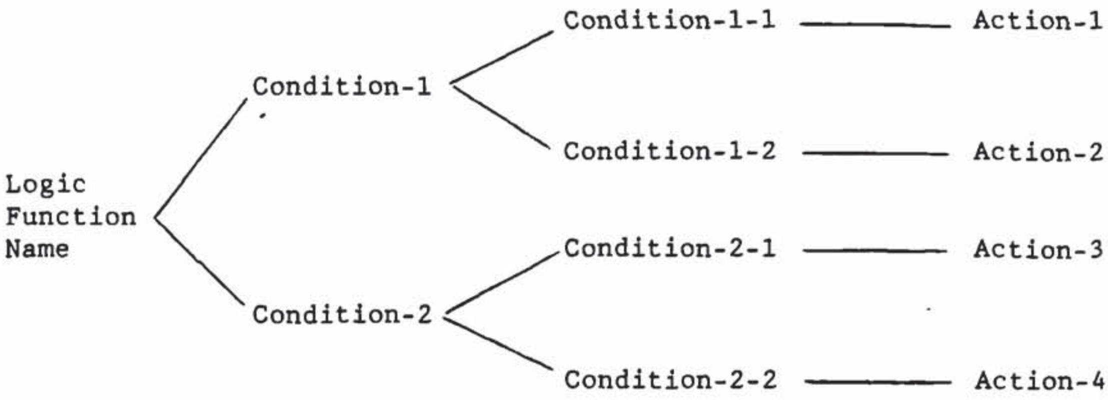
Decision trees can be used to express the logic of processes. Their purpose is to indicate the actions which are to be taken when certain decisions are met in logic. Any number of these decisions can be incorporated into a tree. Each condition specified will show a particular branch to be followed depending on the condition, and at the end of each branch will either be an action to be taken or a further decision point.

Gane and Sarson (1979) describe how to produce a decision tree. Firstly, we must take a statement of the problem and identify the conditions and actions in the statement. This can be revised to give only necessary logic information pertinent to the construction of the decision tree. Each revised sentence can then be used to construct parts of the tree until eventually the complete tree is formulated. If it is not possible to complete the tree because certain information is missing, re-iteration of the design process is needed to obtain the required information. Form ISD8 is to be used to record decision trees. An example decision tree format is shown in table 4.20.

4.4.4 Decision Tables

Decision tables provide a standard way of straightforwardly identifying all the possible combinations of conditions that could arise in a problem, and being able to check these in a systematic way to ensure all conditions and appropriate actions have been identified. Gane and Sarson (1979) describe decision tables further.

Table 4.20 Example Decision Tree Format



A decision table is constructed as follows. The various actions to be executed are listed in the bottom left hand part of the table. This is known as the action stub. In the top left hand part, the conditions that can arise are listed and this is known as the condition stub. Each condition will be stated as a question which can be answered positively or negatively. All the possible combinations of 'yes' and 'no' responses can then be recorded in the upper right hand part of the table. Each combination of responses is known as a rule. In the lower right hand part of the table, a series of 'X's can be placed for each action to be taken depending on the rule of that column. Form ISD7 is to be used to record decision tables.

Once an initial table has been constructed, it can be consolidated by merging rules where the same actions are required. Dashes can be placed in the response fields which represent "don't care" conditions. This results in a consolidated decision table. Table 4.21 and 4.22 illustrate an example decision table and subsequent consolidated table respectively.

Table 4.21 Example Decision Table Format

CONDITION STUB	RULES							
1. Invoice > $ 100	Y	Y	Y	Y	N	N	N	N
2. Account Overdue by > 1 Month	Y	Y	N	N	Y	Y	N	N
3. New Customer	Y	N	N	Y	N	Y	Y	N
ACTION STUB	1	2	3	4	5	6	7	8
1. Inform Solicitor	X	-	-	X	X	-	-	X
2. Write First Reminder Letter	-	X	X	-	X	-	-	-
3. Write Second Reminder Letter	-	-	-	-	X	-	-	-
4. Cancel Credit Limit	-	-	-	X	-	X	X	-

Table 4.22 Example Consolidated Decision Table

CONDITION STUB	RULES					
1) Invoice > $ 100	Y	Y	Y	N	N	N
2) Account Overdue by > 1 Month	Y	-	N	Y	-	N
3) New Customer	Y	N	Y	N	Y	N
ACTION STUB	1	2	3	4	5	6
1) Inform Solicitor	X	-	X	X	-	X
2) Write First Reminder Letter	-	X	-	X	-	-
3) Write Second Reminder Letter	-	-	-	X	-	-
4) Cancel Credit Limit	-	-	X	-	X	-

In table 4.22, rules 2 and 3 have been merged into a new consolidated rule 2, with a "don't care" condition existing for condition 2. This is because the same process needs to be executed whether of not condition 2 is positive or negative.

4.4.5 Structured English

Structured English can be used to produce unambiguous logic which is easy to understand and not open to misinterpretation. Any logical specification can be written in structured English using just four basic structures of sequencing, selection, case and repetition. Form ISD10 will record structured English definitions.

The four structures are shown below along with suggested layouts:

Sequencing:

```
Statement-1
Statement-2
                Statement-2-1
                Statement-2-2
                Statement-2-3
Statement-3
    -
    -
    -
    -
Statement-n
```

Selection:

```
IF Condition
THEN Statements
ELSE (not condition)
SO Statements
```

Repetition:

```
REPEAT
        Statements
UNTIL
        Condition
```

```
Case:                 CASE Expression
                      OF Condition-1  :  Statements
                         Condition-2  :  Statements
                              -
                              -
                              -
                              -
                         Condition-n  :  Statements
                         OTHERWISE    :  Statements
                      ENDCASE
```

These structures need to conform to the following rules:

a) Use of capital letters indicates a structured English keyword such as IF, THEN or ELSE.

b) Indentation is used to indicate blocks of instructions to be treated together. Hierarchical structures can be built by indenting.

c) Blocks of instructions can be named and this name quoted in capital letters to refer to the block of instructions elsewhere in the code.

d) Any data elements which are included in a data dictionary should be underlined.

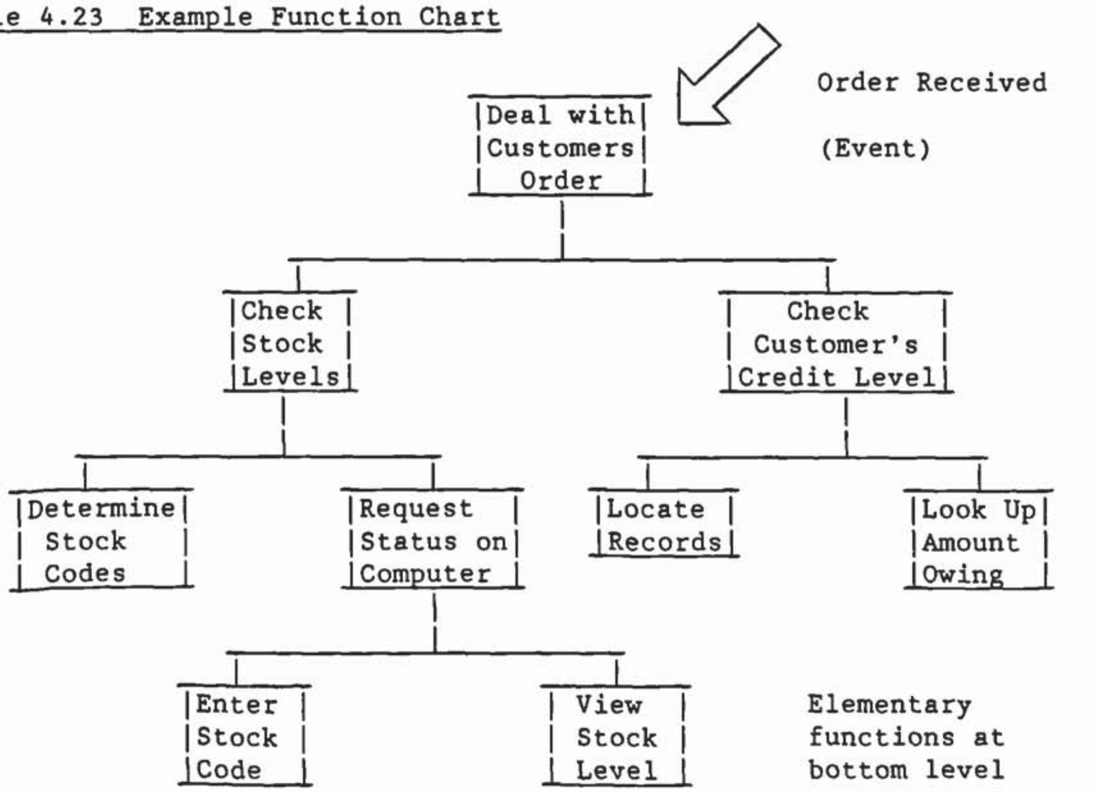
An example section of structured English code is shown below:

```
IF amount of invoice exceeds $ 100
THEN IF account is overdue by more than 1 month
THEN CONTACT-SOLICITOR
ELSE (account is overdue by less than 1 month)
SO write letter to customer
   inform credit-controller
   suspend credit-limit
```

4.4.6 Function Hierarchy Charts

Palmer and Rock-Evans (1981) describe how to analyse a function by breaking it down into its constituent parts using a process known as functional decomposition. At the highest level, a total business can be viewed as a single function and this then decomposed into a hierarchy of lower level sub-functions. Progressive increases in detail are made at each level. Functional decomposition provides a starting point for access path and entity life cycle analysis, since these techniques require the analyst to know about the individual elementary functions or events in a system. Exploding of functions and sub-functions is carried out until the required level of detail is reached and bottom level functions are then known as elementary. Form ISD11 is to be used to record these charts. An example function chart is shown in table 4.23.

Table 4.23 Example Function Chart



4.5 The Data Dictionary

This will be automated, and will be for use throughout the design methodology. The dictionary will be in two parts, the first will store logical definitions of entities, attributes, relationships and functions. The second part will be provided by the implementation system and will give details of physical data definitions. The use of such a dictionary will ensure requirement **[R22 Automated development aids]** is considered along with **[R12 Increased Productivity]**.

Meta-data for inclusion in a data dictionary has been suggested by Davenport (1978), Palmer and Rock-Evans (1981) and Avison (1985). Table 4.25 shows the meta-data which will be defined for elements in the logical part of the dictionary. The meta-data stored for the physical data dictionary will depend on the implementation system used.

The use of this data dictionary will be vital to the project to ensure standard, consistent definitions are made about all data in the organisation. Petterson (1980) argues that because data analysis produces a vast amount of output, to effectively control and use this output, a data dictionary with an established set of standards and procedures is essential.

The dictionary will be constructed as follows:

a) Definitions will be easily accessible by name and other criteria for cross referencing and will be made in a standard, consistent and easily understandable manner.

b) Synonyms will be suitably identified and indicated as such in a synonym field which will be available for each type of element.

c) It must be easy to retrieve and update definitions held in the data dictionary.

d) The data dictionary will serve as a documentation tool. Forms ISD1, ISD2, ISD3 and ISD4 will be used to collect data for the dictionary.

4.6 Conclusion

This chapter has presented a methodology for application in the community health services. It incorporates three underlying philosophies in the form of participative, data-centred and prototyping approaches to systems development. Each section of the methodology is justified by referring to the requirements of section 3.3 which are shown in bold in the text. This methodology now meets more of these requirements than any of those reviewed in section 3.5. The remaining chapters are concerned with the application of this methodology in the problem situation.

Table 4.24 Data Dictionary Contents

Entities	**Relationships**	**Attributes**	**Functions**
Identification	Identification	Identification	Identification
Name	Name	Name	Name
Description	Description	Description	Description
Synonyms	Synonyms	Synonyms	Synonyms
Date	Date	Date	Date
Status	Status	Status	Status
Identifiers	Entities Involved	Length	Minimum Frequency
Minimum Occurrences	Degree	Format	Maximum Frequency
Maximum Occurrences	Optionality	Range	Average Frequency
Average Occurrences	Exclusivity	Entity Involved	% Growth Rate
% Growth Rate	Time State	Functions Involved	Maximum Response Time
Creation Authority	Creation Authority	Creation Authority	Average Response Time
Deletion Authority	Deletion Authority	Deletion Authority	Entities Involved
Access Authority	Access Authority	Access Authority	Attributes Involved
Relationships Involved			Relationships Involved
Attributes Involved			
Functions Involved			
Sub-Type Names			

5. APPLICATION OF METHODOLOGY

5.1 The Formation of a Design Group

In order to meet requirement **[R25 Participation]**, the representative approach was selected. This approach was preferable to consultative participation which still leaves the bulk of design decisions to the traditional systems analyst, and consensus participation, which for this organisation was not practical.

A consensus approach would have allowed all members of the community health services to make an input in the systems design process. However, for this particular problem situation, a continual high quality operational service must be maintained and so the approach would have been impractical in view of the lengthy time scales which would have been involved.

A design group was formed consisting of various grades of staff from the community health services representing the professional staff groups. Volunteers were used who had an interest in the development of a system from the non-management grades. The agreement of senior management was obtained to enable the members of the design group to participate.

An important member of the group was the facilitator who led the group in the tasks to be performed. For this problem situation, the facilitator took on an active role, training the design group in the application of the methodology using the descriptions in section 4.3 and 4.4. The facilitator also carried out tasks which were not thought appropriate or necessary for the group as a whole to participate in.

The composition of the group was as follows:

<u>Management Grades</u>

Director of Nursing Services (Community)
Assistant Director of Nursing Services (Health Visiting)
Assistant Director of Nursing Services (School Nursing)
Assistant Director of Nursing Services (Community Midwifery)
Assistant Director of Nursing Services (Psychiatry)
Assistant Director of Nursing Services (Mental Handicap)
Assistant Director of Nursing Services (District Nursing)

Senior Clinical Medical Officer

District Head Occupational Therapist
District Head Physiotherapist
District Chiropodist
Senior Dietician
Senior Audiology Technician
District Speech Therapist

<u>Non-Management Grades</u>

Health Visitor
School Nurse
Community Midwife
Community Mental Handicap Nurse
Community Psychiatric Nurse
District Nurse

Senior Psychologist
Dietician
Audiology Technician
Speech Therapist

The Facilitator

The design group met together as a whole and in smaller teams during the period of January to December 1986. During this time, the methodology described in chapter 4 was applied, with the author acting as facilitator. As various techniques were required for application, the design group were appropriately trained.

For the facilitator to gain an initial knowledge of the community health services, and more importantly to become familiar with members of the design group, a period was spent where the facilitator worked with all of the design group members for one day each, to observe the tasks they carried out. For example, for the six nursing staff grades, time was spent travelling around in the community, visiting clients in their own homes. This time proved to be well spent and helped form good relationships between the facilitator and design group members.

The following sections describe the application of the methodology. Fourteen professional staff groups participated in the design process through the representative design group. The appendices contain examples of documentation produced from two staff groups. The school nursing service is given as an example of a nursing group and the chiropody service as an example of a para-medical group. The data dictionary which was produced is listed in appendix 14. This covers all staff groups and defines conceptual and logical level entities, relationships and functions, and conceptual, logical and physical level attributes.

5.2 Application of Stages

5.2.1 Analysis of Current System

Describing the current system: Members of the design group were interviewed and group discussions held to determine the objectives for the information system. The technique for producing rich pictures was taught to the group, and exercises carried out to model the present system using rich pictures. Training was carried out in producing entity models and data flow diagrams. Simple entity models to describe data, and simple data flow diagrams, describing processes, were produced by the group depicting the current systems in use. The design group took to constructing rich pictures much more readily than entity models and data flow diagrams, however the group did manage to produce a number of valid models.

Defining objectives of the present system: The group formulated individual objectives for each of the fourteen staff groups.

Identifying the user's needs and priorities: The needs of each staff group were identified by the group and organised into priority order.

Problem definition in the organisation: The group defined the problems in each staff group.

Verification procedure: The group carried out a review of the documentation produced in this stage, and errors and inconsistencies were corrected.

Appendix 4 contains example documentation produced in this stage.

5.2.2 Information System Boundary Definition

The group indicated on the entity models (data) and data flow diagrams (processes) produced previously, areas to be considered for inclusion in the information system. Advice was provided by the facilitator on areas which were technically feasible for automation.

Appendix 5 contains example documentation from this stage.

5.2.3 Information System Requirements

System requirements: Data flow diagrams were constructed by the group showing the functions and data flows for an information system in each of the fourteen staff groups. An explanation of the use of function hierarchy charts was given to the group, and then the main functions of the information system defined in terms of the reporting areas required for each staff group using these charts.

Definition of objectives: The group formulated objectives for sub-systems of the information system for each staff group.

Proposed functions: The group organised the functions identified for each staff group into priority order. Each function was then described further by the group and usage information defined, such as frequency of report production. These descriptions were recorded on functional specification forms. The facilitator entered these details into the conceptual functions part of the data dictionary.

Structured system walkthrough: A formal review session was held at which the group considered all the documentation produced so far for correctness and consistency. Changes thought necessary were recorded and actioned.

Appendix 6 contains examples of documentation from this stage.

5.2.4 Korner Analysis

This stage was carried out by the facilitator alone, without the involvement of the group because this was thought unnecessary. The tasks involved were of a mundane, technical nature concerned with extracting recommendations from the Korner reports and modelling them. There was little benefit to be gained by involving the whole design group with this work.

Korner report data extraction: The Korner reports were studied and their recommendations extracted in the form of written lists. For each data item defined, possible values for that item were identified.

Entity modelling and attribute definition: Entity analysis was carried out by the facilitator to convert these written lists into entity models. Specifications for entities, relationships and attributes were defined. Cross referencing between these items was made and details entered into the conceptual entity, relationship and attribute parts of the data dictionary.

Third normal form relational analysis: The data items defined from entity modelling were converted into third normal form relations.

Appendix 7 contains example documentation from this stage.

5.2.5 Local Data Requirements Analysis

Entity-attribute-relationship modelling: The facilitator carried out entity modelling on data items gathered by the design group, from interviews with individual members of staff, and from studying existing forms and documentation. Formal interviews were written up for later analysis. Entity models and specifications for entities, relationships and attributes were derived. These were verified by holding a series of structured walkthroughs with the design group.

Document driven approach to data modelling: Forms used in the community services were collected together by the facilitator for analysis. Due to the large number of forms in use, this method was not practical to apply to all forms, therefore key documents only were considered. Data usage diagrams and third normal form relations were produced. All of the forms collected were browsed through to check for any omissions in the data items defined during data and Korner analysis.

Relation merging and consolidation: The two sets of relations produced in the tasks above were merged into one single set by the facilitator.

Data dictionary maintenance: All data items defined were entered into the conceptual level entity, relationship and attribute parts of the data dictionary by the facilitator.

Security analysis of attributes: The design group specified access controls for each item in the data dictionary, which was then appropriately updated.

Appendix 8 contains example documentation from this stage.

5.2.6 Process Analysis

Function descriptions: The group defined new specifications for each function identified. A large number of the conceptual function definitions were merged into single logical functions. These were then considered in terms of the report layouts needed and their associated data requirements. Logic definitions were made by the facilitator and recorded in the form of structured English statements.

Report layout design: The facilitator formally recorded the agreed report and screen layout designs.

Access path analysis: The data requirements for each function identified by the group were formally recorded by the facilitator using this technique to produce access path models.

Entity life cycle analysis: The facilitator applied this technique using the entities defined earlier. Entities and the functions using them were recorded on an entity/function matrix. Valid entity states were then defined and life cycle diagrams produced. Finally, state/event transition charts were defined from these life cycles.

Structured walkthrough: The group formally considered the definition of functions, the report layouts, and the data requirements for correctness, and suggested changes were implemented.

Data dictionary maintenance: Details of logical functions were entered into the logical level functions part of the data dictionary by the facilitator.

Example documentation from this stage is contained in appendix 9. All of the identified report layouts suggested for each staff group, are given in appendix 10.

5.2.7 Design Consolidation

Korner item incorporation: The facilitator merged together the relations obtained from 'Korner analysis' and those obtained from 'local data requirements analysis' to remove any duplication. A new set of entity models was constructed by merging earlier models.

Process model verification: The facilitator compared the models produced from access path analysis with the consolidated entity models to ensure that all data access paths could be supported. A series of final cut entity models were produced and specifications for logical level entities, relationships and attributes defined.

Structured system walkthrough: The design group formally reviewed the documentation produced in this stage, and recommended changes were implemented.

Data dictionary maintenance: The facilitator updated the logical level entity, attribute and relationship parts of the data dictionary.

Forms design and acceptance: The group, in association with a number of colleagues, designed forms to collect the required data. These were drawn up formally and circulated widely for review and amendment.

Appendix 11 contains example documentation from this stage and copies of the general form layouts.

5.2.8 Human-Computer Interaction Analysis

User characteristics definition: The group defined details of various users of the information system by considering their levels of ability and experience. After taking advice from the facilitator on technical alternatives, a number of recommendations on interaction methods were made.

Interaction method recommendations: The facilitator defined a number of example screen layouts and templates using the interaction methods recommended by the design group for further study. A screen painter was used to show various alternative screens to the design group. Various layouts were then amended by the group and finally selected as being appropriate for use.

Appendix 12 contains the documentation produced from this stage.

5.2.9 Physical Implementation Stages

In the 'data schema detailed design' stage, the facilitator re-defined the logical data item definitions into a form suitable for implementation using the application generator. The data definitions made were entered into the physical attribute part of the data dictionary. Appendix 13 contains example documentation from this stage.

During 'functions detailed design', each function was defined and checked 'on paper' ready for generation. The tasks concerned with the physical implementation were all geared around the application generator used. These tasks are described in chapter 6.

5.3 Results of Application

The emphasis on taking design decisions in this development has been removed from the traditional systems analyst and given to a design group comprising of potential users of the information system. Through a series of training exercises, several techniques for analysing and designing systems have been taught to the design group and successfully applied by them. In many cases, tools such as rich pictures were welcomed enthusiastically by members of the group, who could see the advantages of using them instead of traditional narrative. In at least one instance, a manager has made use of rich pictures in another part of his job.

Each methodology stage defined in chapter 4 has been systematically applied by the group, with the facilitator controlling the tasks to be carried out. Certain technically orientated tasks were however carried out by the facilitator alone in cases where no benefit would have been attained by subjecting the design group to these tasks. This included the normalisation of relations.

Whilst Korner analysis and process analysis were in principle separate stages, in practice however, process analysis did consider some aspects of Korner, in which the design group were exposed to the reporting requirements needed to satisfy Korner. This was thought beneficial in terms of gaining the groups commitment to these reports.

The design group identified 110 separate reports for all staff groups. In structured walkthroughs, a number of these reports were either deemed unrealistic to produce in the light of the data needed to be stored to construct them or not sensible to include within the remit of a community health information system. The reports agreed as reasonable for the system to produce were then consolidated by the group into 38 individual reports. On average, this met 85% of the original user requirements put forward by each staff group. Table 5.1 shows the number of reports requested from each group. Catchpole and Avison (1987) describe these results further.

Table 5.1 Reports Requested by each Staff Group

Staff Group	No. of Suggested Reports	No. which were Accepted	%
Health Visitors	12	12	100
School Nurses	12	12	100
District Nurses	7	6	85
Community Midwives	6	6	100
Community Psychiatric Nurses	9	6	66
Community Mental Handicap Nurses	8	8	100
Clinical Medical Officers	10	6	60
Occupational Therapists	6	6	100
Physiotherapists	5	5	100
Psychologists	10	6	60
Dieticians	7	5	71
Audiology Technicians	6	6	100
Chiropodists	6	5	83
Speech Therapists	6	4	66
Total:	110	93	

The number of reports required to provide the Korner minimum data set information for the community and para-medical services was fifteen. By merging these reports with those requested by the users, a total of only 38 reports were produced which satisfied the Korner requirements; met 85% of user requirements; and provided facilities for epidemiological and demographic research work.

These reports enable a common approach to data collection. This standardisation means that a single pair of input documents can be used to collect data, thus providing systematic data collection and processing. A patient registration form will be completed for each new patient to be entered on to the patient data base. A diary sheet will be completed each day by all staff members and this form can be used to record all necessary activity data. A simplification in the recording of data at source will be achieved, thereby improving the quality and accuracy of the information recorded. Minor modifications to the standard forms will be provided to meet the individual requirements of each service.

The methodology whilst followed in principle, has been limited in practical effect in the implementation stages described in the next chapter, by the particular application generator used. For example, the inefficient way in which file linkage was implemented by the application generator, meant that traditional file structures had to be used to implement the data schemas developed earlier.

6. SYSTEM IMPLEMENTATION

This chapter describes the generation and implementation of a prototype community health information system. The tasks in the physical design and implementation stages were tailored for the particular application generator used. The first section of this chapter therefore, describes the generator chosen for use, and the tasks involved in producing an application using it. Further sections then describe how the system was actually generated and implemented.

One option that could have been used to collect source data for the system was to use hand held data recorders instead of a paper driven method. A trial was held to evaluate their possible use and the results of this are presented.

6.1 The SourceWriter Application Generator

This was the only suitable product available on the equipment to be used. SourceWriter is an application generator producing CIS Cobol code. It allows the expression of design requirements in a concise and unambiguous way in which the end user can be involved and allows the generation of error free code to match these requirements. The features of SourceWriter are explained by Edwards (1986). These include the ability to specify:

Related data sets and rules: In terms of the relationships between data, and the validation and derivation rules which apply to individual data items.

Defining screens and data sources: Allowing screen painting of text and the definition of data items for a screen. The data items must be extracted from any of the related data sets using the defined relationships.

Defining reports and data sources: Allowing painting of report layouts and the provision of totalling, page and control breaks.

Defining programs: Allowing the definition of a series of program requirements and their inter-relationships. SourceWriter generates programs classified as menu, update, query and report.

SourceWriter provides the four major components outlined below to achieve these design features:

Data dictionary: This contains a definition of the application being developed in terms of application structures, file structures, screen formats and print layouts.

Data dictionary maintenance software: Allows the components of the data dictionary to be maintained, displayed or printed, whilst checking consistency and logic on all updates performed.

Program generation software: Generates source Cobol code to CIS Cobol standards, based on the data dictionary definitions.

Macro Files: These are Cobol macros, accessed by the generation software as the programs are built up.

The components of a SourceWriter application are shown in table 6.1. The following steps are used to design an application:

Application structure: The application is named and all planned files, programs, screens and reports identified. Each application requires an associated set of data files which are maintained and used by programs in the application. More than one application can be developed to access the same set of files. A limit of 20 files and 20 programs per application is imposed. Once an outline design is clear, more detailed design can be carried out as described below.

File design: The files to be used by the application are designed. Each file consists of a fixed number of fixed length fields. A key field must be defined for each file. The number of physical indexed sequential files is limited to five, however up to 20 logical files can be overlayed using sibling definitions. Each record may contain up to 45 fields and have a record length of up to 4000 characters.

Data validation and derivation: Validation and derivation rules need to be defined for data fields as an extension of file definitions. This ensures that consistent rules are applied to all updates and references to data items. The program generators ensure that all relevant rules are incorporated into programs.

Screen design: All the screens required by an application are painted, and the variable fields defined. Almost any screen design

Table 6.1 SourceWriter 20 Development Components

(Source: ICL (1984d) pp 1/3)

is possible, constrained by the limitation that only the first 22 lines of a screen may be accessed. The last two lines of each screen are reserved for SourceWriter special purpose and error messages. A maximum of only 20 variable field locations may be defined, but it is possible to use 'repeating lines'. Screens may be used to display or update fields from up to two data files.

Print design: All print layouts required by an application are painted, and the variable fields associated with each print defined. Page widths and page lengths are variable, and headings and footings are supported. Selection criteria can be specified for data retrieval with up to 15 tests being combined in a variety of ways. An associated screen layout may be specified with each print to allow parameters to be entered. A run time option generated in all print programs allows output to be directed to a screen, printer or named disk file.

Program generation: SourceWriter generates the following types of program:

- Insert: For creating new records in one or more files.
- Amend: For amending existing records.
- Delete: For viewing and deleting existing records.
- Query: For viewing existing records.
- General: For providing all of the above functions.
- Print: For providing reports in a specific format.

Programs can be generated either as 'stand alone' or as part of an integrated suite linked together by a control and menu program. Integrated applications co-ordinate all their file access through the provision of a file handler program. This, along with the control program is permanently resident at execution time. Other programs are swapped in and out of memory as required. The structure of an application generated by SourceWriter is shown in table 6.2.

The designers of SourceWriter suggest the code produced by an application generator can never totally solve the problem of system design, and programs will normally need to be manually amended after generation.

Table 6.2 SourceWriter 20 Application Structure

(Source: ICL (1984d) pp 2/5)

Aston University

Illustration removed for copyright restrictions

6.2 Generating the Prototype Information System

The SourceWriter application generator was used to produce Cobol programs for a prototype system. These programs covered control, file handling and file maintenance aspects. Additional programs had to be written in Cobol to handle the reporting functions required. Major modifications had to be made to each of the SourceWriter generated programs to tune them for what was actually required. The following technical documentation was used for this: ICL (1982a, 1982b, 1983a, 1983b, 1984a, 1984b, 1984c, 1984d, 1985, 1986).

The design group was able to participate in the construction of the system because a prototyping approach was used. The group viewed screen and report layouts as they were 'painted', and suggested any changes they felt necessary. These were implemented and this iterative cycle repeated.

The data dictionary documentation produced by SourceWriter is contained in appendix 15. The original Cobol programs generated from this dictionary are given in appendix 16.

6.2.1 Data Schema Sub-System

The documentation produced from the data schema detailed design stage was used in conjunction with the physical attribute part of the methodology's data dictionary to generate SourceWriter file definitions. This procedure consisted of the following tasks:

Application definition sub-system: For each file required, a name was specified, a unique prefix, and a sibling definition. Files with similar record lengths were suitable for mapping onto one another in order to minimise storage requirements. Nineteen file definitions were mapped onto five physical files.

File definition sub-system: For each data file, the fields required in the file were specified. For each field, the name, format (whether alphabetic, numeric or alphanumeric), length and type were given. Types of field included key, mandatory or link field. Repeating group items were also indicated as such, together with an indication showing if validation was required on that field.

Validation / derivation definition sub-system: For each field requiring validation, the type of validation was specified and any necessary range limits. Types of validation include data table, range or external subroutine search. Fields which derived their values from sub-parts of other fields were identified.

Program generation: From these definitions, SourceWriter generated a Cobol file handler program. This handles all file input and output for the application and is permanently resident in main memory at execution time. It is called by each of the other programs in the system which pass parameter data to control its operation, receive and send data records, and handle error status information.

6.2.2 File Maintenance Sub-System

Programs for data file maintenance were generated by SourceWriter from definitions made as follows:

Application definition sub-system: For each maintenance program required, a name, description, program type, and screen name reference were provided.

Screen definition sub-system: Using a screen painter, the layout for each screen was designed and reviewed by the group. In an iterative cycle, changes were suggested by the group and then implemented. In this way, it was possible to involve the group participatively, even in these physical generation tasks.

Screen field naming sub-system: For each screen defined above, the files to be accessed and usage of the screen were identified. For each blank field on a screen, field names were attached from the file and usage data specified.

Program generation: From these definitions, maintenance programs were generated by SourceWriter. These programs required substantial modifications due to limitations imposed by SourceWriter.

6.2.3 Reporting Functions Sub-System

The design of individual reporting functions was carried out using output from the 'function analysis' and 'design consolidation' stages of the methodology. These were converted into Cobol programs and tested. It was not possible to make use of SourceWriter due to inherent limitations for logic specification. Use was made however of a 'screen and print layout painter' which allowed the design group to collaborate on the production of screen and report layouts. An iterative cycle of identifying and implementing changes was carried out until the layouts were considered satisfactory by the group.

6.2.4 Security and Control Sub-System

A series of menus were designed to provide access through the system in accordance with the recommendations from the human-computer interaction analysis stage. A password security system was also implemented. A number of Cobol programs were written to support this sub-system.

The final Cobol program listings for this system are contained in appendix 17. SourceWriter generated code contains line numbers in columns 1 to 7 of the listings. Lines of code without numbers have been manually inserted. It is therefore possible to note to what extent programs have been amended for tailoring purposes.

Table 6.3 describes the purpose of the programs generated by SourceWriter, and table 6.4 the purpose of the additional programs. All of these programs are contained in appendix 17.

Following the guidelines described for implementation, the file handler was used to generate data files, and test data was entered using the maintenance programs. Testing was carried out of the reporting functions using the test data, and errors corrected. As the system was only a prototype, detailed specifications for monitoring, control and recovery were not set up. Nevertheless, a security system was built into the control programs allowing password protection of the main menu and sensitive sub-menu options.

Table 6.3 Purpose of SourceWriter 20 Programs

No	Program Name	Purpose of Program
1	CHFLIO	File Handler
2	CHGROUP	'Staff Group' File Maintenance
3	CHTEAM	'Staff Team' File Maintenance
4	CHMEMBR	'Staff Member' File Maintenance
5	CHSTDNT	'Student' File Maintenance
6	CHCATEG	'Programme Category' File Maintenance
7	CHTYPE	'Programme Type' File Maintenance
8	CHPROG	'Programme' File Maintenance
9	CHCODEF	'Code File' File Maintenance
10	CHACTIV	'Activity' File Maintenance
11	CHPERS1	Patient Registration & Maintenance Page 1
12	CHPERS2	Patient Registration & Maintenance Page 2
13	CHPERS3	Patient Registration & Maintenance Page 3
14	CHGRPSE	Diary Sheet - Group Sessions Input
15	CHOTRACT	Diary Sheet - Other Activities Input
16	CHTRAVL	Diary Sheet - Travel Details Input
17	CHCONTS	Diary Sheet - Contacts Input
18	CHENQR	Patient 'On-Line' Enquiry
19	CHREGTR	Patient Register Listing Routine

6.3 Data Collection Methods

The traditional method of collecting data in the community services has been achieved by the completion of paper forms designed by the particular managers of each profession. All of the forms in use at Darlington were studied. This proved illuminating and showed that frequently, the same data was being collected on more than one form. Further, some forms seemed complex because they had been amended a number of times over a period. Many of the forms were designed with little thought to layout or instructions for use. Such forms are

Table 6.4 Purpose of Additional Cobol Programs

No	Program Name	Purpose of Program
1	CHMAIN	Menu and Security Control Program
2	CHSYSP	System Parameter/Password File Maintenance
3	CHDIARY	Daily Diary Sheet Input Control
4	CHCLEAR	Transaction Files Monthly Clear Down
5	CHPATI	Patient Analysis Menu and Indexing System
6	CHWORK	Workload Analysis Menu and Indexing System
7	CHCAR	Contact Analysis Reports Menu
8	CHEAR	Episode Analysis Reports Menu
9	CHAAR	Activity Analysis Reports Menu
10	CHK01	Contacts by Location Report
11	CHK02	Contacts by Referral Report
12	CHK03	Contacts by Age / Sex Report
13	CHK04	First Contacts by Location Report
14	CHK05	First Contacts by Age / Sex Report
15	CHK06	Completed Episodes by Location Report
16	CHK07	Episodes by Length and Referral Report
17	CHK08	First Contact Result by Referral Report
18	CHK09	Contact Durations by Location Report
19	CHK010	Contact Durations by Age / Sex Report
20	CHK012	Home Assessments by Type Report
21	CHK014	Group Sessions by Location Report
22	CHK015	Programme Analysis by Age / Sex Report
23	CHK016	Episodes by Length of Episode Report
24	CHK019	Contact Durations by Category Report
25	CHK020	Discharge Analysis by Age Report
26	CHK021	Daily Mileage Summary Report
27	CHK022	Activity Summary Report
28	CHK025	Programme Costings Report
29	CHK027	Voluntary Services Usage Report
30	CHK028	Other Non-NHS Services Usage Report
31	CHK029	Activity Summary by Referral Report
32	CHK030	Activity Summary by Location Report
33	CHK033	Activity Analysis Report
34	CHK035	Group Session Non-Attendance Report
35	CHK036	Social Support Analysis Report
36	CHK037	Functional Impairment Analysis Report

difficult to fill in and error prone at the completion and transcription stages.

The work of community health practitioners lends itself well to automated data collection using hand held data recorders. This is shown by Parkinson (1983). These data recorders are small, battery powered devices, no bigger than a pocket calculator. They can be programmed to collect data, storing it in a random access memory (of up to 128 Kbytes capacity). Data can then be electronically drained from the devices into a host computer for processing.

The design group, whose composition is outlined in section 5.1, were particularly interested in exploring the use of these devices. A small trial was therefore carried out in order to evaluate their use for data collection in the community health service.

The use of the data recorders was evaluated alongside an equivalent paper method of data collection so that comments could be made on the method of data capture rather than on the type or nature of the data captured. The data to be collected was for 'group sessions', describing the location of the session and the number of attendees, and for individual 'client contacts', describing the client's identification, the location of the visit, the time spent, and details of the health professional's activities during this time. Data collected was of both a clinical and a workload nature.

Before the trial, the design group could see possible advantages in using the hand held devices, in particular the fact that data could be directly transferred to a main computer. A paper system requires careful administration and separate and significant keying-in costs. A number of disadvantages were also apparent. Most importantly, the professional staff may well dislike using the devices. Although they had expressed a willingness to try them out, they may well prefer the tried-and-tested paper methods. Further, the keys on the devices available were quite small and this could lead to several keys being pressed simultaneously or the wrong keys being depressed. The machines would be heavily used if adopted, and the group also questioned their robustness. Finally, the liquid crystal display (LCD) might be difficult to read, particularly in strong sunlight.

There were some constraints which affected the size and duration of the trial. The results should be interpreted in the light of these constraints. Firstly, health professionals would be using part of their working day to participate in the trial and this would impact on their service during the trial period. Secondly, only two recorders were available for the trial period. Finally, the recorders contained a fixed demonstration program which was not entirely suitable. If the recorders were adopted, then the program would need to be adapted significantly. As a consequence, the design group decided on a two week trial using six participants.

A number of staff were willing to participate in the trial and it was possible to include participants from various disciplines so that the effects of any working practices particular to any one staff group would be minimised. The participants chosen - health visitors, district nurses and specialist nurses - were representative of the staff groups who would be involved in an operational system. They were asked to report back to the design group through a written questionnaire and informal discussions.

The six participants were divided into three teams of two, each team spending two full days using the new paper system described later, and two full days using the hand held data recorders. Training sessions were held to instruct the participants in the operation of both the paper and data recorder methods. The training session started with a short presentation, followed by a debate on possible problems and practical experience of using the two methods through worked examples.

The data recorders used in the trial prompted completion of a standard form by displaying the individual field names on a 40 character by 4 line display, several fields at a time. Many fields consisted of coded information and the machine displayed the options available where only a small number of options were involved. The operator chooses the required code for entry. In some cases, for example treatment codes, the number of alternatives were too large and the options could not be displayed.

Given these fixed displays in the machines, any forms used for comparison purposes would have to collect the same data, in the same order, and using similar codes. Two forms were designed, one collecting activity data such as time spent in clinics, on teaching, administrative work and so on, and the second completed for all face-to-face contacts. A rubric was added to the forms giving instructions. Thus the two forms, designed to be completed each day, matched the displays which were produced on the hand held data recorder allowing comparisons to be made.

To assess the results of the trial, questionnaires were issued to all participants which consisted of three sections. These related to the manual system, the hand held recorder system, and then a comparison between both. Following completion of the trial, each participant gave an informal interview and these were followed by a lively group discussion. The results of an analysis of the questionnaires and the discussion led to the following conclusions which are discussed further in Catchpole, Avison and Peart (1987).

The hand held recorder was on the whole found to be easy to use, was marginally preferred when compared to the current paper system, and was regarded as being slightly faster. Further, the group discussion was also favourably disposed to the hand held recorder and four out of six respondents said they preferred it to the paper system. The two staff who preferred the paper system were health visitors. The group discussion revealed that this was because much of their work was of necessity unplanned, whereas the work of the other groups tended to be more structured. Where work is unplanned, the necessary information was not always to hand, therefore an entry could not always be made on the spot using the recorder.

The main criticisms of the recorder were related to the programming of the machine itself and therefore could be correctable. Others suggested that it was not possible to review items already entered; displays appeared too slowly and took a long time to clear; and the keys were slow to respond and too closely grouped together. The first of these criticisms can be resolved by programming and the second and third points concern speed and could perhaps be improved with more thoughtful programming. The last criticism is one which the design group feared would be the case, although the problem may be alleviated with practice.

The design group were however, highly encouraged by this trial of hand held data recorders. As well as points of criticism mentioned above there were many positive points expressed, such as the prompting made possible by the use of the recorders and immediate validation of data, also its convenience and 'professional air' were considered very positively. The recommendations of the design group were to consider re-programming the recorder, and to carry out a further trial with a larger sample over an extended period of time.

For the purposes of the prototype information system, it was decided by the group to proceed with a form based method of data collection.

6.4 Implementation of the Prototype

Two pilot staff groups, one nursing and one para-medical, were to use the prototype. These were chosen by the design group. The school nurses were selected as the nursing group because they carry out mainly 'group session' type activities. The chiropodists were selected as the para-medical group because they carry out mainly 'face-to-face contact' type activities. It was thought these two groups provided a contrast to test different parts of the system.

A smaller implementation group was selected from the main design group to work on the production of operational documentation, to consider code and form design, and to co-ordinate transition to the new system. This group consisted of:

Management Grades

Director of Nursing Services (Community)
Assistant Director of Nursing Services (School Nurses)
District Chiropodist

Non-Management Grades

8 School Nurses
4 Chiropodists

The Facilitator

A key member of this group was again the facilitator, who took an active lead role by controlling the tasks to be performed, carrying out training where necessary, providing information, and participating personally in some of the tasks involved.

6.4.1 Forms Design

After the trial of hand held data recorders and an equivalent manual system, it was decided that a form based method of data collection would be employed for the prototype. The implementation group took the general forms produced at the 'design consolidation' stage, and tailored them by removing data items not required by the pilot groups. Appendix 18 shows the forms which were produced.

6.4.2 Selection of Codes

Many of the data items in the system are held in coded format. This both simplifies data collection and reduces storage space. Examples of these items include locations, sources of referral, activities and programmes. For each coded data item, all the possible different values to be taken by that item were identified by the implementation group. After all values had been identified, unique codes were attached to each value. Uniqueness was only required for values pertaining to the same data item.

The group spent some time deliberating over whether numeric or alphabetic codes (based on perhaps the initial letters of the textual value) were preferable. A decision was made by the group to use numeric codes allocated on a sequential basis. A code book was produced containing all coded data values. Appendix 19 contains a copy of the school nursing service code book.

6.4.3 Training and Education

The facilitator carried out the training of an operator, whose tasks included controlling the circulation of input forms, data entry, report extraction and distribution, and the handling of security procedures.

Training was then carried out by the facilitator, with each school nurse and chiropodist on a small group basis, covering form filling and submission, and the use of code books. The comments of the DHSS on implementing computer systems in the health service were considered in DHSS (1985b).

6.4.4 Operation of the Prototype

The prototype operated around the following cycle. Daily diary sheets and patient registration forms were batched together and submitted by individual staff at the end of each week. These were entered into the system during the following week. After the completion of one month's data, reports were extracted for each staff group and sent out to appropriate managers for distribution and perusal. The system was then cleared down and data entry recommenced for the next month. The design group produced operational documentation for users of the system in conjunction with the facilitator.

The prototype system was operated for a period of four months with the two staff groups described. During this time, four cycles of operation were completed, resulting in four sets of reports for use by management and staff. A telephone 'help line' service operated during this period to assist users.

A series of review meetings were held to evaluate progress throughout the period, and consider any problems which had arisen. Reactions by both management and staff to the 'new' information available were favourable. In fact, during the first few months of operation, a number of assumptions concerning the workload of one of the staff groups which had been held for many years, were proved to be incorrect. Appendix 20 contains sample reports produced during one month's operation.

6.5 Conclusion

A prototype information system was developed by initially using the SourceWriter application generator. This package was found to be useful in defining file structures, validations and derivations on data, and screen and print layouts. It did however possess a number of arbitrary restrictions such as a limitation of only 20 variable field locations per screen; restrictions on the use of concatenated fields as keys; and very limited logic which allowed only straightforward selection of data for reports.

A major benefit of SourceWriter was that it allowed a prototyping approach to systems development to be utilised. It also allowed the participation that occurred in the application of the methodology to be extended right through into implementation. The cycle of changes suggested and followed through by the design group, implied that the final system was much more acceptable to the group than would have been the case if a more traditional approach to implementation had been used.

It is concluded that the use of an application generator offers many advantages for a methodology which utilises participative and prototyping approaches to system development. Changes suggested by the design group were implemented quickly and at little cost, and a large amount of overall development time was saved.

The headings in the documentation produced by SourceWriter shown in appendix 15 are not easily understandable by non-technical readers. This confirms the view that SourceWriter falls very much at the 'technologist orientated' product end of the 4GL continuum. This type of application generator can really only be successfully applied by technical staff with a programming background.

The code generated by SourceWriter was inefficient in some aspects, although this was not a major worry. All of the programs generated did need substantial modification to tailor them to requirements, and all the reporting functions had to be coded manually. An application generator such as the one used, can never totally solve the problem of system development. It is estimated that about 25% of the code for this system was generated by SourceWriter and the remainder coded manually.

SourceWriter is only a very limited 4GL with restricted facilities. It was however, all that was available at the time on the equipment, and did serve a valuable purpose in this research.

The hand held data recorder trial was the first of its kind in the national health service to evaluate the particular type of recorder used. The results of this trial showed that for certain staff groups, this method of data collection could be used successfully. The results of the trial were requested and presented to the DHSS, who are mounting a larger trial over a longer period of time.

7. CONCLUSIONS

7.1 Evaluating Information Systems

One of the most critical issues in information systems management concerns how to assess the information systems in an organisation. Assessment or evaluation is an act of placing a value on an information system. This can take place from a number of different points of view, for example, those of the sponsors or owners of a system, the users, or the system designers.

The sponsors of a system are most likely to be interested in economic assessment criteria and less interested in technical or operational aspects. They will be concerned with effects at an institutional level such as the way the organisation does business and how interactions with other organisations occur. System users will be interested in operational aspects and perhaps impact on work quality at an operational level. System designers may be concerned with the impact of an information system on the computing resources of the organisation.

There are techniques which attempt to measure the degree to which a system is effective (how the information system meets organisational type objectives) and efficient (how accurate, timely or appropriate information provided by the system is).

Hawgood and Land (1986) describe three fundamental difficulties in assessing information systems. Firstly, effectiveness is a subjective concept and different people will have different views on the effectiveness of a system. Secondly, information systems are immensely diverse in the functions that they carry out and in the objectives that they seek to meet. Thirdly, an evaluation should really take place by comparing the running of the organisation with and without the aid of the information system. In reality, this comparison is not usually possible.

Blackler and Brown (1986) show that technical difficulties of evaluation are not the only issues which result in so little attention being devoted to post-systems evaluation. They describe attitudes of the form 'if a system works, then that is enough', 'in this organisation there is a lack of any need to demonstrate success', 'top management are not interested in evaluation and quantifying indirect benefits' or 'resources are not made available for evaluation' and so on.

Despite these drawbacks there is an important need to quantify the benefits of an information system and perform evaluation. A multi-disciplinary approach is needed to do this because evaluation can take place from a technical, economic, organisational or societal perspective. There are three stages in the life of a system during which information systems assessment may be applied. In a feasibility study, a cost/benefit analysis may identify economic, technical and operational costs and benefits. During the analysis and design of an information system, quality assurance checks may be applied which cover technical and operational aspects. Finally, a post-implementation audit may be performed which assesses a working information system recently implemented. A number of methods for assessment have been classified by Blackler and Brown (1986):

Cost substitution: The old and new systems may be compared, and relative costs assessed using cost effectiveness or quantitative cost benefit analysis approaches.

Value added: Both quantitative and qualitative comparisons may be made on issues covering improved services to clients, product quality, or increased flexibility offered through the use of the information system.

Organisational evaluation: In this method, the need is stressed to study the impact any system has on hierarchies of control, work and job design. Attitudes of users are considered important here.

Process evaluation: Attention is given here to the evaluation of the processes by which a system is designed and introduced, in other words, the system design methodology. Project management, participation and end user support and development are key issues.

In each of these methods, aspects of the information system can be compared relative to a competitor's system, theoretical ideals, stated goals and objectives, or past performance targets. The methods may employ the gathering of statistics through interviewing techniques, observation, sampling, or the use of questionnaires. Capron (1986) suggests ways of using these techniques for evaluation purposes.

IBM market an evaluation methodology known as 'Sesame' for the retrospective evaluation of information technology in organisations. Sesame tries to identify the full costs and benefits achieved from an information system by producing a data base of proven financial returns from the system. Once these are established, projections can be made over the expected life of the system to a maximum of five years by using cost benefit post audits. These give a comparison between two states. New system costs and benefits can be compared with current or old system costs.

A Sesame study attempts to identify the full costs associated with each system under review. Categories for costing may include system development, operations, training, data input and acquisition, management time required, and general overheads. The methodology uses standard questionnaires and interviewing techniques to gather information on system usage, importance, costs and benefits, user requested enhancements and comments and quotes from the user community about a system.

Lincoln (1986) describes experiences of using Sesame and concludes that there is no single financial measure which adequately describes the full performance of an application. However, by using Sesame it is possible to post-audit the financial returns of a computer system, which in Lincoln's view is a necessary requirement for all major applications.

7.2 A Method for Evaluating the Prototype

In order to evaluate the prototype it was decided to attempt to determine the degree of effectiveness and the degree of efficiency of the system. Effectiveness measurement for the purposes of this study is defined as being the proportion by which the system meets organisational objectives and goals. Efficiency measurement is defined as a measure of the 'mechanical' aspects of the system such as the accuracy, timeliness and speed of access to information.

It was decided to evaluate the prototype by soliciting opinions from the system owners or sponsors, who are senior managers in the organisation and system users, who operate, provide data or make use of information from the system. It is also possible for users to be owners of the system. System owners will evaluate the effectiveness of the system, and system users will evaluate the efficiency aspects.

Where possible, comparison of the prototype was made relative to the previous equivalent manual system which was replaced by the prototype, and both of these comparisons were related to theoretical objectives, goals and needs which were identified by the design group during application of the methodology. Costs and benefits associated with the old and new systems were identified, and then qualitative and quantitative items evaluated covering such issues as services to clients, value added features, changes in the decision making process, and so on.

As well as the above, an indication of the success of the training programme used during implementation was desirable, as were comments on the design process used to produce the system, including the participative aspects.

A number of data collection methods could be used for this type of evaluation. Easterby-Smith (1986) describes many of these. A questionnaire study was selected as being appropriate, because both 'open' and 'closed' questions could be asked, and qualitative and quantitative assessments recorded by the participants. The use of attitude and rating scales was made to gather quantitative data. Attitude scales such as those proposed by Likert and Thurstone are described by Rae (1986) and Easterby-Smith (1986). Follow up interviews were also used to gather further information and to clarify certain points made on the questionnaires.

The questionnaire used contained three sections covering effectiveness, efficiency, training, and design process. Appendix 21 contains a copy of this questionnaire. The following framework was defined for this questionnaire:

```
                     +------  Objectives fulfilled
                     |
                     +------  Problems addressed
                     |
                     +------  Needs addressed
EFFECTIVENESS  -----+
                     +------  Costs and achieved benefits
                     |
                     +------  Impact on work and clients
                     |
                     +------  Impact on decision making and control
```

```
                     +------ Attributes of the information produced
                     |
                     +------ Aspects of using the information system
                     |
                     +------ Value placed on information generated
EFFICIENCY     -----+
                     +------ Data collection methods
                     |
                     +------ Working practices of staff
                     |
                     +------ Personal aspirations of staff

TRAINING

                     +------ Perceived 'success' of implementation
                     |
DESIGN PROCESS -----+------ Contribution made by 'participation'
                     |
                     +------ Personal benefits and gains of staff
```

7.3 Results of Evaluation and Conclusions

In measuring the effectiveness of the information system, tables 7.1 to 7.10 have been produced. These tables reflect the views of those who participated in the project. Table 7.1 would seem to show that the overall objectives for an information system have now been met to a much greater extent than in the past.

Tables 7.2 and 7.3 seem to indicate a similar success, although the chiropody service considered its objectives to have been more fully met than was the case in the school nursing service. For example, the objective of maintaining effective communication with other disciplines has not been addressed successfully and that of maintaining accurate health records for school children has not been improved. A number of problems identified by both services would seem to have been successfully addressed by the information system and tables 7.4 and 7.5 indicate a large increase in the extent to which these problems have been alleviated.

The survey also indicates that specific information objectives for both staff groups have also been fulfilled to a greater extent, although two objectives, for school nursing to provide a scheduling system and to help control stock items, were only partly fulfilled because the system was not designed to offer these facilities. Tables 7.7 and 7.8 show these results. The costs and benefits of the previous system and the new one have been identified and recorded directly from the questionnaire in tables 7.9 and 7.10.

Respondents commented on a number of other organisational issues which are discussed below:

Work tasks: The respondents considered that the system has helped people to perform their work tasks more effectively. The system has directed attention to what is actually being done by staff, thereby improving time management, especially concerning clerical tasks and travelling time. Breaking down the day into time units allows the percentage of time spent on each aspect of the job to be seen. The strengths and weaknesses identified have resulted in a change of working practices. It is now possible to identify constructive and non-constructive tasks.

Quality of service: The system has improved the handling of case loads, and improved timetabling and the utilisation of clinical time. More up-to-date, accurate and easily accessible information will help in both short and long term service planning.

Table 7.1 Overall Objectives for the Information System

Objective (Maximum score is 20) (N = 4)	Old Sys Score N	%	New Sys Score N	%
Information should be as unified as possible throughout all services	0	0	16	80
Systems for information collection and processing should be such as to increase the time available for patient contact	8	40	15	75

Table 7.2 Objectives for the School Nursing Service

Objective (Maximum score is 10) (N = 2)	Old Sys Score N	%	New Sys Score N	%
Recognition and identification of needs, and mobilisation of the appropriate resources where necessary	4	40	8	80
Maintaining accurate health records for all school children	6	60	6	60
Provision of information and statistics to managers	5	50	9	90
Maintaining effective communication with all other disciplines	2	20	4	40
To monitor activity in terms of work done, time spent, point of treatment and source of referral	2	20	9	90

Table 7.3 Objectives for the Chiropody Service

Objective (Maximum score is 10) (N = 2)	Old Sys Score N	Old Sys Score %	New Sys Score N	New Sys Score %
To provide treatment where necessary, and advice to school children, pre-school children and expectant mothers	6	60	10	100
To monitor activity in terms of work done, time spent, point of treatment and source of referral	3	30	10	100

Table 7.4 Problems of the School Nursing Service

Problem (Maximum score is 10) (N = 2) The Score indicates the **Extent** to which each **Problem** was addressed by each **System**	Old Sys Score N	Old Sys Score %	New Sys Score N	New Sys Score %
A manual system currently records all information	2	20	8	80
Data is incomplete for management purposes	0	0	8	80
Too many separate forms are in use	0	0	8	80
It is time consuming to record information	2	20	7	70
The emphasis of data collection is for DHSS, rather than local management purposes	4	40	9	90

Table 7.5 Problems of the Chiropody Service

Problem (Maximum score is 10) (N = 2) The Score indicates the **Extent** to which each **Problem** was addressed by each **System**	Old Sys Score		New Sys Score	
	N	%	N	%
Lack of communication between departments	0	0	7	70
Lack of information regarding planning development in other disciplines, which will ultimately effect the chiropody service	0	0	7	70
Data is not unified with other types of community information	0	0	7	70

Table 7.6 Needs of the Community Health Services

Need (Maximum score is 20) (N = 4)	Old Sys Score		New Sys Score	
	N	%	N	%
A unified information system for recording and presenting information	0	0	18	90

Note:

In each of the tables, a **low** score indicates that a particular system has not addressed an issue successfully, and a **high** score indicates an issue has been addressed to a much greater extent. None of the items in the tables are in priority order, and future work might seek to perform further evaluation by ranking each item by priority.

Table 7.7 Information objectives for the School Nursing Service

Information Objective (Maximum score is 10) (N = 2)	Old Sys Score		New Sys Score	
	N	%	N	%
To meet the Korner requirements	0	0	8	80
To avoid the storage of duplicate information	0	0	9	90
To provide on-line access to basic patient details and recent contacts	3	30	9	90
To save time in accessing information	1	10	10	100
To provide an up-to-date patient register	0	0	10	100
To decrease time spent by staff on form filling	1	10	9	90
To remove the need to manually aggregate statistics	0	0	10	100
To provide more meaningful statistics to staff and management	2	20	10	100
To provide better information for strategic manpower and service planning; education; epidemiology and demography	1	10	8	80
To provide a scheduling system for workload	2	20	5	50
To provide a better controlled stock system from workload	3	30	5	50

Table 7.8 Information objectives for the Chiropody Service

Information Objective (Maximum score is 10) (N = 2)	Old Sys Score		New Sys Score	
	N	%	N	%
To meet the Korner requirements	1	10	9	90
To provide information for planning over and above the Korner minimum data set	2	20	9	90
To provide patient registers	0	0	10	100
To provide a domiciliary appointments system	0	0	7	70

Table 7.9 Costs and Benefits of the Previous System

COSTS (Sacrifices)	Priority
Time taken by professional staff to collect data	1
Time taken by clerical staff to collate and present data	2
Storage space for data collected	3
Diversity of forms in use e.g., 10M, diary, notebooks	4

ACHIEVED BENEFITS (Gains)	Priority
Showed the need for a better system	1
The old and familiar - 'comfortable' to staff	2
Gave a rough guide for planning and development	3

Table 7.10 Costs and Benefits of the new Information System

COSTS (Sacrifices)	Priority
Hardware and Software costs	1
Extra time for coding 'patient identifiers'	2
Initially, staff morale	3
Initially, more time needed to code and fill in forms	4

ACHIEVED BENEFITS (Gains)	Priority
Local, regional and DHSS needs for information are met	1
Information is up-to-date, accurate, wider ranging, and	2
more easily accessible	
Information threw new light on time management	3
Information can be fed back to staff	4
Opportunity to reorganise clerical staff workload	5
Involving staff in the management function	6
Learning new skills	7
Data is electronically aggregated	8

Impact on patients or clients: The maintenance of patient registers has provided better information, allowing better co-ordination of services to particular clients. Improved time management has lead to improved client access.

Impact on decision making and control: The respondents suggested that using the prototype has confirmed their views that this type of system is essential to service management and planning for good care delivery. Decision making will be speeded up because appropriate information will be available at regular intervals. The potential is recognised, but the system has not yet been in use for long enough to make an impact on decision making and control. In the future, it should be possible to identify areas where more staff are required.

Respondents suggested a number of enhancements which could be made to the system:

- making use of the ad hoc research option which although provided had not yet been utilised
- enhancing the information provided on patient registers to show more details about other professions and agencies involved with a a client
- provision of a full workload scheduling system
- provision of a stock control system for nursing equipment or an interface to an existing stock system

The efficiency of the system has been measured and presented in tables 7.11 to 7.13. The value placed on aspects of information provided from the system is shown in tables 7.11 and 7.12. These show a much higher satisfaction with the information provided from the new system over that from the previous system, and certainly show a very positive attitude towards the value of the information generated.

The views of those using the information system are shown in table 7.13. Generally, positive responses were obtained to most aspects, however a negative response was obtained concerning the time saving aspect of the system. From follow up interviews however, it seemed that respondents answers had included an initial period when the system was brought into use, during which time data collection was slower, as staff became familiar with the forms and code books. The fact that the speed of data collection did increase was borne out by further follow up interviews and the responses made to some of the other questions.

The following responses were obtained about various aspects of using the system:

Data collection: Almost all respondents found the method easy to operate. Five respondents found the method very easy to use, twelve, easy to use, and two about average. Two respondents considered the method faster than the previous system, four about the same, and seven slower, but this apparent slowness was not borne out by the discussions described above.

Advantages of the data collection method included a reduction in clerical time, single sheet data collection, greater accuracy and comprehensiveness, and daily recording of data rather than weekly or

Table 7.11 Attributes of the Information System

Attribute (Maximum score is 95) (N = 19)	Old Sys Score		New Sys Score	
	N	%	N	%
Accuracy of information	38	40	80	84
Timeliness of information	26	27	60	63
Appropriateness to your needs	37	39	70	74
Reliability of information	41	43	83	87
Completeness of information	34	36	81	85
Speed of access to information	41	43	64	67

Table 7.12 Views on the Value of the Information Provided

	-2 -1 0 +1 +2		Ave.
Trivial	-----*-----*-----*X----	Sophisticated	+1.19
Useless	-----*-----*-----*--X--	Useful	+1.50
Un-important	-----*-----*-----*--X--	Important	+1.50
Boring	-----*-----*-----*X----	Interesting	+1.13
Valueless	-----*-----*-----*-X---	Valuable	+1.44
Meaningless	-----*-----*-----*-X---	Meaningful	+1.38
Un-clear	-----*-----*-----*-X---	Clear	+1.25

Table 7.13 Views on Using the Information System

	-2 -1 0 +1 +2		Ave.
Difficult to Learn	-----*-----*-----*-X---	Easy to Learn	+1.38
Difficult to Use	-----*-----*-----*-X---	Easy to Use	+1.25
Troublesome	-----*----X*-----*-----	Un-troublesome	-0.13
Time Consuming	-----*-X---*-----*-----	Time Saving	-0.81
Imposing	-----*----X*-----*-----	Un-imposing	-0.19
Inflexible	-----*-----*-----X-----	Flexible	+1.06

monthly recording. Disadvantages included the problems concerning breaking the day down into time units by estimation, getting used to the codes, and sometimes a difficulty in obtaining the required data for forms. One particular problem proved to be that dates of birth were not always to hand when formulating 'patient identifiers'.

Effect on working practices: A slight reorganisation of working practices to collect and record data was needed. Some other comments collected were: 'it was satisfying to see what work had been done at the end of the month', 'I have been made more aware of what I have been doing', 'we can see what has been done on a day-to-day basis', 'I have realised what a large amount of time is spent travelling and walking to homes and schools' and 'our time management has been improved and certain practices re-assessed'.

Personal aspirations and hopes: The following comments were made and considered to have been satisfied by varying degrees:

'To have a better overview of what the staff are doing'

'To reduce time spent on clerical duties'

'To have accurate, up-to-date, accessible details of each client'

'To have help with workload planning'

'Simplification of record keeping and collection of statistics'

'More valuable feedback of information to staff'

'That the information we recorded would be useful to management'

'To learn the codes off by heart and speed up form filling'

'To show how much time is spent on clerical and 'other' activities'

Training: An evaluation of the training programme is shown in table 7.14. This table shows that perhaps the duration of the programme should have been longer.

Success of implementation: Twelve respondents thought the system had been successful, six were unsure, and nobody thought the system was unsuccessful. The respondents attributed a number of reasons to this success: firstly, the fact that staff were involved from the beginning in the development process and were clearly instructed; secondly, the provision of a telephone 'help line' service, regular assessment meetings and quick response to problems; thirdly, the fact that all requirements had been fulfilled; and fourthly, that the school nursing service had lent itself well to the system. These were all thought to have contributed to the success of the project. As one school nurse recorded, the system had been a success 'because we are all still using it after the pilot has been completed'.

Table 7.14 Evaluation of Training Aspects

Aspect of Training (Maximum score is 90) (N = 18)	Score	%
Duration	67	74
Level of Detail	71	79
Comprehensiveness	73	81
Appropriateness	76	80

Participation: Seventeen respondents considered that participation by staff in the project had contributed to its success, and two were unsure. The following reasons were given for this. Respondents felt that participation lowered anxiety, created an interest in the system, reduced fears as to the ability of staff to cope, and created the feeling that the system took into account the needs of each particular service and those who ran them. Additionally, respondents thought that without a clear understanding of the rules and functions of the staff concerned and work practices carried out, the design of the system would not have been as effective. As one school nurse commented 'as it is the community health professionals who have to use the system, we are in the best place to help design it; we know what information is important and relevant for recording'.

Personal benefits from participation: The following comments were recorded:

'I have gained a knowledge of modelling techniques and now find that they are applicable in other areas of my work'

'Taking part in the design has given me a greater insight into how these systems work'

'I have been made aware of the difficulties in the system design process'

'I have benefited and gained experience in collecting more detailed data to provide more accurate statistics'

'I have improved my understanding of information systems'

'I have gained experience in designing stationery and code books'

'I have discovered areas of neglect in my job and seen just how diverse my contacts are within a multi-disciplinary team'

'I have learned something of how systems are set up and work'

'I have gone through a period of personal re-assessment in my job'

'I have improved my knowledge of computer systems, and found this experience both interesting and beneficial'

'It is good to be involved with developing new systems'

'The system created an awareness of the different aspects of my job, and the time spent on each'

'I have been made aware of the potential of such a system'

'I feel I have been able to make a valid input in the designing of a system which meets our needs'

General comments: Some of the respondents offered general comments about the project. Many of the participants had enjoyed being involved with the development, and recognised that with a flexible attitude as the system operates, it is likely that future enhancements can be made successfully. Users suggested that speed of data collection had increased greatly throughout the trial, as users became familiar with the new forms and code books. Although the system was a management tool, the information provided has had a beneficial effect upon clinical service provision, as staff took a new look at their individual performance, time management and effectiveness. In the long term, the system should help produce a better service.

To conclude, the design and implementation of this information system seems to have been successful, at least according to the questionnaire evaluation performed. Group discussions and follow up interviews also seemed to confirm this.

7.4 General Conclusions of the Research Programme

This research programme has attempted to address four sub-objectives (1 to 4) which helped fulfil the primary objective (5):

1. '**Identify and document the current state of computer applications in the community health services**'

A national survey mounted to determine the present position of community health applications addressed this sub-objective. It confirmed that there was no existing information system which covered all staff groups, met the local needs of community health service staff and the statutory recommendations of the Korner steering group.

2. '<u>Identify the requirements of a successful design methodology suitable for producing a community health information system</u>'

A literature search and study of the problem situation allowed the formulation of a series of general and specific requirements for a methodology to be used in the problem situation.

3. '<u>By using the requirements, identify, or define instead, a methodology suitable for producing a community health information system</u>'

A further literature search identified and assessed the suitability of a number of methodologies for possible application. None were found to be totally suitable. It proved unreasonable to rely on a single methodology to develop applications in this type of problem situation. It was decided instead to define a methodology based on current approaches, tools and techniques. The proven ideas of the past were utilised to provide a sound basis for information system development. The following conclusion is presented:

<u>Adaptive methodologies</u>: A methodology for developing information systems should not be used with the expectancy that it can be rigidly applied for all applications. It may need to be adapted. This could involve selection from a 'box' of tools and techniques those which are appropriate for the problem situation. It may be necessary to add or delete stages from the overall structure of the methodology. A specific stage in this community methodology involved 'Korner analysis' which dealt with the statutory requirements for community

information. Aspects of a methodology may not be appropriate in all situations, for example user participation, which was appropriate in 'process analysis', was not appropriate during 'Korner analysis'. There is a need for adaption and flexibility.

4. '<u>To involve members of the community health service in the design and implementation of a new system</u>'

This was considered an essential sub-objective, and was fulfilled by using a representative design group approach to participation at points considered appropriate throughout application of the methodology. The following conclusion is presented:

<u>Participation</u>: By involving those people who are to use an information system in its design, a project is more likely to succeed.

Participation was helpful in a number of areas, for example, in applying the tools and techniques used in analysing the current system, defining information requirements, defining data and functions, and implementing the prototype. Users were willing to use techniques which were new to them, for example, drawing up rich pictures, which would then be discussed, modified and used as a basis for further analysis. In addition, no resistance was encountered to a trial of portable data capture equipment or to the introduction of the prototype system using a form driven method of data collection. This was regarded as quite a major change in the organisation. In fact, users responded positively and accepted the new system, which appeared to be well liked by them.

The author was fortunate to receive such participation in the project, and notes that the active co-operation from users has resulted in the production of a much more successful and enthusiastically received system than would otherwise be the case. Section 7.3 seems to indicate the success of using participation in this research programme.

5. **'<u>Design and implement a prototype version of a community health information system, which has as its strategic objectives</u>:**

1. Fulfilment of the local needs of all community health service staff groups, and

2. Fulfilment of the statutory requirements of the Korner steering group concerning community and para-medical information'

To fulfil the primary objective above, a system has been designed and implemented by applying the methodology developed in the research programme. After a period of operation, a formal evaluation was carried out which determined how closely the system did meet the needs of users and address the strategic objectives defined above. Section 7.3 discussed the results of this evaluation which were encouraging.

Some further general conclusions are presented below:

Systems approach: One option that could have been implemented was the development of separate information systems for each staff group, and a separate system to provide the information required for Korner. The previous manual systems were designed in this way and inevitably, information was frequently duplicated.

Some district health authorities are pursuing the use of discrete information systems covering physiotherapy, district nursing, and so on. By integration of the requirements of each of the fourteen disciplines, originally defined in terms of 110 separate reports, a series of 38 report definitions were produced which went some way towards satisfying the requirements of each individual discipline and those of Korner.

Although there is a greater risk involved using integrated instead of discrete systems, if failure was to occur, it was felt that this risk was justified. In taking a holistic view, a large saving in data collection, validation and storage costs has been made. A great deal of overall development time has also been saved. There is still however the flexibility in this approach to give users their own reports on their own terminals. These aspects are described in Avison and Catchpole (1987a).

Job satisfaction: The introduction of the system has led to a much better feedback of information to the staff originally collecting source data. This, combined with the benefits resulting from participation has, it is felt, increased the job satisfaction of the professionals working in the field. Avison and Catchpole (1987b) describe this further.

Achieved benefits: Many of the reasons outlined in section 1.3 for originally developing a community health information system have been realised. These include the following: a single integrated system now provides information for many staff groups; previous duplication of information has been reduced; the recommendations of aspects of the Korner steering group reports have been addressed; data collection costs have been reduced; and information in the form of reports, can now be fed back to staff; and the value of information has been increased.

7.5 Directions for Future Research

There are a number of areas concerned with methodological issues and the further development of a community health information system worthy of exploration. These are outlined below:

Tools / techniques in the methodology: A study of whether there are other tools or techniques which could be incorporated into the methodology to enhance it. There may be other, more appropriate tools for describing logic (to replace decision trees, decision tables and structured English) which better suit systems which are developed using 4GLs. Further work may involve the use of a more advanced 4GL which is more 'end user' orientated.

Internal evaluation: The methodology might be developed to provide evaluation and assessment facilities during its application. More use of interviewing and questionnaires might be made to enhance assessment and quality assurance in each stage of the methodology.

Automated data collection: A larger trial might be held to evaluate hand held recorders for data collection with the prototype. It is possible to hold a case load (giving basic details of each client seen by an individual staff member) within the memory of a recorder, thereby utilising the devices not just for data collection, but also for the presentation of relevant client information to users. A study of the practicalities of operating such a method could be carried out.

Improvements to the prototype: Incorporation of a number of the enhancements suggested by users in the evaluation phase. These were listed in section 7.3.

Links to other NHS systems: The possibility of electronic links to down-load or up-load data from family practitioner committee (FPC), or other hospital based information systems could be explored. Common data items might be identified for possible electronic transfer. The use of a district 'community index' might be explored to provide a link between all district based computer systems.

Validation of Korner minimum data set: A comparison of the Korner minimum data set items with the locally requested data items of district management would help to demonstrate the appropriateness of collecting Korner data. One of the assumptions of the Korner steering group was that all management information can be derived from 'off the back' of operational systems. An assessment of whether this is the case could be performed. Scrivens (1987) addresses this issue in her assessment of the information needs of district general managers. A 'shift' in information requirements may be occurring to satisfy the needs of NHS general management.

National survey of applications: The questionnaire survey to health authorities to determine what community systems are in use could be repeated to identify the response of the NHS as a whole to the Korner exercise. At the present time, it is known that there are a number of districts who failed to implement systems by the first deadlines.

This research programme has attempted to provide a prototype system to fulfil some aspects of the Korner recommendations covering community and para-medical services within the framework of a much larger community health information system, designed by, and geared to, the needs of the practitioners working in and managing the community health services.

Appendix 1 - Survey Questionnaire and Standard Letter

Darlington Health Authority

Community Health Service Computer Systems

Questionnaire

for Durham Health Authority

General

Name of Package / System ....

Description of what the Package / System does and the Application Area

....

....

....

....

....

....

Name and Contact Address or Telephone No. of Person who is knowledgeable about the System

....

....

....

....

Please tick which of the following apply to your package / system :

1. The package was written by an outside agency for your District [ ]
2. The package was written by someone within your District/Region [ ]
3. The package is a standard or commercial package bought 'off-the-shelf' [ ]

a. The package is generally available free of charge to NHS Users [ ]
b. The package is generally available at a cost to NHS Users [ ]
c. The package is not available for distribution through the service [ ]
d. The package may be available in the future for general distribution [ ]

e. Is the package : Operational [ ] Under Development [ ] Undergoing Trials [ ] — Number of Sites using the System : ......

Please indicate the approximate Date the package became <u>or</u> will become Operational ....

What is the Expected Lifespan (in Years) of the System ....

Please Turn Over

Technical

Please tick the appropriate boxes in response to the following :

1. Is the package running on a :
   - Micro-computer [ ]
   - Mini-computer [ ]
   - Mainframe [ ]

2. What is the name of the computer hardware in use ....

3. Do you have :
   - Sole access to the computer [ ]
   - Share the computer with another department [ ]

4. Is the computer :
   - Sited locally in your Department [ ]
   - Sited at another Location or Department [ ]

5. Which of the following peripherals does the package need access to :
   - Magnetic Tape Drive [ ]
   - Floppy Disc Drive [ ]
   - Hard Disc Drive [ ]
   - Printer [ ]

   Other Peripherals, please specify ....

6. What are the minimum memory requirements for the package :
   - Up to 8K [ ]
   - Up to 32K [ ]
   - Up to 64K [ ]
   - Up to 256K [ ]
   - More than 256K [ ]

7. What are the backing storage (e.g. Disc) requirements for the package :
   - Up to 64K [ ]
   - Up to 256K [ ]
   - Up to 512K [ ]
   - Up to 1Mb [ ]
   - Up to 5Mb [ ]
   - Up to 10Mb [ ]
   - More than 10M [ ]

8. Which language are the programs written in :
   - Basic [ ]
   - Cobol [ ]
   - Mumps [ ]
   - dBASE II (DBMS) [ ]

   or

   If Other Language, please give Name and Type (e.g., High Level) ....

9. Which operating system does the package run under :
   - CP/M [ ]
   - VME [ ]
   - MS/DOS [ ]
   - DRX [ ]

   Other, please specify ....

10. Would you describe the user documentation available for the system as :
    - Non-Existent [ ]
    - Inadequate [ ]
    - Concise but Difficult to Understand [ ]
    - Concise and Easily Understandable [ ]
    - Fully Comprehensive and Simple to Use [ ]

11. Was there any systems analysis work carried out before the system was designed :
    - Yes [ ]
    - No [ ]

12. Could the system be transferred to other hardware ?
    - Yes [ ]
    - No [ ]

13. What was the Development Effort/Cost that went into producing the Software (e.g. Money or Man/Months) ? ....

District Information / Computer Officer
Durham Health Authority
Appleton House
Earls House Hospital
DURHAM
DH1 5XZ

November 1984

Dear Sir,

I am currently researching into the applications of computers within the community health services, with a particular interest in producing a community health information system for Darlington, suitable for adoption by other health authorities who may be interested.

To further this research, I am compiling a register of current computer applications within the community, and to aid this, the enclosed questionnaire has been produced. A computerised register will be made nationally available to participating authorities once complete.

If your authority has computerised any applications in the community, or just as importantly, is developing any applications, I would be very grateful, if you could arrange for the questionnaire to be completed, by an appropriate member, or members of staff, with knowledge of the systems in use. The enclosed envelope should be used to return the questionnaire. If you have no applications or developments in progress, I should be grateful if you could complete the tear off slip at the bottom of this letter, and return it to me in the envelope provided.

Should you be running more than one application, it would be most helpful if you could take a photocopy of the questionnaire, and complete one for each application you run.

When completing the questionnaire, I should be grateful if you could leave the responses blank to any questions you cannot answer. This may be the case for programs which are currently being developed, since some of the information asked for may not yet be known.

To indicate a response to most of the questions, simply place a tick in the appropriate box on the questionnaire. For some questions, it will be appropriate to tick <u>more</u> than one box. Please feel free to add more information or comments if you wish to do so.

Many thanks for your participation.

Yours sincerely,

<u>C. P. Catchpole</u>

<u>To</u>: Mr C P Catchpole, Researcher, Darlington Health Authority

Within the Durham Health Authority we have <u>no</u> applications in the community using computers, or developments in progress.

Signed ....
District Information / Computer Officer

Appendix 2 - Community Health Applications Register

Note

The names given to each of the fields on the questionnaire shown overleaf, correspond with the names given in the heading line of the register. Where a question response consists of a series of boxes, a coding system is used in the register whereby a '1' is used to indicate a tick being placed in a corresponding box, and a '0' no tick.

For example, in response to the question:

Is the Package running on a:	Micro	✓
	Mini	
	Mainframe	✓

the above response would be coded in the TYPE field as '101' in the register.

Darlington Health Authority

Community Health Service Computer Systems

Questionnaire

for **HEALTH AUTHORITY**

General

Name of Package / System	**TITLE OF PROGRAM** ....
Description of what the Package / System does and the Application Area	**DESCRIPTION LINE 1** .... **DESCRIPTION LINE 2** .... **DESCRIPTION LINE 3** .... **DESCRIPTION LINE 4** .... **DESCRIPTION LINE 5** .... **DESCRIPTION LINE 6** ....
Name and Contact Address or Telephone No. of Person who is knowledgeable about the System	**NAME OF CONTACT** .... **CONTACT ADDRESS LINE 1** .... **CONTACT ADDRESS LINE 2** .... **CONTACT ADDRESS LINE 3** ....

Please tick which of the following apply to your package / system :

1. The package was written by an outside agency for your District **WRITTEN BY** [ ]
2. The package was written by someone within your District/Region [ ]
3. The package is a standard or commercial package bought 'off-the-shelf' [ ]

a. The package is generally available free of charge to NHS Users [ ]
b. The package is generally available at a cost to NHS Users **AVAILABILITY** [ ]
c. The package is not available for distribution through the service [ ]
d. The package may be available in the future for general distribution [ ]

e. Is the package : Operational [ ] / Under Development **STATE** [ ] / Undergoing Trials [ ] — Number of Sites using the System : **NUMBER OF SITES**

DATE

Please indicate the approximate Date the package became or will become Operational ....

What is the Expected Lifespan (in Years) of the System .... **LIFESPAN OF SYSTEM**

Please Turn Over

Technical

Please tick the appropriate boxes in response to the following :

1. Is the package running on a :
   - Micro-computer [ ]
   - Mini-computer [ ]
   - Mainframe **TYPE** [ ]

2. What is the name of the computer hardware in use ..... **NAME OF COMPUTER** .....

3. Do you have :
   - Sole access to the computer **ACCESS** [ ]
   - Share the computer with another department [ ]

4. Is the computer :
   - Sited locally in your Department **SITED** [ ]
   - Sited at another Location or Department [ ]

5. Which of the following peripherals does the package need access to : **PERIPHERALS**
   - Magnetic Tape Drive [ ]
   - Floppy Disc Drive [ ]
   - Hard Disc Drive [ ]
   - Printer [ ]

   Other Peripherals, please specify ....

6. What are the minimum memory requirements for the package :
   - Up to 8K [ ]
   - Up to 32K [ ]
   - Up to 64K [ ]
   - Up to 256K [ ]
   - More than 256K [ ]

7. What are the backing storage (e.g. Disc) requirements for the package : **BACKING STORAGE**
   - Up to 64K [ ]
   - Up to 256K [ ]
   - Up to 512K [ ]
   - Up to 1Mb [ ]
   - Up to 5Mb [ ]
   - Up to 10Mb [ ]
   - More than 10Mb [ ]

8. Which language are the programs written in : **LANGUAGE** or
   - Basic [ ]
   - Cobol [ ]
   - Mumps [ ]
   - dBASE II (DBMS) [ ]

   If Other Language, please give Name and Type (e.g., High Level) ... **OTHER LANGUAGE** ...

9. Which operating system does the package run under : **OS**
   - CP/M [ ]
   - VME [ ]
   - MS/DOS [ ]
   - DRX [ ]

   Other, please specify ....

10. Would you describe the user documentation available for the system as : **USERDOC**
    - Non-Existent [ ]
    - Inadequate [ ]
    - Concise but Difficult to Understand [ ]
    - Concise and Easily Understandable [ ]
    - Fully Comprehensive and Simple to Use [ ]

11. Was there any systems analysis work carried out before the system was designed : **SYSTEMDOC**
    - Yes [ ]
    - No [ ]

12. Could the system be transferred to other hardware ? **TRANSFER**
    - Yes [ ]
    - No [ ]

13. What was the Development Effort/Cost that went into producing the Software (e.g. Money or Man/Months) ? **DEVELOPMENT EFFORT** ....

Health Authority Title of Program Description Line 1 Description Line 2 Description Line 3	Description Line 4 Description Line 5 Description Line 6 Description Line 7 Transfer|BackingStorage|language|Other Language	Name of Contact Contact Address Line 1 Contact Address Line 2 written by|availability|state|date|type| Name of Computer | OS | Development Effort	Contact Address Line 3 Number of Sites | Lifespan of System | |access|sited|peripherals| |UserDoc|SystemDoc|
AIREDALE	| | |	| | | | | | |	0 | 0 | | | | | | | |
ARGYLL AND CLYDE HEALTH BOARD General Practice Administration System The software is developed, maintained and provided free of charge to Scottish G.P's. It provides an administration	system for use on their surgery micro-computers. Downloading of age/sex registers from local Community Health Indexes is provided. 10 | 0000010 | 1000 |	Norma I A Paterson West Coast Computer Services Consortium Westward House, 15-17 St. James Street 010 | 1000 | 100 | 010184 | 100 | Apricot | 0010 |	PAISLEY PA3 2HJ. 041 889 3200 99 | 0 | | 10 | 01 | 0111 | | 00001 | 10 |
ARGYLL AND CLYDE HEALTH BOARD Standard Immunisation Recall System Scottish version of first two modules of Standard Child Health System altered to link to Community Health Index.	01 | 0000001 | 0100 |	Norma I A Paterson West Coast Computer Services Consortium Westward House, 15-17 St. James Street 000 | 1000 | 100 | 010179 | 001 | ICL 2966 | 0000 |	PAISLEY PA3 2JH 041 889 3200 5 | 2 | | 01 | 10 | 1011 | | 00001 | 10 |
ARGYLL AND CLYDE HEALTH BOARD Community Health Index Provides an index of all the patients within the consortium (Argyll & Clyde, Ayrshire & Arran, Dumfries & Galloway,	Western Isles Health Boards). It is used predominantly by the four Primary Care Departments for day to day running of their departments. 01 | 0000001 | 0100 | Plan	Norma I A Paterson West Coast Computer Services Consortium Westward House, 15-17 St. James Street 000 | 1000 | 100 | 010179 | 001 | ICL 2966 | 0000 |	PAISLEY PA3 2JH 041 889 3200 4 | 2 | | 01 | 10 | 1011 | | 00010 | 10 |
ARGYLL AND CLYDE HEALTH BOARD Cervical Cytology Recall A system is currently being developed as an interim solution for the West Coast consortium until a National policy or	Standard system is developed. It is a simple module of the Community Health Index 01 | 0000001 | 0100 |	Norma I A Paterson West Coast Computer Services Consortium Westward House, 15-17 St. James Street 010 | 0010 | 010 | 010186 | 001 | ICL 2966 | 0000 |	PAISLEY PA3 2JH 041 889 3200 2 | 2 | | 01 | 10 | 1011 | | 00001 | 10 |
AYLESBURY Child Health System This system is currently operated as a batch computer system on the Regional Health Authority mainframe computer.	The system is currently based on a manual paperflow through to the District Child Health Office, batched daily to the RHA for input into the computer. 00 | 0000000 | 0000 |	000 | 0000 | 000 | | 001 | | 0000 |	0 | 0 | | 00 | 00 | 0000 | | 00000 | 00 |
AYLESBURY MIPP ComCare Looking into the use of ComCare on an ICL DRS network system which is being installed at the Community HQ.	| | |	| | | | | | |	0 | 0 | | | | | | | |

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| BARKING, HAVERING AND BRENTWOOD     |                                     |                                          |                       |
|                                     |                                     |                                          | 0 |                   |
|                                     |                                     |                                          | 0 |                   |
|                                     |                                     | 000 |    |    |    |    |                                     | 00 |  | 0000 |
|                                     |  |      | 0000 |                      |          |    |                 |         | 00 |           |
-------------------------------------------------------------------------------------------------------------------------------------
| BARNET                              |                                     |                                          |                       |
|                                     |                                     |                                          | 0 |                   |
|                                     |                                     |                                          | 0 |                   |
|                                     |                                     |   |    |    |    |    |                                     |  |  |  |
|                                     |  |      |  |                          |          |    |                 |      |  |              |
-------------------------------------------------------------------------------------------------------------------------------------
| BARNSLEY                            | and notifications and records all   | Mrs L Little                             | SHEFFIELD  SIO 3TH    |
| Vaccination and Immunisation System | vaccinations given.  (Run by Region on | Computer Division, Trent R.H.A        | 1 |                   |
| The system maintains a register of  | behalf of Districts)  Does not provide | Fulwood House, Old Fulwood Road       | 0 |                   |
| children who should receive certain | KORNER compatible data.             | 000 | 0000 | 100 |      | 001 | ICL 2966                      | 01 | 01 | 1011 |
| vaccinations.  It produces clinic lists | 00 | 0000001 | 0100 |           | 0100 |                     | 00000 | 00 |              |
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| BASILDON AND THURROCK               |                                     | Mrs G Whitaker                           |                       |
| Health Education                    |                                     | Thurrock Education Centre                | 1 |                   |
| Patient / Client mailing lists and  |                                     | 891100                                   | 1 |                   |
| catalogue lists.                    |                                     | 001 | 0100 | 100 | 010185 | 000 | Apricot FE                   | 10 | 10 | 0101 |
|                                     | 10 | 0001000 | 0000 |                | 0010 |                     | 00010 | 01 |              |
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| BASILDON AND THURROCK               |                                     | Mr P Bush, District Dental Officer       | 22401                 |
| Dental Statistics                   |                                     | Great Oaks Clinic,                       | 1 |                   |
| Reads in data from cards using optical |                                  | BASILDON                                 | 3 |                   |
| character reader and stores counts of |                                   | 100 | 0100 | 100 | 010184 | 100 | Commodore PET 8050           | 01 | 10 | 0101 |
| nature of treatment.                | 10 | 0100000 | 1000 |                | 1000 | 3 Man Months      | 10000 | 01 |              |
-------------------------------------------------------------------------------------------------------------------------------------
| BASILDON AND THURROCK               |                                     | Mrs N Richardson                         | 22401                 |
| Speech Therapy                      |                                     | Great Oaks Clinic                        | 1 |                   |
| List of clients and progress reports. |                                   | BASILDON                                 | 1 |                   |
| Appointments made.                  |                                     | 001 | 0100 | 100 | 010186 | 100 | Apple Plus                   | 10 | 10 | 0100 |
|                                     | 10 | 0100000 | 0000 |                | 0000 |                     | 00010 | 01 |              |
-------------------------------------------------------------------------------------------------------------------------------------
| BASILDON AND THURROCK               |                                     | Mrs E Stoby                              | BASILDON  3911 Ext. 3466 |
| Financial Information Project System |                                    | DNS Community                            | 6 |                   |
| Community Nursing records. Loan of  |                                     | Basildon Hospital                        | 1 |                   |
| Equipment. Health visitors records. |                                     | 100 | 0100 | 010 | 010186 | 010 | Plessey PDP 11/73            | 10 | 10 | 1010 |
|                                     | 01 | 0000001 | 0010 |                | 0000 | 2 Years           | 00001 | 10 |              |
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| BASINGSTOKE AND NORTH HAMPSHIRE     | used as a Management Information tool. | Mrs Sue Price or Miss Kate Needham    | Hants. RH24 9NB   B'stoke 473202 |
| Speech Therapy Management Information |                                   | Basingstoke & North Hampshire HA         | 1 |                   |
| Designed specifically to collect all |                                    | Harness House, BASINGSTOKE               | 0 |                   |
| patient information required by KORNER |                                  | 010 | 0100 | 010 | 010487 | 100 | IBM                          | 01 | 10 | 0001 |
| for the Speech Therapy Department. To be | 10 | 0000000 | 0000 | Delta   | 0010 | 12 Man Months     | 10000 | 10 |              |
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| BASSETLAW                                |                                          |                                          |                                        |
|                                          |                                          |                                          | 0 |
|                                          |                                          |                                          | 0 |
|                                          |                                          | |   |   |   |   |                        |   |   |   |   |
|                                          | |   |   |                                |   |                                      |   |   |
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| BATH                                     | number of visits by age group, and       | H F Traylen ADONS (Service Planning)     | Combe Park, BATH  BA1 3NG              |
| Community Work load Information System   | dependancy and disease classification    | Community Health Department              | 0 |
| Provides an analysis of work under       | for DN's and by visit reason for HV's.   | Royal United Hospital                    | 0 |
| taken each month by DN's, HV's, Midwives | Each nurse receives own analysis.        | 010 | 0100 | 100 | 010980 | 010 | ICL Mainframe and Hytec Prelude for | 01 | 10 | 1111 |
| and School Nurses. Data collected on     |   | 0000001 | 1100 |                     |   | 1000 |                               | 01000 | 01 |
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| BEXLEY                                   |                                          |                                          |                                        |
|                                          |                                          |                                          | 0 |
|                                          |                                          |                                          | 0 |
|                                          |                                          | 000 |   |   |   |                         |   | 00 |   | 0000 |
|                                          | |   | 0000 |                             |   |                                      |   | 00 |
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| BLACKBURN, HYNDBURN AND RIBBLE           |                                          | Mr G Bryan, District Offices             |                                        |
| Cervical Cytology                        |                                          | Queens Park Hospital, Blackburn          | 0 |
| Used for Recall                          |                                          | Lancs.  BB2 3HH                          | 0 |
|                                          |                                          | 000 |   | 100 |   | 010 |                    | 01 | 11 | 0111 |
|                                          | | 0000000 | 0000 |                      | 0000 |                                   | 00110 | 00 |
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| BLACKBURN, HYNDBURN AND RIBBLE           |                                          | Mr G Bryan,                              | Lancs  BB2 3HH                         |
| TB                                       |                                          | District Offices,                        | 0 |
| Records contact, trace, treatment        |                                          | Queens Park Hospital, Blackburn          | 0 |
| and recall of TB patients                |                                          | 000 | 0000 | 100 |   | 010 |               | 01 | 11 | 0111 |
|                                          | | 0000000 | 0000 |                      | 0000 |                                   | 00110 | 00 |
-----------------------------------------------------------------------------------------------------------------------------------------------------
| BLACKBURN, HYNDBURN AND RIBBLE           |                                          | Mr G Bryan                               | Lancs.  BB2 3HH                        |
| Health Net                               |                                          | District Offices                         | 0 |
| Record and Communication System          |                                          | Queens Park Hospital, Blackburn          | 0 |
|                                          |                                          | 000 | 0000 | 010 |   85 | 100 |           | 01 | 11 | 0000 |
|                                          | | 0000000 | 0000 |                      | 0000 |                                   | 00000 | 00 |
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| BLACKBURN, HYNDBURN AND RIBBLE           |                                          | Mr G Bryan,                              | Lancs, BB2 3HH                         |
| GP Primary Care System                   |                                          | District Offices,                        | 0 |
| Retains clinical details and details     |                                          | Queens park Hospital, Blackburn,         | 0 |
| of screening programmes.  Also used      |                                          | 000 | 0000 | 100 |   | 010 |               | 00 | 11 | 0111 |
| for Recall Purposes                      | | 0000000 | 0000 |                      | 0000 |                                   | 00110 | 00 |
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| BLACKPOOL, WYRE AND FYLDE                |                                          |                                          |                                        |
|                                          |                                          |                                          | 0 |
|                                          |                                          |                                          | 0 |
|                                          |                                          | |   |   |   |   |                        |   |   |   |   |
|                                          | |   |   |                                |   |                                      |   |   |
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| BLOOMSBURY                            | designed for use in clinics.          | R Grace                                    | 01 388 3628                     |
| Community Information                 |                                       | Bloomsbury D.H.A., 25 Grafton Way          | 1 |
| Child Health: Interactive child health|                                       | LONDON WC1E 6DB                            | 0 |
| system which will form first module of|                                       | 100 | 0100 | 001 | 011086 | 010 | DEC                    | 01 | 01 | 0011 |
| full community services system and is | 10 | 0000000 | 0010 |              | 0000 |                       | 00000 | 10 |
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| BOLTON                                |                                       | Mr S Fox                                   | BOLTON                          |
| Mental Handicap Register              |                                       | District Information Services Manager      | 1 |
| Database of Patient Details.          |                                       | 43 Churchgate                              | 0 |
|                                       |                                       | 100 | 0001 | 100 | 010184 | 010 | ICL DRS                | 10 | 01 | 0111 |
|                                       | 00 | 0000000 | 0000 |              | 0000 |                       | 00000 | 00 |
-----------------------------------------------------------------------------------------------------------------------------------------------
| BOLTON                                |                                       | Mr S Fox                                   | BOLTON                          |
| Viewtext Electronic Mail              |                                       | District Information Services Manager      | 22 |
|                                       |                                       | 43 Churchgate                              | 1 |
|                                       |                                       | 000 | 0100 | 001 | 011086 | 010 | DEC PDP                | 00 | 01 | 1011 |
|                                       | 10 | 0000000 | 0000 |              | 0000 |                       | 00001 | 01 |
-----------------------------------------------------------------------------------------------------------------------------------------------
| BORDERS HEALTH BOARD                  | extensive enquiries of database by    | Dr I H Maclean                             | Roxburghshire TD6 9BP 089 682 2662 |
| Mental Handicap Register              | unskilled user for service and research| Borders Health Board                      | 1 |
| Application: Mental Handicap Service. | purposes. Limited free text facility. | Huntlyburn, MELROSE                        | 10 |
| Predominantly community based. Supports|                                      | 010 | 0001 | 010 | 011086 | 100 | Apricot XI             | 01 | 01 | 0011 |
| existing manual records system. Permits| 10 | 0000100 | 0001 |              | 0010 | 4 Man Months          | 10000 | 01 |
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| BRADFORD                              |                                       |                                            |                                 |
| Vaccination and Immunisation          |                                       |                                            | 0 |
|                                       |                                       |                                            | 0 |
|                                       |                                       |   |   |   |   |   |                           |   |   |   |
|                                       |   |   |   |                           |   |                           |   |   |
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| BRENT                                 | recording for under 5's.              | Graham Benwell, Senior Systems Analyst     | Lane, LONDON N11                |
| National Child Health System          |                                       | North West Thames R.H.A.                   | 0 |
| Provides a birth register, immunisation|                                      | R.H.A. Computer Centre, Colney Hatch       | 0 |
| appointments and recording and        |                                       | 000 | 0100 | 100 | 010178 | 001 |                        | 00 | 01 | 1111 |
| developmental checks appointments or  |   | 0000001 | 0100 |                 |   |                           | 00010 | 01 |
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| BRENT                                 | incontinence pads etc.                | Colin Nolder, Deputy Unit Administrator    | WEMBLEY, Middlesex              |
| Incontinence Register                 |                                       | Primary Health Care Services, Brent H.A.   | 0 |
| Maintains a master patient index of   |                                       | Wembley Hospital, Fairview Avenue,         | 0 |
| approximately 600. Works out delivery |                                       | 100 | 0001 | 010 | 010384 | 100 | Televideo (TS4)        | 10 | 10 | 0101 |
| schedules and stock control of        |   | 0000000 | 1000 |                 | 1000 |                       | 01000 | 10 |
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| BRENT                                 |                                       | Ann Jack, Unit Personnel Officer,          | WEMBLEY                         |
| Personnel Data System                 |                                       | Primary Health Care Services               | 0 |
| Matches current personnel list against|                                       | Brent Health Authority, Fairview Avenue    | 0 |
| establishment                         |                                       | 010 | 0001 | 110 | 010185 | 100 | Televideo              | 01 | 01 | 0101 |
|                                       |   | 0000000 | 0001 |                 | 1000 |                       | 10000 | 01 |
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<table>
<tr><td>BRIGHTON
Child Record System
Phase 1 - Establishment of data base of
childrens records and set up vaccination
and immunisation programs.</td><td>Phase 2 - Set up Developmental
Surveillance programme for pre-school
children in the above data base.

| 0000001 | 0100 | Some FILETAB</td><td>Angela Davies, Project Leader
Computer Section, Treasurers Dept.
East Sussex County Council, County Hall,
| 010 | 1000 | 110 | 010284 | 001 | ICL 2966
| |</td><td>St. Annes Crescent, LEWES, East Sussex |
0 |
0 |
| 01 | 01 | 1010 |
| 00010 | 10 |</td></tr>
<tr><td>BRISTOL AND WESTON
Cervical Cytology
Maintains a Register of all Cytology
Requests for information (HMR101).
Links records on above file for</td><td>individual patients and selects patients
for recall also.

| 0000000 | 0100 |</td><td>Mr D Simpson
Systems Development Officer
Level 1, Greyfriars, Lewins Mead,
| 010 | 0001 | 100 | | 001 | IBM 3033
| |</td><td>BRISTOL, BS1 2EE |
0 |
0 |
| 00 | 01 | 1011 |
| 00000 | 10 |</td></tr>
<tr><td>BRISTOL AND WESTON
Pre-School Child Health
Maintains a file of births, and children
under 5 years. Schedules appointments
for pre-school vaccination, development-</td><td>al programmes and early vision testing
and sends monthly lists to health
visitors for hearing tests.

| 0000000 | 0100 |</td><td>Mr D Simpson
Systems Development Officer
Level 1, Greyfriars, Lewins Mead
| 010 | 0001 | 100 | | 001 | IBM 3033
| |</td><td>BRISTOL, BS1 2EE |
0 |
0 |
| 00 | 01 | 1011 |
| 00000 | 10 |</td></tr>
<tr><td>BROMLEY
National Child Health System
Birth Register and Vaccination and
Immunisation in Use.
Pre-School and School modules will also</td><td>be brought into use eventually.

| 0000001 | 0100 |</td><td>Mrs Janet Chadwick, Medical Records
Bromley Health Authority
Sherman House, 16 Sherman Road
| 010 | 1000 | 100 | 011278 | 001 |
| |</td><td>BROMLEY, BR1 3TA |
0 |
0 |
| 01 | 01 | 1011 |
| 00001 | 01 |</td></tr>
<tr><td>BROMLEY
Speech Therapy Statistics
Records and calculates the statistics
required by DHSS and additional data
to aid local management of the service.</td><td>

| 0000000 | 1000 |</td><td>Mrs S Dunn, District Speech Therapist
Bromley Health Authority

| 010 | 1000 | 100 | 010182 | 100 | TransData 502
| 1000 |</td><td>|
0 |
0 |
| 01 | 10 | 0101 |
| 01000 | 00 |</td></tr>
<tr><td>BROMSGROVE AND REDDITCH
Child Health Computing System
The first two modules are in Operation.</td><td>

| 0000000 | 0100 |</td><td>Mr. D. A. J. Clarke
Primary Care Unit,
Smallwood Health Centre, REDDITCH
| 010 | 1000 | 010 | 010285 | 101 | ICL DRS 20/50
| 0001 |</td><td>Worcestershire |
0 |
0 |
| 10 | 10 | 0111 |
| 00000 | 00 |</td></tr>
<tr><td>BROMSGROVE AND REDDITCH
MIPP ComCare System
Please see DHSS Produced literature on
the MIPP systems written throughout
1985 and 1986.</td><td>

| 0000001 | 0100 |</td><td>Mr. D. A. J. Clarke,
Primary Care Unit,
Smallwood Health Centre, Redditch,
| 100 | 0000 | 010 | 010485 | 100 | ICL DRS 20/50
| 0001 |</td><td>Worcestershire |
0 |
0 |
| 10 | 10 | 0111 |
| 00000 | 01 |</td></tr>
<tr><td>BURNLEY, PENDLE AND ROSSENDALE
Community Loans System
Community Loan Store System under
development to be based on a
micro-computer system.</td><td>The machine will be used to monitor
Stock Movements between the store and
the client, and will maintain an
Inventory of aids issued and for recall.
| | | 0000 |</td><td>M C Kirby, Assistant Supplies Officer
Burnley Health Authority
Burnley General Hospital, Casterton Av.
| 000 | | 010 | | 100 |
| |</td><td>BURNLEY, Lancs, BB10 2PQ |
0 |
0 |
| 00 | | 0000 |
| | 00 |</td></tr>
</table>

<table>
<tr><td>BURY
Community and Paramedic System
No. of visits by Community staff. Time
spent at each type of visit is recorded.
This is an interim system only.</td><td>

00 | 0000000 | 1000 |</td><td>

100 | 0000 | 010 | 010488 | 010 | McDonnell Douglas, DEC
0000 |</td><td>
0 |
0 |

| 00000 | 00 |</td><td>

| 01 | 10 | 1011 |</td></tr>
<tr><td>CALDERDALE</td><td>

| | 0000 |</td><td>

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0 |
0 |

| | 00 |</td><td>

| 00 | | 0000 |</td></tr>
<tr><td>CAMBERWELL</td><td>

| | |</td><td>

| | | | |
| |</td><td>
0 |
0 |

| | |</td><td>

| | | |</td></tr>
<tr><td>CAMBRIDGE
School and Pre-School Records System
Database holding personal details of
all school & pre-school children who
have medical records. Extensive programs</td><td>to produce: Medical lists, Ad-Hoc
enquiries, reports, lists and letters,
processing appointments.

10 | 0000001 | 0001 |</td><td>Alan Bampton
0223 245151 Ext.7519

010 | 0011 | 100 | | 100 | Comart
| 1000 |</td><td>
1 |
0 |

| 00001 | 01 |</td><td>

| 10 | 10 | 1111 |</td></tr>
<tr><td>CAMBRIDGE
Welfare Foods Monitoring
Holds all clinic returns, produces
statistics for DHSS returns, used for
stock control.</td><td>

00 | 0000000 | 0001 |</td><td>Alan Bampton
0223 245151 Ext.7519

010 | 0010 | 100 | | 100 | Comart
| 1000 |</td><td>
1 |
0 |

| 00001 | 00 |</td><td>

| 10 | 10 | 1111 |</td></tr>
<tr><td>CAMBRIDGE
Child Health System
Pre-school Immunisations and Vaccination
Generates appointments for all pre-
school immunisations as appropriate.</td><td>Adapted from Bucks Local Authority
System.

10 | 0000000 | 0100 |</td><td>Computer Centre
East Anglia Regional H.A
0223 61212
100 | 0100 | 100 | | 001 | ICL
| 0100 |</td><td>
0 |
0 |

| 00100 | 10 |</td><td>

| 01 | 01 | 0000 |</td></tr>
<tr><td>CAMBRIDGE
Distribution of Incontinence Pads
Patient register, record of all needs by
centre or by nurse. Full Ad-Hoc
enquiries.</td><td>

10 | 0000000 | 0001 |</td><td>April Beckerleg
Information Unit
Fulbourn Hospital
010 | 0010 | 001 | 010187 | 100 | Comart
| 1000 |</td><td>CAMBRIDGE
0 |
0 |

| 00000 | 10 |</td><td>

| 01 | 10 | 0011 |</td></tr>
<tr><td>CANTERBURY AND THANET
Nursing Activity Analysis Program
Collates disease analysis dependancy/
visits/age group for District Nursing,
Health Visiting and School Nursing</td><td>

| 0000010 | 1000 |</td><td>Unit Administrator
41 Old Dover Road
Canterbury
100 | 0100 | 001 | 010185 | 100 | Alpha Micro
| 0000 |</td><td>
0 |
0 |

| 10000 | 01 |</td><td>

| 01 | 01 | 0111 |</td></tr>
</table>

CENTRAL BIRMINGHAM Financial Information Project System District Nursing, home loans, analysis, incontinence supplies, record keeping & case-load management.	10 | 0000001 | 0010	Mike Davis Patient Services & Information Officer St. Patricks, Highgate Street 010 | 1000 | 110 | 010184 | 010 | Plessey 8603 | 0000 |	BIRMINGHAM B12 OYA 3 7 | 00100 | 10	| 10 | 10 | 1011 |
CENTRAL BIRMINGHAM Child Health System Child register, Immunisation and Vaccination schedules for pre-school age group.	00 | 0000001 | 0100	Mike Davis Patient Services & Information Officer St. Patricks, Highgate Street 010 | 0001 | 100 | 010182 | 010 | Hewlett Packard 3000 | 0000 | Over 100 Man Months	BIRMINGHAM B12 OYA 6 6 | 01000 | 10	| 01 | 01 | 1011 |
CENTRAL MANCHESTER Community Nursing Directory Stores useful information available to Community and Other Staff	| 0100000 | 0001	Dr. Rector, Department of Computation Manchester Royal Infirmary 010 | 1000 | 001 | | 100 | Sirius | 0010 |	 0 0 | 00010 | 01	| 01 | 10 | 0101 |
CENTRAL NOTTINGHAMSHIRE PSP Package Mother and Child Health Survey Computer is on loan from the Foundation for the Study of Infant Deaths	| 0000000 | 1000	Mrs. A. Wright, HCO, Community Nursing Office, Birch House, Ransom Hospital, RAINWORTH 100 | 0000 | 100 | 010883 | 100 | Commodore 8032 | |	 0 0 | 00100 | 01	| 10 | 10 | 0100 |
CHELTENHAM AND DISTRICT	| | |	| | | | | | |	 0 0 | | |	| | | |
CHESTER Survey Plus System 1 - Epidemiology 2 - Statistical functions 3 - Staff performance	4 - Stock control 5 - Dental KORNER 6 - Screening analysis 01 | 1000000 | 1000	Mr T Dowell District Dental Officer Bristol & Weston Health Authority 001 | 0100 | 100 | 010181 | 100 | Commodore 8296 | 0000 |	10 Harlborough St. BRISTOL BS1 3NP 0 0 | 00100 | 00	| 10 | 10 | 0101 |
CHESTER Child Health System Used for Vaccination and Developmental Screening - Stated as not being strictly Community Health System.	| 0000001 | 0100	010 | 1000 | 100 | | 001 | | |	 0 0 | | 10	| 00 | 01 | 1011 |
CHICHESTER Return of Nurses (RON) Validates nurses returns and generates a data file. Vetted data file updated monthly to master. Control reports and	statistics produced. Various runs to produce statistics can be made for a selected period, category of nurse etc. Selective prints for each nurse possible | 0010000 | 0100	R. J. Bignell Project Leader West Sussex County Council 100 | 0000 | 100 | 010182 | 001 | IBM 4341 | |	CHICHESTER, West Sussex 0 0 | 01000 | 01	| 01 | 01 | 1011 |

CHORLEY AND SOUTH RIBBLE	| | 0000 |	000 | | | | |	0 | 0 | | | 00 |	| | 00 | | 0000 |
CITY AND HACKNEY	10 | 0000001 | 0001 | DBMS	000 | 0000 | 000 | | 100 | IBM-Compatible (Possibly networked) | 0010 |	0 | 0 | | 00001 | 10 |	| | 10 | 01 | 1111 |
CLWYD Rubella Records parental authorisations for vaccination and notes cases where consent refused, forms not returned, or	girls vaccinated by own gp's. Reports are produced in the categories above and sorted into school and gp code order Labels also produced for gp use. | 0000000 | 0000 | Condor - DBMS	J L Thomas Clwyd Health Authority 010 | 1000 | 100 | | 100 | Hewlett Packard 150 | 1010 |	0 | 0 | | 10000 | 01 |	| | 10 | 10 | 0111 |
CLWYD Dental Statistics Produces dental statistics based on work of Community Dental Officers. Quarterly statistics for HA.	Yearly Statistics for DHSS. Dental Officer performance statistics. Some clinic work load information. 00 | 0000000 | 0000 | Powerhouse (4GL)	Andrew Wells Clywd Health Authority Hendry Road, MOLD 010 | 0010 | 010 | 010187 | 010 | HP 3000/37 | 0000 |	Clwyd CH7 1PZ 0352 2171 0 | 0 | | 10000 | 10 |	| | 10 | 10 | 0011 |
CLYWD Community Nursing System Produces statistics based on the work of Community Nurses.	00 | 0000000 | 0000 | Powerhouse (4GL)	Andrew Wells Clywd Health Authority Preswylfa, Hendry Road, MOLD 010 | 0010 | 010 | 011286 | 010 | HP 3000/37 | 0000 |	Clywd CH7 1PZ 0352 2171 0 | 0 | | 10000 | 10 |	| | 10 | 10 | 0011 |
CORNWALL	| | 0000 |	000 | | | | |	0 | 0 | | | 00 |	| | 00 | | 0000 |
COVENTRY Financial Information Project System Operational Community Management System. Basic Community System. District Nursing System. Loan of equipment and	Domiciliary incontinence records. 00 | 0000000 | 0010 |	FIP (Birmingham) or Information Department Coventry 55311 Ext.217 100 | 1000 | 010 | 010887 | 001 | DEC PDP 11/84 | 0000 |	0 | 0 | | 00000 | 00 |	| | 01 | 01 | 0011 |
COVENTRY Computerised Case Register To assist in providing an up to date comprehensive register of the mentally handicapped in Coventry incorporating	relevant case information on each individual for use by multidisciplinary professionals in the field. | 0000000 | 0000 |	Mr Derek Miller Treasurers Department, Coventry H.A. 000 | 0000 | 000 | | 000 | | 0000 |	0 | 0 | | 00000 | 01 |	| | 00 | 00 | 0000 |

COVENTRY
Manpower Information
At the Devlopment Stage - will give details regarding each member of the nursing staff in the Community Unit.

Including sickness and other absences and continuing education and training
| 0000000 | 0001 |

Mrs M Currie, DNS (Community)
Coventry Health Authority
Spire House, New Union Street, COVENTRY
| 010 | 0001 | 010 | | 100 | Atlos

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CROYDON
MENINDEX - Computerised M.H. Register
For use by Community M.H. Team.
Records in 81 fields/client, personal and medical details & carer problems.

Allows for routine scan print-out, deletions, additions and amendments. Another program collates any combination of fields under headings. Used by HV/DNs
| 0000100 | 1000 |

Mr. M. Holdsworth, Deputy C.N.O.
Mayday Hospital, Mayday Road,
Thornton Heath, Surrey, CR4 7YE
| 010 | 0101 | 001 | 010185 | 100 |

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| 0 |
| 00001 | 10 |
| 01 | 10 | 0101 |

DARLINGTON
National Standard Child Health System
The Child Register and Vaccination and Immunisation Modular are currently in operation, and we are looking at using

the pre-school module in the near future
| 0000001 | 0100 |

C. P. Catchpole, Researcher
Darlington Health Authority
Memorial Hospital
| 010 | 1000 | 100 | | 001 |

DARLINGTON, DL3 6HX
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DARTFORD AND GRAVESHAM

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DEWSBURY
Child Health System
Child Health Register: total index system on line details. Schools attended past and present, GP's, Health Visitor,

Sex, D.O.B, Current and previous address Operates school entry medical system and will eventually operate BCG / Rubella and school leavers booster campaigns.
| 00 | 0000001 | 0000 |

Gillian Mesparry
Administrator Child Health
Dewsbury Health Authority
| 100 | 0010 | 110 | | 100 | InfoSpec
| 1000 | 2 Man Months

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DONCASTER

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DUDLEY
Special Needs Register
A comprehensive database of all those in the district who use the Mental Handicap Service. Both individual and aggregate

information can be obtained from the register. There is no requirement for KORNER compatible data.
| 01 | 0100000 | 1000 |

Mrs Judy Pepper
Special Needs Register Manager
Ridge Hill Mental Handicap Unit
| 000 | 0000 | 100 | 011086 | 100 | IBM PC
| 0010 |

KINGSWINFORD 288778 Ext.426
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| 00010 | 10 |
| 10 | 10 | 0111 |

DUMFRIES AND GALLOWAY HEALTH BOARD			0 0
DURHAM			0 0
EALING Community Nurse Workload System Fulfills the requirements of the minimum data sets (Korner Community) for District Nurses and Health Visitors.	Also includes additional information for operational managers. 0000010 | 0000 | Oracle	Mr. P. Colson 9 Beechcroft Road Orpington 100 | 0000 | 010 | 010685 | 100 | IBM Personal Computer XT | 10000 | 10	Kent 0 0 10 | 10 | 0011
EAST BERKSHIRE Storage Master Inventory Control System.	00 | 0000000 | 0000	Mrs P Holliday SLOUGH 820456 100 | 0100 | 100 | 010185 | 100 | Apricot | 0000 | #2,000 | 00100 | 10	2 0 01 | 10 | 0101
EAST BERKSHIRE Fleet Master Transport Management System	10 | 0000000 | 0000	Mr R Davies SLOUGH 820456 100 | 0100 | 100 | 010186 | 100 | Apricot | 0000 | #2,000 | 00010 | 10	1 0 01 | 10 | 0101
EAST BIRMINGHAM Financial Information Project System Basic Community System - of 3 linked modules, activity manpower and costs. Collects KORNER data and outputs forms	such as mileage, individual patient records and duty rotas. 10 | 0000001 | 0010	Ms Christine Greenholgh Marketing and Implementation, Financial Information Project, 12th Floor Alpha 010 | 0100 | 111 | | 010 | DEC | 0000 | 00010 | 10	Tower, Suffolk St Queensway, BIRMINGHAM 0 0 10 | 10 | 0011
EAST CUMBRIA MIPP ComCare System Proposed application (system definition is ongoing) for CMOs,HVs,DNs,CPNs,Speech Therapists and other professions allied	to medicine subject to feasibility. Discrete systems : Dental Survey Plus and Stand-alone Chiropody System also. 01 | 0000000 | 0100	P R Wiggins Planning & Information Officer 0228 23444 Ext.600 001 | 1000 | 010 | 010687 | 100 | ICL DRS 20/155 | 0001 | 00000 | 10	0 5 10 | 10 | 0111
EAST DORSET Community Nursing Workload Statistics Input of Community Nursing Statistics on patient visits, allocation of time, onto a district microcomputer for transfer	of data via telephone line to central mainframe collected on a yearly file for standard and 'ad-hoc analysis reports. 01 | 0000001 | 1100	Mr Pete Coffin Computer Centre Annexe Silver Hill 010 | 0100 | 110 | 010883 | 101 | Hytec ECS 4500 and ICL 2966 | 1000 | 00001 | 10	WINCHESTER 5 0 00 | 11 | 1111

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| EAST DYFED                             |                                       | A W Savill / C B Goldberg               | CARMARTHEN, Dyfed  SA31 3HL              |
| MIPP ComCare System                    |                                       | East Dyfed HA                           | 1 |
| Each member of the Community Staff will|                                       | Johnstown                               | 0 |
| use the Psion Organiser II to capture  |                                       | 100 | 1000 | 011 | 010187 | 100 | ICL DRS 20/300 and Psion Organiser | 01 | 01 | 0111 |
| data for the system.                   | 10 | 0000001 | 0100 |                            | 0001 | #11,000             | 00001 | 10 |
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| EAST DYFED                             |                                       | Mr C B Goldberg, OR & Computer Officer  |                                          |
| National Child Health System           |                                       | East Dyfed Health Authority             | 0 |
| Running Modules 1, 2 and 3 of the system|                                      |                                         | 0 |
|                                        |                                       | 010 | 1000 | 100 |        | 001 |                                    | 00 | 01 | 1011 |
|                                        |    | 0000001 | 0100 |                       |        |                     |    | 10 |
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| EAST HERTFORDSHIRE                     | follow-up. Link to County Council     | V A Dickinson                           |                                          |
| Child Health System                    | education roll to produce 10M labels for | 0707 328111 Ext.3627                 | 4 |
| Provides a Child Register and          | school entrants.                      |                                         | 0 |
| Vaccination and Immunisation.          |                                       | 010 | 0100 | 100 | 010172 | 001 | IBM 4341                          | 01 | 01 | 1011 |
| Some Health Visitor reminders for      | 01 | 0000001 | 0100 |                   | 0000 |                             | 00010 | 10 |
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| EAST SUFFOLK                           |                                       |                                         |                                          |
|                                        |                                       |                                         | 0 |
|                                        |                                       |                                         | 0 |
|                                        |                                       |     |     |     |          |     |                             |    |    |    |
|                                        |    |          |    |                  |     |                          |     |    |
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| EAST SURREY                            |                                       | Mr. M. Warboys,                         |                                          |
| Special Needs Recall                   |                                       | Earlswood Mount, Mountview Drive,       | 0 |
| Memory Only - Recall for Reporting by  |                                       | Redhill, Surrey                         | 0 |
| Health Visitors on the Special Needs of|                                       | 010 | 0000 | 100 |        | 100 | Commodore PET                      | 10 | 10 | 0000 |
| Children.                              |    | 0000000 | 1000 |                       |        |                     | 00100 | 01 |
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| EAST SURREY                            |                                       | Mr. M. Warboys,                         |                                          |
| Birth Register                         |                                       | Earlswood Mount, Mountview Drive,       | 0 |
| To include Immunisation Records        |                                       | Redhill, Surrey                         | 0 |
|                                        |                                       | 010 | 0000 | 100 |        | 100 | Commodore PET                      | 10 | 10 | 0000 |
|                                        |    | 0000000 | 1000 |                       |        |                     | 00100 | 01 |
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| EAST SURREY                            |                                       | Mr. M. Warboys,                         |                                          |
| Nursing Staff in Post                  |                                       | Earlswood Mount, Mountview Drive,       | 0 |
| Calculation of Monthly Returns.        |                                       | Redhill, Surrey                         | 0 |
| Basic information details on Community |                                      | 010 | 0000 | 100 |        | 100 | Commodore PET                      | 10 | 10 | 0000 |
| Staff, base, number of hours worked.   |    | 0000000 | 1000 |                       |        |                     | 00100 | 01 |
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| EAST SURREY                            |                                       | Mr. M Warboys,                          |                                          |
| School Health Records for Normal       |                                       | Earlswood Mount, Mountview Drive,       | 0 |
| Children, excluding Special Needs.     |                                       | Redhill, Surrey                         | 0 |
|                                        |                                       | 010 | 0000 | 100 |        | 100 | Commodore PET                      | 10 | 10 | 0000 |
|                                        |    | 1000000 | 0000 |                       |        |                     | 00100 | 01 |
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EAST YORKSHIRE Equipment Loans Management Specialised application software written using dBASE III.	10 | 0001000 | 0001 | dBASE III	Dr M Brookes, Principle Physician East Yorkshire H.A Westwood Hospital, BEVERLEY 010 | 0001 | 010 | 010187 | 100 | IBM PC/XT | 0010 | #500 & 5 Man Months	North Humberside 0 5 | 01000 | 10 |	| 01 | 10 | 0111 |
EASTBOURNE Mental Handicap Register Stores information about people with a Mental Handicap who are or have been the responsiblity of Eastbourne H.A. and/or	East Sussex Social Services Department. 10 | 0000010 | 1000 |	Mr D Hodges Registrar Mental Handincap Register 26 Bedfordwell Road 001 | 0100 | 100 | 010185 | 100 | ICL PC | 1000 |	EASTBOURNE 1 7 | 00010 | 10 |	| 10 | 01 | 0111 |
EASTERN HEALTH AND SOCIAL SERVICES BOARD Child Health Recall System Takes Notification details, also Social and Clinical data of parents & siblings and includes an Immunisation Module for	Infants. BCG, booster doses and Rubella Vaccination will be considered later. | 0000001 | 0100 |	Mr. J. Barry Computer Branch, R A C House, Chichester Street 010 | 1001 | 110 | 85 | 101 | ICL | 0001 |	BELFAST 0 0 | 00010 | 10 |	| 00 | 01 | 1111 |
ENFIELD	| | |	| | | | | | |	0 0 | | |	| | | |
EXETER Primary Health Care System	| | 0000 |	| 000 | | | | | |	0 0 | | 00 |	| 00 | | 0000 |
FIFE Communicable Disease Management System From Patient/Disease details entered, generates a large number of reports : lists of patients with a particular	disease, cases notified in any period, imported disease list, list of patients in an outbreak, production of standard returns for S.H.H.D. | 0001000 | 0001 |	A. Stevenson, Senior Analyst/Programmer Fife Health Board Glenrothes House 010 | 1000 | 100 | 010184 | 100 | Act Sirius 1 | 0010 |	GLENROTHES, Fife KY7 5PB 0 0 | 00001 | 01 |	| 01 | 01 | 0100 |
FIFE WellWoman System Records attendances at wellwoman, family planning clinics. Records smear tests, lists of patients with outstand-	ing results produced together with clinic recall lists, patient registers, abnormal smear results etc. | 0000001 | 0000 | DataBasic (PICK), Procs	A Stevenson, Senior Analyst/Programmer Fife Health Board Glenrothes House 010 | 0000 | 100 | 010183 | 010 | MicroData Reality | 0000 |	GLENROTHES, Fife KY7 5PB 0 0 | 10000 | 00 |	| 01 | 10 | 0010 |
FORTH VALLEY HEALTH BOARD Community Health Index Database of Patient Information. Population of F.V.H.B covered. System currently used for GP registration	procedures, contraceptive services and prescription exemption and prepayment. | 00 | 0000000 | 0000 |	Mr D Harris, Administrator Primary Care Forth Valley Health Board 33 Spittal Street 010 | 0000 | 100 | 010986 | 001 | ICL 2966 | 0100 |	STILRING (0786 63031) 1 0 | 00001 | 00 |	| 01 | 01 | 1001 |

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| FRENCHAY                             |                                    | Dr I McIntosh, Medical Physics      |                          |
| Community Nurse Personnel            |                                    | Frenchay Hospital                   | 0 |
| Very basic data on staff is held.    |                                    |                                     | 0 |
| Personal Information provides a report |                                  | 010 | 0000 | 001 |        | 010 |                            | 10 | 10 | 1011 |
| for establishment.                   | | 0000000 | 1000 |                |              | 0000 |          | 00010 | 01 |
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| FRENCHAY                             |                                    | Dr I McIntosh, Medical Physics      |                          |
| Child Health - Handicap Register     |                                    | Frenchay Hospital                   | 0 |
| Provides Reports on all Children with |                                   |                                     | 0 |
| any Handicaps in the District        |                                    | 010 | 0000 | 001 |        | 010 |                            | 10 | 10 | 1011 |
|                                      | | 0000000 | 1000 |                |              | 0000 |          | 00010 | 01 |
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| GATESHEAD                            | clinical lists and records information | Mr I Allinson                   | GATESHEAD 091 4783711     |
| Chiropody Package                    | from clinical returns. Prints treatment | Gateshead Health Centre        | 1 |
| Appointments system. Keeps a record of | lists and notification cards. Collects | Prince Consort Road           | 10 |
| patients currently on file, including | annual statistics.                 | 100 | 0100 | 010 | 010187 | 100 | Apple Macintosh          | 10 | 10 | 0111 |
| their GP and medical history. Makes  | 10 | 0000000 | 0000 |             |              | 0000 |          | 00010 | 01 |
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| GLOUCESTER                           |                                    | J Law                               | Montpellier, GLOUCESTER   |
| Child Health                         |                                    | GHA Headquarters                    | 0 |
| Using WHTSO system on RCC Mainframe  |                                    | Rikenel                             | 0 |
| with local DEC PDP 11/44 Minicomputer |                                   | 010 | 1000 | 010 | 011085 | 011 | ICL Mainframe, DEC PDP   | 01 | 01 | 1011 |
|                                      | | 0000001 | 0110 |                |              |    |            | 00000 | 10 |
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| GREAT YARMOUTH AND WAVENEY           | and their interaction. The system is | Mrs S Cornfield, Senior Nursing Officer | GREAT YARMOUTH    |
| Psychiatric Nurse Management System  | based on a patient index and staff | Community Psychiatric Nursing Service | 1 |
| Provides the manager of the Community | activity record.                  | St. Nicholas Hospital, Queens Road  | 0 |
| Psychiatric Nursing Service with     |                                    | 100 | 0001 | 001 | 010187 | 100 |                            | 10 | 10 | 0111 |
| information about the patients and staff | 00 | 0000001 | 0001 |         |              | 1010 |          | 00000 | 01 |
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| GREENWICH                            |                                    |                                     |                          |
|                                      |                                    |                                     | 0 |
|                                      |                                    |                                     | 0 |
|                                      |                                    |   |   |   |   |   |                                       |   |   |   |
|                                      |   |   |   |                        |              |   |            |   |   |
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| GRIMSBY                              |                                    |                                     |                          |
|                                      |                                    |                                     | 0 |
|                                      |                                    |                                     | 0 |
|                                      |                                    | 000 |   |   |   |   |                                     | 00 |   | 0000 |
|                                      |   |   | 0000 |                   |              |   |            |   | 00 |
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| GWENT                                |                                    | Mrs G Parry                         |                          |
| Community Manpower Information System |                                   | Unit Personnel Officer              | 1 |
| Maintenance of personnel records.    |                                    | Community Unit HQ                   | 0 |
|                                      |                                    | 010 | 1000 | 100 |        | 100 | Hytec Prelude              | 10 | 01 | 0101 |
|                                      | 00 | 0000000 | 0001 |             |              | 0010 |          | 01000 | 00 |
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GWENT Health Visitor Daily Diary Sheets Survey of health visiting activity for a period of one month. Completed by all health visitors within this authority.	00 / 0000000 / 1000	Miss E Baker Community Unit HQ 001 / 1000 / 100 / / 100 / Apricot XEN 0010	0 0 00010 / 10	10 / 10 / 0110
GWENT Elderly Survey Provides information on the needs of the elderly and shortfalls in service provision. All elderly residents over 75	years are recorded. 10 / 0000000 / 0000 / dBASE III	Miss E Baker Community Unit HQ 010 / 0001 / 001 / 010187 / 100 / Apricot XEN 0010	0 0 01000 / 01	10 / 10 / 0110
GWENT Non-Accidental Injury Register All children under 5 years who attend casualty in all Gwent hospitals following an injury are recorded.	Identifies frequent attenders who could be at risk. 10 / 0000000 / 0001	Miss E Baker Senior Nurse Staff Support Community Unit HQ 100 / 0001 / 010 / 010185 / 100 / Apricot XEN 0010	CAERLEON, Gwent 0 0 00010 / 01	10 / 10 / 0110
GWENT National Child Health System Issues appointments for preventative care and identifies children with special needs and also provides related	statistical information. Gwent use the first four modules of the system. 0000001 / 0100	Mr Kerry M Charles Child Health Section Community Health Unit 010 / 1000 / 100 / 010176 / 001 / ICL 2966	Gwent Health Authority 0 0 00100 / 01	00 / 01 / 1011
GWYNEDD Standard Child Health System	0000001 / 0100	010 / 1000 / 100 / / 001	0 0 / 10	00 / 01 / 1011
HALTON Cheshire Computer Managed Child Health Immunisation and Vaccination Appointments. Paediatric developmental screening for appointments and follow up	0000000 / 0000	Mr D. Jones, Chester Health Authority PO Box 41, Lightfoot Street CHESTER CH2 3HD 000 / 0000 / 000 / / 000 0000	0 0 00000 / 00	00 / 00 / 0000
HAMMERSMITH AND FULHAM HealthNet Communications and Information System for transmitting forms, letters, memos from point to point over the telephone	using microcomputer based terminals. These have limited memory but may be connected to a mainframe. Development work is still going on. 0000000 / 0000	000 / 0001 / 011 / / 100 / Acorn Micro based Systems 0000	0 0 00001 / 00	00 / 00 / 0101
HAMMERSMITH AND FULHAM Telford Manpower Time-Out Records WTE used and time taken out by reason. This district plans to implement the system for all nursing	services including the community. 0000010 / 0000	Ms M C Dorman, Senior Nurse Planning 116 Fulham Palace Road LONDON W6 000 / 0100 / 100 / / 100 / TeleVideo 1000	0 0 01000 / 00	10 / 10 / 0011

HAMMERSMITH AND FULHAM Mental Handicap Register	| 0000000 | 0000 |	Mr Abdul Peerbux 20 Old Oak Road LONDON W3 010 | 0000 | 100 | | 100 | | 0000 |	0 | 0 | | 00000 | 00 |	| 10 | 10 | 0000 |
HAMPSTEAD Hampstead Child Health System / Rubella Provides an A-Z Register of birth details and identifying data for all children born since January, 1984.	Provides a recall for immunisation, producing labels, printouts and letters of appointment. A-Z Register of 10-11 year olds unimmunised against Rubella | 0000010 | 1000 |	Barbara Hand Hampstead Health Authority Community 21 Pond Street 100 | 0011 | 110 | 010884 | 100 | Minstrel | |	LONDON NW3 2PN 0 | 0 | | 00000 | 10 |	| 10 | 10 | 1011 |
HARINGEY National Standard Child Health System Child Health Register Immunisation Module, Statistical and ad-hoc programs also available, pre-school health module	and school health module (neither yet used by Haringey). The system is run from the RCC with remote data capture in Haringey submitted in batch on floppy | 0000001 | 1100 |	Mr K Murphy Immunisation Department Haringey Community Health Department 100 | 1000 | 010 | 010177 | 101 | North Star for Data Collection | 1000 |	Tottenham Town Hall, LONDON N15 0 | 0 | | 00000 | 01 |	| 10 | 10 | 0111 |
HARROGATE Cervical Cytology Recall System Recalls women for follow-up Cervical Cytology examinations.	10 | 0000010 | 0000 |	Mr M Fisher Community Health Department 50 Lancaster Park Road 010 | 1000 | 100 | 010484 | 100 | Equinox | 1000 |	HARROGATE 1 | 5 | | 00000 | 00 |	| 10 | 10 | 0011 |
HARROW	| | 0000 |	000 | | | | | | |	0 | 0 | . | | 00 |	| 00 | | 0000 |
HARTLEPOOL Mental Handicap System Maintains a database of Mental Handicap patients in district including details of diagnosis, degree of handicap,	special needs, future needs, service provision as well as personal details. 00 | 0000000 | 0000 |	Mr J Thompson Victoria Road Health Centre HARTLEPOOL 001 | 0100 | 000 | | 100 | ICL DRS 300 or ICL PC | 0001 |	0 | 0 | | 00000 | 10 |	| 00 | 00 | 0111 |
HASTINGS Child Health System Similar to national system with 3 modules, 2 operational now.	10 | 0000000 | 0100 |	Dorothy Seymour Murley Street Clinic BRIGHTON 100 | 0010 | 100 | | 001 | | 0100 |	0273 693600 0 | 0 | | 00010 | 10 |	| 01 | 01 | 1011 |
HASTINGS Chiropody System Chiropody Statistics, treatments given by Chiropodists VFM Exercise.	. | 0100000 | 1001 |	Mr P Millington Unit Administrator, Community Service St Annes House, 729 The Ridge 100 | 0000 | 111 | | 100 | Prelude 20-2 (Hytec) | 1000 |	ST-LEONARDS-ON-SEA, East Sussex 0 | 0 | | 00100 | 01 |	| 10 | 11 | 0101 |

HEREFORDSHIRE National Standard Child Health System			0 0
HILLINGDON Death Register User inputs a list of all deaths with name, address, cause etc. Simple data set.	10 | 0010000 | 0000 | dBASE III / Clipper	K A Smith Computer Services, Hillingdon Health St. Johns Hospital, Kingston Lane, 010 | 0100 | 100 | 010186 | 100 | Compaq Portable 0010 | 2 Weeks	UXBRIDGE UB8 3PL 58191 Ext.253 1 5 10 | 10 | 0100 00010 | 10
HILLINGDON Handicap Register Basic database of handicapped in district - used particularly by Community Nursing.	10 | 0010000 | 0000 | dBASE III	K A Smith Hillingdon Health Authority St Johns Hospital, Kingston Lane 010 | 0100 | 100 | 010486 | 100 | Compaq Portable 0010 | 4 Weeks	UXBRIDGE UB8 3PL 58191 Ext.253 1 5 10 | 10 | 0100 00010 | 10
HILLINGDON National Child Health System Child Register and Immunisation Module Provides complete child register and records all immunisation given to	children. Schedules appointments, makes clinic lists, produces follow up lists and records for each child. 0000001 | 0100	Graham Berwell NWTRHA Computer Centre Colney Hatch Lane 000 | 0000 | 100 | 010176 | 001 0000	New Southgate, LONDON N11 3DW 0 0 00 | 01 | 1011 00001 | 01
HILLINGDON Korner Statistics Korner information is provided from this system	0000000 | 0000 | Delta	Miss C Alexander, Assistant Unit Admin. 146 Field End Road, Eastcote, Pinner Middlesex, HA5 1SB 010 | 0000 | 010 | 010185 | 100 | ACT Sirius 1 0010	0 0 10 | 10 | 0101 00000 | 00
HOUNSLOW AND SPELTHORNE Mental Handicap Register Database set up for storage of M.H clients registered in this authority. Full medical assessment details held and	personal information. Output can range from full printout to numeric tables. Word-processor & database management system also in use. 10 | 0000100 | 0000	Mr A Rich 92 Bath Road HOUNSLOW TW3 3EL 110 | 0100 | 100 | 010884 | 100 | ICL Personal 25 1000	01 570 7715 Ext.2412 1 0 10 | 10 | 0111 00001 | 10
HOUNSLOW AND SPELTHORNE Special Needs Register Database for planning of resources and information on children in school that may require additional or special needs	from the health authority. Additional software: Wordprocessor, Database management system, Spreadsheet. 10 | 0001000 | 0000	Mr A Rich 92 Bath Road HOUNSLOW TW3 3EL 011 | 0000 | 110 | | 100 | Sirius 1010	01 570 7715 Ext.2412 1 0 01 | 10 | 0111 00010 | 10
HUDDERSFIELD National Standard Child Health System Child Register and Immunisation and Vaccination in Use	0000001 | 0100	010 | 1000 | 100 | | 001 0000	0 0 00 | 01 | 1011 00000 | 10

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| HULL                                  |                                        |                                          |                          |
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|                                       |                                        |                                          | 0 |                      |
|                                       |                                        | 000 |    |    |    |    |                                  | 00 |  | 0000 |
|                                       |   |       | 0000 |                       |                |   |                         |   | 00 |
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| HUNTINGDON                            | system and patient register.           | M P Smith                                | CAMBRIDGE  PD17 4DG  0480 57131   |
| DataMaker / DataScan                  |                                        | Community Unit                           | 1 |                               |
| Full KORNER implementation to provide |                                        | St Peter's Road, Huntingdon              | 5 |                               |
| DHSS statistics and management        |                                        | 001 | 0100 | 100 | 010686 | 101 | Datapoint                | 01 | 11 | 0011 |
| information.  Maintains an appointments | 10 | 0000001 | 0000 | DBC          |                | 0010 | #1,000                | 00100 | 10 |
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| ISLE OF WIGHT                         |                                        |                                          |                          |
|                                       |                                        |                                          | 0 |                      |
|                                       |                                        |                                          | 0 |                      |
|                                       |                                        | 000 |    |    |    |    |                                  | 00 |  | 0000 |
|                                       |   |       | 0000 |                       |                |   |                         |   | 00 |
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| ISLINGTON                             | who are now in long stay hospitals, who | Ms. Carol Jones, Register Organiser,    |                          |
| Register of People/Learning Difficulties | use special services or may do in the | Community Team, 49 Leigh Road          | 0 |                      |
| Provides a list of People with learning | future. Provides information on present | LONDON  N5                             | 0 |                      |
| disabilities (MH). 5 years old and up | or future needs for Service Planning.  | 010 | 0101 | 100 | 011283 | 100 | Rair System              | 10 | 10 | 0101 |
| who live in Islington or come from there |   | 1000000 | 1000 |                |                | 1000 |                   | 00010 | 10 |
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| ISLINGTON                             | London Borough of Islington Social     | Mr B V Lofts                             | LONDON N19 5RR           |
| Green Walk Aids System                | Services Department                    | Joint Aids Service                       | 0 |                      |
| Control of aids issued from stores    |                                        | Church Cottages, Pemberton Gardens       | 0 |                      |
| operated on a joint basis by          |                                        | 100 | 0100 | 100 | 010484 | 100 | Minstrel                 | 10 | 10 | 0111 |
| Islington Health Authority and the    |   | 0000001 | 1000 |                    |                |   |                         | 10000 | 01 |
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| KETTERING                             | design a micro package to enable       | John L Hughes                            |                          |
| CONCEPT                               | district nurses to collect data required | Senior Nurse (Planning)                | 0 |                      |
| Computerisation of Nursing Contact and | by Korner 5.                          | Kettering Health Authority               | 0 |                      |
| Evaluation of Patient Transactions.   |                                        | 010 | 0001 | 011 | 010386 | 100 | Sirius with twin floppy discs  | 10 | 11 | 0101 |
| This is a 2 year study project to     |   | 0010000 | 0001 |                    |                | 0010 |                   | 10000 | 01 |
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| KIDDERMINSTER                         |                                        |                                          |                          |
|                                       |                                        |                                          | 0 |                      |
|                                       |                                        |                                          | 0 |                      |
|                                       |                                        | 000 |    |    |    |    |                                  | 00 |  | 0000 |
|                                       |   |       | 0000 |                       |                |   |                         |   | 00 |
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| KINGSTON AND ESHER                    | covered.                               | Mr G Kennedy A.D.N.S                     | Surrey                   |
| Financial Information Project System  |                                        | Surbiton Hospital                        | 4 |                      |
| Patient based statistics. KORNER      |                                        | Ewell Road, SURBITON                     | 10 |                     |
| information. Financial information.   |                                        | 100 | 1100 | 000 | 010487 | 010 | Plessey PDP 11/73        | 10 | 10 | 1001 |
| Mileage, Equipment, Incontinence aids | 10 | 0000001 | 0010 |                 |                | 0000 |                   | 00000 | 10 |
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KINGSTON AND ESHER Child Health System A modular system comprising of existing modules: Vaccination & Immunisation, Pre-school, School health. Additional	links to provide services for Community dentistry MAY be developed. 10 | 0000001 | 0000 | Framework	A M Bellman, Project Manager Surbiton Hospital Ewell Road, SURBITON 010 | 0001 | 111 | 010183 | 010 | DEC VAX 785 | 0000 |	Surrey 01 399 7111 | 8 | 0 | | 01 | 01 | 0011 | | 01000 | 10 |
LANCASTER 	 | | |	 | | | | | | | |	| 0 | 0 | | | | | | | |
LEEDS EASTERN Loan Aids System This system administers the loan of medical aids to patients and provides a stock control system recording issues	and receipts. 00 | 0000010 | 1000 |	Mrs M Hutchinson Community Health HQ Meanwood Park Hospital 100 | 0000 | 100 | 010185 | 100 | Sperry Model 45 | 0010 |	LEEDS 6 | 1 | 0 | | 10 | 10 | 0011 | | 01000 | 10 |
LEEDS EASTERN Cervical Cytology Recall System This is a computer based system to facilitate recall of women resident in the Leeds Eastern Health Authority who	have been registered for Cervical Cytology screening. Notifies results of screening tests. The information is not required for KORNER. 01 | 0000001 | 1000 | Microbase	Mr R Oliver Computing & Information Services Dept. Leeds Eastern Health Authority 010 | 0010 | 001 | | 100 | Infospec | 1000 | 14 Man Months	St Mary's House, St Mary's Road, LEEDS 7 | 1 | 2 | | 10 | 10 | 0111 | | 00001 | 10 |
LEEDS EASTERN Merlin HealthNet This is a communications network for conveying and retrieving messages. .	 00 | 0000000 | 0000 |	Community Health Administrator Community Health HQ Meanwood Park Hospital 001 | 0000 | 100 | 010185 | 100 | BT Business Systems NET M2105 | 0000 |	LEEDS 6 | 0 | 0 | | 00 | 00 | 0000 | | 00100 | 00 |
LEEDS EASTERN Community Health Stores System This system provides stock control in the community store and also relates financial and administrative information	for management. 00 | 0000010 | 1000 |	Miss Jane Hargreaves Community Store Seacroft Hospital, York Road 100 | 0000 | 000 | 010885 | 100 | Sperry Model 45 | 0010 |	LEEDS | 1 | 0 | | 10 | 10 | 0011 | | 00010 | 10 |
LEEDS EASTERN National Standard Child Health System Child Health and Vaccination and Immunisation Modules running 	 | 0000001 | 0100 |	Mr. G. Hartley Yorkshire Regional Health Authority Computer Centre, Windsor House 010 | 1000 | 100 | 010476 | 001 | ICL 2966 | |	Cornwall Road, HARROGATE | 0 | 0 | | 01 | 01 | 1011 | | 00001 | 01 |
LEEDS EASTERN Child Health System Locally Produced Variation of the National Standard System 	 | 0000000 | 1000 |	Salino Lo St. Mary's House St. Mary's Road 010 | 1000 | 010 | 010185 | 010 | MicroData Reality | |	LEEDS | 0 | 0 | | 01 | 10 | 0011 | | 00001 | 10 |

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| LEEDS WESTERN                        | claims calculated.                     | Ms L Carruthers, Computing Officer          |                                    |
| Community Nursing System             |                                        | LEEDS 432799 Ext.2633                       | 1 |                                |
| Diary page sheets completed by each  |                                        |                                             | 5 |                                |
| Community Nurse are entered. Reports on |                                     | 010 | 0001 | 110 | 010685 | 100 | Infospec 8700                    | 10 | 01 | 0111 |
| activities are produced and mileage  | 10 | 0000001 | 1000 | Microbase        |                  | 1000 | 6 Man Months  | 01000 | 10 |
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| LEWISHAM AND NORTH SOUTHWARK         | chiropody patients.                    | Leona Browning                              |                                    |
| Chiropody Patient Administration     |                                        | 01 407 7600  Ext.3544                       | 2 |                                |
| Database to hold clerical information |                                       |                                             | 0 |                                |
| and information regarding treatments of |                                     | 001 | 0010 | 010 | 010187 | 100 | Fortune                          | 10 | 10 | 0111 |
| domiciliary, clinic and hospital     | 10 | 0000001 | 0000 | Informix Database Management  | 0000 |            | 01000 | 10 |
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| LEWISHAM AND NORTH SOUTHWARK         |                                        | Leona Browning                              |                                    |
| Special Needs Register               |                                        | 01 407 7600  Ext.3544                       | 1 |                                |
| Records details of each child on the |                                        |                                             | 0 |                                |
| Special Needs Register and produces  |                                        | 001 | 0100 | 100 | 010486 | 100 | Cifer 2887                       | 10 | 10 | 0111 |
| reports providing relevant statistics. | 10 | 0001000 | 1000 |                |                  | 1000 |                | 00100 | 01 |
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| LEWISHAM AND NORTH SOUTHWARK         | domiciliary sessions. Prints reports   | Leona Browning                              |                                    |
| Family Planning Statistics           | which total each column of data by     | 01 407 7600 Ext.3544                        | 1 |                                |
| Collects data using optical mark reader | session / clinic / quarter. Covers most |                                          | 0 |                                |
| and creates files for each individual | KORNER requirements.                  | 001 | 0100 | 100 | 010186 | 100 | Cifer 2887                       | 10 | 10 | 0111 |
| session held. These can be clinic or | 10 | 0001000 | 1000 |                  |                  | 1000 |                | 00100 | 01 |
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| LEWISHAM AND NORTH SOUTHWARK         | records. Vaccination and Immunisation  | Mr Steve Saxby                              | LONDON SE11                        |
| National Standard Child Health System | records.  Default lists. Transfer of MOW | South East Thames Regional Computer      | 0 |                                |
| Child Registry and Vaccination Modules | Records.                             | Centre, Lambeth Hospital, Brook Drive       | 0 |                                |
| are in use.  Notification of births  |                                        | 010 | 0100 | 100 | 010183 | 001 | ICL 2904 to be upgraded to 2960    | 00 | 01 | 1011 |
| procedure.  Production of child health |   | 0000001 | 0100 |                  |                  | 0000 |                | 00001 | 10 |
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| LIVERPOOL                            |                                        |                                             |                                    |
|                                      |                                        |                                             | 0 |                                |
|                                      |                                        |                                             | 0 |                                |
|                                      |                                        | 000 |    |    |    |    |                                       | 00 |    | 0000 |
|                                      |   |      | 0000 |                          |                  |    |                |    | 00 |
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| MACCLESFIELD                         |                                        |                                             |                                    |
|                                      |                                        |                                             | 0 |                                |
|                                      |                                        |                                             | 0 |                                |
|                                      |                                        |     |    |    |    |    |                                      |    |    |    |
|                                      |   |      |    |                             |                  |    |                |    |    |
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| MAIDSTONE                            | obstetrics system.                     | Mrs M Leeson                                | MAIDSTONE ME16 9QQ   0622 29000    |
| Midwifery Liaison System             |                                        | Community Midwifery                         | 1 |                                |
| Community midwifery liasion. Simple data |                                    | Maidstone Hospital, Heritage Lane           | 4 |                                |
| base system to collect post-natal & ante |                                    | 010 | 0000 | 100 | 010184 | 100 | Sirius                           | 10 | 10 | 0101 |
| natal information. Precursor to full | 01 | 0100000 | 0000 | CardBox          |                  | 0010 |                | 00010 | 01 |
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MEDWAY		David Ovenden District Computer Adviser	0634 401334 Ext.250	
InfoCom		Computer Dept., Medway Hospital	1	
Death Register. Health visitor/District		Windmill Road, GILLINGHAM, Kent ME7 5NY	0	
nursing Statistics. Speech therapy		010 | 0001 | 100 | 011186 | 010 | General Automation Zebra 5500		01 | 10 | 1011
Register.	10 | 0000001 | 1000	| | 3 Man Months	01000 | 01	
MEDWAY		Mike O'Meara, Unit Administrator		
Child Health System		'B' Block, Medway Hospital	1	
Provides Vaccination and Immunisation		0634 46111 Ext.282	0	
System within the Community Unit.		100 | 0100 | 100 | 010487 | 001 | ICL DRS 20 and ICL 2966 MAINFRAME		01 | 01 | 1011
	0000001 | 0100	| |	00100 | 10	
MERTON AND SUTTON	reports.	Mrs W D Volk (DDNS) or Mr P McGinn	643 1221 Ext.33	
Lotus 123 and DataMaster		Community Nursing	0	
Lotus used for spreadsheets and Data		6 Homeland Drive, SUTTON	2	
Master for databases and for creating		001 | 0100 | 100 | | 000 | IBM PC		10 | 10 | 0101
and maintaining records and producing	00 | 0000000 | 0000	| 0000 |	10001 | 00	
MERTON AND SUTTON	chiropodists. Produces a brought	P D Graham	6 Homeland Drive, SUTTON, Surrey	
Chiropody System	forward list of patients requiring	Merton & Sutton Health Authority	2	
General database. Makes Chiropody	treatment.	Chiropody Department	5	
patient appointments for KORNER.		010 | 1001 | 010 | 010287 | 100 | IBM AT		10 | 10 | 0111
Used to produce clinical programmes for	10 | 0010000 | 0000 | DBMS	| 0010 | 6 Man Months	10000 | 10	
MID DOWNES	Computer, with full terminal access from	A. Pennicott, P.A.A, Tel. 0243-781111	CHICHESTER, West Sussex, PO19 4RZ	
Nearly all Health Care Activities	the Health Branch	Community Health Branch,	0	
Vaccination and Immunisation,	.	Spitalfield Lane,	0	
Cervical Screening, in use since 1970.		000 | | 100 | | 001 |		00 | | 0000
Uses West Sussex County Councils	0000001 | 0100	| |.	| 00	
MID ESSEX	Management information required hourly.	Peter Greenwood, Assistant Administrator	Essex CM8 2TT	
Nurse II and Nurse III		Mid Essex District Health Authority	0	
Meets all Korner Community and		Collingwood, WITHAM	5	
Paramedical requirements, except Child		100 | 0000 | 010 | 010487 | 100 | Minstrel IV		01 | 01 | 0011
Health, through optical marked cards.	10 | 0000001 | 0000 | DBMS .	| 0000 | #10,000	00000 | 10	
MID ESSEX	CPN's	Mrs May Gambles	Witham	
MicroFind		Temporary Clerical Officer	0	
Register of people aged 69 and		Community Unit, District HQ	0	
over who have had involvement with		010 | 0100 | 010 | 010685 | 100 | Minstrel		01 | 10 | 0111
psychogeriatric services including	0000001 | 0000	| 1000 |	01000 | 01	
MID GLAMORGAN	operation as from September, 1985. .	WHTSO, Heron House, 35-43 Newport Road		
Standard Child Health System		CARDIFF	0	
Child Register, Immunisation Module and	.	CF2 1SB	0	
Pre School Health in Operation. The		100 | 0101 | 110 | 010985 | 001 | ICL 2966		01 | 01 | 1011
School Health Module will come into	0000001 | 0100	| |	00100 | 10	

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| MID STAFFORDSHIRE                      |                                        | Mrs. M. Smith, Miss Tina Randall, GAA  |                                 |
| Standard Child Health System           |                                        |                                        | 0 |
| Part 1 (Child Register) and Part 2     |                                        |                                        | 0 |
| (Immunisation) In Use                  |                                        | 110 | 1100 | 100 | 010783 | 101 | Ontel, for Data Capture and ICL at | 11 | 11 | 0111 |
|                                        | | 0000001 | 0100 | O.P.L for Ontel Computers   |   |                           | 00100 | 01 |
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| MID SURREY                             | data to a disk file.  These can be     | Simon Fancis                           |                                 |
| LEEP                                   | appended to as often as required.      | Santhams, West Park Hospital           | 0 |
| Leep is a group of programs which enable | Statistics and totals can then be    | Horton Lane, EPSOM                     | 0 |
| the user to write and edit a question  | extracted, individually or in batch mode | 000 | 0001 | 011 | 010385 | 100 | DEC Rainbow 100+   | 10 | 10 | 0111 |
| file then write and edit any amount of |   | 0000000 | 1000 |                  | 1000 |                      | 10000 | 01 |
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| MILTON KEYNES                          |                                        |                                        |                                 |
|                                        |                                        |                                        | 0 |
|                                        |                                        |                                        | 0 |
|                                        |                                        | 000 |   |   |   |   |                                    | 00 |   | 0000 |
|                                        |   |   | 0000 |                          |   |                          |   | 00 |
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| NEWCASTLE                              |                                        | Northern RHA, Computer Section         |                                 |
| Loan Equipment                         |                                        |                                        | 0 |
| Batch system run at NRHA. Keeps track of |                                      |                                        | 0 |
| loans and returns. Regular printouts   |                                        | 010 | 0000 | 100 |   | 001 | ICL 2900 Series               | 00 | 00 | 0000 |
| reflect stock levels.                  | 00 | 0000000 | 0000 |                  | 0000 |                      | 00000 | 00 |
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| NEWHAM                                 | activity through pencil strokes on a   | T Matus                                | LONDON  E13 0DZ                 |
| CardBase                               | card, aggregates and analyses. Can     | District Information Specialist        | 5 |
| Collects and analyses activity         | produce KORNER requirements for each   | District Headquarters, 1 Helena Road   | 5 |
| information for every Community and most | discipline.                          | 100 | 0100 | 100 | 011086 | 100 | IBM PC Clones              | 01 | 01 | 0111 |
| Paramedical disiplines. Staff record   | 10 | 0000001 | 1000 |                   | 1010 |                      | 00010 | 10 |
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| NORTH BEDFORDSHIRE                     |                                        |                                        |                                 |
|                                        |                                        |                                        | 0 |
|                                        |                                        |                                        | 0 |
|                                        |                                        | 000 |   |   |   |   |                                    | 00 |   | 0000 |
|                                        |   |   | 0000 |                          |   |                          |   | 00 |
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| NORTH BIRMINGHAM                       | nurses, health visitors are covered by | Malcolm McCleod                        |                                 |
| Financial Information Project System   | the system, and para-medical services  | West Midlands RHA                      | 2 |
| Maintains patient records, patient     | are to be developed.                   | 021 456 1444                           | 0 |
| assessment, daily activity records,    |                                        | 010 | 1000 | 100 | 010887 | 010 | DEC PDP 11/84              | 10 | 10 | 1011 |
| stock control for aids & linen, District | 10 | 0000100 | 0010 |                 | 0000 |                      | 00000 | 10 |
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| NORTH DERBYSHIRE                       |                                        | Mrs Caroline Trustwell                 |                                 |
| Vaccination and Immunisation System    |                                        | 0246 200131                            | 1 |
| Birth Certification.                   |                                        |                                        | 0 |
| Pre-school Vaccination and Immunisation. |                                      | 011 | 0010 | 100 | 010184 | 100 | ACT Sirius                 | 10 | 10 | 0111 |
| Child Development.                     | 01 | 0000000 | 0000 | Condor Data Base System    | 0010 |           | 10000 | 01 |
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| NORTH DEVON                               |                                    |                                                   |                        |
|                                           |                                    |                                                   | 0 |                    |
|                                           |                                    |                                                   | 0 |                    |
|                                           |                                    | |  |  |  |  |                                     |                        | |  |  |  |
|                                           |  |  |  |                           |   |  |                                             |  |  |  |
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| NORTH EAST ESSEX                          | Produces: Patient index. Assessment | Charles Millar                                   | BIRMINGHAM  B1 2JP     |
| Financial Information Project System      | ratings. Management reports.       | Financial Information Project                     | 5 |
| Collects: Registration details of         |                                    | Alpha Tower, Suffolk Street Queensway             | 5 |
| patients. Assessment details of patients  |                                    | 001 | 0100 | 100 | 010487 | 010 | PDP 11                              | 10 | 01 | 1011 |
| Activity of staff (D.Nurses/H.Visitors).  | 10 | 0000001 | 0010 |            |   | 0000 |                                    | 00010 | 10 |
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| NORTH EAST ESSEX                          | Statistics.                        | Mrs. E. Bacon, Immunisation Department            |                        |
| National Standard Child Health System     | Also, interim pre-school system which | Central Clinic, High Street                    | 0 |
| (Module 1)                                | notifies health visitors when to   | COLCHESTER                                        | 0 |
| Creates Child Register - Increase         | complete Surveillance Tests        | 110 | 0100 | 010 |      | 101 |                                         | 10 | 01 | 1011 |
| Immunisation uptake and provides          |    | 0000001 | 1100 |               |   |  |                                           | 00010 | 00 |
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| NORTH HERTFORDSHIRE                       |                                    | Mrs P A Sutton                                    | HITCHIN                |
| Zardax,  PFS File / Report                |                                    | Health Centre                                     | 0 |
| Zardax Word Processing and PFS file/      |                                    | Bedford Road                                      | 0 |
| report for entering and creating reports  |                                    | 000 | 0100 | 100 |      | 100 | Apple IIe                             | 10 | 10 | 0101 |
|                                           |   | 1000000 | 1000 |              |   | 0000 |                                    | 00010 | 00 |
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| NORTH LINCOLNSHIRE                        |                                    |                                                   |                        |
|                                           |                                    |                                                   | 0 |                    |
|                                           |                                    |                                                   | 0 |                    |
|                                           |                                    | |  |  |  |  |                                     |                        | |  |  |  |
|                                           |  |  |  |                           |   |  |                                             |  |  |  |
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| NORTH MANCHESTER                          |                                    |                                                   |                        |
|                                           |                                    |                                                   | 0 |                    |
|                                           |                                    |                                                   | 0 |                    |
|                                           |                                    | |  |  |  |  |                                     |                        | |  |  |  |
|                                           |  |  |  |                           |   |  |                                             |  |  |  |
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| NORTH STAFFORDSHIRE                       |                                    | K G Rhead District Information Officer            | STOKE-ON-TRENT         |
| Loan of Nursing Equipment                 |                                    | North Staffordshire HA                            | 1 |
| Community Stock control and disposal of   |                                    | Princes Road, Hartshill                           | 2 |
| equipment system.                         |                                    | 000 | 0100 | 100 | 010184 | 100 | Tandy                                 | 10 | 10 | 0101 |
|                                           | 00 | 0000000 | 1000 |            |   | 0000 |                                    | 01000 | 00 |
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| NORTH STAFFORDSHIRE                       |                                    | Mr R Nisbet                                       | STOKE-ON-TRENT         |
| Standard Child Health System              |                                    | Community Unit                                    | 0 |
| Child Register 0-5 years, Vaccination     |                                    | 79 London Road                                    | 0 |
| and Immunisation Scheduling and Pre-      |                                    | 000 | 1000 | 100 | 010582 | 101 | ICL Mainframe and Ontel Microcomput | 00 | 10 | 1011 |
| School Child Health                       |   | 0000001 | 0100 |              |   | 0010 |                                    | 00010 | 10 |
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| NORTH TEES                              |                                   | Mrs Jean Woodhouse                        | THORNABY, Cleveland TS17 0EE           |
| CalcStar                                |                                   | Health Centre                             | 1 |
| Collection of family planning statistics | .                                | Trenchard Avenue                          | 0 |
| as required by KORNER.                  |                                   | 001 | 0100 | 100 | 010186 | 100 | Apple IIe                | 01 | 01 | 0101 |
|                                         | 10 | 0000000 | 0000 |             | 1000 |                         | 00100 | 01 |
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| NORTH TEES                              | module permits the scheduling of  | Mr P Dobson                               | STOCKTON-ON-TEES, Cleveland            |
| Immunisation and Vaccination            | children according to an agreed policy | Administrator - Community Records    | 0 |
| Establishes a central identification    | & provides clinic lists, non-attendance | Child Health Services, 163 Durham Road | 0 |
| file using the birth notification as the | lists, printed appointments cards etc. | 110 | 0010 | 110 | 010168 | 001 | IBM 3081        | 01 | 01 | 1011 |
| source document.  The immunisation      | | 0000001 | 0100 | Easytrieve / IMS |             | 0000 |                         | 00010 | 01 |
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| NORTH TYNESIDE                          |                                   |                                           |                                        |
|                                         |                                   |                                           | 0 |
|                                         |                                   |                                           | 0 |
|                                         |                                   | 000 |      |     |      |      |                     | 00 |   | 0000 |
|                                         |    |        | 0000 |               |              |     |                     |       | 00 |
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| NORTH WARWICKSHIRE                      | FPC eventually.                   | Data Manager                              |                                        |
| Elderly Register                        |                                   |                                       .   | 0 |
| Age, Sex, Address, Points of Contact,   |                                   |                                           | 0 |
| Local Authority and Health Recorded     |                                   | 100 | 0100 | 010 | 010685 | 100 | BMDS - DEC Professional  | 10 | 10 | 0101 |
| It is hoped to link this with the       |    | 0010000 | 0010 |             |              | 0000 |                  | 00000 | 01 |
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| NORTH WARWICKSHIRE                      |                                   | Dr. G. W. Page                            |                                        |
| Unique Child and School Health System   |                                   | North Warwickshire Health Authority       | 0 |
| Including Immunisation, serving three   |                                   |                                           | 0 |
| Districts, and running on an IBM        |                                   | 000 |      | 100 |      | 001 | IBM Mainframe          | 00 | 01 | 0000 |
| Mainframe at Warwick.                   |    |        | 0000 |               |              |     |                     |       | 00 |
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| NORTH WARWICKSHIRE                      | therefore will be fully compatible with | agreed dictionary of chronic conditions. |                                |
| Epidemiological Information System      | ICD9, which will enable 2 files to be | Dr. G. W. Page                          | 0 |
| 20% of Pop. on.A plain language encoding | generated from a single entry, one of | North Warwickshire Health Authority    | 0 |
| module, using the latest RCGP code      | acute episodes, the other from an | 100 | 0000 | 100 |      | 100 | DEC Professional          | 10 | 10 | 0000 |
| is being developed by BMDS, and         | | 0000000 | 0010 | BMDS GP 20 System |          |     |                     |       | 00 |
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| NORTH WEST DURHAM                       |                                   |                                           |                                        |
| Vaccination and Immunisation            |                                   |                                           | 0 |
| Also School Health to a lesser degree.  |                                   |                                           | 0 |
| Uses Regional Mainframe                 |                                   | 010 | 1000 | 100 |      | 001 |                     | 00 | 01 | 1011 |
|                                         |    | 0000001 | 0100 |             |              |     |                     |       | 10 |
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| NORTH WEST HERTFORDSHIRE                | treatment. It should produce KORNER | District Chiropody Officer              | Herts                                  |
| OptiData System                         | statistics and it is hoped to hold a | Waverly Lodge                          | 0 |
| The system is used to hold the lists for | wide range of Management information. | Normandy Road, ST. ALBANS            | 0 |
| both Hospital & Community based patients |                                  | 101 | 0101 | 001 |      | 100 |                     | 10 | 10 | 0111 |
| receiving either clinical or domicillary | 00 | 1000000 | 1000 |            |              | 0000 |                  | 00000 | 00 |
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| NORTH WEST SURREY                     |                                       |                                           |                                          |
|                                       |                                       |                                           | 0 |                                      |
|                                       |                                       |                                           | 0 |                                      |
|                                       |                                       |  |   |   |   |   |                        |                          |   |   |   |
|                                       |  |   |   |                            |                   |   |                   |  |   |   |                                 
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| NORTHALLERTON                         | maintained.                           | Mr B. Staymaker, Regional Computer        |                                          |
| Birth Register and V and I System     |                                       | Centre                                    | 0 |                                      |
| Records and identifies all children   |                                       | Park Parade, HARROGATE,  HG1 4AH          | 0 |                                      |
| who are or have been the responsibility |                                     | 100 | 1000 | 100 |      | 001 |             |                   | 00 | 01 | 1011 |   |
| of the Authority.  A Birth register is |  | 0000001 | 0100 |                  |                |   |                      | 01000 | 10 |                               |
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| NORTHAMPTON                           |                                       | Mr M Chew Assistant Administator          | 21155 Ext.246                            |
| Medical Loans System                  |                                       | Community Services, 'Sunnyside'           | 1 |                                      |
| Patient Record and Stock Control System. |                                    | Cliftonville, NORTHAMPTON  NN1 5BE        | 5 |                                      |
|                                       |                                       | 100 | 0100 | 100 | 140486 | 100 |         |                   | 10 | 10 | 0111 |   |
|                                       | 10 | 0001000 | 0000 | Delta 4         |                | 0010 | #6,000             | 00010 | 10 |                               |
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| NORTHERN HEALTH & SOCIAL SERVICES BOARD | notifications. Enter mortality details. | Mr E N Thorn                          | County Hall, 182 Galgorm Road, BALLYMENA |
| Child Health Record System            | Amend existing Child Health Records.  | Area Information Officer                  | 0 |                                      |
| The system enables the user by means of | Amend diagnosis etc. End of day and | Northern Health & Social Services Board   | 7 |                                      |
| screen prompts to input the following: | period procedures.                   | 010 | 0000 | 100 | 070884 | 100 | ICL DRS 20/50 |                  | 10 | 10 | 0111 |   |
| Child Health Records UHC3. Enter birth | 00 | 0000001 | 0100 |               |                | 0001 |                    | 00010 | 10 |                               |
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| NORTHUMBERLAND                        | operational throughout the county of  | Mrs Sophia Hoggarth                       | NRHA, Benfield Road, NEWCASTLE           |
| Cervical Cytology Recall System       | Northumberland.                       | Morpeth 514331  Ext.2037  OR              | 0 |                                      |
| The system selects women between the  |                                       | Miss Jackie Throp                         | 0 |                                      |
| ages of 35/65 for cervical cytology call |                                    | 000 | 1000 | 100 | 011185 | 010 | PDP 11/44 |                      | 01 | 01 | 1011 |   |
| and recall. It is a 5 year recall     | 10 | 0000001 | 0010 |                  |                | 0000 |                    | 01000 | 00 |                               |
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| NORTHUMBERLAND                        |                                       | Miss V J Male                             | MORPETH,  Northumberland                 |
| Child Health System                   |                                       | Northumberland Health Authority           | 1 |                                      |
| Register of all births in Northumberland |                                    | East Cottingwood                          | 0 |                                      |
| Records all vacccinations/immunisations |                                     | 100 | 0001 | 010 | 010187 | 100 | IBM PC AT |                      | 10 | 10 | 0111 |   |
| and pre-school health checks.         | 10 | 0000001 | 0000 | dBASE III       |                | 0000 | #1,200             | 00000 | 10 |                               |
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| NORTHUMBERLAND                        | Planning of services                  | Allan Calder                              |                                          |
| Child Handicap Register               | Epidemiology of spinal handicaps      | 0670 714225                               | 1 |                                      |
| Register of children with handicaps   | Research                              |                                           | 20 |                                     |
| in Northumberland used for :-         |                                       | 010 | 0001 | 100 | 010785 | 100 | Apricot XI |                     | 10 | 10 | 0011 |   |
| Individual Care                       | 10 | 0100000 | 0001 |                  |                | 0010 |                    | 00001 | 00 |                               |
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| NORTHUMBERLAND                        | issues. Produces a delivery schedule of | Mrs M Seeber                            |                                          |
| Supplies Department Loan Service      | issues. Controls stocks of equipment / | After Care Service                       | 0 |                                      |
| Maintains records of issues of After  | aids.                                 | Northumberland Health Authority           | 0 |                                      |
| Care equipment to patients in the     |                                       | 100 | 0001 | 010 | 010387 | 100 | IBM PC |                         | 10 | 10 | 0101 |   |
| Community. Produces advice note of    | 00 | 0000000 | 0000 | dBASE III       |                | 0000 |                    | 01000 | 00 |                               |
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NORWICH Chiropody System Used solely by the Chiropody Department for maintaining patient registration data, maintaining an Appoinment	Management System (not yet in full use) and collecting statistics. 01 / 0010000 / 0000 / Pascal	Mr H Prior District Chiropody Officer Norwich 611911 100 / 0000 / 100 / 010886 / 100 / Burroughs B25 0000 / 2.5 Years	 1 5 10 / 10 / 1111 00000 / 10
NOTTINGHAM Demon Micro database that can access DRX files or its own database files. Record indices may be alpha or numeric. Used	for a comprehensive nursing work load system. 0000000 / 0000	Mr J Basinger Transaction Point Ltd., Stuart House 43-47 Crown Street, 100 / 0000 / 000 / 150186 / 100 / ICL DRS 20 Model 50 0001	READING, Berks 0 0 10 / 10 / 0111 00000 / 10
NOTTINGHAM CHILDFILE Progam summarises information on all children by both non-medical and screening test information results.	Program searches sets of files (up to 1400) for any combination of characteristics 0010000 / 1000	Dr. M. Elphinck Department of Child Health, University Hospital, Queens Medical Centre, 010 / 0010 / 100 / / 100 / Commodore PET	NOTTINGHAM 0 0 10 / 10 / 0101 01000 / 01
OLDHAM	 0000	 000	 0 0 00 / 0000 00
ORKNEY HEALTH BOARD Community Health Index Maintain a population index based on a Primary Care Registration System which is G.P based.	 01 / 0000001 / 0100 / Plan (low level), FTL6 (high level)	Philip Murphy Grampian Health Board Computing Centre 010 / 1000 / 100 / 010686 / 001 / ICL 2966 0000	ABERDEEN 0224 681818 Ext.2984 1 2 01 / 01 / 1011 00010 / 10
OXFORDSHIRE Observation Register Compiling an Observation Register. All children will be observed for at least one year. System will provide a limited	amount of KORNER data if necessary. 10 / 0000001 / 0000 / Sensible Solution	June Carlisle 249891 Ext.4649 010 / 0001 / 101 / 010986 / 100 / DMS HiNet 0010 / 1 Man Month	 1 5 01 / 10 / 0011 00100 / 10
OXFORDSHIRE Nursing Aids Stock Control System Provides stock control facilities.	 10 / 0000100 / 0000	Martin Couchman Slade Hospital 46841 010 / 0001 / 101 / 040486 / 100 / Apricot 0000 / 20 Days	 1 5 10 / 10 / 0101 00100 / 10
PADDINGTON AND NORTH KENSINGTON Family Planning System Records activity entered from session sheets on dBASE program with menu system Analysis of KORNER and some extra data	available. 10 / 0000000 / 0001	R Brand / C Cohen Information Unit Dept. Community Medicine 010 / 0000 / 001 / / 100 / Rair 0000 / 6 Days	St. Mary's Hospital 01 725 1531/1525 1 0 10 / 10 / 0101 10000 / 01

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| PEMBROKESHIRE                           | the community.  Based on the detailed   | Mr A James                                  | 0437 67801 Ext.251        |
| MIPP ComCare System                     | analysis of staff activity and the      | Community Health Department                 | 1 |
| Designed to meet KORNER requirements of | maintenance of an index of patient      | Merlins Hill, HAVERFORD WEST, Dyfed         | 0 |
| Patient Care in the community. It covers| contacts.                               | 000 | 0100 | 001 | 010187 | 100 | ICL DRS 150                      | 10 | 10 | 1111 |
| the full range of operational staff in  | 00 | 0000001 | 0100 |                   |                 | 0001 |                              | 00010 | 10 |
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| PETERBOROUGH                            |                                         | J E Bates                                   |                           |
| District Nurse / Health Visitor System  |                                         | Information Services (0733 51461)           | 0 |
| Being developed by R.C.C at East Anglian|                                         |                                             | 0 |
| Regional Health Authority, contact R.H.A|                                         | 000 | 0000 | 000 |        | 000 |                                  | 00 | 00 | 0000 |
| for further details.                    | 00 | 0000000 | 0000 |                   |                 | 0000 |                              | 00000 | 00 |
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| PETERBOROUGH                            |                                         | J E Bates                                   |                           |
| Pre-School Health System                |                                         | Information Services  (0733 51461)          | 1 |
| Under development, applications unclear |                                         |                                             | 0 |
| as yet.                                 |                                         | 010 | 0000 | 010 |        | 100 |                                  | 10 | 10 | 0101 |
|                                         | 00 | 0000000 | 0001 |                   |                 | 0000 |                              | 10000 | 01 |
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| PLYMOUTH                                | access to the computer by 1987/88       | P. A. W. Moore, Unit Administrator          | PLYMOUTH, PL4 7JG         |
| National Child Health System            | depending on finance available.         | Community Health Department                 | 0 |
| In use on the Regional Mainframe, with  |                                         | Longfield House, Greenbank Road,            | 0 |
| terminal based at Exeter, however       |                                         | 010 | 1000 | 100 |        | 001 |                                  | 00 | 01 | 1011 |
| arrangements are being made for direct  |      | 0000001 | 0100 |                   |                 |      |                              |       | 10 |
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| PLYMOUTH                                | at risk and non-accidental injuries in  | P. A. W. Moore, Unit Administrator          | PLYMOUTH, PL4 7JG         |
| Child Surveillance, Children at Risk    | particular.                             | Community Health Department                 | 0 |
| In the Process of acquiring a micro for |                                         | Longfield House, Greenbank Road,            | 0 |
| the purposes of child surveillance in   |                                         | 000 | 0000 | 010 |        | 100 | Commodore 8296                   | 10 | 10 | 0101 |
| general and sudden cot deaths, children |      | 0000000 | 1000 |                   |                 |      |                              |       | 00 |
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| PONTEFRACT                              |                                         |                                             |                           |
| School Health System                    |                                         |                                             | 0 |
| Pontefract is trial district for the    |                                         |                                             | 0 |
| National Scheme for School Health       |                                         | 010 | 1000 | 100 |        | 001 |                                  | 00 | 01 | 1011 |
|                                         |      | 0000001 | 0100 |                   |                 |      |                              |       | 10 |
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| PORTSMOUTH AND SOUTH EAST HAMPSHIRE     | of high/low risk babies to individual   | Mrs J Powell, Infant Surveillance CO        |                           |
| Scores Children at Risk of Sudden Death | health visitors.  Monthly data to       | Gosport Health Centre                       | 0 |
| Issues information to g.p.'s and h.v's  | infant surveillance co-ordinator re 56  | Bury Road, GOSPORT                          | 0 |
| re. risk children, produces child health| variables from IS/1 and 36 from IS/2    | 010 | 0001 | 100 |        | 100 | Commodore CBM 8032               | 10 | 10 | 0101 |
| slip for child health clinic.  Listing  |      | 0010000 | 1000 |                   |                 |      |                              | 10000 | 01 |
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| POWYS                                   |                                         |                                             |                           |
|                                         |                                         |                                             | 0 |
|                                         |                                         |                                             | 0 |
|                                         |                                         | 000 |      |      |        |     |                                  | 00 |    | 0000 |
|                                         |      |             | 0000 |                   |                 |      |                              |       | 00 |
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| REDBRIDGE                                 | These are commercial packages bought off |                                            |                                    |
| Wordstar/Mailmerge/Reportstar/Supercalc2  | the shelf.                               |                                            | 0 |                                |
| Records Community Health Statistics       |                                          |                                            | 0 |                                |
| and used for routine Word Processing.     |                                          | 000 |    | 100 | 031283 | 100 |             |                 | 10 | 10 | 0111 |
|                                           |    | 0010000 | 0000 |                      |                 | 1000 |                     |        | 00100 | 00 |           |
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| RENFREW                                   |                                          |                                            |                                    |
|                                           |                                          |                                            | 0 |                                |
|                                           |                                          |                                            | 0 |                                |
|                                           |                                          | 000 |    |    |    |    |                     |                 | 00 |    | 0000 |
|                                           |    |    | 0000 |                         |                 |    |                      |        |    | 00 |              |
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| ROTHERHAM                                 |                                          |                                            |                                    |
|                                           |                                          |                                            | 0 |                                |
|                                           |                                          |                                            | 0 |                                |
|                                           |                                          | 000 |    |    |    |    |                     |                 | 00 |    | 0000 |
|                                           |    |    | 0000 |                         |                 |    |                      |        |    | 00 |              |
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| RUGBY                                     | for this activity, and provide managers  | Mrs C Greenhalgh (Project Officer)         | BIRMINGHAM B1 1TT 021 643 6596     |
| Financial Information Project System      | with a breakdown of the utilisation of   | Financial Information Project              | 0 |                                |
| The authority is taking the District      | staff time. Travel claims for field      | Alpha Tower, Suffolk Street                | 0 |                                |
| Nursing Module only at present. This      | staff will be generated automatically.   | 001 | 0101 | 010 | 011186 | 010 | DEC VAX, PDP 11/25                  | 01 | 10 | 1001 |
| module will provide KORNER requirements   | 10 | 0000000 | 0000 |                     |                 | 0000 |                     | 10000 | 10 |                       |
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| SALFORD                                   | and appointment scheduling.              | John A Gurney                              | 061 707 6611 Ext.242               |
| Para-Medical Information System           |                                          | District Chief Chiropodist, Salford H.A    | 3 |                                |
| Master Patient Index with Management      |                                          | Peel House, ECCLES M30 0NJ                 | 10 |                               |
| reporting, KORNER reporting and Staff     |                                          | 101 | 0100 | 100 | 010483 | 110 | Equinox                        | 10 | 10 | 0011 |
| records. Also available: equipment loans  | 10 | 0000001 | 1000 | Pick              |                 | 0000 | 2 Years             | 00001 | 10 |                       |
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| SALISBURY                                 |                                          | Miss K Ponsford                            |                                    |
| Wessex Region Community Nursing System    |                                          | District Office, Odstock Hospital,         | 0 |                                |
| Records Work load of all Community        |                                          | Salisbury, Wiltshire                       | 0 |                                |
| Nurses and Health Visitors                |                                          | 010 | 0001 | 100 |        | 100 | Hytec 4500/D                        | 10 | 10 | 0111 |
|                                           |    | 0100000 | 1000 |                      |                 | 1000 |                     | 00010 | 01 |                       |
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| SANDWELL                                  |                                          | Miss L MacFarlane District Speech Thera    | Lodge Road, WEST BROMWICH          |
| Speech Therapy Computer System            |                                          | Sandwell H.A.                              | 1 |                                |
| The system records detailed information   |                                          | Community Unit                             | 5 |                                |
| on patient contacts and produces output   |                                          | 100 | 0001 | 010 | 010187 | 100 | DMS                            | 01 | 10 | 0100 |
| for Management and KORNER.                | 10 | 0100000 | 0001 |                     |                 | 1000 | #8,500              | 00010 | 10 |                       |
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| SANDWELL                                  | to treatment centres in details and      | Mr D Antony, Research Nurse                | WEST BROMWICH B70 9LD              |
| Domicilliary Visits System                | numbers of subsequent visits. Reports    | Sandwell H.A.                              | 1 |                                |
| Stores data of first visits made by       | in detail and summary are available.     | Kingston House                             | 3 |                                |
| District Nurses in detail, and numbers    |                                          | 010 | 0000 | 100 | 010186 | 100 | TeleVideo PC                   | 10 | 01 | 0111 |
| of subsequent visits only. First visits   | 10 | 0100000 | 0001 |                     |                 | 0010 | 3 Man Months        | 10000 | 01 |                       |
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SANDWELL Family Practitioner Committee System National Standard Registration System Cervical Cytology recall and Finance Packages to be added. Uses 6400	Processor | | 0000 |	Mr. F. J. Alton, FPC Administrator Sandwell Health Authority | 000 | | | | | | |	Shaftesbury House, High St, W. BROMWICH | 0 | 0 | | 00 | | 0000 | | | 00 |
SANDWELL Environmental Health Uses Commodore 8032 for statistics and Word Processing	 | | 0000 |	Dr. V. Rao, Specialist in Comm Medicine Sandwell Health Authority, Kingston Hse. West Bromwich | 000 | | 100 | | 100 | | |	| 0 | 0 | | 00 | | 0000 | | | 00 |
SANDWELL Child Health 1 - Commodore 8090 for Register of Pre-School Handicapped Children and Register of children with hearing	aids. 2 - WMRHA Vaccination / Immunisation Scheme | 0000001 | 1100 |	Dr. Joannes, Specialist in Comm Medicine Sandwell Health Authority Kingston House, West Bromwich | 100 | 1000 | 100 | | 101 | Commodore and Mainframe | |	| 0 | 0.| | 00 | 11 | 1011 | | | 10 |
SCARBOROUGH	 | | |	 | | | | | | | |	| 0 | 0 | | | | | | | |
SCUNTHORPE	 | | |	 | | | | | | | |	| 0 | 0 | | | | | | | |
SHEFFIELD	 | | 0000 |	 | 000 | | | | | | |	| 0 | 0 | | 00 | | 0000 | | | 00 |
SHETLAND HEALTH BOARD	 | | |	 | | | | | | | |	| 0 | 0 | | | | | | | |
SHROPSHIRE Cervical Cytology Recall System Creates patient records which can be up dated and amended as required. Produces name and address labels which can be	used to recall women after 5 years. Produces lists of women who failed to attend, oustanding. Print-out of patient record for onward transfers | 00 | 0000000 | 0000 |	Miss B A Matthews Community Services, Cross House Hospital Cross Houses, Nr SHREWSBURY, Shrops | 000 | 0000 | 100 | 010482 | 001 | ICL | 0000 |	Cross Houses 242 Ext.379 | 1 | 0 | | 00 | 00 | 0000 | | 00010 | 00 |

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| SHROPSHIRE                                 |                                     | R G D Alexander                          | TELFORD SY8 3AJ  44767                    |
| Day Sheet Statistics                       |                                     | Dental Dept., Health Centre              | 1 |
| Stores and analyses data of staff output   |                                     | Chapel Lane, Wellington                  | 3 |
| in Dental Clinics.                         |                                     | 001 | 0000 | 100 | 010185 | 100 | CBM 8000                  | 10 | 01 | 0101 |
|                                            | 01 | 0001000 | 1000 |                                | 0000 | 12 Man Months     | 10000 | 01 |
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| SHROPSHIRE                                 |                                     | R G D Alexander                          | TELFORD  SY8 3AJ   44767                  |
| Epidemiology / Statistics System           |                                     | Dental Dept., Health Centre              | 1 |
| Enables research and survey work to be     |                                     | Chapel Lane, Wellington                  | 5 |
| carried out on dental matters and          |                                     | 001 | 0000 | 100 | 010185 | 100 | CBM 8000                  | 10 | 10 | 0101 |
| subjects.                                  | 01 | 0001000 | 1000 |                                | 0000 |                   | 00100 | 01 |
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| SHROPSHIRE                                 |                                     |                                          |                                           |
| Chiropody Services System                  |                                     | Cross Houses Hospital                    | 1 |
| Patient appointments. KORNER data sets.    |                                     | 242 Ext.356                              | 2 |
| Patient care details. Staff monthly        |                                     | 110 | 0100 | 100 | 010785 | 100 | Apple 2e                  | 10 | 10 | 0111 |
| returns.                                   | 10 | 0100000 | 0000 | Pascal                     | 0000 | 15 Man Months     | 01000 | 00 |
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| SOLIHULL                                   |                                     | Mr M McCloud                             | Queensway, BIRMINGHAM  B1 2JP             |
| Financial Information Project System       |                                     | Financial Information Project            | 0 |
| Provides management and operational        |                                     | 11th Floor, Alpha Tower, Suffolk Street  | 0 |
| data for Community and Loan Aids Systems   |                                     | 010 | 0100 | 011 | 010487 | 010 | PDP 11                    | 01 | 10 | 0001 |
|                                            | 10 | 0000000 | 0010 |                                | 0000 |                   | 00000 | 00 |
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| SOLIHULL                                   |                                     | West Midlands Regional Health Authority  | BIRMINGHAM                                |
| National Standard Child Health System      |                                     | 426 High Street                          | 0 |
| Birth Registration and Vaccination and     |                                     | Harborne                                 | 0 |
| Immunisation are in use.                   |                                     | 000 | 1000 | 100 |      | 001 | Ontel for Data Capture , ICL 2966 a | 00 | 11 | 1111 |
|                                            | | 0000100 | 0100 | OPL on Ontel           | 0000 |                   | 00001 | 01 |
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| SOMERSET                                   |                                     | Mr M Protherough, Computer Services      |                                           |
| Community Nursing Services Returns         |                                     | Officer, Somerset Health Authority,      | 0 |
| Provides statistical information for       |                                     | Burton Place, TAUNTON                    | 0 |
| Local use and the DHSS LHS 27/3 Annual     |                                     | 010 | 1000 | 100 | 011281 | 100 | Hytec 4520                | 10 | 10 | 0011 |
| Community Health Service Statistics        | | 0000100 | 0001 |                   | 1000 |                   | 01000 | 01 |
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| SOUTH BEDFORDSHIRE                         | profiles, Number of visits and medical | Mr P wood                             |                                           |
| District Nursing Case List Monitor         | loans catered for.                  | Senior Nurse Planning                    | 1 |
| Provides a live register of all clients,   |                                     | LUTON 37121                              | 5 |
| and Community Nurse visits in district.    |                                     | 010 | 0100 | 100 | 010486 | 100 | Victor 9000               | 10 | 11 | 0111 |
| Patient profiles, G.P profiles, Practice   | 10 | 0000001 | 1000 |                   | 0010 | #1,000            | 00010 | 10 |
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| SOUTH BEDFORDSHIRE                         | records of Chiropody patients throughout | Mr G Fields / Mr K Fletcher        | SOUTHAMPTON SO4 3NB  0703 869922          |
| Chiropody Records System                   | the district. Keyed entry generally only | Kendata Peripherals Limited        | 2 |
| Optical reader system for automatic        | required for entering new patients onto | Nutsey Lane, Totton                 | 5 |
| update of database and preparation of      | system database.                    | 101 | 0101 | 011 | 011186 | 100 | IBM XT                    | 10 | 10 | 0111 |
| KORNER data. Used for the central          | 10 | 0000001 | 0000 | dBASE III         | 0010 | 12 Man Months     | 01000 | 10 |
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| SOUTH BIRMINGHAM                     | Module: Loan of incontinence equipment. | Mr P Edwards                            | Springfields, BIRMINGHAM        |
| Financial Information Project System |                                          | Acting Community Administrator          | 2 |
| District Nursing Module: assessment, |                                          | Community Health Services, S.B.H.A      | 10 |
| activity, claims, and travel.        |                                          | 010 | 1000 | 110 |        | 010 | DEC PDP 11/84                     | 10 | 10 | 1011 |
| Basic Community System. Health Visiting | 01 | 0000001 | 0010 |                             | 0000 |                      | 00010 | 10 |
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| SOUTH BIRMINGHAM                     |                                          | Mrs P Platt                             | Hospital, BIRMINGHAM B15        |
| Child Health System                  |                                          | WMRHA Computer Services                 | 5 |
| Immunisation and Vaccination.        |                                          | Watson Computer Centre, Queen Elizabeth | 2 |
|                                      |                                          | 010 | 0000 | 100 |        | 010 | Hewlett Packard                   | 01 | 10 | 1011 |
|                                      | 01 | 0000001 | 0000 |                             | 0000 |                      | 01000 | 10 |
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| SOUTH BIRMINGHAM                     | retrieval facilities.                    | Mr P Edwards                            |                                 |
| South Western RHA Child Health System |                                         | Acting Community Administrator          | 0 |
| "Front Ends" the National Child Health |                                        |                                         | 10 |
| System giving limited interative access |                                       | 000 | 0101 | 100 | 010488 | 010 | DEC PDP 11/84                   | 00 | 00 | 0000 |
| to data, data capture and information | 01 | 0000001 | 0010 |                           | 0000 |                      | 00010 | 10 |
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| SOUTH CUMBRIA                        |                                          | G.A.A                                   | BARROW                          |
| Standard Child Health System         |                                          | Community Health                        | 0 |
| Vaccination and Immunisation Module  |                                          | Hardy Street                            | 0 |
|                                      |                                          | 000 | 1000 | 100 | 010174 | 011 | ICL 2966                        | 01 | 01 | 1011 |
|                                      |    | 0000001 | 0100 |                            | 0000 |                      | 00000 | 10 |
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| SOUTH EAST KENT                      | exercise by life of equipment. Total    | Mr A S McCord                           |                                 |
| Loan Equipment Service Information Sys. | items of particular types in use. Ident- | Director of Nursing Services        | 0 |
| Record system for all patients using | ifying performance of service by date of | South East Kent Health Authority      | 0 |
| the service. Retrieval system for unused | request/delivery and by use / 1000 pop. | 010 | 0001 | 001 | 010285 | 100 | Sirius Hardware    | 10 | 10 | 0011 |
| equipment in the Community. Cost/Benefit |    | 0000010 | 0001 | DMS Delta Software | 0010 |                | 00100 | 01 |
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| SOUTH EAST STAFFORDSHIRE             |                                          |                                         |                                 |
|                                      |                                          |                                         | 0 |
|                                      |                                          |                                         | 0 |
|                                      |                                          | 000 |      |     |     |     |                                  | 00 |    | 0000 |
|                                      |    |            | 0000 |                            |     |                      |     | 00 |
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| SOUTH GLAMORGAN                      |                                          | Miss S M K Williams, UGM                | CARDIFF  CF1 8UL  372451        |
| MIPP ComCare System                  |                                          | Community Health Services Unit          | 6 |
| Provides KORNER data for community and |                                        | Lansdown Hospital, Carton               | 10 |
| para-medical services. DHSS sponsored |                                         | 001 | 1000 | 111 | 010487 | 010 | ICL DRS 300                     | 10 | 10 | 0001 |
| system.                              | 01 | 0000001 | 0100 |                             | 0000 |                      | 00000 | 10 |
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| SOUTH LINCOLNSHIRE                   | specific report facilities for           | Mr T Brothwell                          | Eastgate, SLEAFORD, Lincolnshire |
| Pre-School System                    | statistical purposes and supplies        | Unit Computer Co-Ordinator              | 1 |
| The system currently records and     | printed information for registrars and   | South Lincs. HA, Community Unit,        | 5 |
| collates data on pre-school children | health visiting staff. KORNER compatible | 111 | 0100 | 100 | 010186 | 100 | Torch T750                    | 10 | 10 | 0111 |
| born on or after 1.1.86. It gives    | 10 | 0000000 | 0000 | Informix           | 0000 | #1,000               | 00100 | 10 |
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| SOUTH SEFTON                            |                                     | Mr P Rothwell                          | Rice Lane, LIVERPOOL  L9                   |
| Para-Medical System                     |                                     | Korner Implementation Officer          |  3 |
| Paramedical departments KORNER data     |                                     | Walton Hospital                        |  0 |
| collection system. The package has been |                                     | 010 | 0100 | 100 | 010486 | 100 | Amstrad PCW 8256                  | 00 | 00 | 0101 |
| developed in house.                     | 10 | 0000000 | 1000 |                | 1000 |                           | 00000 | 01 |
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| SOUTH TEES                              | booster. Package also provides      | B Gowling                              | 813144  Ext.220                            |
| Vaccination and Immunisation System     | statistics for DHSS use.            | West Lane Hospital                     |  1 |
| All new born births registered and this |                                     | MIDDLESBROUGH                          |  0 |
| triggers routine vaccination and        |                                     | 100 | 0010 | 100 | 010168 | 001 | IBM                               | 01 | 01 | 1001 |
| immunisation including pre-school       | 01 | 0000000 | 0000 |                | 0000 |                           | 01000 | 00 |
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| SOUTH TYNESIDE                          |                                     | M Aimley                               |                                            |
| Automated L.A.R.S.P                     |                                     | 091 456 8821                           |  1 |
( Analysis of Grammatical structures for  |                                     |                                        |  0 |
| Speech Therapy Department               |                                     | 001 | 0000 | 100 |        | 100 | Apple 2e                            | 10 | 10 | 0101 |
|                                         | 10 | 1000000 | 1000 |                | 0010 |                           | 00010 | 00 |
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| SOUTH WARWICKSHIRE                      |                                     | Mr. P. Squire, DNO                     | WARWICK, CV34 4PE                          |
| Correlates District Nursing Statistics  |                                     | South Warwickshire Health Authority    |  0 |
| Uses Data which is currently available. |                                     | Westgate House, Market Street,         |  0 |
|                                         |                                     | 010 | 0011 | 010 | 010485 | 100 | Xerox 821                         | 10 | 10 | 0101 |
|                                         |    |         | 1000 |                | 1000 |                           | 10000 | 01 |
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| SOUTH WEST DURHAM                       |                                     | N Warburton                            | BISHOP AUCKLAND  0388 661131               |
| MIPP ComCare System                     |                                     | The Health Centre                      |  0 |
| Community information system to meet    |                                     | Escomb Road                            |  0 |
| KORNER requirements.                    |                                     | 001 | 1000 | 000 |        | 010 | ICL DRS                             | 10 | 10 | 0000 |
|                                         | 00 | 0000000 | 0000 |                | 0000 |                           | 00000 | 00 |
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| SOUTH WEST HERTFORDSHIRE                | comprehensive set of functions for  | Simon Frost (Information Officer)      | Hertfordshire  WD1 8UB                     |
| Financial Information Project System    | Community Nurses.                   | South West Herts H.A                   |  0 |
| The system is essentially an activity   |                                     | 43 Kings Close, WATFORD                |  0 |
| recording system for Health Care        |                                     | 001 | 0100 | 010 | 010687 | 010 | DEC / Plessey                     | 10 | 10 | 0011 |
| Management and Planning. It has a       | 01 | 0000001 | 0010 |                | 0000 |                           | 00000 | 10 |
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| SOUTH WEST SURREY                       | selective medical examination lists | Mrs. M. Baxter                         | Porridge Pot Alley, GUILDFORD, Surrey      |
| Silicon Office                          |                                     | South West Surrey Health Authority     |  0 |
| Program operates a school roll system   |                                     | Millmead Lodge Community Unit          |  0 |
| from which we produce vision testing    |                                     | 100 | 0100 | 100 | 010484 | 100 | Commodore                         | 10 | 10 | 0101 |
| lists, audio, rubella/immunisation and  |    | 1000000 | 0000 |                |      |                           | 00010 | 10 |
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| SOUTHAMPTON                             |                                     |                                        |                                            |
|                                         |                                     |                                        |  0 |
|                                         |                                     |                                        |  0 |
|                                         |                                     | 000 |      |     |        |     |                                     | 00 |    | 0000 |
|                                         |    |         | 0000 |                |      |                           |       | 00 |
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| SOUTHEND                             | established.  It will provide costing  | Mr D Foster                           |                  |
| PACTS / Community Nursing Information| data by patient, diagnosis, case loads | Health Information Officer            | 0 |
| Provides Korner Compatible data on   | and data about referals and treatments | Southend Health Authority             | 0 |
| Community nursing activity in a patient | performed.                          | 010 | 0001 | 001 |   85 | 100 |                         | 11 | 10 | 0101 |
| based format. System is currently being |  | 0000001 | 0001 |               |            | 1000 |                  | 10000 | 10 |
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| SOUTHERN DERBYSHIRE                  | records.                               | Miss P J Newall                       | 0332 363971 Ext.217 |
| Child Health System                  |                                        | 5th Floor, Boden House, Main Centre   | 1 |
| Child Registration. Vaccination and  |                                        | DERBY DE1 2PH                         | 8 |
| Immunisation appointments and records. |                                      | 000 | 1000 | 001 | 011186 | 010 | DEC PDP 11/83               | 10 | 01 | 1011 |
| Pre-school screening appointments and | 10 | 0000001 | 0000 | RPL            |            | 0000 |                  | 00100 | 10 |
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| SOUTHERN DERBYSHIRE                  |                                        | Mr G M Stevenson                      | 0332 363371 Ext.213 |
| Home Loans and Domicilliary Incontinence |                                    | 123 Osmaston Road                     | 0 |
| Stock keeping and delivery scheduling of |                                    | DERBY                                 | 0 |
| home loans and incontinence aids.    |                                        | 100 | 0100 | 001 | 011086 | 100 | HM Mistral                  | 10 | 10 | 0101 |
|                                      | 10 | 0000001 | 1000 |                   |            | 1000 |                  | 00000 | 10 |
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| SOUTHERN HEALTH & SOCIAL SERVICES BOARD |                                     |                                       |                  |
| Systems as for Eastern Health Board. |                                        |                                       | 0 |
| They go forward together as a province. |                                     |                                       | 0 |
|                                      |                                        | 010 | 1001 | 110 | 010185 | 101 | ICL                         | 00 | 01 | 1111 |
|                                      |  | 0000001 | 0100 |                    |            | 0001 |                  | 00010 | 10 |
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| SOUTHMEAD                            |                                        |                                       |                  |
|                                      |                                        |                                       | 0 |
|                                      |                                        |                                       | 0 |
|                                      |                                        | 000 |     |     |     |     |                                    | 00 |    | 0000 |
|                                      |  |      | 0000 |                        |            |     |                  |     | 00 |
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| SOUTHPORT AND FORMBY                 |                                        |                                       |                  |
| MIPP ComCare System                  |                                        |                                       | 0 |
| Community Nursing and Para-Medical   |                                        |                                       | 3 |
| Records System for KORNER.           |                                        | 000 | 1000 | 001 | 010187 | 100 | ICL DRS 150                 | 10 | 01 | 1111 |
|                                      | 10 | 0000001 | 0100 |                   |            | 0001 |                  | 00001 | 00 |
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| ST HELENS AND KNOWSLEY               |                                        |                                       |                  |
|                                      |                                        |                                       | 0 |
|                                      |                                        |                                       | 0 |
|                                      |                                        |     |     |     |     |     |                                    |    |    |    |
|                                      |  |      |     |                          |            |     |                  |     |     |
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| STOCKPORT                            |                                        |                                       |                  |
|                                      |                                        |                                       | 0 |
|                                      |                                        |                                       | 0 |
|                                      |                                        |     |     |     |     |     |                                    |    |    |    |
|                                      |  |      |     |                          |            |     |                  |     |     |
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| SWINDON                               | (not related directly to disease)       | Mrs P Stephenson, DNS                         |                      |
| Community Nursing System              |                                         | Community Services, Empire House          | 0 |                      |
| Analysis of Workload of community     |                                         | SWINDON                                   | 0 |                      |
| nurses - identification of disease    |                                         | 010 | 0100 | 100 | 010183 | 101 | Hytec Micro            | 10 | 10 | 0101 |
| classification and time spent         |     | 0000000 | 1000 |                  |                  | 1000 |                | 00010 | 01 |
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| TAMESIDE AND GLOSSOP                  |                                         | Miss J Boulter District Physiotherapist | 061 320 7000             |
| Physiotherapy Contact System          |                                         | Ann Street Health Centre                  | 4 |                      |
| Produced by Astech Ltd in Manchester  |                                         | Ann Street  DENTON                        | 5 |                      |
|                                       |                                         | 100 | 0100 | 110 | 010486 | 100 | Motorola 6350          | 10 | 10 | 1111 |
|                                       | 10 | 0000001 | 1000 | dBASE INFORMIX                   | 0000 | 36 Man Months  | 00010 | 10 |
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| TAYSIDE HEALTH BOARD                  |                                         |                                           |                          |
|                                       |                                         |                                           | 0 |                      |
|                                       |                                         |                                           | 0 |                      |
|                                       |                                         |     |      |     |        |     |                       |    |    |      |
|                                       |     |         |      |                                     |      |                |       |    |
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| TORBAY                                |                                         |                                           |                          |
| National Child Health System          |                                         |                                           | 0 |                      |
| Birth Notifications Module,           |                                         |                                           | 0 |                      |
| Vaccination and Immunisation Module,  |                                         | 100 | 1000 | 100 |        | 001 |                             | 00 | 01 | 1011 |
| Hearing Assessment Modules are used.  |     | 0000001 | 0100 |                                     |      |                |       | 10 |
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| TOWER HAMLETS                         | Returns.                                | Antony Morgan                             | 01 377 7947              |
| Community Health Service Returns      |                                         | 97-99 Bow Road                            | 0 |                      |
| Under development. System hoped to    |                                         | LONDON  E3                                | 0 |                      |
| computerise existing manual returns for |                                       | 000 | 0000 | 000 |        | 100 | Minstrel IV                 | 10 | 10 | 0111 |
| Community Health Service Statutory    | 00 | 0000000 | 0000 | DataFlex                           | 0010 |                | 00000 | 00 |
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| TRAFFORD                              |                                         |                                           |                          |
|                                       |                                         |                                           | 0 |                      |
|                                       |                                         |                                           | 0 |                      |
|                                       |                                         | 000 |      |     |        |     |                       | 00 |    | 0000 |
|                                       |     |         | 0000 |                                     |      |                |       | 00 |
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| WAKEFIELD                             |                                         |                                           |                          |
| National Child Health System          |                                         |                                           | 0 |                      |
| Vaccination and Immunisation Module   |                                         |                                           | 0 |                      |
| Runs on Regional Mainframe            |                                         | 100 | 1000 | 100 |        | 001 |                             | 00 | 01 | 1011 |
|                                       |     | 0000001 | 0100 |                                     |      |                |       | 10 |
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| WALSALL                               |                                         | D Harrison                                |                          |
| Financial Information Project System  |                                         | WALSALL 38255                             | 0 |                      |
| Community nursing and health visitor  |                                         |                                           | 8 |                      |
| records are maintained and a home loans |                                       | 000 | 1000 | 100 | 010187 | 010 | DEC                         | 01 | 01 | 1011 |
| system.                               | 01 | 0000001 | 0010 |                                   | 0000 |                | 00010 | 10 |
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| WALSALL                               | historical records and current data     | Mrs E Langford                          |                              |
| Standard Child Health System          | and statistics                          | Child Health Department          | 0 |
| Includes child register, vaccination &|                                         | Lichfield House                  | 0 |
| immunisation and pre-school module.   |                                         | 010 | 1000 | 110 | 010179 | 011 | Ontel Computer and ICL Mainframe   | 10 | 10 | 1011 |
| Produces clinic lists, appointments,  |    | 0000001 | 1100 |                  | 0010 |                              | 00010 | 01 |
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| WALSALL                               |                                         | Mrs E Langford                          |                              |
| Cervical Cytology Recall System       |                                         | Child Health Department          | 0 |
| Produces clinic lists, appointments,  |                                         | Lichfield House                  | 0 |
| historical records and current data   |                                         | 010 | 1000 | 100 | 010179 | 011 | Ontel Computer and ICL mainframe   | 10 | 10 | 0100 |
| and statistics                        |    | 0000000 | 1100 |                  | 0010 |                              | 00010 | 01 |
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| WALTHAM FOREST                        |                                         |                                  |                                     |
|                                       |                                         |                                  | 0 |
|                                       |                                         |                                  | 0 |
|                                       |                                         | 000 |     |     |     |     |                              | 00 |     | 0000 |
|                                       |    |         | 0000 |                   |     |                        |     | 00 |
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| WANDSWORTH                            |                                         | Miss H Stapleton                 | St. Georges Hospital                 |
| District Nursing Allocation           |                                         | Information Manager              | 1 |
| Allocation of District Nurses to      |                                         | Clare House                      | 2 |
| patients on evening service.          |                                         | 011 | 0100 | 100 | 010184 | 100 | Commodore 8096                     | 01 | 10 | 0101 |
|                                       | 10 | 0010000 | 0000 | Silicon Office   | 0000 |                              | 10000 | 01 |
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| WANDSWORTH                            |                                         | Miss H Stapleton                 | St. Georges Hospital                 |
| Child Health System                   |                                         | Information Manager              | 4 |
| Birth notification, child registration, |                                       | Clare House                      | 0 |
| vaccination and immunisation and school |                                       | 010 | 0001 | 110 | 010185 | 010 | DEC VAX 11/785                     | 01 | 01 | 1011 |
| health records are maintained.        | 10 | 0000001 | 0010 |                  | 0000 |                              | 01000 | 10 |
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| WANDSWORTH                            |                                         | Miss H Stapleton                 | St. Georges Hospital                 |
| Cervical Cytology Recall              |                                         | Information Manager              | 0 |
| Cytology recall system.               |                                         | Clare House                      | 2 |
|                                       |                                         | 001 | 0100 | 100 | 010186 | 100 | Olivetti M24                       | 10 | 10 | 0111 |
|                                       | 10 | 0000010 | 0000 |                  | 0010 |                              | 00100 | 00 |
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| WARRINGTON                            | returns for Community Dental Services,  | E K Adams  District Dental Officer | 0925 51188  Ext.211               |
| Survey Plus                           | and Epidemiological surveys.            | Garven Place Clinic              | 1 |
| A suite of programs for the editing,  |                                         | Warrington H.A.                  | 5 |
| cross tabulation and statistical      |                                         | 001 | 0100 | 100 | 010185 | 100 | CBM 8296                           | 10 | 10 | 0100 |
| analysis of data used for annual/monthly | 10 | 0010000 | 1000 |             | 0010 | #540                         | 00010 | 01 |
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| WARRINGTON                            | immunisation master file.               | E. J. Lightfoot                  | WARRINGTON                           |
| Vaccination and Immunisation          | Appointment scheduling is carried out   | Borough Treasurers Department    | 0 |
| The system processes details of births | and follow up treatments arranged for  | Warrington Borough Council       | 0 |
| to produce a birth register which is  | non-attenders.                          | 100 | 0000 | 100 |    73 | 001 | ICL 2958                           | 01 | 01 | 1011 |
| then used to compile a vaccination and |    | 0000001 | 0100 |                 |     |                              | 00010 | 01 |
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WEST BERKSHIRE DHSS Stats for HVs, DNs, School Nurses Child Health Clinics and Enuresis The system collects and Produces Statistics.	0001100 | 0001	Mr J Long, Deputy Administrator 25 Erleigh Road READING, Berks. 100 | 0100 | 100 | 100 | ACT Sirius 0010	0 0 00010 | 00	10 | 10 | 0111
WEST BERKSHIRE Entrance School Health Medicals Produces Lists and Letters.	0001100 | 0001	Mr J Long, Deputy Unit Administrator 25 Erleigh Road READING, Berks. 100 | 0100 | 100 | 100 | ACT Sirius 0010	0 0 00010 | 00	10 | 10 | 0111
WEST BERKSHIRE Patient / Client Data Base Holds basic data on a group of patients in the Community Service. Not yet up and running, but is at more	than the idea stage, e.g., appointments, recalls, age reviews etc. 0001	G. Hunt Wokingham Unit 010 | 0001 | 010 | 1285 | 100 | Sirius 0010	0 0 10000 | 00	10 | 10 | 0111
WEST BIRMINGHAM Financial Information Project System		J J Flynn Project Leader Community Project 12th Floor Alpha Tower, Suffolk Street	Queensway, BIRMINGHAM B1 2JP 0 0	
WEST BIRMINGHAM Child Health System Imm and Vacc. Schedules and prints appointments at appropriate times for i/v of children. Produces primary	cards for health visitors and consent cards for parents signature 0000001 | 0100	Mrs. J Asheton Wolfson Centre West Midlands Regional Health Authority 010 | 0001 | 110 | 001 | Hewlett packard 3000	Queen Elizabeth Medical Centre 0 0 00000 | 10	01 | 01 | 1111
WEST CUMBRIA MIPP ComCare System Contemplating the purchase of a DRS 300 which will implement KORNER, utilising the ComCare software.			0 0	
WEST DORSET Standard Child Health System Birth Registration Module Immunisation and Vaccination Module Pre-School Developmental Examinations	School Health Examinations Statistics Module 0000001 | 0100	Mr. D.J. Ackroyd, Medical Applications, Wessex RHA, Computer Centre Annexe, Kings Walk, Silver Hill 010 | 0100 | 100 | 76 | 001 | ICL 2966	WINCHESTER 0 0 00100 | 10	01 | 01 | 1011
WEST DORSET Community Nursing Workload Statistics Input of Community Nursing Statistics on Patient Visits, Allocation of Time on a District Microcomputer, transmission	of that data via telephone line to central mainframe, collected on a yearly file for Standard or Ad Hoc Analysis Reports. 0000001 | 1100	Mr. Les Bishop, Medical Applications The Computer Centre Annexe Kings Walk, Silverhill, 010 | 0100 | 110 | 010484 | 101 | Hytec ECS 4500 Micro, ICL 2966 Main 1000	WINCHESTER 0 0 00001 | 01	00 | 11 | 1111

<table>
<tr><td>WEST ESSEX
National Child Health Computer System
Sets up main register of all children
born within the health authority area.
Schedules relevant children for a</td><td>primary course of appointments and
flags non-attenders

| 0000001 | 1100 |</td><td>Mr S O'Brien, Regional Computer Centre
Harold Wood Hospital

000 | 0000 | 100 | 010484 | 101 |
| 1000 |</td><td>
0 |
0 |

| | 01 |</td><td>

| 10 | 10 | 1011 |</td></tr>
<tr><td>WEST GLAMORGAN
Cervical Cytology Recall System
Minicomputer system: Records the
results of the smear tests notified by
the Path Lab, and changes in patient</td><td>personal details notified by GP's
and/or by reference to FPC records.
Generates recall schedules by date band.
Microcomputer system: Letters for recall
01 | 0000000 | 0100 |</td><td>Mr C R Gardner
Computer Services Officer
West Glamorgan Health Authority
010 | 0010 | 000 | 010885 | 110 | ME29 and Torch System
| 1000 | 12 Man Months</td><td>0792 42066 Ext.249
0 |
0 |

| 01000 | 10 |</td><td>

| 01 | 01 | 0111 |</td></tr>
<tr><td>WEST GLAMORGAN
Child Health Data Capture
Adaption of Generalised Data Capture
package for use on West Glamorgan ME29
to front end the Standard Child Health</td><td>System running on regional mainframe
at WHTSO, Cardiff

| 0000001 | 0100 |</td><td>Mr J McTaggert, WHTSO

000 | 0000 | 000 | | 011 | ICL ME29
| 0000 |</td><td>
0 |
0 |

| 00000 | 00 |</td><td>

| 00 | 00 | 0011 |</td></tr>
<tr><td>WEST LAMBETH
SMART
Integrated system of Word Processing /
Data Manager / Spreadsheet / Time
Manager / Communications. Project</td><td>currently being carried out to enable
the system to produce monthly
statistical returns for Community Care
Centre.
10 | 0000001 | 0000 |</td><td>Linda Jarrett
Lambeth Community Care Centre
Monkton Street, LONDON SE11 4TX
001 | 0010 | 010 | 011286 | 100 | Olivetti M24
| 0010 | #900 for 4 Days</td><td>01 582 5513
1 |
0 |

| 00110 | 01 |</td><td>

| 10 | 10 | 0111 |</td></tr>
<tr><td>WEST LANCASHIRE</td><td>

| | |</td><td>

| | | | |
| |</td><td>
0 |
0 |

| | |</td><td>

| | | |</td></tr>
<tr><td>WEST NORFOLK AND WISBECH
Korner Data Collection
Collection of minimum data set for
KORNER plus some additional information
requested by the Speech Therapy and</td><td>Chiropody departments.

01 | 0001000 | 1000 |</td><td>Mr I Parkinson
Planning Dept. Stanley House
Littleport Street, KINGS LYNN
010 | 0010 | 001 | 010487 | 100 | BBC
| 0000 | 6 Man Months</td><td>Norfolk PE30 1PP 0553 773951
2 |
2 |

| 00001 | 10 |</td><td>

| 10 | 01 | 0111 |</td></tr>
<tr><td>WEST SUFFOLK
Community Child Health System
Aids administration of ad-hoc survey's
etc. Test bed for KORNER.</td><td>

10 | 0000000 | 0001 | WordStar</td><td>Mr M R Bone
Child Health Administration Officer
Child Health Dept.,Community Health Unit
010 | 0100 | 111 | | 100 | Comart CP2545
| 1000 |</td><td>36 Mill Road, BURY-ST-EDMUNDS, Suffolk
1 |
3 |

| 00010 | 10 |</td><td>

| 10 | 10 | 1111 |</td></tr>
<tr><td>WEST SUFFOLK
Child Health System Data Capture
Names and details of children being
admitted or withdrawn from schools, are
entered and then transmitted to the</td><td>School Health Module of the Child Health
System.

00 | 0010000 | 0001 |</td><td>Mr M R Bone
Child Health Administration Officer
Child Health Dept.,Community Health Unit
010 | 0100 | 100 | | 100 | Comart CP2545
| 1000 | 2 Man Months</td><td>36 Mill Road, BURY-ST-EDMUNDS, Suffolk
1 |
2 |

| 01000 | 01 |</td><td>

| 10 | 10 | 1111 |</td></tr>
</table>

WEST SUFFOLK Observation Register Stores details including medical data & levels of handicap of children. Provides statutory and optional review dates	facility and schedules them for HV or CMO visits. All coded conditions using ICD 9. Full screen display and print. 00 | 0000001 | 0001 |	Mr M R Bone Child Health Administration Officer Child Health Dept.,Community Health Unit 010 | 0100 | 100 | | 100 | Comart CP2545 | 1000 |	36 Mill Road, BURY-ST-EDMUNDS, Suffolk | 1 | 2 | | 10 | 10 | 1111 | | 00010 | 10 |
WEST SUFFOLK Audiology System (Pre-School) Recalls names and details of children requiring Audiology. Prints labels for appointment letters. Prints appointment	letter. 00 | 0000001 | 0001 | Wordstar	Mr M R Bone Child Health Administration Officer Child Health Dept.,Community Health Unit 010 | 0100 | 100 | | 100 | Comart CP2545 | 1000 | 3 Man Months	36 Mill Road, BURY-ST-EDMUNDS, Suffolk | 1 | 2 | | 10 | 10 | 1111 | | 00100 | 10 |
WEST SUFFOLK On-Line Information System Screen display of Community addresses of all the DHA's in UK. Also all local schools, GP's, HV's, Health and Clinical	offices and often used addresses and telephone numbers. Sticky labels for all also available. 00 | 0000001 | 0001 |	Mr M R Bone Child Health Administration Officer Child Health Dept.,Community Health Unit 010 | 0100 | 100 | | 100 | Comart CP2545 | 1000 | 1 Man Month	36 Mill Road, BURY-ST-EDMUNDS, Suffolk | 0 | 2 | | 10 | 10 | 1111 | | 01000 | 10 |
WEST SURREY AND NORTH EAST HAMPSHIRE Chiropody Lists Appointments, Recalls and has Special Features	| 0000000 | 1000 |	Gill Smith Community Services Office Primley Childrens Centre, Church Road 000 | 0000 | 000 | | 100 | Commodore PET | 0000 |	Primley, CAMBERLEY, Surrey | 0 | 0 | | 10 | 10 | 0101 | | 00010 | 01 |
WEST SURREY AND NORTH EAST HAMPSHIRE Handicapped Children Lists by Various Categories are available such as a list by age and lists according to aids required.	| 0000000 | 1000 |	Gill Smith Community Services Office Primley Childrens Centre, Church Road 000 | 0000 | 000 | 010685 | Com | Commodore PET | 0000 |	Primley, CAMBERLEY, Surrey | 0 | 0 | | 10 | 10 | 0101 | | 00010 | 01 |
WEST SURREY AND NORTH EAST HAMPSHIRE Audiology Lists and Appointments can be Produced	| 0000000 | 1000 |	Gill Smith Community Services Office Primley Childrens Centre, Church Road 000 | 0000 | 000 | | 100 | Commodore PET | 0000 |	Primley, CAMBERLEY, Surrey | 0 | 0 | | 10 | 10 | 0101 | | 00010 | 01 |
WESTERN HEALTH AND SOCIAL SERVICES BOARD Birth Notification and Child Health	| 0000000 | 0000 |	000 | | | | 001 | | |	0 | 0 | | 00 | | 0000 | | | 00 |
WIGAN National Standard Child Health System	| | |	| | | | | | | |	0 | 0 | | | | | | | |

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| WINCHESTER                           | put out in October 1984, for completion |                                          |                                        |
| Community Care Information System    | of work by October 1985 and             |                                          | 0 |                                    |
| Under the Regional System Plan,      | implementation by Spring 1986           |                                          | 0 |                                    |
| Winchester is the core module for this |                                       | 000 |      | 010 |        |    |                                | 00 |    | 0000 |
| system.  Tenders for investigation were |  |       | 0000 |                          |    |                          |      | 00 |
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| WIRRAL                               | children 0-5 years at certain key ages  | Mr. D. Jones                             | PO Box 41, Lightfoot St., CHESTER      |
| Cheshire Child Health Computer System | together with further recalls as       | Senior Administrative Assistant          | 0 |
| Birth Notification, Paediatrics -    | necessary.  Immunisation - Diptheria,   | Computer Preperation Section, Chester HA | 0 |
| Appointment, Recall and Recording System | Tetanus, Pertussis and Polio, & measles. | 010 | 0010 | 100 |     | 001 | IBM 3031     | 01 | 01 | 1011 |
| Developmental examination of pre-school |  | 0000000 | 0000 |                     |    |                          | 00010 | 01 |
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| WOLVERHAMPTON                        |                                         | Management Services Division             | BIRMINGHAM                             |
| Cervical Cytology Recall System      |                                         | Techno House, 326 High Street            | 1 |
| Recalls women for Cytology tests on 3 |                                        | Harborne                                 | 0 |
| year recall. Highlights abnormal tests |                                       | 010 | 0000 | 100 |      | 100 | ICL DRS 20                          | 10 | 10 | 0010 |
| and gives some statistical output.   | 01 | 0000000 | 0100 |                    | 0100 |                          | 00100 | 10 |
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| WOLVERHAMPTON                        | Individual files are set up to amend,   | Mr David Morgan                          | DUDLEY, West Midlands                  |
| Label Printing Facility              | add, delete and print a batch of labels. | Management Services Division            | 1 |
| Programme written for use on ICL DRS |                                         | WMRHA, Falcon House                      | 0 |
| computers to produce labels for      |                                         | 010 | 0010 | 100 | 010486 | 100 | ICL DRS 20                        | 10 | 10 | 0011 |
| secretarial and administrative use.  | 10 | 0000000 | 1000 |                    | 1000 |                          | 10000 | 01 |
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| WOLVERHAMPTON                        |                                         | Miss J Y Webb, Training Officer          | West Midlands                          |
| Word Processing Systems (DTM)        |                                         | Management Services Division             | 1 |
| Word processing package used to produce |                                      | Falcon House, DUDLEY                     | 0 |
| forms, documents and lists etc. Used by |                                      | 001 | 0100 | 100 | 010985 | 100 | ICL DRS 20                        | 01 | 10 | 0011 |
| secretarial and administative staff. | 10 | 0000000 | 1000 |                    | 1000 |                          | 00001 | 00 |
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| WOLVERHAMPTON                        |                                         | Dr J M Morfitt                           | George House, St Johns Square          |
| Handicap Register                    |                                         | Specialist in Community Medicine         | 1 |
| Database to store information about  |                                         | Community Health Services                | 0 |
| handicapped children and permits     |                                         | 001 | 0000 | 100 |      | 100 | Commodore                            | 01 | 01 | 0101 |
| analysis to be carried out.          | 01 | 0001000 | 1000 |                    | 0000 |                          | 00100 | 10 |
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| WOLVERHAMPTON                        | in the community.                       | Financial Information Project            | BIRMINGHAM B1 2JP                      |
| Financial Information Project System |                                         | 11th Floor, Alpha Tower                  | 0 |
| To provide systems for Health Care   |                                         | Suffolk Street Queensway                 | 0 |
| Management and Planning and offers   |                                         | 100 | 1000 | 010 | 010687 | 100 | DEC                               | 00 | 00 | 0011 |
| computerised information systems for use | 10 | 0000001 | 0010 |                | 0000 |                          | 00000 | 10 |
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| WORCESTER                            | KORNER and management budgeting         | J M Keetch                               | 353507 Ext.31337                       |
| Community Activity System            | requirments.                            | Worcester & District Health Authority    | 0 |
| The system collects and analyses data of |                                     | Shrub Hill Road, WORCESTER               | 3 |
| all Community Nursing and Paramedical |                                        | 100 | 1000 | 100 | 011085 | 100 | IBM PC                            | 10 | 01 | 1111 |
| staff. The main applications are in both | 10 | 0000001 | 0000 | Sculptor (4GL) | 0010 | #132,000           | 01000 | 10 |
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WORCESTER Standard Child Health System Vaccination and Immunisation in Operation, Pre-School Module is to be implemented by June 1985.	0000001 | 0100	Mrs. J. Stephens Child Health, Loves Lane, Castle Street WORCESTER 000 | 1000 | 110 | 010184 | 001 0000	0 0	00000 | 10	00 | 01 | 1011
WORTHING Analysis of Community Nursing Statistics	0010000 | 0000 | Silicon Office	Miss J Oram, Nursing Officer c/o 129 Brighton Road WORTHING 010 | 0001 | 010 | 010485 | 100 | DEC Rainbow 100 0010	Sussex 0 0	10000 | 00	01 | 10 | 0111
WYCOMBE			0 0		
YORK			0 0		

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