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HOSPITAL INFORMATION SYSTEMS :

A Nursing Viewpoint.

A thesis presented in partial fulfilment
of the requirements for the degree of Master of Arts
in Nursing Studies at Massey University.

JANICE WENN

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ABSTRACT

This thesis is concerned with hospital information systems. The literature relating to management information systems is examined in conjunction with the literature which specifically focuses upon hospital and nursing information systems.

A field study, using a case study approach, is designed and implemented, its purpose being to analyse five sub-systems of a current hospital information system in use in one Hospital Board. This field study utilises a basic systems analysis methodology focusing upon the problem identification and performance identifications of the analysis cycle.

In the problem identification phase forty-two subjects are interviewed, (83.3% of the sample being nurses in management positions). Check lists designed to test the sub-systems abilities to generate, store, retrieve and utilise data, and test the subjects knowledge of the sub-systems are devised and applied. The data obtained from the application of check lists is analysed and data flow charts and in-depth interview schedules developed for use in phase two or the performance identification phase of the field study.

In phase two (performance identification) eleven subjects in administrative positions within the Hospital Board

are interviewed using the data flow charts and the in-depth interview schedules as tools for eliciting data.

Contrary to the author's expectations the field study results reveal a considerable diversity. In phase one the respondents possessed a sound knowledge of the admission/discharge, patient care and nursing management sub-systems. 85,7% of the nurse respondents have knowledge of the patient care sub-system and a further 79.2% have some knowledge of its ability to generate, store, retrieve and utilise information. In common with the administrators the high level of knowledge of retrieval and utilisation (89.2%) would indicate frequent use of the system. By contrast only 5.4% of the respondents in phase one had knowledge of retrieval and utilisation of the staffing information sub-system as compared with 100% in the administrators group. This same pattern emerges for the financial sub-system with 13.5% of the respondents having knowledge of retrieval and 18.9% of utilisation of the sub-system compared with 81.8% of administrators.

These results indicate to the author that information systems development tends to be associated with each health discipline rather than with the macro development of a relevant, comprehensive hospital information system. To this end a series of questions are raised and possible answers provided. Finally a model which

could become a prescription for future development
is presented.

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GLOSSARY

- CASE STUDY A detailed, factual, largely narrative description and analysis of an existing system.
- CLUSTER ANALYSIS A technique for determining clusters. It is analogous to the technique of factor analysis.
- COMPUTER A piece of electronic equipment that: performs large numbers of mathematical calculations at high speed; operates under the command of a set of changeable instructions called programmes; stores both programmes and data in electronic and electromagnetic devices called memories.
- CONSTRAINTS The boundaries or limitations, rules and regulations, legal and organizational, that affect a particular operation.
- CORRELATION ANALYSIS An analysis of the significant relationships occurring between stated criteria.
- CYBERNETIC MODEL A model or depiction of the 'real world' which incorporates a control and/or feedback mechanism.
- DATA A general term used to denote any or all facts, numbers, letters, symbols that refer to or describe an object, idea, condition, situation, or other factors e.g. time delineation.

DATA-FLOW
CHART

A graphic depiction of the flow of data through a system or sub-system.

EQUITABLE
HOSPITAL BOARD
FUNDING

A population based formula which provides equitable funding for Hospital Boards. This formula was adopted on April 1 1983. It is a descriptive model possessing a considerable number of variables.

FREQUENCY
DISTRIBUTION

A grouping of data collected in a study that indicates the number of study subjects possessing the different values of the scale of the variable measured.

G R A S P

An H I S specifically designed in 1976 by the Greater Vancouver Regional Hospitals Management Engineering Unit to investigate the feasibility of patient classification.

HARDWARE

The electric, electronic and mechanical equipment used for processing data, consisting of cabinets, racks, tubes, transistors, wires, notes etc. Terminals used for on-line patient registration are examples of hardware.

HOSPITAL
INFORMATION
SYSTEM

H I S : An Information system designed specifically for use in the hospital health care system.

INFOLOGICAL

Pertaining specifically to the generation of information.

| | |
|---|---|
| INFORMATION | Data which has been specifically ordered and interpreted. An increased level of knowledge derived from processing data. |
| INFORMATION SYSTEM | An open system specifically designed to create, collect, store, process, distribute and interpret data so as to produce relevant information for the purpose of assisting in the decision making, problem solving and evaluating the management processes within organizations. |
| INFORMATION SYSTEMS : ANALYSIS OF CHANGES | I S A C : An analysis methodology based on the needs, problems and ideas experienced by users of manual routines and computer programmes. Devised by Lundeberg et al 1978. |
| INFORMATION THEORY | A process of defining information. A sub-set of decision theory. It is based on the determination of the value of perfect information. |
| INPUT DEVICES | Devices primarily responsible for making information available to the system, transferring and retrieving data. |
| INTERFACE | Electronic components that allow for two different devices or systems to communicate. |
| MANAGEMENT INFORMATION SYSTEM | M I S : An information system designed specifically for a management function: A data base bearing all relevant data relating to the resources deployed by |

an organization; a set of systems enabling the resources and their use to be costed and to produce financial information; a set of systems permitting the management of the resources in quantitative but non financial terms, including the measurement of outputs; a set of management models to aid planning and decision making.

MICROCOMPUTER A small, limited capability, relatively slower than a mini, low cost computer made up of a microprocessor and memory and input/output devices.

MINICOMPUTER A small low priced computer which has the same components as a full sized system and can be programmed to perform the tasks of larger computers.

NURSES
QUALIFICATIONS These are explained in the Nurses Act 1977.

| | |
|----------|-------------------------------|
| R.N. | Registered Nurse |
| R.G.O.N. | " General and Obstetric Nurse |
| R.Cp.N. | " Comprehensive Nurse |
| R.Pd.N. | " Psychopaedic Nurse |
| R.P.N. | " Psychiatric Nurse |

Other qualifications -

| | |
|----------------|--|
| Dip.N.(SANS) | Diploma of Nursing from the New Zealand School of Advanced Nursing Studies. Phased out 1978. |
| Dip.N.(Massey) | Diploma of Nursing. Massey University. |
| Adv.Dip. | Advanced Diploma. Obtained at a Technical Institute. |

NURSING AUDIT A logical system of measuring whether Nursing Standards are being achieved. A measurement tool.

NURSING
INFORMATION
SYSTEM

N I S : An information system designed to include those parts of an H I S which are oriented specifically to nursing.

NURSING
STANDARDS

A criterion, a level or degree of quality considered proper and adequate for a specific purpose. A model or example established by authority, custom or consent. A value against which to measure nursing care.

ON LINE

Descriptive of a system and peripheral equipment in a system in which the operation of such equipment is under control of a central processing unit.

ORGANIZATION
CHART

A graphic depiction of functions performed within an organization. Through vertical and horizontal lines it demonstrates the authority and responsibility relationship of workers and administrators. Depicts line and staff relationships and identifies the titles of jobs in accordance with job descriptions.

PLANNING

The process of making decisions in the present to bring about an outcome in the future. The determining of proper goals and the means of achieving them.

PROBLEM ORIENTED
MEDICAL
INFORMATION
SYSTEM

A comprehensive patient care system utilizing a problem oriented approach. The system has the ability to integrate data to enable it to be utilized for

planning purposes. It is designed to help solve four major problems: Lack of co-ordination of data; failure to record logically; dependence upon human memory; lack of meaningful feedback. It provides general patient information, has flexibility, streamlines input, validates and provides scheduled reports.

RELIABILITY

A criterion for assessing the quality of data. Data are reliable if they are consistent, accurate and precise.

own

STAND-ALONE SYSTEM

A part of a total system capable of functioning autonomously.

SUB=SYSTEM

A complete component of a total system. Capable of being analysed as a system.

SYSTEMS ANALYSIS

A scientific method of problem solving. A process that can be used to examine an activity, procedure, method, technique or business. It utilizes a structured order to determine what must be accomplished to achieve change, select the best method for achieving a goal, and provide direction and evaluation for implementing change or introducing new methods.

THE HOSPITALS ACT 1957 - SECTION 62

That section of the Act which refers to non disclosure of medical information.

Chapter 1

AN INTRODUCTION TO INFORMATION SYSTEMS

This thesis examines the extent to which nurses and other health administrators are aware of, and make use of management information. It is the author's intention to do this by undertaking:

1. a literature search focusing on the general aspects of management information systems and their development;
2. a literature search relating to the application of the concept of management information systems to the hospital health care system and specifically to nursing services;
3. a descriptive study relating to the generation, collection, retrieval and use of information associated with a hospital board health care service in general and nursing services in particular;
4. the induction of one or more data flow models for information systems;
5. the application of these models to existing systems to provide for the development of a more relevant and comprehensive hospital board information system.

A DEFINITION OF INFORMATION

The Oxford Dictionary defines information as knowledge or items of knowledge. In today's world this definition conveys little meaning and for the purpose of this thesis information will be defined as follows:

Information - an increased level of knowledge derived from processing data. Information can be derived only to the extent that the data are accurate, timely, unexpected and relevant to the subject under consideration.

Waters & Murphy, 1983 (p.412)

Sanders (1974) supports this view, making the distinction that data must be ordered to become information and it should provide new knowledge or add to existing knowledge. The author accepts this but views ordering as only part of the process and adds to it by stating that data must also be interpreted. It is the act of interpretation which translates data into information. Without including the act of interpretation in the process, data can only be regarded as unevaluated messages and therefore as information in a very restricted or limiting sense.

The process of translating data into information is planned to meet the information needs of individuals and the institutions they are associated with. Information can be as simple or as complex as the users' wish. It is they that set the parameters for the process from generation of data through to its

interpretation.

For the purpose of this thesis information is regarded as data which has been collected, stored, retrieved and interpreted for a specifically defined use. The complex process of translating data into information theory and management information systems development.

INFORMATION THEORY

According to the Report of the Committee on Management Information Systems (1971)

The purpose of information — is to reduce the uncertainty as to the outcome that will result from each action — . Obviously, the best any information could do would be to completely eliminate the uncertainty and, thus, permit the decision maker to predict, with certainty, the state that would occur.

(p.302)

Information theory is concerned with the process of defining information in order to proceed from a state of uncertainty to a state of certainty.

Patston (1978) makes the point that:

the theory of information is based on the determination of the value of perfect information.

(p.13)

Miller (1953) believes that information, organisation and predictability are all related. This thinking leads into the costing of information. Scott (1967) and Patston (1978) concur that the price paid for greater organisation is the cost of the information necessary to introduce more order or certainty into a system.

Shannon & Weaver (1949) believe:

that the amount of information in a system is related to what you can say about the system, rather than what you do say.

(p.100)

It follows that the more you can say about a system the more disorganised it is. If a system is well organised it is predictable. This has particular relevance for health care and the development of hospital board information services in an environment of economic constraint. The Committee on Management Information Systems (1971) states in its report that:

the expected value of perfect information places an upper limit on the value of any information. If the value of perfect information is not sufficient to justify an expenditure for the additional information being considered, there is no point in obtaining it.

(p.302)

Since the development of information systems is subject to organisational constraints, the importance of defining relevant information cannot be ignored. Technology and an environment emphasising economic constraint makes it imperative that administrators are aware of, and have access to information. To be effective it is essential that this group have an understanding of information processing and its theoretical basis.

INFORMATION SYSTEMS

Information systems have their basis in General Systems Theory as presented by Bertalanffy in 1951. Boulding (1962) describes Bertalanffy's theory as:

a level of theoretical model building which lies somewhere between the highly generalised constructions of pure mathematics and the specific theories of the specialised disciplines.

(p.7)

Bouldings' development of general systems theory represents one attempt to produce order in the overall approach to science. His aim was to identify a hierarchy of theoretical levels of complexity for which models could be structured. The initial level relates to static structures or frameworks and moves on to simple dynamic structures with predetermined processes. The third level introduces a control or cybernetic mechanism which provides for the transmission and interpretation of information as an essential part of the system. It is at this level that this author sees the relevance for information systems development and this system is depicted in Figure 1.1.

Boulding constructed five further levels of theoretical development that become more intricate and which have little relevance to this thesis.

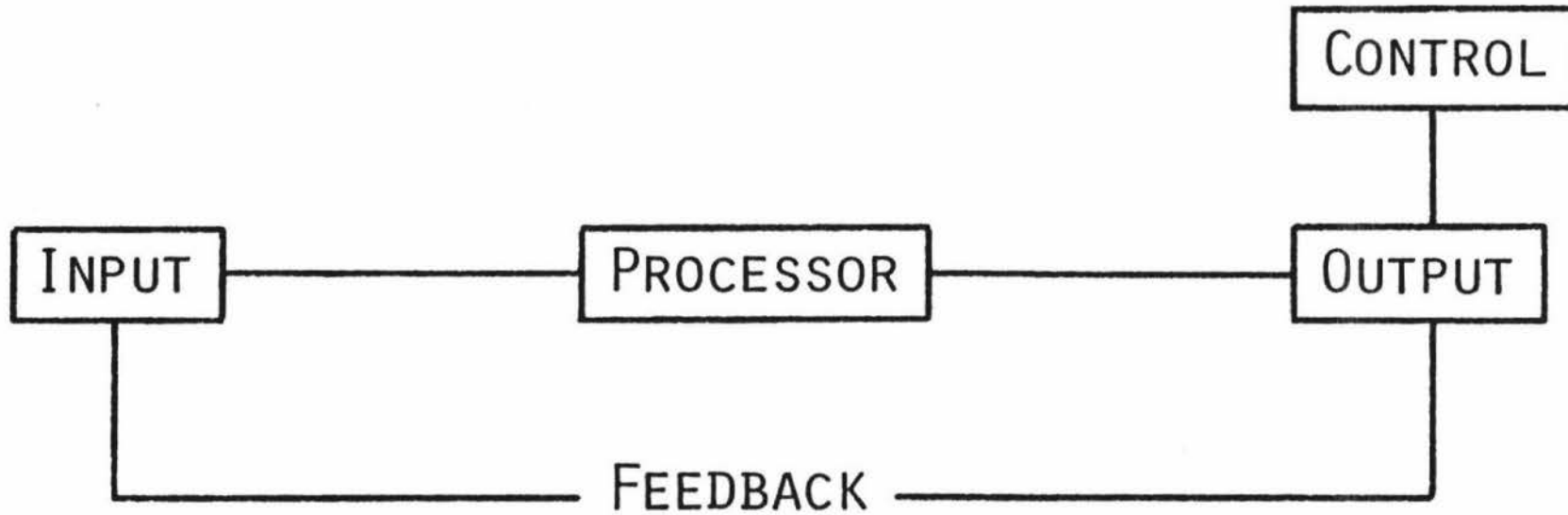


Fig. 1.1 Basic Systems Model for Information Systems Development.

Denotes Level Three of Boulding's (1962) Hierarchical Theory. Note Control or Cybernetic Component.

It is the third level which appears to have relevance for information systems. This view is reflected by Lundeberg (1979) who defines an information system as:

a system that has been developed to create, collect, store, process, distribute and interpret information. By information we mean knowledge or addition to knowledge. Information is represented by data (ordered collected symbols (signs & signals)).

(p.1)

Langefors (1977) writes that:

an information system provides an information service, i.e. the system must be capable of receiving, storing, accessing, transferring and processing information.

(p.206)

These two definitions indicate the level of development of information systems and illustrate their relationship to current 'open systems' theory. In the current environment of nil growth in economic terms health administrators are concerned, not with the maintenance of a static state of equilibrium, but with the ability of a system to move to a state of equilibrium which is congruent with the external environment. To be effective, an information system must be flexible and have the ability to expand and adapt to new organisational information requirements and new technologies.

The defining of an organisation's information needs and the developing of an information system to provide these may be viewed as a strategy designed to make an improved use of an existing system or as a change strategy. Both improve administrative function.

Langefors (1977) states:

the information system is useful only if it is accommodated into some activity system in a way that leads to improved activities.

(p.207)

Farlee (1977) asks the question:

why change an existing system if in its present state it is meeting organisational objectives?

(p.341)

Lundeberg (1979) indicates that:

information systems should be developed only when needed.

(p.1)

These views indicate that any alteration in existing information systems or development of new information systems must be justified in terms of organisational objectives and information theory parameters. The author supports the view expressed in the literature, that any information system development must increase organisational effectiveness.

Lundeberg (1979) supports this view and believes that from the outset, the decision to develop a system

must be a corporate one and that co-operation and participation of designers and users of the proposed system is essential. This view is supported by Somers (1976) and Zielstorff (1977) who emphasise the need for nurse administrators to become involved in the development and implementation of information systems.

The information system, according to Thompson and Handelman (1978):

has manipulated and transferred data into a meaningful guide for specific purposes.

(p.30)

and has, as stated by Sanders (1974):

reduced managerial uncertainty by providing relevant information.

(p.5)

Information is a valuable resource and therefore it is necessary to establish that the cost involved in acquiring it is balanced by the output, i.e. there must be some tangible benefits from developing the system and utilising the information it generates.

The qualities that should be inherent in an information system are:

- ° accuracy, which can be defined as the ratio of correct information to the total amount of information produced over a period of time;
- ° timeliness, the response interval varies but it should be short enough so that

information remains relevant long enough to reduce report volume and reveals trends that can be interpreted as cues for action;

- ° completeness, reports should provide all the information required for decision making; and
- ° conciseness, information should summarise relevant data so that it gives cues to positive action.

Sanders, 1974, (p.6-9)

THE PROCESS OF INFORMATION SYSTEMS DEVELOPMENT

The process of information systems development as described by Lundeberg (1979) sets out the first step in the process as analysing the existing system and recognising its strengths and weaknesses. The second step involves the recognition that an information system consists of two inter-related sub-systems, the data sub-system and the information sub-system.

The Data Sub-System.

The function of this sub-system is to order and interpret (process) data to support management activities. This sub-system or component of an information system demonstrates the pattern of how data is put together, either by the nature of the data or the design of the system. Gane and Sarson (1979) distinguish problems that relate to the data sub-system:

- ° data is frequently used on an intuitive basis rather than considering its logical and purposive development;
- ° users are unable to interpret available data;
- ° there is a tendency toward the over production of detailed data, instead of initially determining data requirements;
- ° finally there is no attempt to formalise how a data system shall be structured and utilised.

Thompson and Handelman (1978) support these views and believe that it is essential that the data sub-system should have an overall theoretical structure which indicates all possible linkages between the variables about which data is obtained.

The Information Sub-System.

The information sub-system's function is to convey information to people (users) to provide the necessary cues for management action. This raises the question as to why the term 'Information System' is preferred to 'Data System'. The answer relates to the systems usage, viz., that it is wished to emphasise the importance of the infological or information usage function of the total system.

Lundeberg (1979) states that:

an information system has to be developed before it can be used. You thus have to perform some kind of analysis and design, and then realise (build) an information system before it can be utilised. An information system can be regarded as an organised co-operation between human beings in order to process and convey information to each other. It has to be organised co-operation to be an information system.

(p.2)

This process is depicted in Figure 1.2 which describes a specific information systems development process.

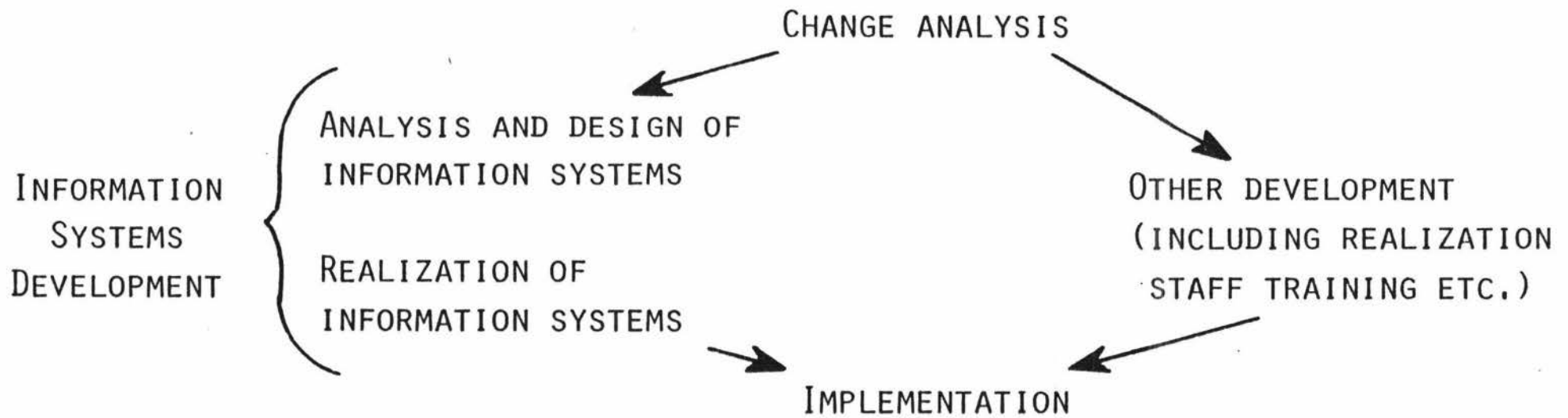


Fig. 1.2 Information Systems Development
(Adapted from Lundeburg et al (1978) (p3))

Problems Encountered in Information Systems Development.

The development of a data based Management Information System is not without problems as noted by Zielstorff (1982). A number of these problems were noted by the author of this thesis at a prototype site where a computerised health related Management Information System was being introduced. The observations made were that:

- communication between individuals with different expectations of the system were ineffectual;
- the basic method of data collection was not understood by the users;
- a tendency to develop ancillary information systems of little use to the majority of users occurred;
- the cost of information was underestimated;
- the basis upon which development commenced was not clearly defined;
- documentation from the design and analysis system was incomplete;
- finally, no clearly defined statement of the information needs of the organisation was recorded.

These problems are similar to those reported by Lundeberg (1979) as occurring in Scandinavian enterprises. Some of these problems are organisational and others are specific to the information system. They are not

independent of one another. The first two in the above list tend to influence the development of later problems. The problem of communication is found to exist at a number of levels, e.g. between users and designers, a situation emphasised by Gane and Sarson (1979) and between different categories of users. The fact that different 'languages' are used is frequently a contributing factor, and others may relate to uncertainty as to the objectives of a system, which naturally contributes to uncertainty about it. Where there is a language gap which remains unresolved, a system can be developed which is far too ambitious for the users needs; work takes longer than scheduled, and costs are underestimated.

Lundeberg et al (1979) recognised the problems inherent in the changing information needs of organisations. The group with which he and his co-authors are currently working, is experimenting with an approach to information systems development which may reduce this problem. This approach, (Information Systems Work and Analysis of Change, ISAC) is reported to be as yet incomplete and it is beyond the scope of this thesis to discuss it in any depth. What this method does indicate is that the use of information as a management resource is in a developing phase. Lundeberg et al (1979) describe the ISAC approach as an information systems development as set out in Figure 1.2.

It is essential to recognise that analysis of the existing system is the first step in information systems development. This analysis includes an investigation of how data provided is presently utilised and a study of the options for different methods of generating, storing and retrieving data which will assist in meeting organisational objectives. Gane and Sarson (1979) do not place emphasis on change analysis although they make the point that any design must be able to be changed (p.183). The inclusion of change analysis by Lundeberg et al (1979) is for the purpose of studying the changes (improvements) needed to resolve problems encountered in organisational activities. An evaluation of the social, human and economic factors contributing to information systems development is essential, and this causes the author to view the model Figure 1.2 as part of a total systems model. This relationship is shown in Figure 1.3.

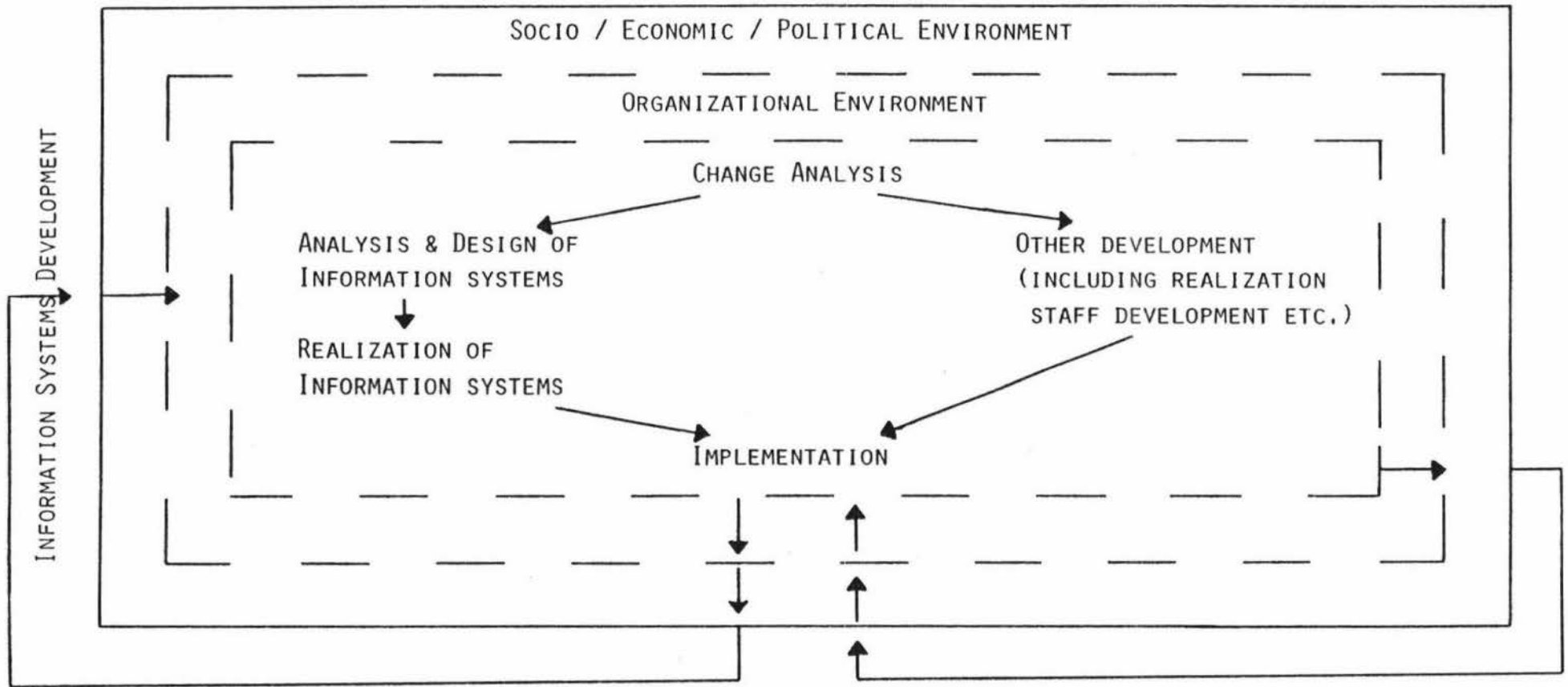


Fig. 1.3 Information Systems Development within a Macro Environment.

Information systems development is recognised as suitable only if the change analysis indicates that change is a solution to the problems and needs of personnel. In building information systems it should be recognised that a theoretical framework for the analysis and design of information systems is important.

Lundeberg's (1979) ISAC approach utilised the two steps of problem orientation, then data orientation. The users' problems and needs are in focus during the problem oriented phase and the models describe what the information system will provide in order to solve problems. In the data oriented phase, the focus is on producing solutions which will meet information needs and indicate suitable methods of data processing. By utilising this method, information systems are developed only when there is a need for them, and only when they make a positive contribution to the activities of an organisation. Information systems are developed so that the user understands what they contain and how they perform, and the user must be aware that the system is capable of further change. This raises the point that it is essential that designer and user have meaningful discussion so that each is speaking the same language.

It is this author's experience that design consultants from outside the New Zealand health care system have been poorly prepared for the particular problems of the user population.

Gane and Sarson (1979) make a similar point when they enumerate the problems systems analysts face:

Problem 1 - We built an excellent system, but it wasn't what the user wanted! — The heart of the problem is that the managers 'doers' — acquire and handle information they need on an intuitive basis, without thinking in terms of information flow or decision logic.

Problem 2 - People in the user community do not yet know enough about data processing to know what is feasible and what is not. — (Thus the need for models)

Problem 3 - The analyst can quickly be overwhelmed with detail of the business and technical detail of the new system. — The detail is needed and must be available when required, but the analyst must have tools to control detail. —

Problem 4 - The document setting out the details of the new system (system specification, or general design, or functional specification) effectively forms a contract between user department and the systems development group yet it is frequently impossible for the user to understand.

Problem 5 - If the specification document can be written in such a way as to make sense

to users, it may not be very useful to the physical designers and programmers who build the system.

(p.2-4)

It is essential that the designer and user group work together to ensure that the system designed is functional and provides information to the users which is explicit and meaningful.

In the present environment of economic constraint it is of interest to note that in the health industry the need for information has never been greater. When the New Zealand economy was such that resources were finite little attention was paid to the importance of information. Even now only 1% of Gross National Product is devoted to information generation as compared with 3% in countries which are more concerned with the information aspect of organisational control and development. It is essential that this point be recognised and a technology adopted which will allow for information development.

USE OF INFORMATION SYSTEMS

Simon (1965) makes reference to the present era in information generation as the third information revolution. The first revolution related to the discovery of the written word, the second to the advent of the printing press and the production of books, and the third to the development of technology and communication. Human beings are being bombarded with what is routinely labelled 'information' which is often irrelevant or of little use. The author of this thesis believes that within the health services there is a wealth of data which is largely disregarded and therefore unused. Thompson and Handelman (1978) support this view. They state that health service organisation is becoming increasingly complex and difficult to manage as increasing centralisation forces the integration of previously separate health care functions into unified systems.

Utaiwan (1979) when examining the medical information system at Louisville General Hospital observes that:

the organisation of the system is considerably complicated. The system's information processing activities are still in a primitive state. Excluding medical instruments and methodologies, little information technology is applied to the existing system. Clinical information flow in the hospital is almost completely accomplished by personnel without the help of machines.

— the hospital staff are confronted with data redundancy or omission. Other problems are inconsistency of data and delay in information needed for a prompt response. These kinds of incidents bring about substandard health care and unnecessary expenditure.

(p.1-2)

It would not be difficult to translate this situation to almost any hospital in New Zealand. The current political and economic pressures demand that the most effective use be made of the money available to allow for the equitable development of a service to meet the established health needs of the population. Financial considerations, associated with technological advances, demand that data be generated in a consistent manner and that it be readily ordered, interpreted and available to health administrators so that it can be utilised in the evaluation of existing services and the planning for future health care system development. Planners who have access to a consistent data base would contribute to the logical development of a macro health care system. This author is convinced that the very essence of logical and realistic development requires the establishment of a health services information system which is planned to meet the information needs of the users, with linked local, regional and national systems.

SUMMARY

This chapter defines information, and explores concepts relating to information systems and their development and utilisation. For the purpose of this thesis the author has developed the definition of an information system set out below.

An information system is an open system specifically designed to create, collect, store, process, distribute and interpret data so as to produce relevant information for the purpose of decision making; problem solving and evaluating the management process within a variety of organisations. Its design must be adaptable to the process of change and it must recognise the influence of human variables upon its design and upon the analysis of existing and future systems.

Chapter 2

INFORMATION SYSTEMS IN HOSPITAL HEALTH CARE

Information systems exist within each hospital health care system, the orientation depending upon the organisation and its stated objectives. Reasons given for information systems development in the existing economic, political and technological environments are that:

- ° a data base is required which relates to all relevant activities of the organisation; This data base focuses on three main areas
 - people;
 - the work environment;
 - equipment and the financial resource;
- ° a set of systems is required which allows for the surveillance of the financial aspects of the organisation;
- ° a set of systems is required for the management of resources in quantitative but non-financial terms;
- ° a set of management models is required which aid planning and decision making.

A hospital information system requires all these factors but the sub-systems may focus specifically on one aspect more than another.

In this chapter, the literature relevant to hospital health care information systems is examined and a selection of hospital information systems are discussed.

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These systems range from linked, stand alone systems, to systems which have developed as a result of comprehensive planning. This author regards comprehensive development as the most desirable but sub-system linkage is not regarded as impractical, rather this method can be regarded as a basis for further development towards a comprehensive information system.

The GRASP and PROMIS Systems.

These two systems are examples of sub-system linkage development. They focus specifically on patient care but are utilised in the administrative processes of planning, decision making and controlling.

GRASP was initially developed at Richmond General Hospital, Vancouver, in 1976 and by 1977/78 had been extended to eight other hospitals in British Columbia. Initially designed for improving patient care delivery it has become a valuable planning tool for administrators.

PROMIS has been described by McIntyre (1981). The system, implemented over the last decade at Burlington, Vermont, U.S.A, was developed by Weed et al (1969).

It is currently in use at Burlington Hospital and at the London Free Hospital, London, England. PROMIS is a comprehensive patient care information system which has the ability to integrate data in such a manner that the resulting information is available for planning purposes. It is designed to help solve

four major problems facing medicine today. That is, a lack of co-ordination, a failure to record data in logical order, excessive dependence upon human memory, and a lack of meaningful feedback. The system then has developed three main characteristics in response to this. It is:

- responsive
- reliable, and
- accessible to the user.

It is a modular system and has the facility for further development and can be planned for the minimum redundancy and can utilise inexpensive components.

PROMIS is reported to provide:

- general information;
- an increased capacity and flexibility;
- streamlining of input;
- validating and edit checking;
- scheduled versus on-demand output.

Care is co-ordinated through the patient record. PROMIS promotes a multidisciplinary approach involving all health professionals and serves virtually all hospital activities. It has the capability of being utilised for administration, teaching and research.

The John Hopkins' Experience.

Perhaps the most significant sub-system development is that reported by Simborg et al (1972), who describes a ward information system which was developed and

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implemented on one medical floor of the John Hopkins Hospital. To determine its effectiveness, a rigorous evaluation was designed to monitor the effects of the system on patient care by nursing staff. Costs and cost benefits of the incremental expenditures of the system were also measured. The results of the evaluation showed that the system caused significant changes in personnel work patterns, in that direct patient care activities increased materially. Errors in carrying out physicians orders were significantly decreased. Further evaluations indicate that the cost of the system should be effectively offset by improved staff effectiveness. The system seems to have potential to help identify those personnel cost savings available if reduced hospital expenses became the objective. The ward information management system seems to be able to provide the ability to improve care on a constant basis without personnel increases.

There is no definitive reference to cost savings, nor to the fact that installation costs should have been included in the cost accounting for the system. The financial aspects are mentioned in terms of the general introduction and the difficulty experienced in equating improved patient care with financial considerations. The fact that this system was developed in isolation and is not part of a total system may be one of the causes for the nebulous conclusions reached. Another consideration relates to the actual implementation

utilising an experimental and a control group method. No attempt was made to provide an ideal nursing staff coverage throughout and in both groups newly graduated nurses were introduced in varying numbers during the period of implementation. As these nurses' experience as first level practitioners would be minimal, their functioning, even with some orientation to the system, could have biased results.

The El Camino Approach to Hospital Information Systems.

The literature has numerous examples of information systems which have been developed within hospital settings. The El Camino approach to developing a Health Information System may be regarded as the most comprehensive available to date, it is fully described by Watson (1977) and the report is regarded by Jenkins (1977) as "a good presentation of the state of maturation of what must be regarded as a true prototype health information system". The El Camino experience indicates that the introduction of a health management information system assisted greatly in combating rising labour costs and under-utilisation of professional nursing skills.

It was believed that the introduction of an information system would improve the usage of resources, free nurses from non-nursing duties and allow them to work in a manner more commensurate with their professional skills. Reduction of clerical work would reduce

staff numbers in that area and at the same time enhance the quality of care by allowing for accurate and timely collection, storage and retrieval of data, provide an accurate communication device and organise a computerised patient data base.

The impact of this Hospital Information System was felt throughout the organisation. Nurses were relieved of a large percentage of clerical duties and were provided with relevant and timely patient related data for planning purposes. After a period of time, as reported by Norwood (1976) and Watson (1977), ninety-four percent of the nursing staff accepted the system. This acceptance was based upon two factors, viz; reduction of the clerical component of the nurses' work load with increased activity involving their professional skills leading to a demonstrable improvement in quality of care and increased job satisfaction. It was found that the quantity and quality of care delivered by professional nurses was affected by the degree of accuracy, availability and completeness of patient information. The Hospital Information System improved accuracy substantially by eliminating multiple entries of patient data and that information was available and current, being brought together at a base source.

At the outset the Hospital's Board of Directors stipulated that the introduction of the system must not increase the cost of hospital care. Watson (1977) reports

that studies were undertaken by the El Camino Systems Engineering Department and the conclusions reached were that the system pays its way. These conclusions did not assign values for new capabilities allowed in the system. Jenkins (1977) believes in the El Camino experience and writes:

While there have been other similar systems in various stages of implementation in the past decade, none have dealt as directly with the most important issue of orienting the system to the medical professionals who use it on a day-to-day basis, and still try to do it in a cost-beneficial way, thus assuring its continued function even after 'outside' funding sources have disappeared. For the medical professional to use it, the information must be reliable and accurate. For it to be reliable and accurate it must be captured as close to its source as possible, which necessarily means directly interfacing with a representative number of health providers who use it, including the physician.

(p.16)

Watson (1977); Bahr et al (1977); Jenkins (1977); all indicate that the El Camino Board of Management's objective to develop a system which costs no more than the existing system was achieved. All these writers conclude that all the changes made in the El Camino Hospital Information System were cost effective.

McKendrick (1982) commenting on overseas leave, makes the following statement of the El Camino Hospital:

I decided to visit this hospital after reading a paper written on the system by Dr. Ralph D. Watson (1977) — I would recommend Dr. Watson's paper as required reading for anyone interested in the introduction of patient care systems.

(private communication)

McKendrick also points out that the El Camino system has demonstrated a cost saving. He doubts whether it is at the 25% level that management claim they enjoy over any other similar sized hospital in North California. Further, management claims that the El Camino system is one of the most comprehensive available. McKendrick supports this statement as he believes that it has an excellent storage and retrieval system. However, there is no in-built mechanism which allows for tracking and the design tends toward a rigidity which does not allow the system to lend itself to minor programming changes.

STRATEGIES FOR CHANGE AND DEVELOPMENT

The opening paragraph of this chapter makes reference to some of the reasons as to why information systems exist and these also apply to the development of existing systems or the introduction of new systems. The decision to alter an existing system must relate to improving that system in some way. The exception usually relates to political constraints, e.g. where import restrictions are imposed making it imperative to alter an existing system to come into line with the availability of hardware. This situation was experienced in the health service in New Zealand in 1977 when import regulations were introduced and the amount of available hardware restricted. When a situation such as this occurs a degree of urgency is associated with change.

According to the literature, the majority of decisions to change a system are made on two grounds:

the need to utilise financial resources in a more demonstrably realistic manner; and, the need to improve patient care.

Watson (1977) raises what he refers to as a 'point in theory' in relation to this:

basically there are cost raising applications of technology and cost reducing applications. In order for the application of automation to a health care environment to be successful, it has to produce bottom-line savings while

simultaneously providing more benefits or advantages in the delivery of health care.

(p.4)

Felstein (1971) supports this theory stating:

new and sophisticated equipment has been a crucial factor in rising medical care outlays. New technology (automation in medicine), unlike that in other industries, has unfortunately tended, on the whole, to be cost raising.— The initial expense for the new equipment and its installation is often high. Once the equipment is in place, operating costs, including the cost of highly trained personnel usually required, can be substantial.

(p.4)

These statements indicate the need to recognise and accept hospital information systems as a means of rationalising resources as the opening paragraph of this chapter indicates.

Strategies for Change.

In chapter one reference was made to the first step in any change strategy being that of analysis of the existing system. The process of analysis should according to Zielstorff (1977) and Somers (1976) be multidisciplinary and it is of the utmost importance that each discipline be represented. The representatives

35.

should have knowledge of change and of automation if they are to make a positive contribution. The literature further indicates that there are two approaches to setting up a multidisciplinary team for the purpose of accomplishing changes in an existing information system. One involves the use of existing staff within the organisation, the other involves one or more change agents from outside the system participating in the process.

Simborg et al (1972) utilised the first approach when developing and implementing a ward information system at the John Hopkins Hospital and used existing staff - this system is already described in this chapter. Somers (1971 & 1979) reports utilising existing staff when introducing change to nursing specific systems.

Watson (1977) when reporting on the El Camino project indicates that a firm of consultants was employed to plan and implement change in the existing system. He comments that 'in-house development is totally inappropriate'. He regards the use of health professionals' time and skills on this type of development as an inappropriate use of patients' funds. However, he maintains that consultation with key hospital personnel is also required and these persons can act as co-ordinators.

Observations made by the author at a prototype site in New Zealand when a sub section of the National Health Computer was introduced highlight the need for a multidisciplinary approach with maximum consultation

with users. (Refer Chapter 1, p.15)

Utilisation of Models for Planning and Development.

Another strategy of relevance in planning for development and change in hospital information systems is the utilisation of models when defining information needs for planning and decision making. Systems theory has been described in Chapter 1 of this thesis and this discussion of the utilisation of models has its basis in this theory. Meadows (1957) defines a model as:

an abstraction in which patterns of symbols, rules and processes are regarded as matching, in part or totally, some real world phenomena.

(p.4)

In the process of abstraction, details may be omitted but the parts of the system and their relationship to one another are represented.

Reference has been made to the work of Boulding (1962) (p.7) and his work in developing a hierarchy of eight theoretical constructs. The third level of this hierarchy makes reference to a cybernetic or control mechanism which provides for data transmission and interpretation as an essential part of the system. This level has particular relevance for information systems development.

Howland (1968) developed a cybernetic model for the

analysis of the relationships between the patient, the nurse and the doctor. This was a triadic model at the 'micro' level.

He also examined or analysed systems at the 'macro' level. Figures 2.1 and 2.2 sets out the three functional levels within which resources in health care delivery can be considered. This author has applied these three levels to the concept of hospital information systems.

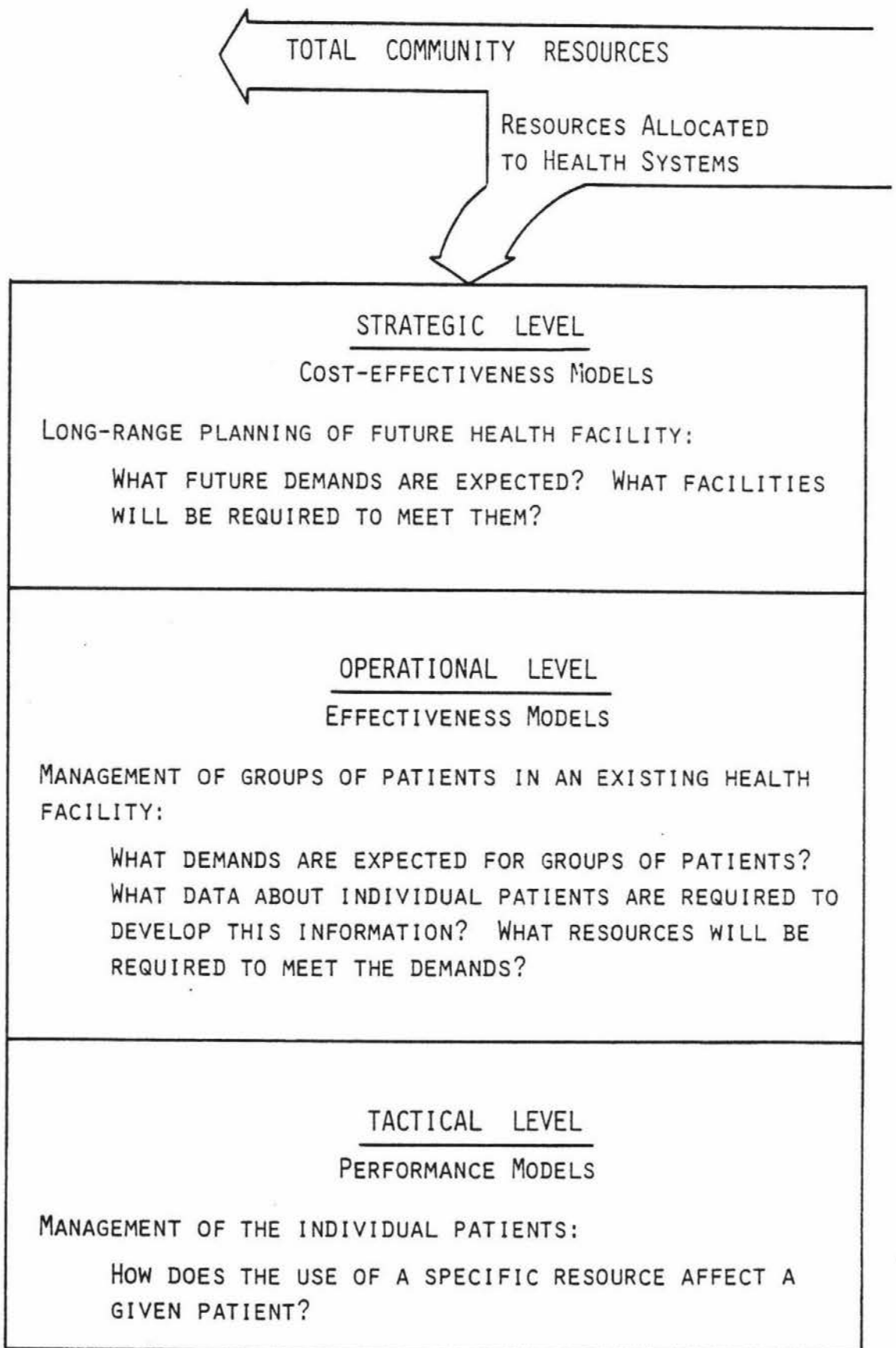


Fig. 2.1 Functional Levels of a System
(as described by Howland 1968)

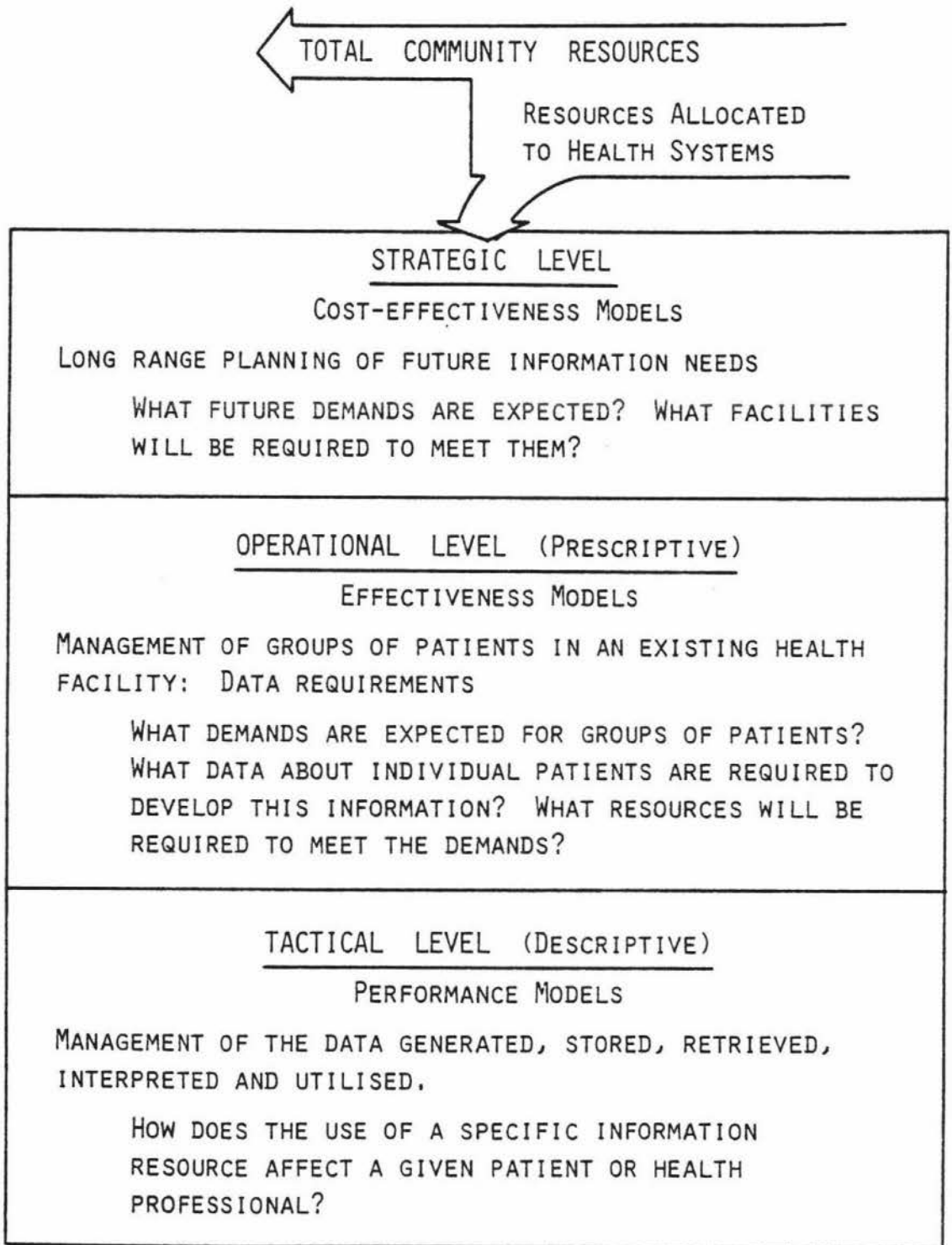


Fig. 2.2 Functional Levels of a System as adapted to Information Systems Analysis (Adapted from Howland (1968))

Figure 2.1 describes the functional levels of Hospital Health Care Systems and this has been altered in Figure 2.2 to describe a hospital information systems as follows:

Tactical Level - At this level a choice has to be made regarding the resources available. The persons involved in making this choice must function in an immediate time frame and utilise only those resources that are immediately available. In an information systems framework this implies analysis of the existing system, manipulation of data variables, and refinement of the system without utilising other resources. This entails implementing an adaptive approach.

Operational Level. - At this level it is at first necessary to establish an extension of the data base required at the tactical level and to extend the time frame. Parameters, which at the tactical level were constraining factors, e.g. limited resources, may now assume the role of variables. At this level the task is to organise available resources for the immediate future. In an information system environment this entails analysis of what exists and how this can best be adapted to meet clearly defined information needs in the here and now. There is a need to integrate and interface with other data.

Howland (1968) believes that a problem, viz.,

that of trading off individual demands against existing systems may occur.

It is at the operational level that the major part of the system of analysis takes place.

Prescriptive, rather than descriptive, models are used and they provide a guide as to what ought to be done or what is possible.

Strategic Level - This is future oriented.

Factors which have been parameters at the two previous levels become variables, e.g. resources and technology. Decisions made in relation to information system development will relate to making the financial resource available, choice of hardware, development of software, staff preparation, timing. Present and future information requirements will need to be made.

Application of Functional Levels of Model Development to Management Information Systems Development.

The advantages of utilising the concept of functional levels of model development is that it provides for the examination of information needs at each step.

It prevents the likelihood of the system functioning at one level at the expense of the operations at another, e.g. imposing automation without systems analysis.

This format is of relevance in analysing an existing information system and planning for future development.

Another writer utilising the cybernetic concept in information systems development is Patston (1978). He develops a model for a total Information System which has relevance for the hospital health service. It encompasses all the reasons for information system development which are stated at the commencement of the chapter. This model demonstrates the principles of systems theory and is depicted in Figure 2.3. This figure develops that of a cybernetic systems model presented in Figure 1.1, p.7.

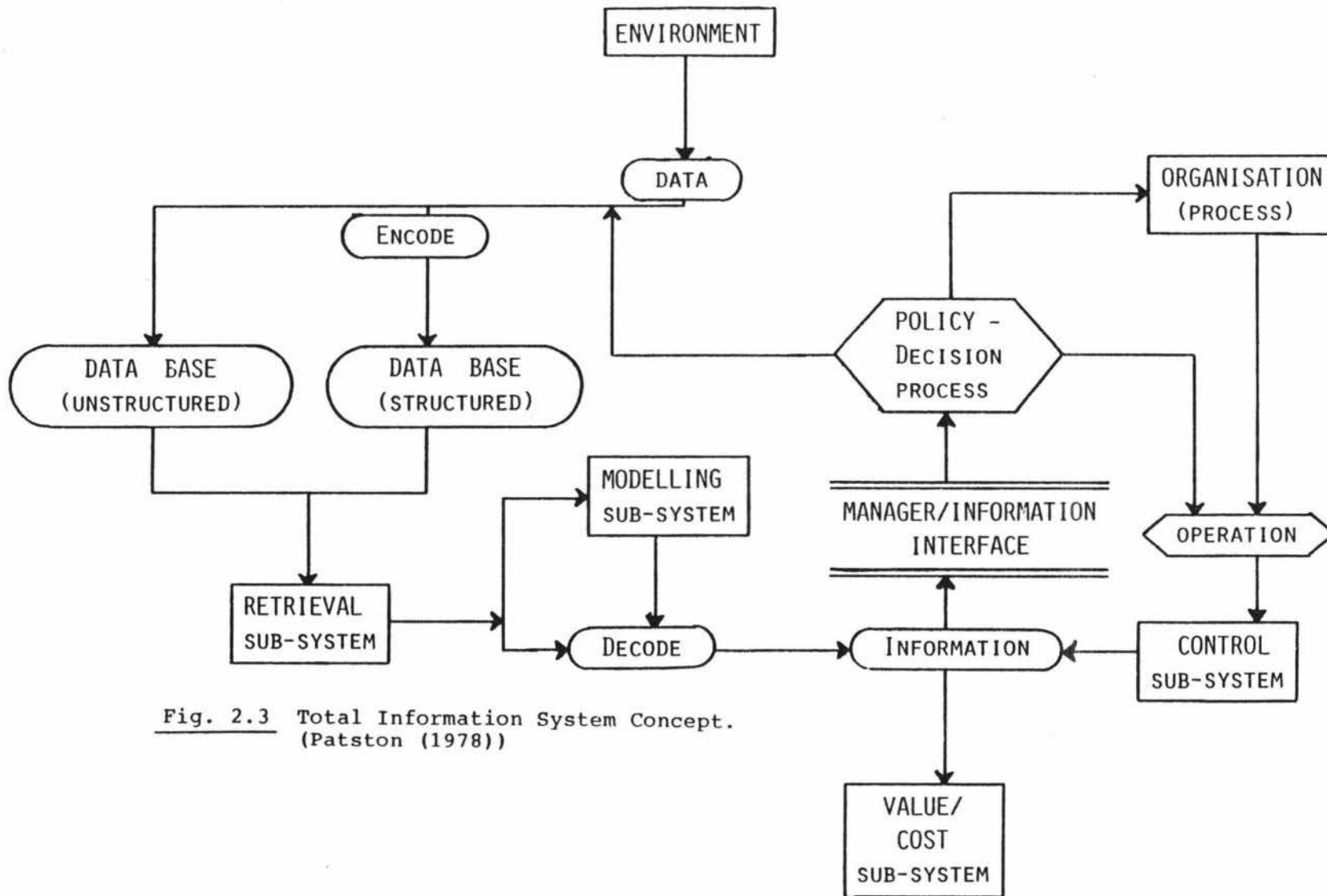


Fig. 2.3 Total Information System Concept.
(Patston (1978))

Cybernetic models are sensitive to information needs and Ribbens (1981) describes the building utilising this type of model of a hospital information system as designed to:

meet the predictable information requirements imposed by hospital routine as well as answer the unforeseen queries raised by medical practice, clinical research and long term management planning.

(p.1)

Howland (1968) and Patston (1973) both utilise cybernetic concepts in developing models. This approach is relevant to the field work described in Chapters 4 and 5 of this thesis.

SUMMARY

This chapter has given reasons as to why information systems exist, and why they should be being continually developed. Examples of existing hospital information systems are presented to the reader in a series commencing with stand alone and linked systems through to systems which have a planned, comprehensive development.

The need to plan for continuing development and strategies for change are presented. These latter include personnel involvement and the utilisation of general system theory from which have been induced models for change. These models have specific applicability to hospital information system development.

Chapter 3

THE NURSING INFORMATION COMPONENT
OF A HOSPITAL INFORMATION SYSTEM

At the outset it is essential to establish why reference is made to the nursing component of a hospital information system. Some nursing related systems are stand alone systems and it would therefore be correct to refer to them as Nursing Information Systems. Others are part of a comprehensively planned information system and it would therefore be correct to refer to them as nursing sub-systems. In this chapter the literature is examined in terms of nursing specific information and therefore there is justification in referring to the systems or sub-systems discussed as Nursing Information Systems.

Price in 1967 writes:

Minimally automation will force us to redefine nursing if, as the sociologists writing "The Nursing Profession" have warned, nursing is to remain viable in a computerised society.

(p.2258-2264)

In 1983 these words remain relevant and give direction for information systems development in nursing, focusing particularly on information generation and utilisation. Observations made by the author indicate that generally nurses are unsure of automation but that they are

knowledgeable and skilled when planning and implementing effective, manually operated nursing information systems. It is necessary to prepare nurses for automation and to demonstrate to them the positive attributes of the system, e.g. assistance in the planning of patient care and the management of ward staff.

McKendrick (1983) in private correspondence indicates that at one large hospital in New Zealand, information needs are to be defined in relation to the development of a medically oriented information system. The initial planning team does not include a nurse. Nurses may require some reassurance as to the role they have to play in hospital information systems development.

The attributes required by the nurse in defining information needs and in developing nursing and/or hospital information systems varies with the expectation of the system. A series of nursing information systems presented in the literature are explored so that an overview of existing systems is provided. They are presented in order of complexity.

York Hospital, Ontario, Canada.

Lord (1982) responding to the question 'What sort of knowledge does a nurse need to have when interacting with a computer system?' states:

First of all we train our staff so that they are capable of interacting with the system,

which takes about two hours — so you see it is not a very complex system to learn. Its fairly self-instructing in telling you what to do. You don't need any data processing knowledge; you need to know how to read; you need to know how to use a light pen; you must be able to at least peck and stab at a typewriter——.

(p.16)

Lord's (1982) writing relates to a computer based 'health care system' pioneered at York Central Hospital, Ontario, a 238-bed facility. Her answer quoted above is perhaps a little simplistic and raises questions for this author. Does the system provide nursing staff with ordered data and does it generate cues for action? Questions which are not answered in the literature. Little reference is made to the planning of the system or its co-ordination. Lord (1982) does allay fears that the system has a 'big brother' image and that users are subservient. An idea which has been observed by the author to be common among New Zealand nurses. Lord (1982) summarises the situation by stating:

What nurses need to know is what they want.
I need to know what I want it to do for me.
I need to know what kind of information I want it to give me and then I have to tell it to the computer.— You have to decide what you want it to do and you have to control it.

(p.17)

The system referred to is a nursing sub-system of a hospital information system and, according to Lord (1982), it is able to demonstrate qualitative improvements in patient care. The system provides nurses with more time to be with patients by reducing the clerical functions within their work schedule.

The Royal Children's Hospital, Melbourne - Ward Management System.

The Royal Children's Hospital, Melbourne, implemented a comprehensive automated hospital information system in the 1970's. Prior to implementation, automated bureau services had been available and had demonstrated time saving and a qualitative improvement in patient care. As part of a comprehensive system a ward management sub-system was developed. Mather (1973) reports an automated ward census and reporting system but gives no indication of the implementation date. In Mather's (1973) view the greatest factor in the successful implementation of this sub-system is the acceptance by staff of innovation. The support of the Director of Nursing is important because, according to Mather, she has 'idiosyncratic credit'. That is, it was accepted by the nursing staff of the Royal Children's Hospital, Melbourne, that this person fully understood the nursing work under consideration, and that her views concerning the proposed changes were acceptable. Mather (1973) observed that:

the attitude of nursing staff to the use of

computers in their daily work ranged, with a few fortunately placed exceptions, from the sceptical to the frankly hostile.

(p.20)

No formal evaluation of staff attitudes was made but Mather (1973) states that his impressions were confirmed by Stortsmo and Robinson (1972) who studied staff attitudes in a large university medical centre where, with the exception of ancillary workers, nurses were the group least likely to have favourable attitudes towards automation. McKendrick (1982) (in private correspondence) has made a similar observation at Ninewells Hospital, Dundee. Theis (1975) carried out research which supports Mather's observations. Theis (1975) undertook a study of attitudes and perceptions of hospital personnel and computer-based systems. He indicates that he utilised an attitudinal scaling instrument (Thurstone scale) to measure attitudinal changes in staff over a period of six months. Analysis of attitude changes initially indicated that nurses' attitudes to computerised information systems were more negative than those of physicians and administrators. However, over the research period there was a significant change in measured attitudes among nurses with the exception of nurses who initially demonstrated essentially negative attitudes.

Mather's (1973) observations are supported by the findings of Theis (1975) and suggest to the author that the writings of Langefors (1976) be heeded.

That is:

information derives not from the data alone but depends equally on the conceptions of the users — Psychology — teaches us that also the attitudes and motivations of people strongly control their acceptance of information.

(p.208)

The automated ward information census and reporting system described by Mather (1973) consists of two parts:

the Ward Census Report; and

the Administrative Report;

in each case the system was initially implemented in two wards and the operation was not extended to other wards until the Charge Nurse requested it. During the implementation phase the data processing team worked closely with ward staff resolving problems in a timely and acceptable manner.

Mather (1973) expresses the view, supported by Farlee (1971), that introduction of an automated system should not include changes that could be introduced independent of automation. This is one reason for avoiding pre designed 'packages'. Systems are best designed to meet local needs. The system implemented at the Royal Children's Hospital, Melbourne, has obtained nursing acceptance by senior nursing staff. It cannot demonstrate cost savings per se, but it can demonstrate time savings by providing regularly up-dated

patient information, i.e. patient's condition, treatments, e.g. intravenous therapy, and total hospital assessment which assists in the planning of improved patient care.

It is further demonstrated by Mather (1973) that sub-system development is costing the hospital between \$A3 - 4 per day with an initial outlay of \$A100 per day during the implementation period. A single system development is costed at \$A300 for implementation with operating costs of \$A20 per day. The final comment relates to cost, that initial costs may seem excessive because the system must initially inaugurate the cost of data capture.

Mather's (1973) conclusions should be treated with caution as this is an anecdotal paper, written by a member of the medical profession. He supports his findings with only one example from the literature. Despite these criticisms, Mather (1973) does make points that do have general application. In particular he stresses the need for all staff to be adequately prepared to use the system and to fully understand its capabilities and limitations.

Ninewells Project

Another patient oriented information system has been developed at Ninewells Hospital, Dundee. This proposal suggests the integration of three existing systems, viz. the Master Patient Index, the Ward System and the

Laboratory System. At Ninewells the tendency is to link 'stand alone systems'. A method which the author has reservations about, especially if nursing care quality may be an outcome measurement and cost savings are unable to be demonstrated. The system proposes to make available demographic data and interfaces the three systems. Data is not as yet available as to the effectiveness of this, mainly because each stand alone system has reached a different level of development.

The Texas Institute of Research and Rehabilitation.

The Texas Institute of Research and Rehabilitation is one institute in which patient information and patient care information are combined. Cornell and Garrick (1973) report on this system. (It is noted that one author (Cornell) is a nurse whilst the other (Garrick) is a systems analyst.) The belief at this hospital is that:

Patients in rehabilitation units require many more hours of direct care over a longer time than do acutely ill patients. Further, they need care from personnel in many hospital departments, which makes the co-ordination of services and medical and nursing care a complex time scheduling operation.

(p.781)

In 1968 the Texas Institute for Research and Rehabilitation implemented an experimental automated patient care

system. The rationale for the system is stated above and the writers develop this further by stating that:

the difference between returning rehabilitated, self-sustaining members to society and providing institutional care for the physically disabled amounts to billions of dollars each year. Any approach that can speed up the scheduling process and release nurses for nursing assists in the rehabilitation process.

(p.782)

The implementation commenced with a rather interesting and somewhat unorthodox move. The nursing service department was reorganised and a non-nurse unit manager employed. The reason given was that the Head Nurse was currently employed as both ward manager and patient care planner and this could not be so in terms of the Institute's newly developed philosophy. The unit manager had the task of developing ways to manage clerical routines, supplies, transport, safety and co-ordinate patient care units. This person is entirely responsible for hiring of staff whose activities related to the environment and to the servicing of professional personnel. The nurse administrator's role is that of pure supervision and instruction of personnel assigned to patient care.

Staff preparation for the introduction of the system varied somewhat from that commonly reported in the literature. The unit prepared three nurses for

'specialist' roles and they, at the completion of their programme, were assigned to the nursing care management of specific patients. The reorganisation of staff to develop a position for a unit manager, a new role for the supervisors/administrators, and the advent of the specialist nurse, highlighted the need for individualised patient care information. That is, automated information that would provide both individualised patient information and patient care information. The medical staff involved adopted a policy that allowed the specialist nurses to write nursing orders. (Refer Figure 3.1)

The standard manual of care plans are written and automated so that a standard plan for a category of patient is available and this can be modified according to individual requirements.

The process adopted for updating plans at Texas Institute of Research and Rehabilitation is a little different from Ninewells where nursing staff accept this responsibility. The nursing staff record changes on a printout and the clerical person alters these on the computer. Printouts are updated four times a day and two sets of information are received on the unit, a patient oriented printout and a station oriented composite printout. The patient oriented printout provides the nursing care plan and a schedule of events for the day which are recorded in time sequence. As well a master printout is available to certain members

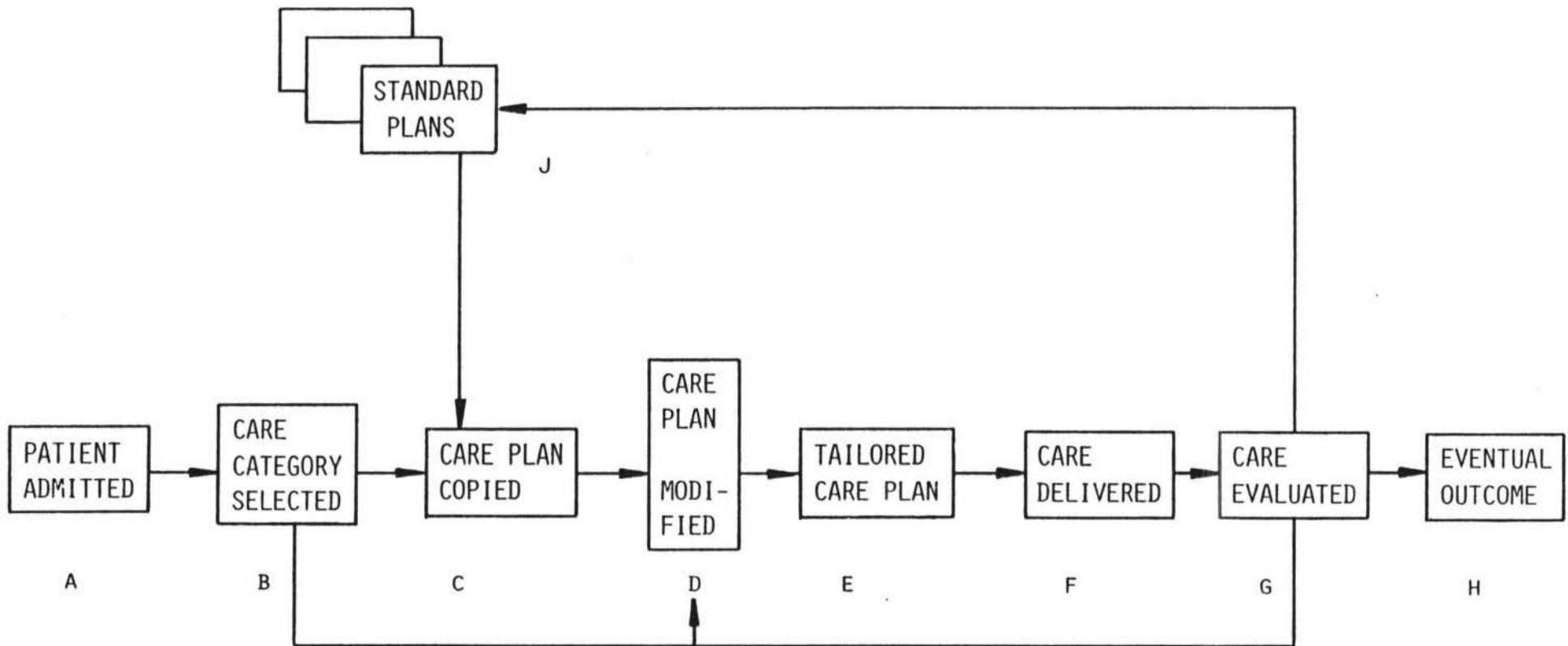


Fig. 3.1 The Care Plan Functional Flow As Practised at the Texas Institute of Research or Rehabilitation. Connell & Garrick 1973 (p782)

of staff. Here the author of this thesis notes with interest that this printout is not made available to the patient, his family or visitors. It is used for planning purposes only.

This aspect of automation is one which should be carefully considered. One of the exciting possibilities of automated patient care information sub-systems is that of ready access to data, not only for staff but for patients. Patients could have access to those parts of their patient history which are relevant to them. They could also be involved in planning their own schedules and they, and their families, would have access to relevant and current progress reports. Other printouts are prepared for other departments within the Institute according to their requirements for individualised information. With this kind of information available telephone contact is reduced and planning can be carried out realistically and efficiently.

Statistics available on average length of stay at the Texas Institute of Research and Rehabilitation indicate that the average length of stay for cervical spine injuries has been reduced from 120 days to 94.9 days. This alone is no indication as to the efficiency of automation. It does perhaps indicate that nurses, because they are no longer involved in clerical and co-ordinating functions are able to spend increased time implementing the care regime of their patients.

This leads to more effective delivery of patient care.

According to Cornell and Garrick (1973):

they (the nurses) need no longer spend time
co-ordinating hospital services or
manipulating care plan guides.

(p. 782)

As a nurse administrator the author's concern is that she perceives the nursing role as having a co-ordinating component and therefore has some difficulty in terms of the Texas Institute of Research and Rehabilitation's interpretation of the role. It is possible however that nurses working in rehabilitation perceive their roles in a different manner, and co-ordination is not one of their functions.

After several years the system in operation at the Texas Institute of Research and Rehabilitation has been altered to allow nurses a greater role in data input. They now feed data into the computer as it is considered that the knowledge of the clerical staff involved is not sufficient to make nursing and medical decisions in relation to error, omission or illegibility. These alterations, i.e. increased nursing involvement, allow for a more detailed scheduling process to be implemented and this allows for checking of time and recognition of resource constraints associated with each scheduled activity. The future plan is to build in an option component from which a nurse can select items rather than having her compose and insert them.

The programme implemented at the Texas Institute of Research and Rehabilitation is an exciting and innovative one which makes a positive contribution to the positive use of automation in nursing. It is a stand alone system which makes a qualitative contribution to information systems development.

The Charlotte Hospital System.

Somers (1971) reports a comprehensive computerised nursing care system at the Charlotte Hospital, North Carolina. This system, for computerising nursing care plans, is part of a total patient information system. It has been developed to formulate nursing care plans and to keep them current. The system is on-line and real time (refer glossary) and is accessible in each patient care unit. There is direct and ready access to the data base. The system is manned by former ward clerks who have received special preparation to use the system and are the only people allowed to record and access data. Each transaction requires special entry to the system.

The prime objective of this system is to communicate to all units concerned with the care of individual patients that information which is crucial to the planning of their care. The method of processing data has been standardised as is evident in other literature reviewed. This data is recorded in two parts:

personal information;

patient care information;

and provides nursing with an information base relating to individual patients on which they can realise a relevant patient care information system.

To allow this system to develop as described it was necessary to formulate a 'Components of Care' manual. In undertaking this the nursing staff involved recognised that there existed a lack of established nursing standards so it was necessary that they document their own standards. Following this the manual containing two hundred initiators was published. The manual, 'Components of Care', was produced after all nurses involved had considered them and were given the opportunity to comment, an exercise which took approximately two years to complete. The manual is utilised to produce nurses' orders and is the source for the individualised nursing care plan. A standardised method of communicating data has been established and input is correctly recorded. An abbreviated form of the manual has been computerised and this allows for more accurate and speedy production of individualised nursing orders. Once the initiator is coded the computer furnishes the appropriate nursing care plan. The system is flexible in that it allows for the nurse to change the stored components of care to meet individual needs. These changes must be incorporated before the nurses' orders become part of the final care plan. Somers (1971) explains clearly the process involved in the interaction between user

and computer:

An initiator when put into the computer with its special number is called a macro. The steps in care, or the components of care, are called micros. The nurse writes the macro, and the computer furnishes the micros, which the nurse can manipulate to meet the patient's individual needs. There are three basic care macros; 'patient care - total assistance', 'patient care - partial assistance', and 'patient care - supportive assistance'. The admitting nurse evaluates the patient and writes an order for one of these basic care macros —. After the computer furnishes the predetermined micros, the nurse then designs the micros specially for that patient.

(p.99)

The interesting point is that this ensures consistency and continuity of care, and the judgments are made by the professional nurse. The system also allows for nurses to evaluate patient care. It is the belief of Somers (1971), in which this author concurs, that to evaluate patient care it is necessary to have documented evidence. An automated nursing care plan allows for this, it is available not just to ward staff but to supervisors who are then able to evaluate care and to advise.

Somers (1971) raises the point that it was necessary at the Charlotte Hospital to establish standards by

which to evaluate patient care, and that it was essential that these standards be formally recorded. It has been demonstrated, Haussman et al (1974), that it is possible to automate the quality monitoring instrument as has occurred in the Rush Medicus study. The settling of nursing standards is part of the evaluatory process that all nursing care should undergo.

The Rush-Medicus Study.

Haussman et al (1974) makes reference to the Rush-Medicus Study as an example of a nursing standard setting project. It is one of the most comprehensive described in the literature and has been used as a model for other such projects, e.g. St. Joseph's Hospital, Denver. The project was undertaken because all methodologies available for evaluating nursing care were deemed to have deficiencies. That is, that those available focused upon the non clinical aspects of patient care. Many criteria developed for standards were considered to be of uncertain value and many were regarded as limited in their ability to discriminate between high and low quality care. Haussman et al (1974) draw the conclusion that:

existing methodologies are unnecessarily redundant and inefficient and the quality readings are misleading.

In 1972 the Medicus Corporation, the Rush-Presbyterian-St. Lukes Medical Centre, Chicago, and the Baptist

Medical Centre, Birmingham, Alabama, worked together to develop a centralised scheduling system for nursing personnel. According to Haussman et al (1974) the study was designed to:

synthesise and incorporate the best elements from existing methodologies and available research;
establish a conceptual framework for nursing process independent of existing criteria;
design an observation and scoring methodology utilising criteria developed within the framework that would maximise measurement efficiency and minimise bias;
test this methodology and refine criteria by statistical analysis aimed at assessing criteria reliability and redundancy.

A three step approach has been described:

- ° defining a structure for nursing care within which quality monitoring is relevant;
- ° developing criteria for evaluating quality within the structure;
- ° statistically testing both criteria and structure.

Defining the structure for nursing care was regarded as the first step in monitoring the quality of nursing care. In this study the structure of nursing care was defined in terms of objectives and sub objectives of the nursing care process. In order to ensure that the objectives had conceptual continuity and

would reflect the comprehensive nature of the nursing process and the inter-relatedness of care, the study defined nursing care as consisting of activities occurring at three levels.

Primary Level. Relating to persons and activities involved directly with the patient, i.e. assessment, planning, implementation and evaluation of care.

Secondary Level. Defined as all elements that impinge on direct care.

Tertiary Level. Relating to the infrastructure of the delivery of care.

A conceptual framework was developed within which the process of nursing care could be evaluated. Objectives and sub objectives were used to define the nursing process and a framework developed that would allow individual institutions to measure performance at different levels, regardless of how they defined nursing care.

The selection of criteria used to evaluate aspects of nursing care proceeded in three stages:

- ° identifying and incorporating appropriate criteria from existing methodologies and research;
- ° writing new criteria; and
- ° determining criteria applicability to patients and units, and identifying sources of information.

In the context of this thesis this undertaking may be viewed as an analysis of an existing system and a redefining of information needs so that resources can be qualitatively rationalised to improve the existing patient care system.

In general the methodology meets the initial objectives for monitoring the quality of nursing care and the instrument reflects state-of-the-art knowledge in monitoring, incorporating all useful elements of existing methodologies. The expansion of the number of valid quality criteria through extensive statistical and theoretical analysis of the reliability and consistency of the criteria is carried out and the final instrument is capable of expansion to incorporate additional findings or situations unique to any given institution.

The methodology is straightforward to implement and any hospital with a data processing system or access to such a system can install and operate it.

The master list criteria, although comprehensive, needs further refinement, especially at the level of interpretation. Findings relate to two hospitals only and therefore the instrument requires further testing on a larger sample.

Hegyvary (1979) found that the relationship between nursing process and patient outcomes is inconsistent, and further investigation should take place on the

variables that influence the final results of patient care given by a team of health workers.

The problems recognised in the Rush-Medicus Study were:

problems of a methodological nature. The outcome instruments were usually based upon medical classification systems;

problems of standardisation. Standards of care relate to groups or categories of patients rather than individuals;

problems of timing the monitoring of the outcome.

In 1979 the United States Department of Health, Education and Welfare, said of the Rush-Medicus instrument:

This methodology represents careful and impressive attention to conceptual framework, detail, planning, testing and evaluation. As one of the widely tested, most thoroughly analysed methodologies available for measuring the quality of care at this time, it can make a significant contribution to the nursing profession. It may also be the most expensive in terms of resources. Any potential user must be cognisant of the costs and make his-her own decisions regarding the cost versus benefits which would result from the use of this methodology.

(p.147)

The St. Josephs Study, Denver.

The Rush-Medicus Study formed the basis of a study reported by Barney (1981) at the St. Joseph's Hospital in Denver, Colorado. This study developed a system designed to measure the quality of nursing care delivered to patients and the results have been computerised for more efficient use and feedback of data. Barney (1981) reports of the historical factors contributing to the development of the system - these related to legislation passed in 1972 which authorised the formation of the Professional Standards Review Organisation (PSRO). This legislation motivated many of the resulting studies.

In Colorado each hospital conducted Medical Care Evaluation (MCE) studies each year and these studies consisted of four major parts:

- medical audit - collecting data on selected topics against criteria for examination of patients charts;
- data assessment - displaying the data using previously set criteria as a guide to determine if discrepancies exist;
- corrective action - methods of alleviating any problems determined in the assessment of data (Study results must be circulated to all staff involved);
- restudy - performed 6-12 months after the original study using those criteria elements where problems were identified to determine

the impact of the corrective action.

Each Medical Care Evaluation committee had nursing representation, their task was to provide nursing criteria. These Medical Care Evaluation studies are retrospective and provided some information about the quality of nursing care, this proved to be minimal and had to be retrieved from patients' charts, and if recordings were incomplete nursing information was limited. This inadequacy caused nursing to develop a measurement system for the specific evaluation of the quality of nursing care.

Nursing Service set their objectives, designed to measure the quality of patient care. These were:

- ° to identify desired nursing practice criteria;
- ° to establish a system of comparing actual nursing care to these criteria;
- ° to establish a statistical system for provision of feedback to nursing personnel after comparison to actual practice to establish criteria;
- ° to improve the quality of nursing care in areas where need is demonstrated;
- ° to statistically demonstrate the quality of patient care.

Nursing Service selected process criteria as it provided for the measurement of those operational activities that are both controllable and should be direct indicators of quality patient care. A concurrent approach was

chosen as it was felt that the nursing process be examined as it occurs by those delivering care. This methodology was based upon that utilised in the Rush-Medicus study.

To computerise the system for information input and feedback a numerical value system was designed. Items were given a numerical value of 1 -5, depending on a subjective analysis of items contributing to the quality of patient care. The answers to each item were arranged so that a yes answer equalled the numerical weight of the item, any inapplicable or unanswerable options were coded X or Y - these were then deleted from the computer as a category of nursing care. There is then a possible score for each category and it then becomes possible to compare the actual and possible scores - feedback is readily available and can be readily revised.

In implementing the system the Rush-Medicus study was adhered to, sources of information were similar and validity and reliability were tested in the same way as in the Rush-Medicus study. In conclusion Barney (1981) believes that the computerised information and feedback system will be fully realised.

A natural follow on from developing standards for care is the development of a system of nursing audit. The literature indicates that most audit systems are designed to evaluate either process or outcomes of

care. Bloch (1975) has presented an excellent paper entitled "Evaluation of Nursing Care in Terms of Process and Outcome", (Refer Figure 3.2, p.72). In this paper a reason is given for the motivation for such development and this is followed by a presentation of Donabedian's (1966) classical structure, process and outcome framework for developing a system for evaluating patient care.

It appears the Joint Commission for the Accreditation of Hospitals in the United States favours outcome type evaluation and several systems of retrospective outcome audit are reported in the literature, e.g. Rinaldi and Rubin (1975). They report on the St. Luke's Hospital Centre's experience in developing retrospective chart audit. In terms of information systems development, retrieval and use of information is a significant factor. This system is not automated and these authors see the retrieval of data as a non nursing function and the retrieved data would be utilised by nursing personnel in planning.

Watson and Meyers (1976) refer to the data retrieval function as being able to be carried out by a non nursing person, they further believe that the audit can be carried out by this person using audit lists of established criteria. Audit information is then able to be reviewed by nursing staff and actions planned. It is this author's view that retrieval is a non nursing function and where there is an admission-discharge

sub-system in operation random sampling of the patient population would be a comparatively easy function to perform.

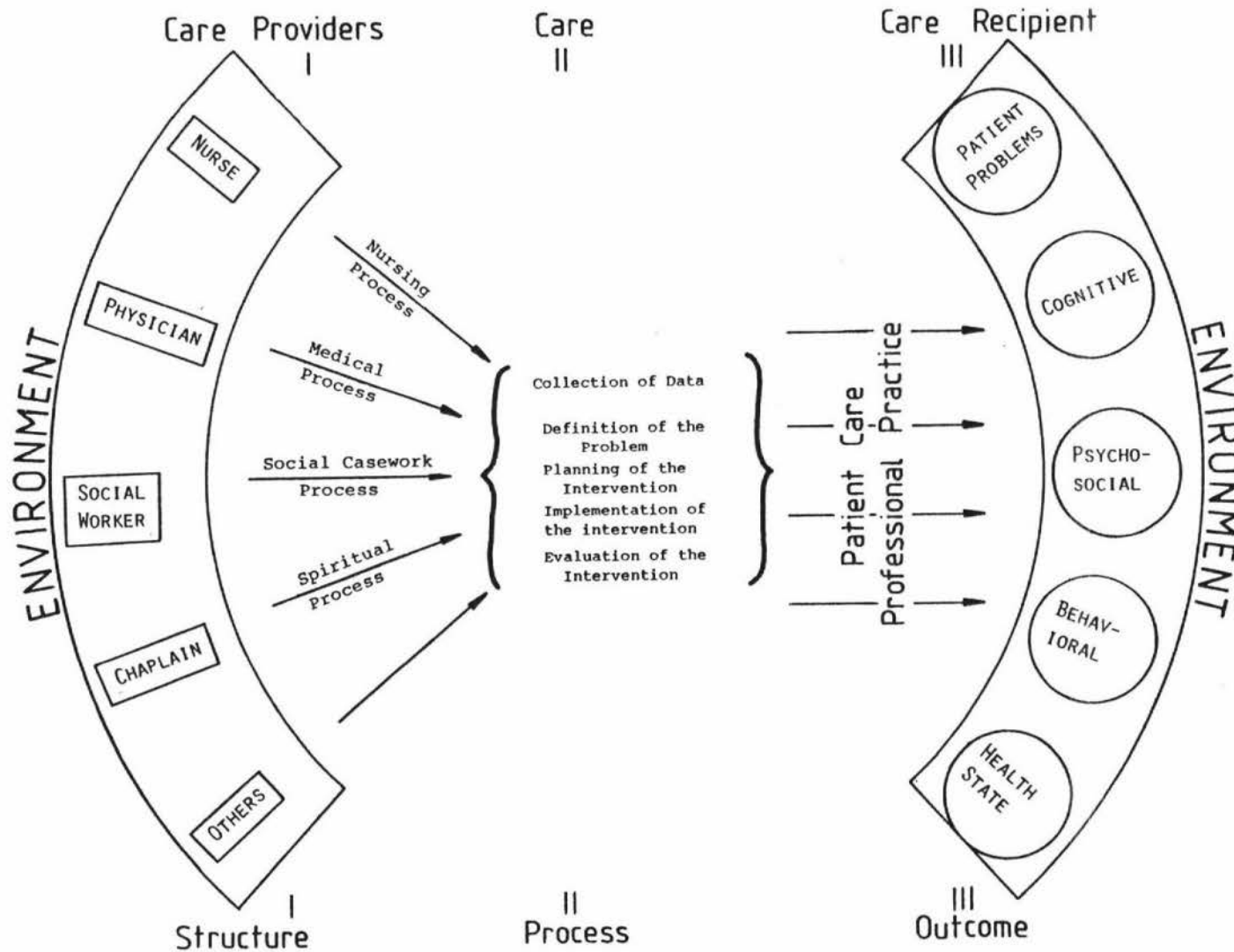


Fig. 3.2 Factors Influencing the Evaluation of Nursing Care. Bloch (1975)

NURSING INFORMATION SYSTEMS - THE STAFFING SUB-SYSTEM

Baptist Medical Centre.

Jelinek (1973) writes:

The majority of hospitals today, regardless of organisational and staffing philosophies, have inadequate personnel control systems in terms of scheduling and allocating nursing personnel to best match patient needs.

Staffing the nursing service is a difficult and critical problem, not only because it represents the single most costly component of hospital operations, but also because it has a direct bearing on the quality of patient care.

(p.81)

A series of attempts at solving the staff allocation problem have been recorded in the literature. Jelinek (1973) indicates that at the Baptist Medical Centre-Montclair, Birmingham, Alabama, the 'Personnel Allocation and Scheduling System' (PASS) was implemented throughout the institution, and the Rush-Presbyterian St. Luke's Medical Centre in Chicago utilise the system in surgical, medical, paediatrics, obstetric and gynaecology units. The Personnel Allocation and Scheduling System is reported to provide a methodology which predicts workload on a daily basis for each ward or unit, provides computerised scheduling of nursing staff by day and shift, subject to hospital policy constraints. It also

provides data to adjust available staff on a daily basis to match projected workloads and finally the system provides management reports relating to performance information in terms of nursing staff utilisation and standards of nursing care. Jelinek (1973) maintains that this system is capable of reducing overall staffing levels while keeping the level of service constant, or increasing the level of service and keeping staff numbers constant.

The data that a system such as the Personnel Allocation and Scheduling System provides, is a useful planning tool for nurse administrators in that it is a flexible system and staffing can be planned on an open ended or a cyclical method.

The system generates individualised staff schedules for two, four and six weeks, and it is designed to allow for individual patient needs and hospital policies. The Personnel Allocation and Scheduling System provides a minimal required coverage for each duty, adherence to specific staffing policies, systematic and equitable rostering so that peak periods are covered, the ability to adapt to management's requests re special time off etc., scheduling of part time workers to cover any inadequacies after full time staff have been rostered and finally achievement of a high degree of equity between staff numbers and workload.

The Personnel Allocation and Scheduling System is designed to provide timely planning information for nurse administrators and to provide an accurate system of reporting on performance and control. Each reporting system is tailored to meet the needs of institutions - it is usual that these provide operational and management control information, e.g. staff scheduling by unit, employee coverage by unit including per cent of over or under staffing, patient care unit allocation, admissions control, summaries of staff mix and staff workload ratios.

Jelinek (1973) points out the importance of developing a quality monitoring system to run in conjunction with the Personnel Allocation and Scheduling System and he suggests that the tool developed in the Rush-Medicus study is the best developed to date, a view supported by the author having conducted a reasonably comprehensive literature search relating to this topic. This supports the question discussed earlier in this thesis as to the importance of interfacing systems to provide a comprehensive information cycle.

The Personnel Allocation and Scheduling System is similar to other implementation processes with the exception that in this instance specific mention is made of the need for change analysis. Involvement of staff is essential from the outset as this allows for what Jelinek (1973) refers to as 'customisation' of the system. The total implementation will take

from 9 - 18 months and must be subject to continual evaluation and re-evaluation. As in other systems there is reference to reduction in clerical staff, improved professional staff utilisation, maximum unit efficiency, provision of up-to-date information, improved staffing practices and the capability of monitoring patient care. The Pacific Medical Centre in San Francisco has the system operating in acute and critical care units and has demonstrated in a 12% decrease in required nursing hours and an annual savings of \$325,000.

A selection of nursing information systems has been presented. All indicate that change is constant and that every system must be flexible and aware of variables which produce change in existing systems.

Another point which the literature search raises is that of semantic dichotomy. When is a nursing information system a sub-system, and at what stage does it become a patient information system, or a patient care information system? It is this author's belief that any data which has any relevance for direct patient care is part of a nursing information system and this allows for management data to be included in such a system.

How do changes occur in nursing information system?

In the final section of this chapter the use of nursing models as a strategy for change will be explored.

THE USE OF MODELS AS A CHANGE STRATEGY

In Chapter 2 reference is made to the utilisation of models in planning for change. A model demonstrates the parts of a system, their inter-relationships, inter-dependence, and their inter-actions. Reference is made to cybernetic models and the work of Howland (1968) and Patston (1978). In a nursing information systems framework cybernetic models have specific relevance. Pierce in Riehl and Roy (1974) demonstrated Howland's (1968) cybernetic model as one means of assessing the quality of patient care. Howland himself had planned the original model for this purpose. The use of cybernetic modelling is an attempt to find a more effective way in which to manage direct patient care. According to Howland (1968) this work examined ways in which to:

manage health systems in such a way that the possible level of care is assured within resource constraints,

and further, that there is a growing realisation that the delivery of health services is a system, rather than a component problem. The nurse, patient and physician must be viewed as interacting components of a health system, rather than independent entities —

new ways of managing health systems are needed.

(p.3)

He made observations which are expressed in the Information Theory section of Chapter 1 of this thesis and

is supported by the statement that:

The requirement for planning has a salutary effect. The mere fact that it is required forces managers to look ahead and develop long range plans which, hopefully, will reduce the requirements for day to day crisis management. In addition — this development helps to ensure continual monitoring of system performance.

(p.4)

This and the following statement reinforce the view that models can be a responsive tool in systems analysis:

The model, if it is to be of any help to the planner in tracing the relations between inputs and outputs, resources and objectives, for each of the systems to be compared, so that we can predict the relevant consequences of choosing any system, must be descriptive of the system for which plans are being made.

(p.9)

The model, Figure 3.3, was originally designed to describe the adaptive behaviour of health team members in response to the needs of the individual patient. Pierce in Riehl and Roy (1974) developed the model further and the functions of each component are explained. The model is one means by which investigators can study what information nurses require, generated and utilised in planning, implementing and evaluating patient care. In terms of this thesis the components of the model are seen as having the following functions:

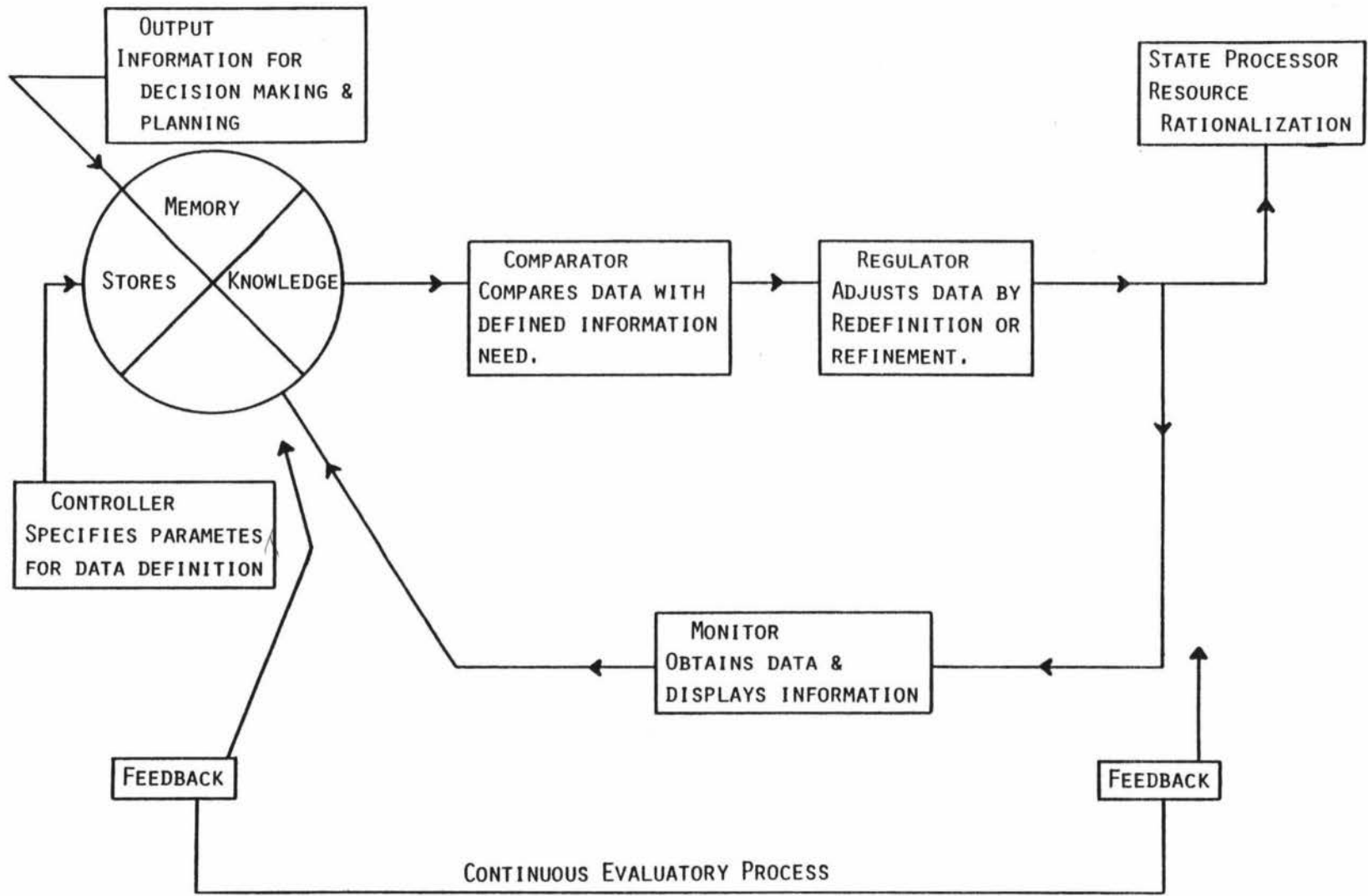


Fig. 3.3 A Model of the Information Process

Memory - stores knowledge;

Controller - specifies the parameters for information generation;

Comparator - compares input with defined information needs, adjust input/output function;

Regulator - makes adjustments to software - selects resource that can best process data;

State Processor - source of information;

Monitor - obtains, records and displays information;

Feedback - continuous evaluating function.

This model is presented in this section because it was originally designed to be the basis for analysis of the patient - nurse - doctor triadic interaction.

The author of this thesis has given some thought to a nursing specific information system and has developed a model which utilises the structure, process and outcome stages described by Bloch (1975) and depicted in Figure 3.2.

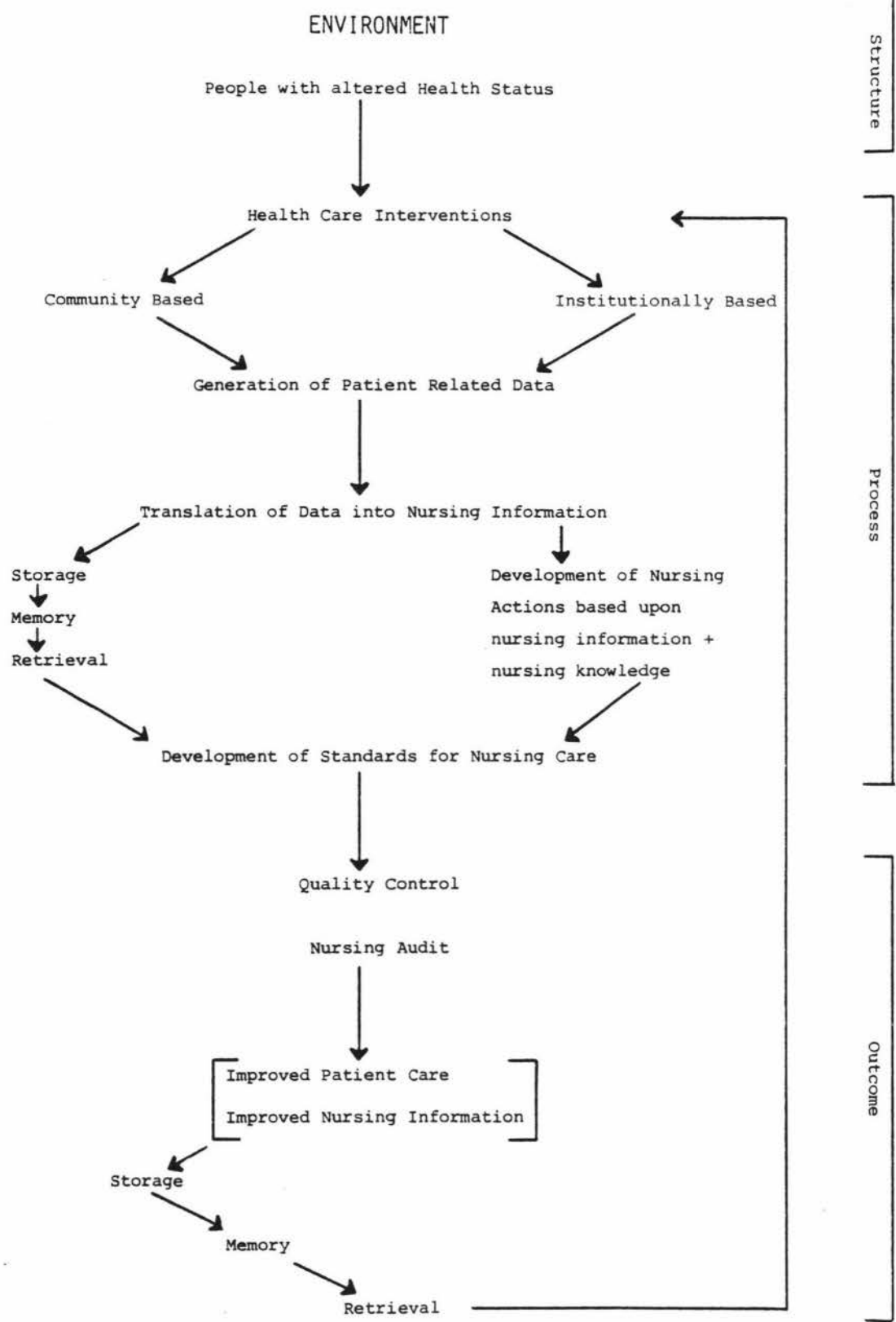


Fig. 3.4 Data Flow Chart of Nursing Information System.

The flow chart set out in Figure 3.3 has been constructed to incorporate the aspects which the author believes are relevant to effective decision making in nursing and which therefore form the basis of a nursing information system.

This model can be used on an ongoing basis to analyse the situation it represents and has a function in planning and decision making. It has the capability of demonstrating what is happening in a system in relation to the provision of accurate information for the purpose. Decisions made on the basis of this model will influence and control the nursing information system. The main emphasis of this flow chart (Figure 3.3) is to emphasise the interaction between the system and the environment. This figure (3.3) also demonstrates the reactive aspect of the system it describes and is planned to react to specific inputs from and outputs to the environment in terms of quality and time. It describes how patient related data is ultimately translated or utilised into a consistent nursing information system which will, in turn, contribute to a comprehensive information system.

SUMMARY

This chapter justifies the selection of the term nursing information system and provides examples of specific developments of such systems. Descriptions progress from simple design and application through to the more specific, rigorous system evolved in the Rush-Medicus study. It introduces the concept of standards as a parameter for the generation of information and examines specifically designed systems. In all the systems examined change is a constant variable so the author extends the material presented in Chapter 2 of this thesis in which a variety of strategies for change are presented.

Chapter 4

FIELD STUDY : DESIGN, METHODOLOGY AND PROCEDURE

INTRODUCTION

The decision to alter or develop an existing information system or to install a completely new system should be preceded by an analysis of the existing system. This point is emphasised in the writings of Langefors (1977) and Lundeberg (1979). Rosove (1967) describes three major reasons for initiating the process of analysis:

- ° problems with the existing system;
- ° problems resulting from advances in science and technology;
- ° requirements for long range planning

(p.65)

The literature indicates various methods for the process of analysis. Watson (1977) and Zielstorff (1977) both support the utilisation of an independent analyst. Somers (1971) examines the possibility of utilising existing staff.

The Process of Systems Analysis.

Levy and Loomba (1973) set out the process of systems analysis as:

- analysis of the existing organisation;
- formulation of objectives in anticipation of future needs;

assessment of current capabilities;
design and evaluation of alternative courses
of action.

(p.219-282)

Systems analysis is dependent on the user/manager giving information to the analyst about the following;

- problem identification;
- performance requirements;
- departmental activities; and
- the method in which staff can participate in a feasibility study.

Table 4.1 sets out the steps in the process of developing an information system, as described by Waters and Murphy (1983).

In this field study, the first two steps set out in the analysis phase (Table 4.1) are used as the basis for activities undertaken by the researcher.

METHODOLOGY

This field study is concerned with the selective analysis of an existing Hospital Information System. The methodology proposed is outlined in the analysis phase of Table 4.1. The field study will test the following stages of the analysis phase, viz.,

problem identification;

performance definition.

This methodology will be used in conjunction with the cybernetic model presented in Figure 3.1 and replicated in this chapter.

TABLE 4.1 The Life Cycle of an Information System
(Manual or Automated) - Adapted from
Waters and Murphy, 1983, p.123.

Analysis Phase

- I. Problem identification
 - A. Plan present system investigation - identify project leader.
 - B. Identify constraints.
 - C. Survey users of the present system.
 - D. Use investigative tools; document activities.
- II. Performance definition
 - A. Determine goals and objectives.
 - B. Develop system flowcharts.
 - C. Describe outputs.
 - D. Prepare functional requirements.
- III. Feasibility analysis
 - A. Plan systems analysis activities.
 - B. Determine operational feasibility.
 - C. Determine technical feasibility.
 - D. Determine cost-benefit analysis.

Design Phase

- I. Functional requirements confirmation
 - A. Review design phase issues.
 - B. Reconfirm the problem.
 - C. Secure management review and approval.
- II. Detailed requirements determination
 - A. Examine detailed outputs.
 - B. Confirm detailed inputs.
 - C. Prepare for file design activities.
 - D. Review program designs.
- III. Documentation needs identification
 - A. Review system documentation requirements.
 - B. Review programmer documentation.
 - C. Plan user documentation.
- IV. Design phase report

Development Phase

- I. Project planning and estimating
 - A. Make formal project schedule.
 - B. Establish plans for monitoring projects.
 - C. Convert information, procedures, and equipment.
- II. Program development and testing
 - A. Establish system test plans.
 - B. Provide user testing.
 - C. Secure effective procedures development.
- III. Personnel training
 - A. Develop positive attitudes.
 - B. Select effective training methods.
- IV. Develop phase report

Implementation (Operation Phase)

- I. System Changeover
 - A. Schedule changeover activities.
 - B. Provide back-up support programs.
 - C. Work with vendors.
- II. Postinstallation audit.
 - A. Apply performance objectives and standards.
 - B. Plan postinstallation evaluation.
 - C. Perform technical audit methods.
 - D. Intergrate computer system performance into work standards.

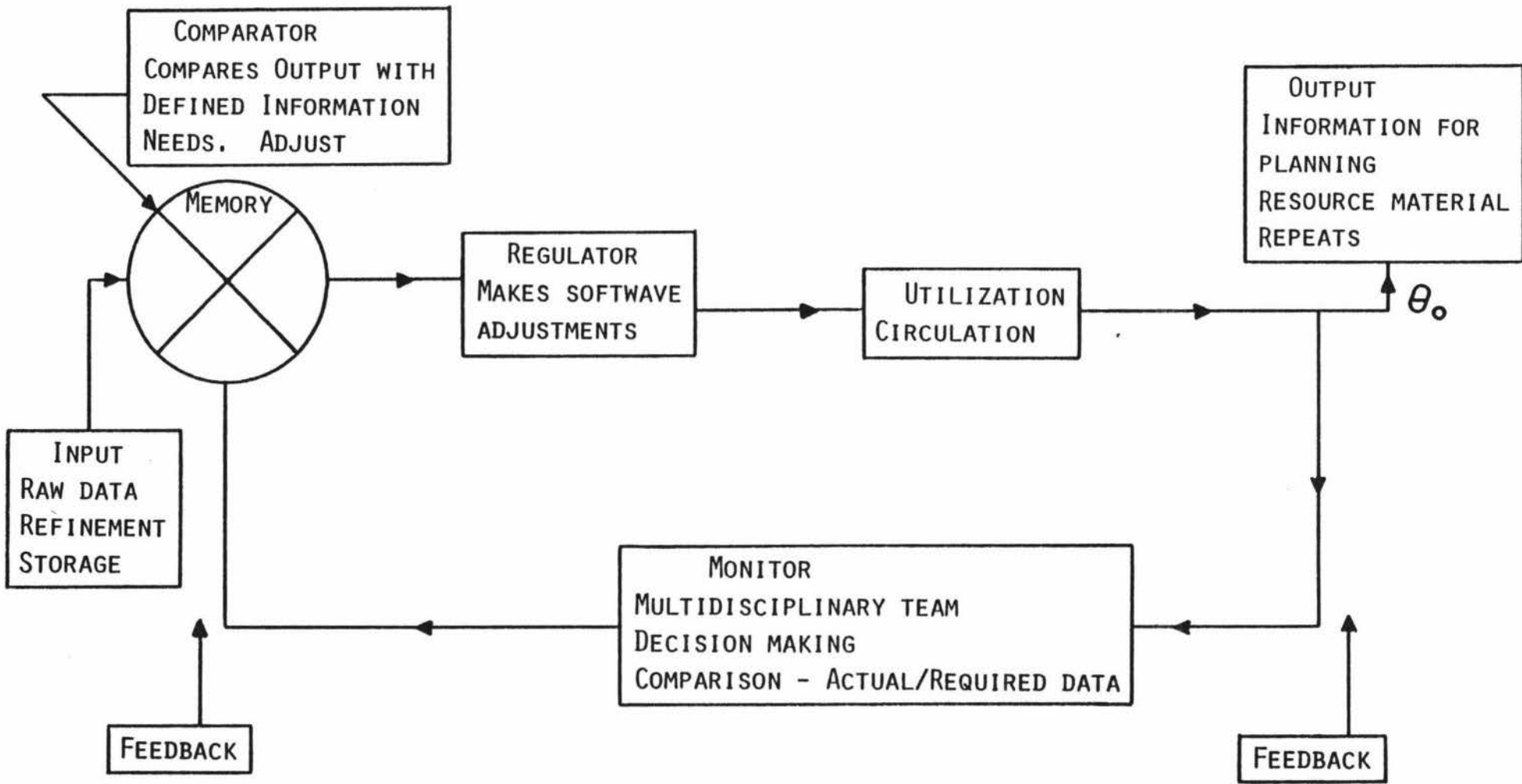


Fig. 3.3 A Model of the Information Process

A FIELD STUDY DEFINED

A field study can be classified as descriptive and empirical in that it examines an existing situation and may uncover new facts about the situation under review. Field research differs from the three commonly employed approaches to research. That is:

- the historical, based on retrospective data;
- the survey method which examines current trends;
- the experimental which is future oriented.

Krampitz and Pavlovich (1981) refer to field research as being pragmatic and humanistic. They state that field research is:

Pragmatic in that it does not require an operational design as do the former methods but freely employs any method of enquiry at any time to ferret out information bearing on the problem. No clear cut, carefully spelled out techniques are specified; extensive leeway in selecting or devising means of gathering data exists. The researcher is free to be creative by inventing his or her method on the spot and selecting one or more techniques as the problem warrants.

The field approach is humanistic, a mode of research linked to social psychology. It thrusts the researcher among the people—. Incidents comprising a constantly fluctuating

situation can never be duplicated exactly,
since they involve people in dynamic
interaction.

(p.167)

Utaiwan (1979) utilised a field study approach in analysing a medical information system. The author has located no other studies which investigate hospital information systems using this method. Patston (1978) uses a case study method to investigate a management information system current in the New Zealand Defence Department and he maintains that this is the most relevant method for analysing information systems.

OBJECTIVES OF THE FIELD STUDY

The objectives of this thesis have been set out in Chapter 1 (p.1). The specific objectives of this field study are to:

- ° describe selected sub-systems of an existing hospital information system focusing upon the facilities for data generation, collection, storage and retrieval;
- ° examine the ways and extent to which senior administrative officers (in particular nurses) make use of the existing information facility;
- ° describe the advantages and disadvantages of the present system;
- ° undertake an in-depth study of those sub-systems concerned with direct patient care;
- ° develop a comprehensive multidisciplinary model for a hospital information system.

THE DESIGN OF THE FIELD STUDY

The field study is designed to analyse five selected sub-systems of a current hospital information system, utilising the analysis phase of Table 4.1, p.87. Only five sub-systems are included because of the complexity of the total hospital board system. The sub-systems selected for analysis are:

- Admission/Discharge information sub-system;
- Patient care information sub-system;
- Nursing management information sub-system;
- Staffing information sub-system;
- Financial information sub-system.

The justification for this selection of sub-systems is based upon the author's previous experience with information systems development. These five sub-systems have a common 'care' element. If they are developing in a comprehensive manner a degree of inter-facing between sub-systems can be demonstrated. Further, the state of hospital information system development in New Zealand has tended, on a national basis, to focus upon these sub-systems so that it is timely to investigate them. Finally, as a nurse administrator, these five sub-systems can be utilised to demonstrate the quality factor in managing the nursing resources and in providing patient care.

The study has been designed to be carried out in phases:

- ° Phase One:
the problem identification phase.

- ° Phase Two:
the performance definition phase.

SELECTION OF AREA IN WHICH FIELD STUDY IS TO BE CONDUCTED.

The area selected is a hospital board (refer glossary) providing a comprehensive, hospital-based, health care system. Two boards providing such services were approached, one indicated that it was about to examine its information needs and planned, over a period of time to define what these information needs would be and how they could best be met. This Board, the Ngaio Hospital Board, was selected for the field study. Other factors that contributed to this selection are:

- the geographical compactness of the area;
- ready access to subjects;
- availability of project advisers.

The Board requested that it and its employees remain anonymous throughout the field study and this request has been respected by the author. The legal and ethical aspects of conducting a field study in a hospital board area were considered and no legislation or policy will be breached.

THE NGAIO HOSPITAL BOARD

The Ngaio Hospital Board provides a comprehensive, hospital-based, health care service to a population of 141,091 persons (1981 census).

It controls an annual government grant of \$62,275,419.00 (1983/84 allocation).

Services are provided by seven institutions and one extra mural service.

The institutions of the Board are set out in Table 4.2.

TABLE 4.2 Hospital Information for Ngaio Hospital Board : Year Ended 31 March 1982

| Hospital | Type of Hospital | Number of Beds | | Inpatient Admissions | Total Births | Total attendances | | Population |
|----------|---------------------|----------------|-------------|----------------------|--------------|-------------------|-------------|------------|
| | | Available | Av.Occupied | | | Day Patients | Outpatients | |
| Ngaio * | General & Maternity | 536.0 | 442.1 | 15,044 | 1,741 | 12,479 | 214,425 | |
| Karaka * | General & Geriatric | 125.0 | 108.2 | 566 | - | 319 | 12,136 | |
| Huia | Geriatric | 126.0 | 121.9 | 72 | - | - | - | |
| Moa | Maternity | 22.0 | 6.0 | 344 | 118 | | 1,190 | |
| Tui | Maternity | 17.0 | 3.7 | 271 | 131 | | 412 | |
| Raumati | Maternity | 10.0 | 1.7 | 99 | 64 | | 670 | |
| Puriri * | Psycho-paedic | 790.0 | 717.7 | 7 | - | 729 | 181 | |
| | | 1,626.0 | 1,401.3 | 16,403 | 2,054 | | 229,014 | 149,091 |

* Included in Field Study

Source : New Zealand Health Statistics 31.3.82

Board Administration

An elected board is responsible for the administration of health services as required by the Hospitals Act 1957. The Board appoint executive members who are representative of administration, nursing and medicine. These persons are titled:

Chief Executive;

Chief Nurse;

Superintendent in Chief.

In the Ngaio Hospital Board these persons are all responsible directly to the Board. Figure 4.1 indicates the relationship of the executive team with the Board and demonstrates executive members' areas of responsibility.

Each member of the executive are appointed by the Board on a whole time basis. Executive function as a team, meeting on a regular basis and jointly contributing to the Board's administration. This team has worked together for eighteen months.

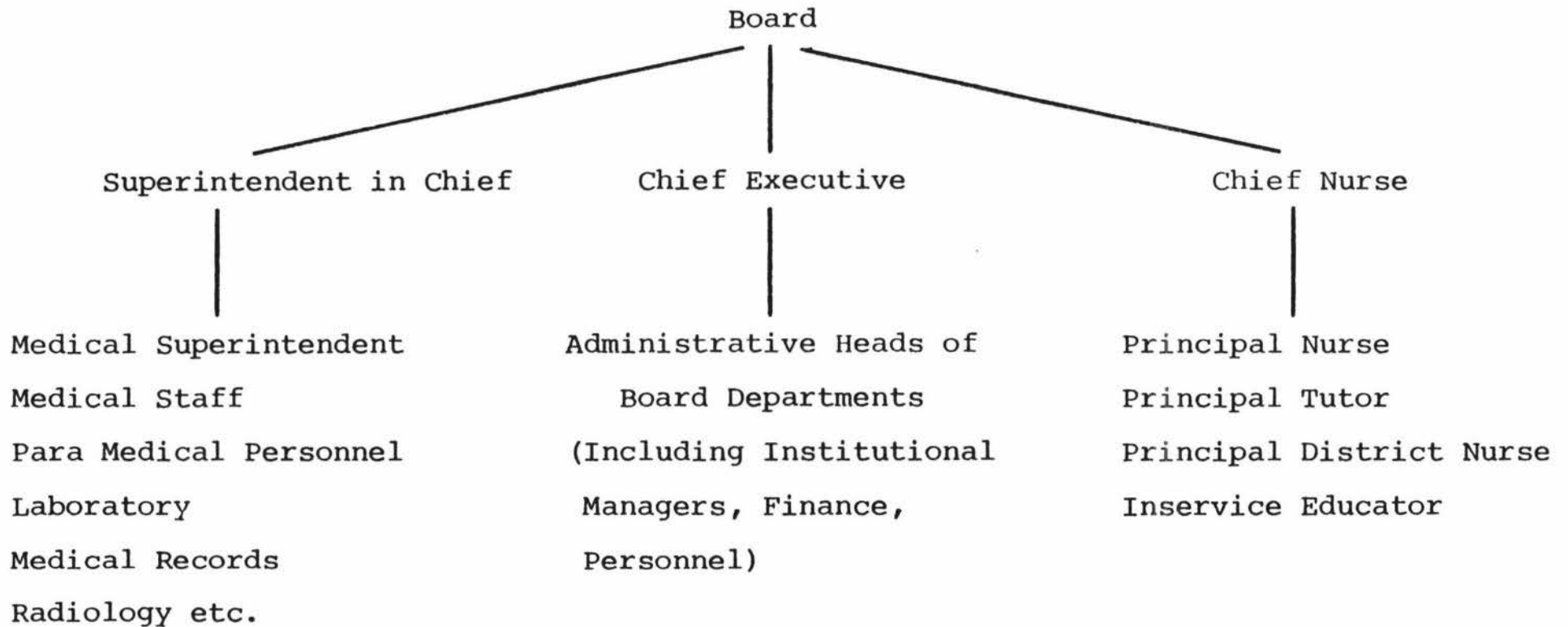


Fig. 4.1 Organisational Structure of Ngaio Hospital Board.

Institutional Management.

The three largest institutions (see Table 4.2) are each managed by a team comprising:

Administration Officer;

Principal Nurse;

Medical Superintendent.

This team is responsible for the day to day running of the institution and each member of the team has a part to play in planning and recommending policy to the Board.

INSTITUTIONS OF THE BOARD

Table 4.2 provides information regarding the institutions controlled by the Board. For the purpose of this study three institutions were chosen. These represent a comprehensive sample of the services provided by the Ngaio Hospital Board.

Ngaio Hospital.

This well established hospital is situated on the outskirts of a city with a University, a Teachers' College and a Technical Institute. The city has a stable population with a large student component. The hospital provides a comprehensive service, including some regional specialities. Specialist services are provided on a sessional basis to neighbouring boards.

Karaka Hospital.

This hospital is situated in the largest town in the area and provides general and geriatric services. General services are provided to the town and surrounding rural area and geriatric services are rationalised for the area. Karaka is a new hospital of a design reflecting the affluence of the health services during its 1960 planning phase. All wards are designed to attract the maximum light and the area of the hospital is extremely generous.

Puriri Hospital.

The largest psychopaedic hospital in the country, Puriri is situated in the country and is built on a villa plan, utilising the architectural hospital design of the 1930-40 era. Services are provided on a regional basis as opposed to a board basis. This hospital receives patients from the lower half of the North Island of New Zealand, i.e. south of Gisborne and New Plymouth.

SELECTION OF SUBJECTS FOR THE FIELD STUDY

As stated, the field study is designed in three phases.

Selection of Subjects for Phase One (the problem identification phase) requires subjects in managerial positions, i.e. personnel who make decisions at the workplace in relation to one or more particular sub-systems. The following personnel were selected:

TABLE 4.3 Subjects included in Phase I of the Field Study.

| | |
|-------------------------------|----------|
| Finance Officers | 2 |
| Staffing/Personnel Officers | 2 |
| Chief Medical Records Officer | 1 |
| Nurse Supervisors | 12 |
| Charge Nurses | 23 |
| Inservice Educator | 1 |
| Principal District Nurse | <u>1</u> |
| Total | 42 |

Selection of Nursing Subjects.

Table 4.3 indicates that nurses comprise the largest numbers of subjects occupying management positions. These subjects are actively involved in data generation and utilisation in the areas for which they are responsible. The selection of nursing subjects was left to the discretion of the Principal Nurses who were invited to provide a representative sample of at least 50% of staff available in the Supervisor and Charge Nurse category. An analysis of nursing subjects

by Hospital and Status (see Table 4.4) and by Hospital, Status and Qualification (see Table 4.5) is included.

TABLE 4.4 Nursing Subjects by Hospital and Status.

| Hospital | Staff Status | Number |
|----------|---------------------------|--------|
| Ngaio | Supervisors | 5 |
| | Charge Nurses | 11 |
| Karaka | Assistant Principal Nurse | 1 |
| | Charge Nurses | 4 |
| Puriri | Assistant Principal Nurse | 2 |
| | Supervisors | 4 |
| | Charge Nurses | 8 |
| Total | | 35 |

TABLE 4.5 Nursing Subjects by Hospital, Status and Qualification*

| Hospital | Staff Status | Qualification | Number |
|----------|-----------------------|----------------------|--------|
| Ngaio | Supervisors | RGON, Dip.N(SANS) | 1 |
| | | RGON, Dip.N(Massey) | 1 |
| | | RGON, RM | 1 |
| | | RGON | 2 |
| | Charge Nurses | RGON, Dip.N(Massey) | 2 |
| | | RGON, Adv.Dip. | 2 |
| | | RGON, RM | 1 |
| | | RGON | 6 |
| Karaka | Asst.Principal Nurse | RGN, RM, Dip.N(SANS) | 1 |
| | Charge Nurses | RGN, RM | 1 |
| | | RGON | 3 |
| Puriri | Asst.Principal Nurses | R.Cp.N. | 1 |
| | | R.Pd.N, RPN. | 1 |
| | Supervisors | R.Pd.N, Dip.N(SANS) | 1 |
| | | R.Pd.N. | 3 |
| | Charge Nurses | R.Pd.N, RGN | 1 |
| | | R.Pd.N. | 7 |
| | Total | | 35 |

* Qualification (refer Glossary)

Selection of Non-Nursing Subjects.

These persons occupied specific positions in the organisation and therefore were nominated by the author for inclusion.

Selection of Subjects for Phases Two of the Field Study.

These phases relate to administrative as opposed to managerial personnel and therefore subjects are nominated rather than selected. The subjects involved in this phase are presented in Table 4.6.

TABLE 4.6 Subjects involved in Phases Two of the Field Study.

| | |
|-------------------------|----------|
| Superintendent in Chief | 1 |
| Chief Nurse | 1 |
| Chief Executive | 1 |
| Medical Superintendents | 3 |
| Principal Nurses | 3 |
| Hospital Administrators | <u>3</u> |
| Total | 12 |

The total number of subjects involved in the field study are presented in Table 4.7.

TABLE 4.7 Total Subjects included in
Field Study

| | |
|---------------------------------|----------|
| Phase One | |
| Finance Officers | 2 |
| Staffing/Personnel Officers | 2 |
| Chief Medical Records Officer | 1 |
| Nurse Supervisors | 12 |
| Charge Nurses | 23 |
| Principal District Nurse | 1 |
| Inservice Educator | 1 |
| Phase Two | |
| Medical Superintendent in Chief | 1 |
| Medical Superintendents | 3 |
| Chief Nurse | 1 |
| Principal Nurses | 3 |
| Chief Executive | 1 |
| Hospital Administrators | <u>3</u> |
| Total | 54 |

INSTRUMENTS FOR DATA COLLECTION

Instruments for data collection have been developed for the three phases of the field study outlined. Problem identification is examined through the use of check lists. Data flow charts have been developed for the definition of performance and in-depth interview schedules constructed to examine the feasibility of the five selected sub-systems.

Check Lists.

A check list for each sub-system has been developed (refer Appendix 4.1). Each check list is designed to elicit answers to the following questions:

- what data is generated?
- what data is received?
- how is data circulated?
- how is data stored?
- how is data retrieved?

The check lists are devised so that respondents are able to answer questions at interview with a yes/no/not applicable answer. After interview subjects are given the opportunity to make relevant comment relating to the items on their particular check list.

Data Flow Charts.

The data flow charts are devised from the analysis of the data obtained from check lists and indicate

the flow of data through each sub-system. The questions asked in relation to data are in effect answered through examining these data flow charts. The data flow charts are presented to the twelve subjects nominated to provide data in Phases One and Two of the field study. This data will test the performance definition phase of the study. (Refer Appendix 4.2)

Interview Schedules.

These schedules are designed to test the feasibility analysis phase of the study. They are planned to ascertain the feasibility of the existing system and highlight areas which could be changed. (Refer Appendix 4.3)

PROCEDURE

The check lists for the five sub-systems were initially pre-tested before they could be applied to the subjects in the field study.

Pre-test of Check Lists.

The check lists were initially pre-tested upon a sample of staff in management and administrative positions with the Taranaki Hospital Board. The pre-test subjects are summarised in Table 4.8.

TABLE 4.8 Subjects Included in Pre-test

| | |
|------------------------------|----------|
| Finance Officers | 2 |
| Staffing/Personnel Officers | 3 |
| Admission/Discharge Officers | 2 |
| Supervisors | 2 |
| Charge Nurses | <u>8</u> |
| Total | 17 |

All pre-test subjects were interviewed individually. Pre-test revealed an area of ambiguity in the finance sub-system check list and this was corrected. The check list analysis indicated that it is possible to elicit from the data how data is generated, stored, retrieved and utilised.

Phase One - Problem Identification.

In this phase check lists are applied to forty-two

subjects (see Table 4.3). These people are in management positions within the Board Office and in three institutions of the Board.

Each subject was interviewed individually.

Ngaio Hospital Board and Hospital.

The Board officer and hospital are located on the same site, the admission/discharge, staffing and financial officers, have Board management functions and they were interviewed first, followed by those nurses occupying charge nurse positions, and finally the nurse supervisors.

Twenty-two persons were interviewed over a two day period at the Ngaio Hospital. A decision was made to analyse this data from which the data flow charts and in-depth interview schedules are to be generated.

Karaka Hospital and Puriri Hospital.

The subjects at these hospitals were charge nurses and nurse supervisors, and they were interviewed over a twenty-four hour period. The data analysed from these two hospitals is included in the final report.

Phase Two - Performance Definition;

As indicated, data flow charts and in-depth interview schedules were developed following analysis of the

Ngaio Hospital check lists. These were applied to the twelve subjects listed in Table 4.6. The data flow charts were presented to the subjects individually and discussion followed. The interview questions were answered by the subjects during discussion. Where questions were omitted the interviewer directed the discussion to obtain answers.

SUMMARY

This chapter presents the methodology utilised in the field study. The objectives for the field study are set out:

the location of the field study is presented;
the selection of subjects is discussed; and
the design and procedure presented.

Chapter 5

A SELECTIVE ANALYSIS OF FIVE SUB-SYSTEMS
OF A HOSPITAL INFORMATION SYSTEM

In this chapter the results obtained from the field study are presented. These results, obtained from an analysis of five sub-systems of a hospital information system, reflect the methodology outline in Chapter 4 (p.86) of this thesis. The data is analysed in terms of each of the two phases of the field study:

- problem identification;
- performance definition.

PHASE ONE : PROBLEM IDENTIFICATION

This summary of results is based upon the analysis of the data obtained from the completed check lists of forty-two subjects. Five summaries are presented, one for each information sub-system.

Admission/Discharge Information Sub-system.

Thirty-seven subjects responded to check list questions (Appendix 4.1) relating to this sub-system. (Thirty-five nurses and two administrative staff working in the area.)

Responses to the check list reveal that the system is a dual system, generating data both manually and by automation.

All subjects gave responses that showed they were aware that demographic and statistical data is generated by the automated system. This data is outlined in the check lists (Appendix 4.1) and it is utilised to provide indicators as to the efficacy of patient management in terms of utilisation of institutional facilities. The responses from the subjects show that this data describes the patient population admitted to hospital, admission trends, and special patient features, e.g. MEDIC ALERT. It is obvious from the responses that not all subjects are aware of the system in relation to its capabilities and use, or of the

fact that data can be manipulated to provide special reports on request.

TABLE 5.1 Summary of Results of Analysis of Admission/Discharge Information Sub-System.

| | Yes | No | Total |
|--|-----|----|-------|
| Knowledge of Existing System | 37 | - | 37 |
| Knowledge of data generated | 37 | - | 37 |
| stored | 33 | 4 | 37 |
| retrieved | 33 | 4 | 37 |
| utilised | 35 | 2 | 37 |
| Knowledge of ability of system | 17 | 20 | 37 |
| Knowledge of ability of system to interface with other sub-systems | 5 | 32 | 37 |

Table 5.1 presents the tabulated results of the data analysis in terms of the questions posed in the check lists. It indicates that users and potential users are aware of the system, but do not have an adequate knowledge of the ability of the system itself or the combinations that can be achieved when it is interfaced with other sub-systems.

The Ngaio Hospital respondents indicated that they had experienced the process of automation in that Phase I and II of the National Health Computer had been implemented there (see Appendix 5.1). The second part of the automated system consists of a 'Bradma' system which is capable of providing individualised hard data, but has no facility for memory or retrieval.

(see Appendix 5.2)

The information obtained about the system from the subjects is reflected in the following.

Generation of Data.

Phase I and II of the National Health Computer is capable of generating, storing, retrieving, and circulating specifically defined data. It provides demographic data, domicile code, clinician caring for patient, previous and provisional diagnosis. This data has two points of storage, at the computer terminal in Christchurch where it is stored on a Deck Ten terminal, and in the patient's permanent record (patient's notes).

The 'Bradma' component generates patient labels and patient admission lists by ward but has no storage facility. It, in fact, supplies data which is available with Phase III of the National Health Computer. Phase III has the added advantage of having a storage and retrieval property.

Demographic data is generated on an automated system only at the Ngaio Hospital. The system is not as yet extended to the Karaka Hospital. The existing system, plus Health Department policy, does not allow for admissions to Puriri Hospital to be registered and therefore all data generated here is handled manually.

Storage of Data.

As previously mentioned the data generated from Phase I and II of the National Health Computer has two points for storage:

- the patient's permanent record;
- the Deck Ten terminal at the National Health Computer at Christchurch, New Zealand. Here the data is incorporated in the National Master Patient Index.

Manual data is stored in the medical records department in the patient's individual record and in specifically defined information categories.

Retrieval of Data.

Retrieval from the National Health Computer is almost instantaneous, patient data is retrieved by patient identification search and once positively identified the data stored is made available to the operator. Data from this system can be manipulated to provide combinations of data for a variety of purposes, e.g. admission by domicile code indicates numbers of patients admitted from outside the Board's region. Provisional diagnosis can be combined with this to indicate use of specialist services. Other combinations can be produced to demonstrate trends in patient population.

Manually stored data is coded and retrievable on request.

Circulation of Data.

The automated and manual data can be combined to provide a comprehensive data base relating to the patient population and to institutional utilisation and efficiency. The data provided enjoys two areas of circulation. Daily data generation of ward statistics, patient admission lists are provided to wards and departments where it is treated as 'for information only' data or utilised as a tool for crisis planning, e.g. deployment of manpower. On a monthly basis full reports are circulated to the Medical Superintendent of each institution and to the Board Executive. This data is used for surveillance of trends and for planning purposes.

A further function of the system is to provide data to the National Health Statistics Centre of the Department of Health where trends on a national basis are compiled.

This description provides information about the existing admission/discharge system, this has been formulated into a data flow chart - Figure 5.1, this indicates the generation movement, storage and usage of data.

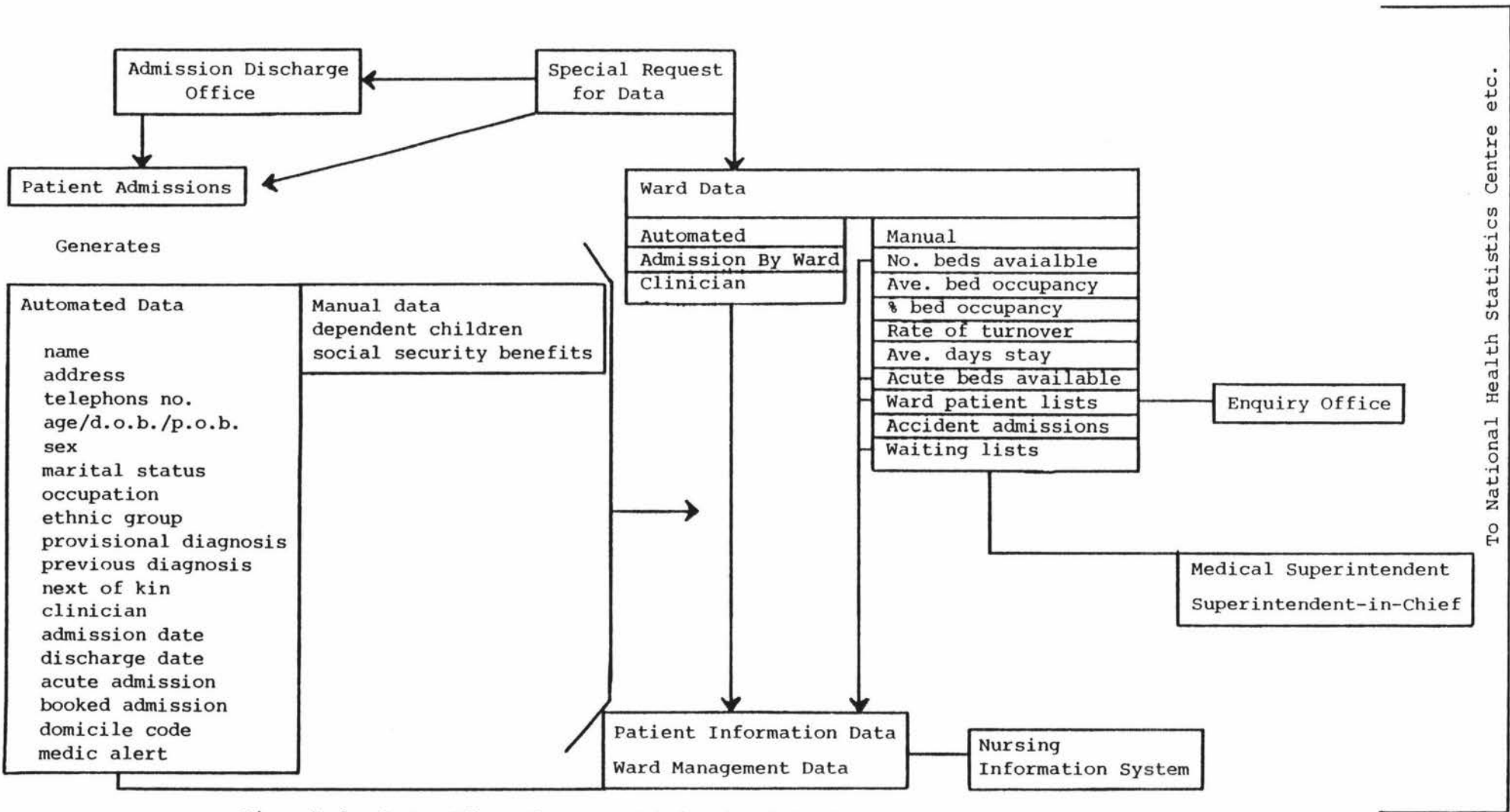


Fig. 5.1 Data Flow Chart. Admission/Discharge Information Sub-system.

Analysis of Data from Field Study.

The admission/discharge information sub-system is viewed by all the subjects as having the capacity to provide relevant, timely and consistent data. It is also regarded as having potential for further development and this is being explored. The sub-system currently has the ability to interface with the other sub-systems analysed, particularly with the patient care and nursing management sub-systems.

Comment.

The Chief Medical Records Officer expressed the view that there is the capacity within the system for the development of a position for a 'co-ordinator for data control'. He believes that such an appointment will ensure a consistent information base being available for management purposes, and further that with consistent data being available there will be an opportunity to rationalise resources more realistically.

Patient Care Information Sub-System.

The check list was administered to all the nurse subjects (N=35). The results of analysis are set out in Table 5.2.

TABLE 5.2 Summary of Results of Analysis of Patient Care Information Sub-System.

| | Yes | No | Total |
|--|-----|----|-------|
| Knowledge of Existing System | 30 | 5 | 35 |
| Knowledge of Data Generated | 30 | 5 | 35 |
| Stored | 30 | 5 | 35 |
| Retrieved | 26 | 9 | 35 |
| Utilised | 26 | 9 | 35 |
| Knowledge of Ability of System | 18 | 17 | 35 |
| Knowledge of Ability of System to interface with other sub-systems | 30 | 5 | 35 |

Data Generation.

In all three institutions the subjects agreed that the check lists provided a comprehensive range of data about this sub-system's ability to generate, store, retrieve and utilise data. With two exceptions the subjects agreed that the data generated should be included in the patient's permanent record. The two exceptions related to patient dependency and nursing care plans.

Data Storage.

At Ngaio Hospital the patient related demographic data is stored at two points, on the National Health Computer and in the patient's permanent record. All other data is, with the exception of nursing care plans and patient dependency ratings, stored manually in the patient's permanent record.

Data at the Karaka Hospital is stored manually.

At the Puriri Hospital patient related data is stored in the patient's permanent record and demographic data is stored on automated systems at two points; on an institutionally based microcomputer and on the University based computer in the area.

Data Retrieval.

All data is retrievable on request.

Circulation of Data.

Patient Care data has two circulation patterns:

the demographic data interfaces with data generated by the admission/discharge system.

In some instances where cross boundary flow (see Glossary) and custodial care is involved there is an interface with the financial system.

Patient information also has a ward and interdepartmental circulation which is related to assessment and care.

The patient record can be utilised for teaching and research and retrieval of data is responded to manually, providing the request is legitimate.

From the information provided by the subjects of the

Ngaio Hospital it is possible to generate a data flow chart which indicates the passage of data through the system. This chart is set out in Figure 5.2.

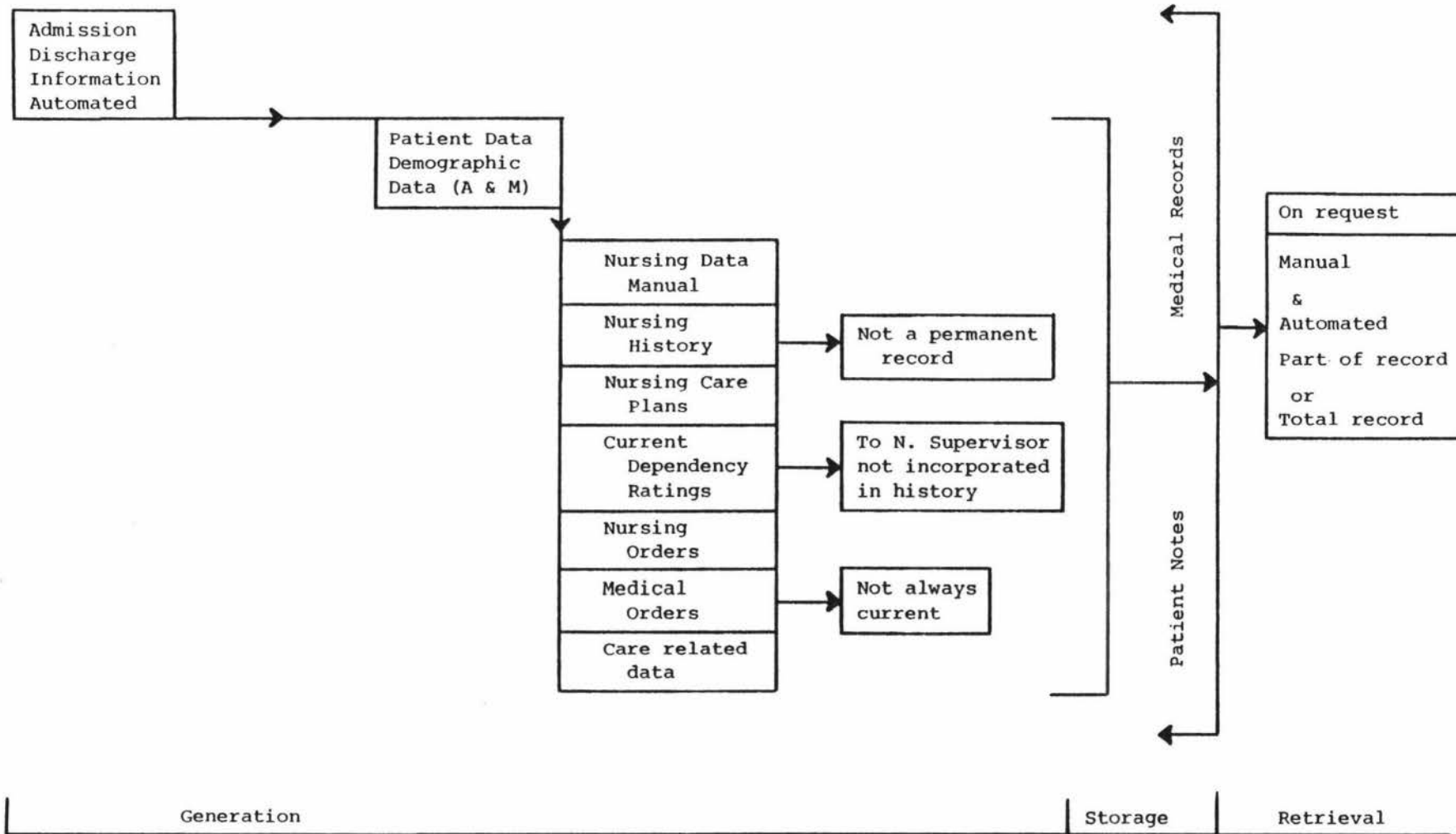


Fig 5.2 Data Flow Chart. Patient Care Information Sub-system.

The Data Flow Chart.

It is possible to describe the data flow in terms of generation, storage and retrieval. It is evident from the data that the subjects were unsure of what happens to the data relating to the patient dependency ratings and the nursing care plans. Data is retained in the patient's permanent record.

Comment.

In obstetric nursing difficulties were expressed in formulating nursing care plans because of the short stay of patients and therefore in this area the nursing care plan has been adapted to the patient population.

One Charge Nurse commented on the need to complete all patient data in a timely manner. Where entries are not dated, efforts at checking or undertaking any form of audit or research were negated.

Analysis.

The subjects agreed that the main source of data is the patient's permanent record and that, providing recordings are timely and accurate, it becomes a valuable source of information.

The procedure practised does not allow for the nursing care plan or individual patient dependency recordings to be included. Nursing care plans are kept up to

date by erasure of obsolete recordings and the dependency ratings are tabulated into categories on a daily basis. The Supervisors interviewed stated that they used these for crisis planning.

It was generally felt by the nursing staff that adequate accurate and timely data was available for planning patient care.

Data could be circulated to staff members as required. Pieces of data regarding specific incidence or incidents could be made available on legitimate request.

Supervisors were able to utilise data and interface it with data provided by the admission/discharge system and assist ward staff in planning for efficient use of resources.

Nursing Management Information System.

Check lists were administered to all nurse subjects (N=35). Table 5.3 sets out the tabulated analysis of the findings from the check list data.

TABLE 5.3 Summary of Results of Analysis of
Nursing Management Information
Sub-System.

| | Yes | No | Total |
|---|-----|----|-------|
| Knowledge of Existing System | 35 | 0 | 35 |
| Knowledge of Data Generated | 35 | 0 | 35 |
| Stored | 29 | 6 | 35 |
| Retrieved | 29 | 6 | 35 |
| Utilised | 15 | 20 | 35 |
| Knowledge of Ability of System | 25 | 10 | 35 |
| Knowledge of Ability of System to interface with other sub-systems | 12 | 23 | 35 |
| Knowledge of Basic Ward | | | |
| Management Data | 35 | 0 | 35 |
| Financial Data | 10 | 25 | 35 |
| Staffing Data | 10 | 25 | 35 |

Data Generation.

The data generated by this system can be divided into three sections, viz:

 basic ward management data;

 financial data;

 staffing data.

All nursing staff involved in this field study are in management positions and therefore involved in the generation, storage, retrieval and utilisation of data.

The basic ward management data is generated manually at ward level and interfaces with the admission/discharge

system and the patient care system already described. There is evidence that the philosophy of care in each hospital places different focus upon the data generated. In part the data is generated in response to data received from other systems, e.g. at the Ngaio Hospital the patient condition index is partially generated from the daily print out from the 'Bradma' machine and partially from data generated by the patient care system.

The subjects expressed a wariness of the automated system and stated that they carried out a manual head count to reinforce the information received from the automated system in relation to occupancy.

Data Storage.

Data is stored in a variety of ways:

Basic ward management data interfaces with the admission/discharge information sub-system and is therefore stored on the National Health Computer and in the Department's manual information system. Data is also available from the patient's permanent record;

Financial data is fed back manually through the system. This relates specifically to requests from the capital expenditure programme; Staffing data is placed on the nursing staff manually operated sub-system and pieces of data relating to absenteeism and salary are stored

by the staffing section on the automated Auckland Hospital Board pay roll system.

Data Retrieval.

Basic ward management data and financial data can be made available by those generating it on request. Data about staffing is more difficult to retrieve. It is retrieved from the manual nursing management sub-system for current staff but requires a manual search from files for data relating to former employees. The automated pay roll system provides little information.

Figure 5.3 indicates the flow of Nursing Management Information data. This data flow chart indicates that data is generated throughout the sub-system and is utilised in a variety of planning mechanisms. It also indicates the need to develop the ability of systems to interface and share data on a consistent basis.

NURSING MANAGEMENT DATA

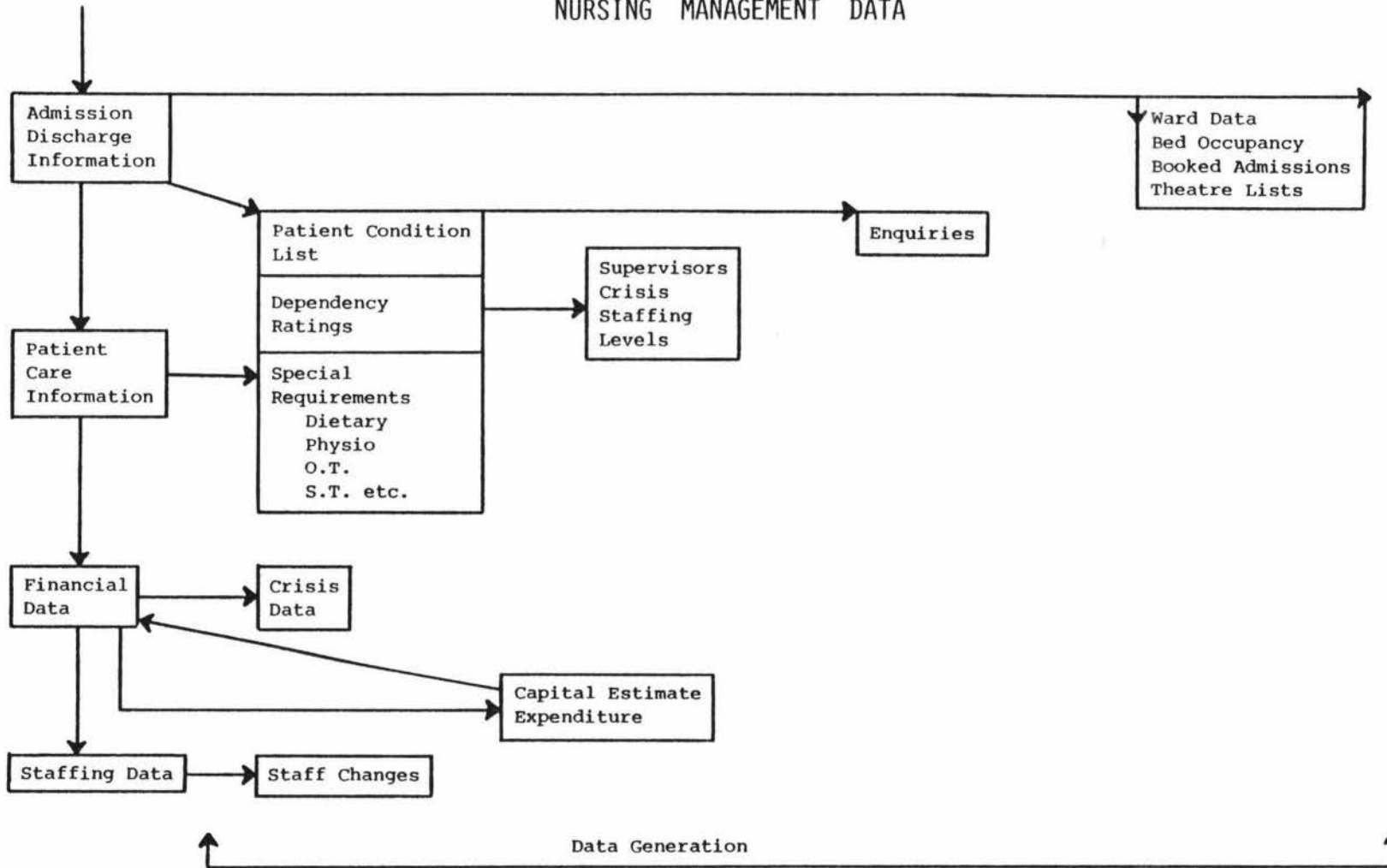


Fig. 5.3 Data Flow Chart. Nursing Management Information Sub-system.

Circulation of Data.

The data generated is fed into other systems and retrieved as part of the admission/discharge reports. It is also manually transmitted by nursing to other sections of nursing management for crisis planning purposes. Circulation is in the form of composite reports for institutional Management Teams and Board Executive, or to Nurse Supervisor.

Subjects report that the provision of financial data is limited. Nursing staff circulate requirements on the annual capital estimates programme but are unsure of what happens to these requests.

The majority of nurse subjects would like more information about financial management systems. They are also interested in active involvement in planning and decision making in relation to the financial allocation and dispersment of monies at ward level, particularly in relation to staffing.

The subjects report that their infrequent requests for financial data are not usually met.

Analysis.

The information sub-system is a manually operated one providing data in three areas, viz:

basic ward management data;
 financial data;
 staffing data.

There is adequate data generated in the ward management area, however, the respondents indicate that financial and staffing data is difficult to obtain. In the staffing area, in particular, it has been necessary for them to develop their own nursing specific data base.

Staffing Information Sub-System.

Thirty-seven respondents provided data for the check lists. (N=35 nurse subjects, plus 2 administrators in the personnel office.) This data is analysed in Table 5.4.

TABLE 5.4 Summary of Results of Analysis of Staffing Information Sub-System.

| | Yes | No | Total |
|---|-----|----|-------|
| Knowledge of Existing System | 9 | 28 | 37 |
| Knowledge of Data Generated | 2 | 35 | 37 |
| Stored | 2 | 35 | 37 |
| Retrieved | 2 | 35 | 37 |
| Utilised | 2 | 35 | 37 |
| Knowledge of Ability of System | 2 | 35 | 37 |
| Knowledge of Ability of System to interface with other Sub-Systems | 5 | 32 | 37 |

Table 5.4 indicates that the thirty-seven respondents concerned have little knowledge of the system. The officer in charge makes the comment that the system has a pay roll focus and utilises hardware and software from a larger hospital board. That is, the sub-system was not designed to meet the needs of the Ngaio Hospital Board in relation to staffing information. The check lists reveal that the function of the sub-system is not known to the majority of subjects. The subjects are emphatic that this sub-system does not provide them with staffing related data on an immediate response basis.

The officer in charge reveals that he is aware that the current sub-system limits the amount and quality of data available and he views the sub-system as a constraining factor in the provision of timely and relevant data. A further comment is that this sub-system is reliant upon a reporting system which is the responsibility of professional personnel and involves them in clerical tasks. This view was supported by all subjects. The result is that throughout the sub-system there is duplication of records.

Data Generation.

Pay roll type data is generated. An annual leave schedule is produced quarterly.

Data Storage.

Basic pay roll type data is stored, this relates to pay rates, hours worked, salary paid.

Data Retrieval. *

It is difficult to retrieve from the existing system as the data available relates to the here and now. Retrospective search for specific data is an impossible task as the memory function is limited.

Data Circulation.

The subjects did not receive staffing reports and had to elicit information from the sub-system or rely on their own record keeping.

Comment.

One comment made by a subject is:

that perhaps the sub-system generated little data which had relevance for this field study!

A data flow sheet for this sub-system has not been generated because of the limited nature of the sub-system revealed by check list analysis.

Financial Information Sub-System.

This sub-system generates, stores and retrieves data using both manual and automated methods. The accounting

component is automated and the budgetary system is manually operated. The annual financial allocation (refer Glossary) is initially estimated on the previous year's annual allocation and is then adjusted when the final allocation is made known by Government. The new system of hospital board funding (Equitable Distribution of Hospital Board Funds - refer Glossary) has been implemented from April 1 1983. The Ngaio Hospital Board is placed in an underfunded position. There must therefore be a movement toward equity which makes current predictions more difficult to make.

From this data base stem all financial decisions. Currently funds are allocated to institutionally based cost centres (refer Glossary). This allocation of funds requires the approval of the Budget Committee of the Board and its Executive.

Further breakdown of Cost Centre allocation into salaries and wages, supplies and expenses, maintenance and capital, is made by the finance officer and submitted for approval. From this base data, the finance officer allocates funds to institutional cost centres with the approval of the Board's Budget Committee which consists of the Chief Executive, the individual institutional Management Directorate, and the Finance Officer.

The final allocation and division of funds into the broad categories of salaries and wages, supplies and expenses, and maintenance and capital, is made by

the finance officer and approved by the Budget Committee.

Analysis of the check lists of thirty-seven subjects (N=35, plus two administrative officers) reveals the following.

TABLE 5.5 Summary of Results of Analysis of Financial Information Sub-System.

| | Yes | No | Total |
|--|-----|----|-------|
| Knowledge of Existing System | 2 | 35 | 37 |
| Knowledge of Data Generated | 9 | 28 | 37 |
| Stored | 5 | 32 | 37 |
| Retrieved | 5 | 32 | 37 |
| Utilised | 7 | 30 | 37 |
| Knowledge of Ability of System | 7 | 30 | 37 |
| Knowledge of Ability of System to interface with other sub-systems | 12 | 25 | 37 |

These results (Table 5.5) indicate a limited knowledge of the financial sub-system by the nurse subjects in the study.

Generation of Data.

Data is generated utilising the annual government allocation as a baseline. The subjects all appear to be aware of this but two respondents were unaware of the specific financial sub-system functioning as it did. The process of data generation has been described.

Storage and Retrieval of Data.

Data is stored manually at Board and Institutional level and is compiled into specific returns and reports as required by statute and by the Ngaio Hospital Board. It is readily retrievable on a routine basis and on request. The majority of subjects responding to the financial questions on the check list (81%) were unaware of the sub-system's ability to accomplish this.

Circulation.

Financial data relating to actual versus estimated expenditure in all divisions of the financial allocation enjoys limited circulation. Executive and the Board receive regular, current budgetary statements and are informed of the financial status of the Board. This allows them the opportunity to adjust to keep within the allocation.

The financial data generated and circulated on a regular and timely basis is utilised for long and short term planning purposes, a fact known by seven subjects.

Analysis.

The financial information sub-system receives information from Government and responds to this by generating financial data relating to expenditure and allocation of funds. Circulation is initially limited to those

groups indicated.

There is a suggestion from staff that crisis intervention is utilised and this can be attributed to the inability of the existing system to provide relevant, timely and consistent financial data, and to incorporate an effective feedback mechanism. This is fully recognised by the Finance Officer.

The check list indicates that the existing financial management information sub-system stands alone (refer Chapter 2) and therefore there is a limited circulation of information and dissemination of data. Other health personnel have commented on the limitations of the system and believe that it contributes to restricting other information sub-systems.

There was disparity expressed as to whether financial data was required by nurse managers. The majority of subjects expressed the view that having access and using financial information would assist in making more effective nursing decisions.

A data flow chart of the existing financial information sub-system is set out in Figure 5.4

Comment.

The provision of financial data is under review and development, and there is a need for a consistent data base which could be utilised by a multidisciplinary group.

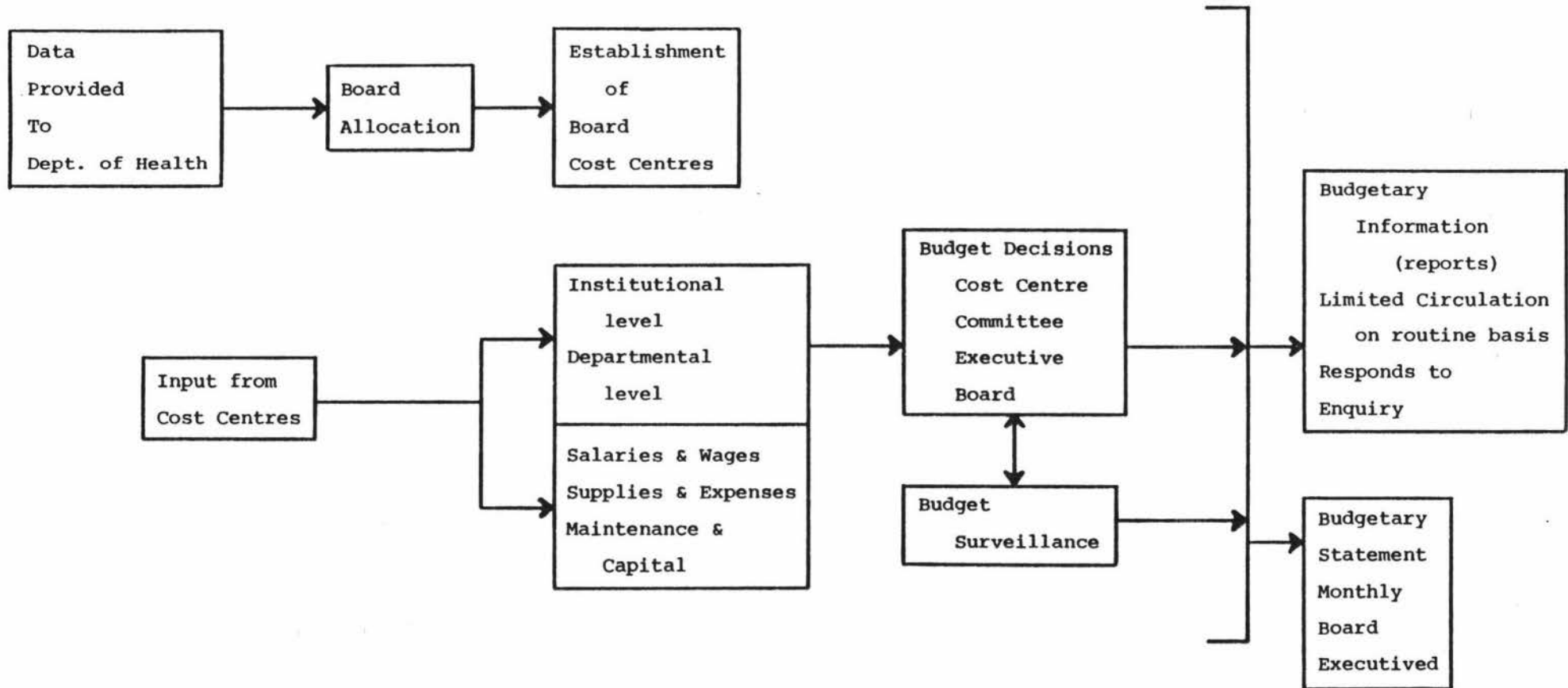


Fig. 5.4 Data Flow Chart. Financial Information Sub-system.

SUMMARY OF PHASE ONE OF THE FIELD STUDY

The aim of Phase One has been to test the problem identification stage of the methodology presented in Table 4.1, p.87. The use of check lists has elicited data which:

- identifies constraints;
- surveys users;
- documents activities; and

as well it is possible to:

- develop flow charts; and
- describe outputs.

Tasks which the methodology place in Phase Two or the performance definition stage of the analysis.

PHASE TWO : PERFORMANCE DEFINITION

The data relating to these two phases of the field study has been collected during a single interview with each of the twelve subjects involved. These subjects are presented in Table 4.6, p.104.

The data flow charts and in-depth interview schedules (refer Appendices 4.2 & 4.3) are the tools used. The method of data collection is described in Chapter 4, p.108. The Institutional Management Teams of the three institutions have been interviewed in the following order :

Ngaio;

Karaka; and

Puriri;

and then the Executive Administrative Team of the Ngaio Hospital Board were interviewed, using the flow charts developed in Phase One.

As indicated in the summary of Phase One of the field study there is some overlap between Phases One and Two. The questions which are to be addressed during these final phases are:

What are the objectives of each information sub-system?

What are the outputs of each sub-system?

Is each sub-system operationally feasible?

TABLE 5.6 Analysis of Data Obtained from
Discussion on Data Flow Charts
and In-Depth Interviews.

| | Yes | No | In Part | No. |
|---|-----|----|---------|-----|
| Data flow charts have been developed for four of the five sub-systems examined. Is this a true representation of the following sub-systems: | | | | |
| Admission/Discharge? | 11 | | 0 | 11 |
| Patient Care? | 8 | | 3 | 11 |
| Nursing Management? | 8 | | 3 | 11 |
| Finance? | 9 | | 2 | 11 |
| Do you as an administrator request and utilise data from the following sub-systems: | | | | |
| Admission/Discharge? | 11 | | | 11 |
| Patient Care? | 6 | 5 | | 11 |
| Nursing Management? | 4 | 7 | | 11 |
| Staffing? | 11 | | | 11 |
| Finance? | 11 | | | 11 |
| Do you initiate request for data from the following sub-systems: | | | | |
| Admission/Discharge? | 11 | | | 11 |
| Patient Care? | 4 | 7 | | 11 |
| Nursing Management? | 6 | 5 | | 11 |
| Staffing? | 11 | | | 11 |
| Finance? | 11 | | | 11 |
| If the five sub-systems were fully automated would you request data on a regular basis? | 11 | | | 11 |
| As part of the process in planning for automation are you prepared to take part in an exercise to define information needs? | 11 | | | 11 |

Note: Eleven subjects only were interviewed.

One subject had been in the current management position for only one month and did not feel competent to respond.

TABLE 5.7 Analysis of Data Obtained from
In-Depth Interviews.

| | Yes | No | Unknown | No. |
|--|-----|----|---------|-----|
| Do you believe unnecessary data is generated in the sub-systems: | | | | |
| Admission/Discharge? | 4 | 7 | | 11 |
| Patient Care? | 11 | | | 11 |
| Nursing Management? | | 6 | 5 | 11 |
| Staffing? | | 2 | 9 | 11 |
| Finance? | | 4 | 7 | 11 |
| In relation to the Financial Sub-System do you approve of the concept of cost centre financial management? | 11 | | | 11 |

Note: Eleven subjects only were interviewed.

One subject had been in the current management position for only one month and did not feel competent to respond.

Table 5.6 presents an analysis of the data obtained from the discussion of the data flow charts and in-depth interviews. Table 5.7 provides further analysis from the in-depth interviews. From the results obtained it appears that these subjects are in general, aware of information as an administrative resource, and regularly make use of data from all five information sub-systems to a greater or lesser degree.

The Data Flow Charts.

These were accepted by the majority as correct representations of sub-system data flow.

The In-Depth Interviews.

The responses from these indicate that not all subjects are fully aware of the availability of data or of the availability of each sub-system to generate data.

If a fully automated system were introduced more data would be requested regularly for planning purposes.

Of interest is the point that this group wish to have institutional cost centres established.

SUMMARY OF PHASE TWO OF THE FIELD STUDY

In this section data was collected and analysed in an attempt to ascertain how health administrators viewed the existing five sub-systems of the hospital information system.

DISCUSSION OF THE FIELD STUDY

In this section of Chapter 5 the results of the field study are discussed, and the efficacy of the methodology and field study design examined.

Four of the five sub-systems examined in the field study fit the description of 'stand alone' systems as set out in Chapter 2, p.27. The fifth sub-system concerned with patient care information co-ordinates data from other sub-systems. Even in this case however it has not been deliberately planned as part of an overall hospital information system development.

In addition, it is evident as indicated by the nurse respondents in the field study the patient's record is the most important document in the system.

Sub-Systems as Stand Alone Systems.

Each of the five sub-systems has been developed independently to meet the information needs of the users. The patient care and nursing management sub-systems are highly developed manual sub-systems providing a consistent data base for the planning of patient care and the nursing management of the wards and departments. The patient care information system co-ordinates data from other sub-systems. This can be seen in the patient's records where the information is stored.

The nursing management sub-system is well developed in the area of patient related data but less effective in the area of staffing and financial related data. In the staffing area nursing management generate their own data which is recorded in the staff's personal records and in the form of special reports as the staffing sub-system does not have the ability to record this centrally. Details of medical and other staffing are also to be found in personal records.

Information from the financial sub-system has a very limited circulation, and along with the staffing sub-system can be regarded as stand alone systems as information is provided upwards in the system and response to requests and provision of feedback is limited.

The admission/discharge sub-system consists of two automated phases and a manual phase. The automated phase which is part of the national health computerised system has potential for further development which would eliminate the second automated phase together with the manual phase. In its existing state there is replication of function and the information resource is not rationalised within the sub-system or across sub-systems.

This independent development of sub-systems makes data replication a feature of the overall hospital information system and tends to isolate rather than

integrate users. As previously stated the field study reveals four stand alone systems rather than a co-ordinated one.

Data Generation, Storage, Retrieval and Utilisation.

Each sub-system possesses these capabilities but the degree to which data is retrieved and utilised varies. Respondents did not indicate that they utilised data routinely for planning but there is evidence of crisis planning in relation to the deployment of nursing staff. In relation to this, patient dependency data is utilised on a day to day basis but not as a means of providing research data or a guide for long term staffing decision making. The nursing care plan is not part of the patient's permanent record and is erased and rewritten in pencil and discarded when the patient is discharged from hospital. These two pieces of data have potential in teaching and research and the possibility of storing these in the patient's record should be considered.

Sub-System Interface.

The results of the study show there is some interfacing at present, particularly between the patient care, nursing management and admission/discharge sub-systems. There is no evidence that this has been planned. As each of these sub-systems has the care of the patient as its focus some interfacing is to be expected. Only one third of the subjects recognised

this ability and only two subjects indicated that they actively engaged in interfacing of the present systems for planning purposes. This supports the view that the sub-systems have been developed to meet the information needs of separate groups of users rather than the information needs of the hospital as a whole.

Other Findings.

The data from both phases indicates that subjects tended to think in disciplines rather than to have a macro view of health planning. One institutional management team did present as a cohesive team possessing a macro view of health planning. The other two institutional management teams see themselves as individuals coming together for specific purposes, e.g. allocation of special portions of the financial resource. One subject indicated that the team is, in his view, a financial resource management team. This subject did not appear to recognise management information as a resource input to the system.

There is evidence to suggest that automation as a process has a 'big brother' image (refer Vancouver General, and Royal Children's Hospital, Chapter 3). Nurses in this field study reported manually re-checking figures generated through an automated system. In discussion with the author, these nurses expressed a suspicion of automation which they admitted was

unfounded. By contrast, the administrators in Phase Two of the field study expressed the view that an automated hospital information system would be most acceptable. The current stage of automation of hospital information is disappointing as the system promises to provide certain data but in actual terms data is not available except in a very restricted sense, i.e. the actual output is unable to match stated requirements as pointed out by this author from her experience, refer Chapter 1, p.15.

DIFFERENCES BETWEEN PHASE ONE AND PHASE TWO

The flow charts used in Phase Two of the field study were constructed from responses obtained in Phase One, where the majority of respondents were nurses in management positions. Contrary to the expectations of the author, there was a marked difference in the responses elicited in the two phases. The majority of the eleven hospital administrators thought the flow charts truly represented the admission/discharge, patient care, nursing management and financial sub-systems. No flow chart was constructed for the staffing sub-system due to the inadequacy of the data base. However, seven of the eleven made no use of existing information regarding nursing management and only six of the eleven made use of the patient care information. By contrast, all eleven made use of admission/discharge, staffing and financial information.

The response to the check list questions in Phase One show that 85.7% of the nurse respondents have some knowledge of the existing patient care information system. A further 79.2% have some knowledge of retrieval from, and utilisation of, this system. In common with the administrators, the high level of knowledge of retrieval and utilisation (89.2%) would indicate frequent use of this system. By contrast, only 5.4% of respondents in Phase One had knowledge of retrieval or utilisation from the staffing information sub-system.

Knowledge of retrieval (13.5%) and utilisation (18.9%) of financial data shows a similar pattern.

Thus the focus of utilisation of data would appear to be different for the two groups. This is important when devising a total hospital information system.

The data obtained from the field study indicates that subjects are aware of the need to establish a consistent information base for planning and decision making. They indicate that if information was freely available from an automated system they will be requesting specific information on a regular and timely basis. In the present situation there is a tendency to utilise outdated or uncorrected data as a basis for planning as manual generation is frequently difficult and tedious.

It is obvious from the responses obtained that the defining of information needs and the planning of information systems development is a priority which all subjects recognise. What is not evident in the data is how this can best be achieved and who shall be involved.

COMMENT ON THE FIELD STUDY :
DESIGN AND METHOD

Table 4.1, p.98, sets out the key features in the life cycle of an information system. This field study makes use of the problem identification and the performance of definition phases of this life cycle in conjunction with the cybernetic model presented in Figure 3.3, p.79.

The existing five sub-systems are analysed using this methodology. The aim is to provide data relating to the actual situation rather than a proposed situation.

By following the path analysis defined in the model, Figure 3.3, p.79, it is possible to define the sub-systems' capabilities and to pin point areas of interface or unnecessary duplication.

The study is designed to collect data in two phases, each phase utilising a separate set of subjects. Subjects for Phase One are selected whereas those for Phase Two are nominated because of the positions they hold within the organisation.

In Phase One there is a strong bias toward nursing (90% of subjects) and in Phase Two only 25% of subjects are nurses. The focus or direction of responses in the two phases respond to this mix. In Phase One responses are biased toward patient care whereas this does not occur in the Phase Two responses.

The consistency of the data obtained can be criticised in relation to this selection, however the majority of subjects in Phase Two indicated that the data flow charts are indicative of the sub-systems. This problem therefore may be more apparent than real.

The process of data collection is an area which should be commented upon. In Phase One a specific face to face interview schedule utilising check lists was employed. A pattern is established and therefore a consistency of data collection method resulted. In Phase Two data collection was conducted in a more informal manner, the data flow charts became the focus for spontaneous discussion and the interviewer manipulated this to obtain the answers for the questions presented in the in-depth interview schedule. This situation is readily manipulated by either the subject or the interviewer. It raises the question as to whether the second phase or even the total data collection process would have been more effective if postal questionnaires had been used?

Special Features of Each Institution.

Each institution exhibits special features in relation to orientation to care.

Ngaio Hospital is a base hospital focusing on acute, episodic care, trauma, specialist services, obstetrics. The information requirements are immediate and more

varied, and this information is utilised by a variety of health professionals.

Karaka Hospital provides basic long term geriatric care with a small proportion of acute episodic care beds. It is a small hospital based in a rural community centre. There are no automated services available and the need for information has been defined by staff and is generated manually.

Puriri Hospital provides care for a large number of psychopaedic patients. Patient turnover is in the vicinity of 4% per annum. Patients are known to staff and much information is transmitted informally. The formal information base requires little alteration.

Special Characteristics of the Institutional Management Teams.

The Ngaio Hospital Management Team view themselves as a resource management team in terms of finance and equipment, but not in terms of manpower planning. Information needs were expressed in terms of single disciplines.

The Karaka Hospital Management Team was newly formed and demonstrated the ability to understand a multi-disciplinary approach to the information resource.

The Puriri Hospital Management Team was cohesive and

demonstrated a multidisciplinary approach to the use of information and the need to generate reliable and consistent data for planning purposes.

All three management teams expressed a view that they would welcome an opportunity to work together with the Board's Executive Team in defining information needs.

SUMMARY

This chapter provides an analysis of the data obtained from the two phases of the field study, in which the five selected information sub-systems of a hospital information system are examined. Figure 5.5 is developed at this stage to summarise these five sub-systems in terms of their input and output functions.

The field study methodology and design are described and discussed and a series of questions raised. These questions will be addressed in the final chapter and possible answers provided.

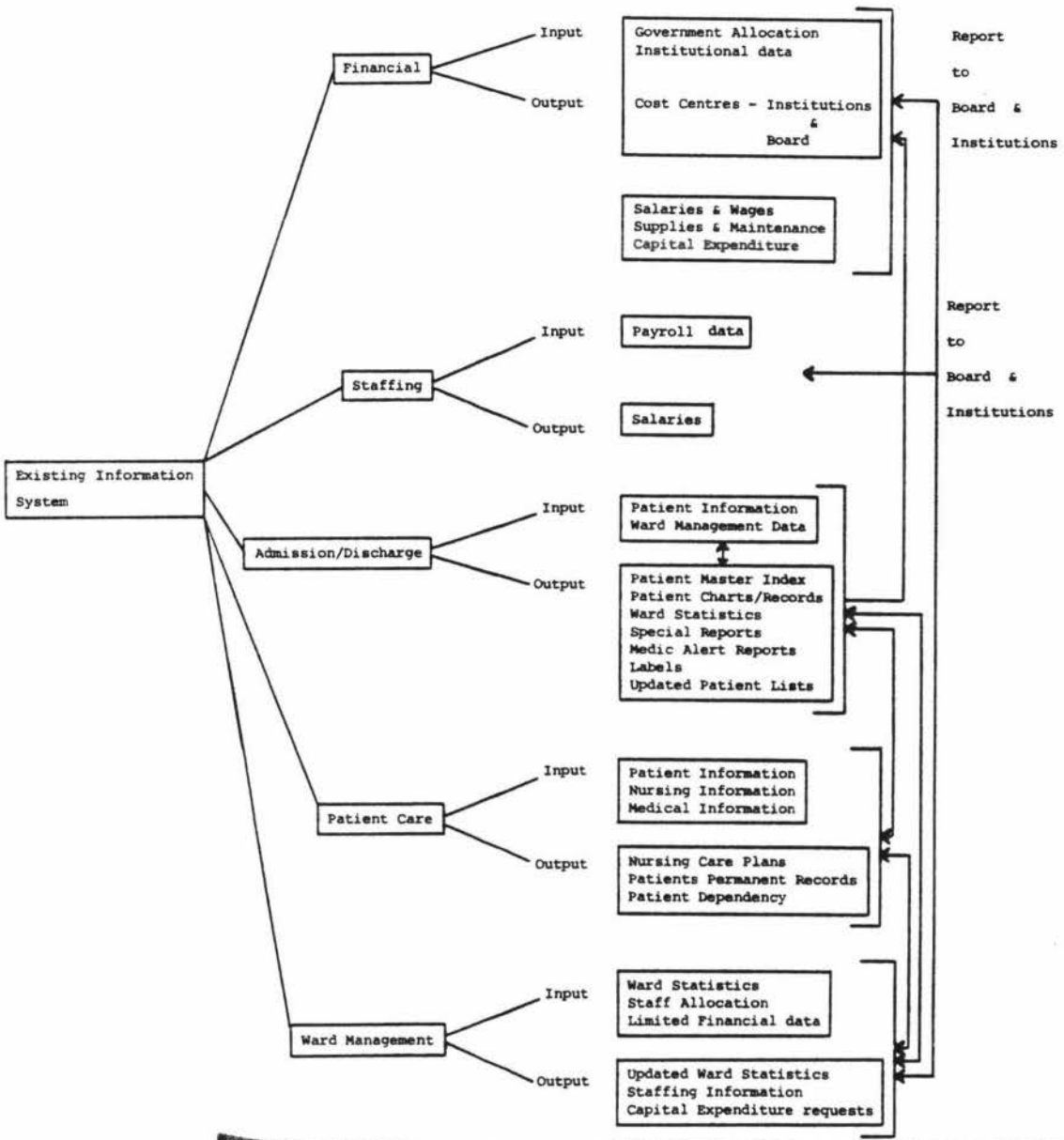


Fig. 5.5 Linkage of the Five Selected Sub-systems.

Chapter 6

PRESCRIPTION FOR THE FUTURE

In this final chapter a series of questions are raised and suggestions as to how they can be resolved are put forward. A model for possible future information systems is developed and discussed, and a general summary of the thesis is presented.

QUESTIONS

The findings from the field study have prompted the author to pose a series of questions relating to information systems development within a hospital health care setting.

Why Change the Existing System?

Farlee (1977) poses the same question in Chapter 1, p. 9, of this thesis. The literature reviewed in the first three chapters indicates a number of reasons for change. The most important of these is the need to rationalise health resources in a realistic manner. This is associated with the need to recognise that information is a health management resource which must be utilised more effectively at the management and administrative levels.

A planned development linking the information sub-systems of the admission/discharge, patient care, nursing management, staffing and finance would provide the hospitals and the Board with a valuable resource.

In the present economic climate in New Zealand, hospital boards must justify expenditure and the provision of a consistent, planned information base is one means of accomplishing this. Ngaio Hospital Board may choose to implement such a comprehensive system in the future.

What Approach Should be Adopted in Relation to
Information Systems Development?

The literature indicates that information systems development must be planned and that this planning phase should involve a variety of health personnel. A multidisciplinary approach to information systems development is preferred and all the literature reviewed cites this as the most effective method available.

Watson (1977) and Zielstorff (1977) both hold the view that this person should be an independent adviser while Somers (1971) supports the use of existing personnel. All writers believe that users must be involved and that they be included in planning for information systems development. Mather's (1973) comments support this view and he further believes that no system should be altered until such time as the users request this. This obviates any negative feeling relating to developing existing systems.

It is apparent that a multidisciplinary approach is the acceptable method to use when considering information systems development. As indicated in the results of the Ngaio Hospital Board field study, there is a tendency for professional groups or disciplines to isolate themselves and previous planning for information systems development has focussed upon the information needs of disciplines rather than those of the health service itself. There is a need for a planned system

of staff education, designed to alter this 'micro' attitude. This leads into the next question which the author raises.

What Kind of Staff Preparation is Required?

Mather (1973) in Chapter 3, p.49, points out the need for staff to be involved from the outset and this view is supported by the authors mentioned above. Lord (1982) makes the point that staff who are going to be involved in information systems development require to state what their expectations of the system will be and how best these can be met.

The author in Chapter 1, p.14, points out the necessity for all personnel involved to be included in the programme designed to prepare people for information systems development and automation. This programme should be prepared in relation to the stated objectives of the planned system. Figure 6.1 presents a flow chart for information systems development and although this thesis is not involved with the technological aspects of automation the process presented is relevant to the situation under consideration.

The Ngaio Hospital Board when defining its information needs must actively plan for the educational requirements of all staff involved.

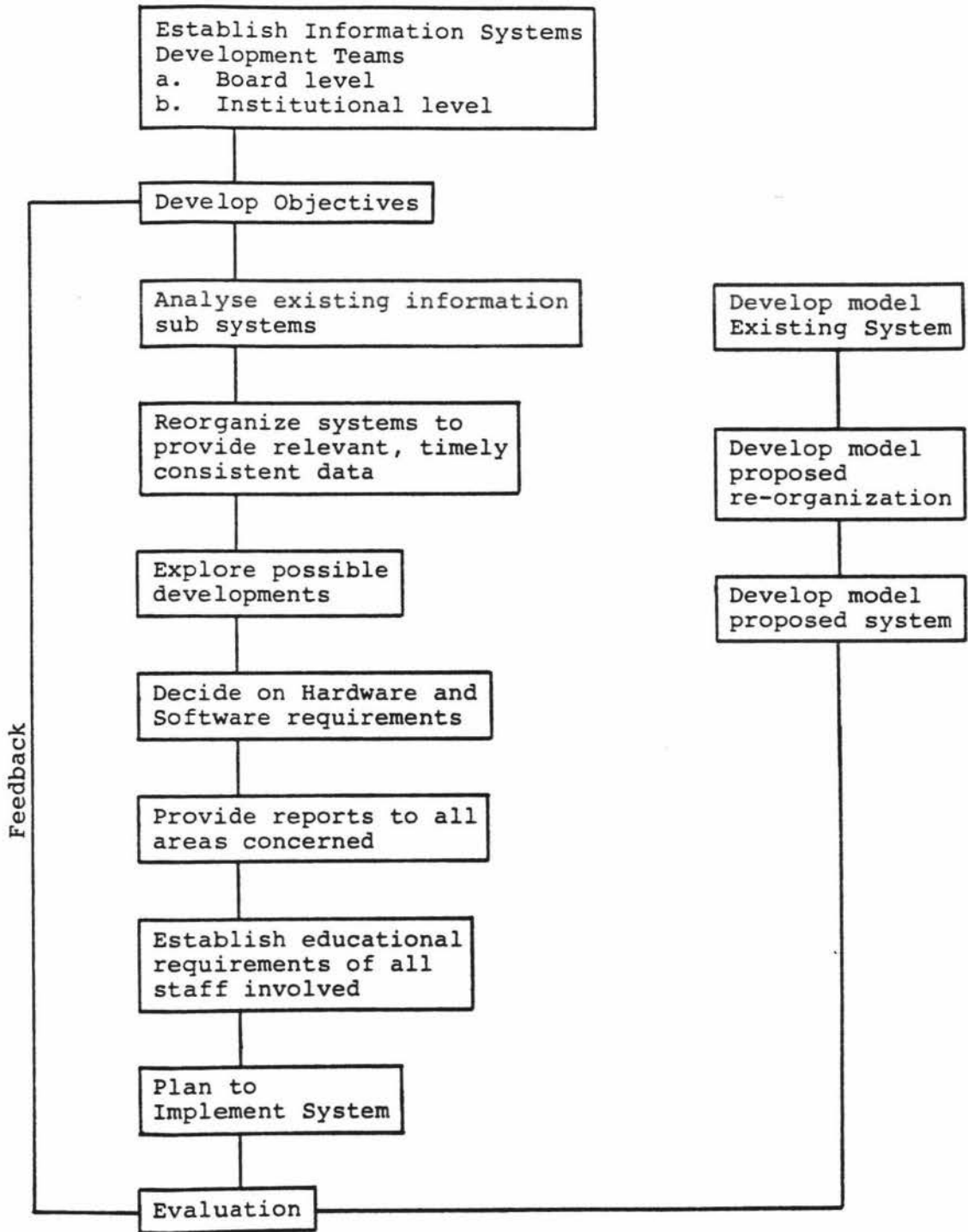


Fig. 6.1 Information Systems Development Flow Chart.
(Adapted from Gane & Sarson 1979, Wales & Murphy 1982)

How Comprehensive Should a System Be?

Should a hospital information system encompass all aspects of information generation, storage, retrieval and utilisation for the total Board area? Or should selected central aspects of the information system be standardised and each institution be given the opportunity to develop a system which meets its own specific information needs? The literature cites examples of comprehensive development. Watson (1977) supports this when describing the El Camino development. Other hospitals have taken certain aspects of a central system and retained this developing the sub-systems around it. This is what occurred at the Royal Children's Hospital, Melbourne. There are other systems which support the development of stand alone systems which can later be linked into a total system. This latter method is the one which most closely fits the situation at the Ngaio Hospital Board where there are existing sub-systems, none of which are fully automated. These could be more effective if a system of linking and sharing was possible. The author supports comprehensive development but in the existing economic climate realises that this is not the most acceptable alternative.

How Specific Should an Information System Be?

Should information systems be developed for separate disciplines? The field study examined two sub-systems specifically relating to nursing. At the outset

patient care information and patient information were combined. The differences between these two systems is debated in Chapter 3, p.76. Patient care information relates to data involving nursing intervention in care whereas patient information relates to hard data or demographic facts about patients.

In retrospect it may be more effective to suggest that a hospital information system consists of three major systems which have the ability to interact:

- ° the administrative information system;
- ° the medical information system; and
- ° the nursing information system.

Each of these systems can define a common core and develop to meet their own information sub-systems around the core or constants. The literature reports examples of nursing information systems development. Somers (1971) reports on the Charlotte Hospital system, and Cornell and Garrick (1973) report upon the system developed at the Texas Institute of Research and Rehabilitation. Both these examples refer to the fact that nurses are free of clerical duties and have more time to spend with patients.

From the data obtained from the field study a nursing information system is described in Figure 6.2. This model demonstrates the core or central focus of the system and the influence of other sub-systems upon it.

If discipline oriented information systems are to be

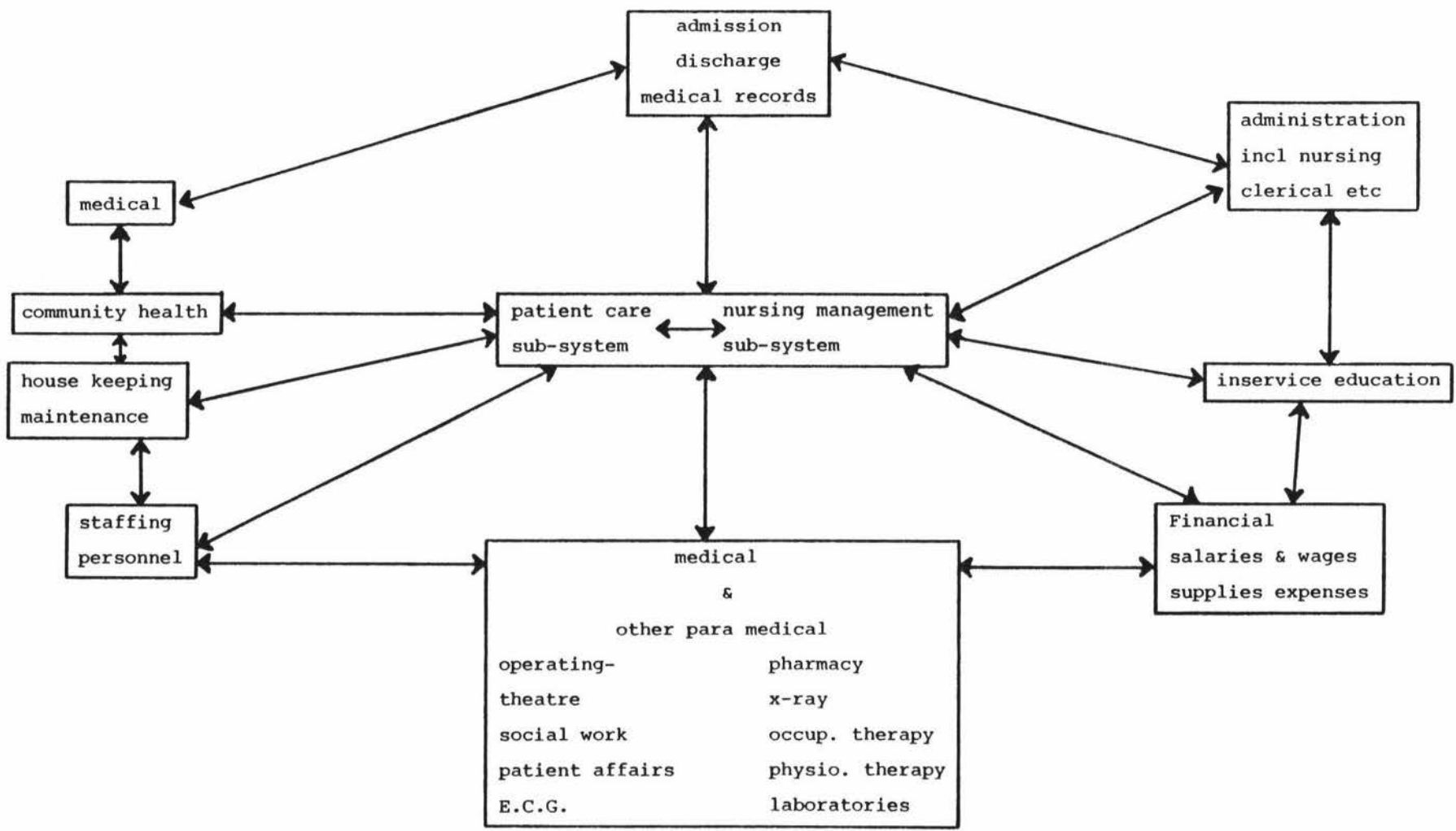


Fig. 6.2 Sub-systems Influencing Nursing. A Nursing Information Sub-system.

planned this type of model is a useful tool in ascertaining information needs and the mechanisms for interfacing.

The field study indicates that a nursing information system exists in all institutions of the Ngaio Hospital Board and that the data is co-ordinated into the patient record. The systems model presented in Figure 3.3, p.79, is indicative of this system and can be utilised in planning for this kind of development.

Why Automate ?

If an existing manual system is meeting the information needs of an organisation there is no need to automate according to Farlee (1977). If, however, the national plan is to provide a means of generating consistent data on a local and national basis, it is necessary to accept automation as the only option. This, according to the literature is the only means of ensuring consistency (Patston, 1978) On a national basis automation is an accepted means of ensuring consistency and it also means that the margin for error in calculating the data base is reduced.

Technology is developing at such a rate that providers of health care are of necessity required to accept automation.

What is the Future of Information Systems in the Hospital Health Care System?

It appears that it is essential that information be recognised as a resource which must be developed and rationalised. The literature indicates cost savings as one of the features of information systems development. This is indicated in financial terms by Watson (1977), and in quality care terms by Cornell and Garrick (1973), Hegyvary et al (1974), Somers (1971). The information resource must be rationalised to enable health care professionals to make the most effective use of other resources and to plan to provide the quality of care the consumer is being educated to expect.

Future development of information systems is exciting and essential. The literature already indicates ways in which information can improve patient care, provide for more effective staffing ratios, and provide administrative data for realistic and timely planning and decision making.

A MODEL FOR FUTURE INFORMATION SYSTEMS DEVELOPMENT

In Chapter 5, Figure 5.5 depicts a model of the Ngaio Hospital Board sub-systems which are analysed in the field study. Figure 6.1 presents a data flow chart which indicates how an information system can be developed. This Figure (6.1) highlights three areas where models should depict the system:

- ° a model of the existing system (Figure 5.5)
- ° a model of any proposed re-organisation (Figure 6.2)
- ° a model of the proposed system.

Figure 6.2 suggests how the nursing information system can be re-organised and this model can be generalised to administration and medicine as is suggested on p.164 of this chapter.

The field study provides the basis for the future development of an information system. A model of a future oriented system is adapted from the work of Bengtsson et al (1977). This model is presented in Figure 6.3.

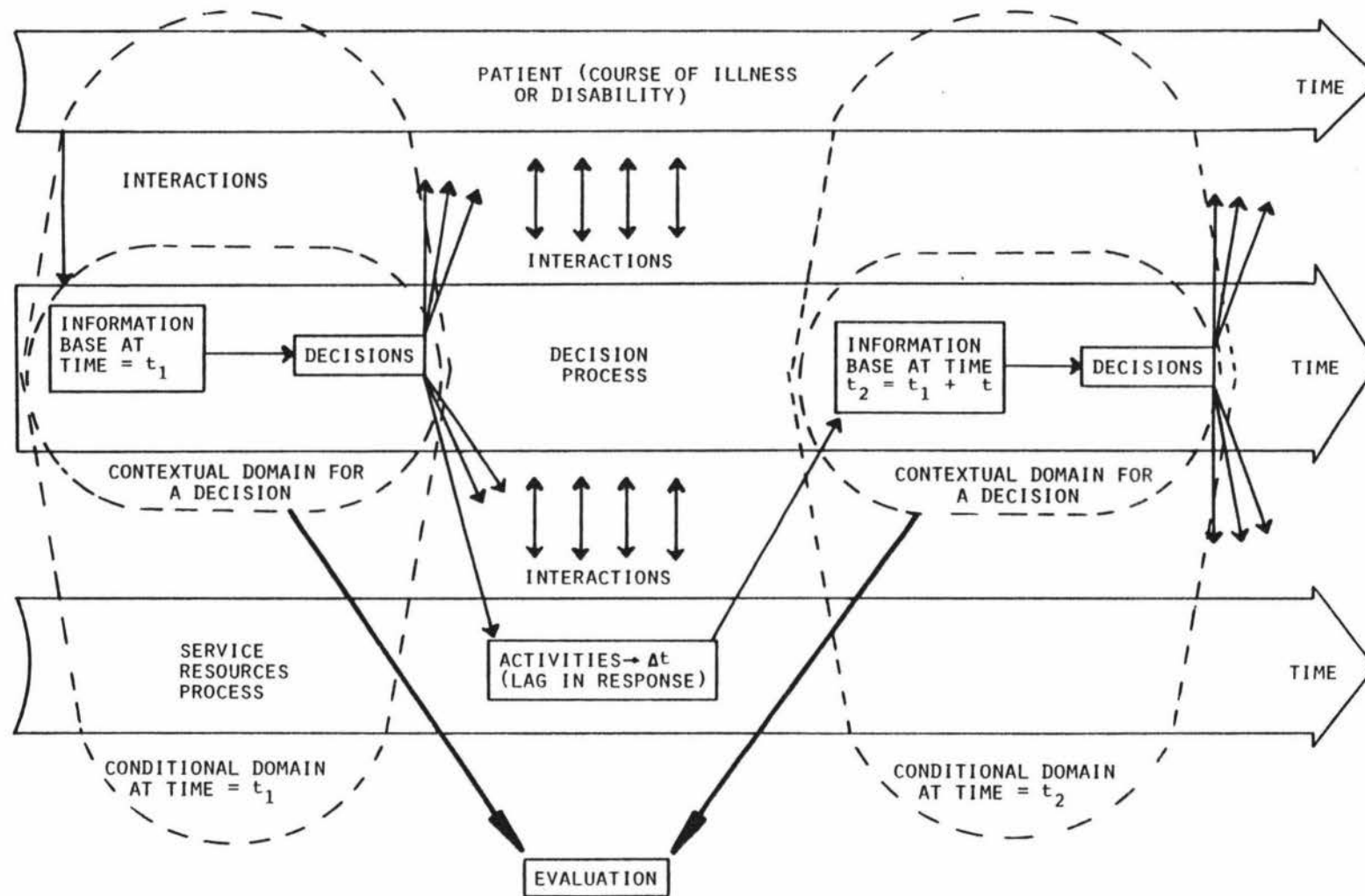


Fig. 6.3 One Model which Encompasses the Concept of Information Systems Development. (Adapted from Bengtsson et al 1977)

Bengtsson et al (1977) developed this model to describe medical information systems. It has similarities to the interactional models (Figures 2.2 & 2.3). The levels in this case can be described as linear rather than hierarchical and time is a critical factor. The model can be utilised to describe the functions of information and for discussing the techniques utilised in data generation, storage, retrieval and utilisation. The model has its basis in cybernetic modelling as each step has a control mechanism and a monitoring mechanism, testing and transferring all information relevant to the system. The main function of this model is to provide relevant information for timely decision making and it therefore can be utilised as a prescription for future development.

According to Bengsston et al (1977):

The future use of this model is evident. It describes involved processes in their actual context. The model can be used to analyse a system and it has a function in developing and evaluating systems— This includes the definition of a set of criteria useful for planning activities

(p.445-446)

This model can be regarded as a prescription for the future.

CONCLUSIONS

This chapter presents possible answers to questions which are raised during the field study. They are only suggestions as it is the function of the manager/user group to explore the alternatives and provide the best possible solution for the organisation. It is recognised that there must be user participation throughout each phase of management information system development. The need for staff preparation for this development is highlighted and as each question is discussed it is linked back to the findings of the literature search.

A data flow chart of one method of information systems development is presented along with a model for a specific nursing information system and a possible model for a future health information system. This last model, Figure 6.3, links back to the original cybernetic model presented in Figure 1.1 and the three interactional levels developed by Howland (1968) and translated into an information systems context in Figure 2.3.

Information systems development in the hospital health care system is an exciting concept. A wealth of data is generated but is poorly utilised. The findings of the field study support this view and the time is right for managers and administrators to become

actively involved in utilising information in an intelligent, effective and efficient manner so that a consistent data base is provided for planning and decision making in the health services to be a rational, well thought out process.

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APPENDIX 4.1

INFORMATION SUB-SYSTEMS CHECK LISTS

PATIENT CARE INFORMATION CHECK LIST

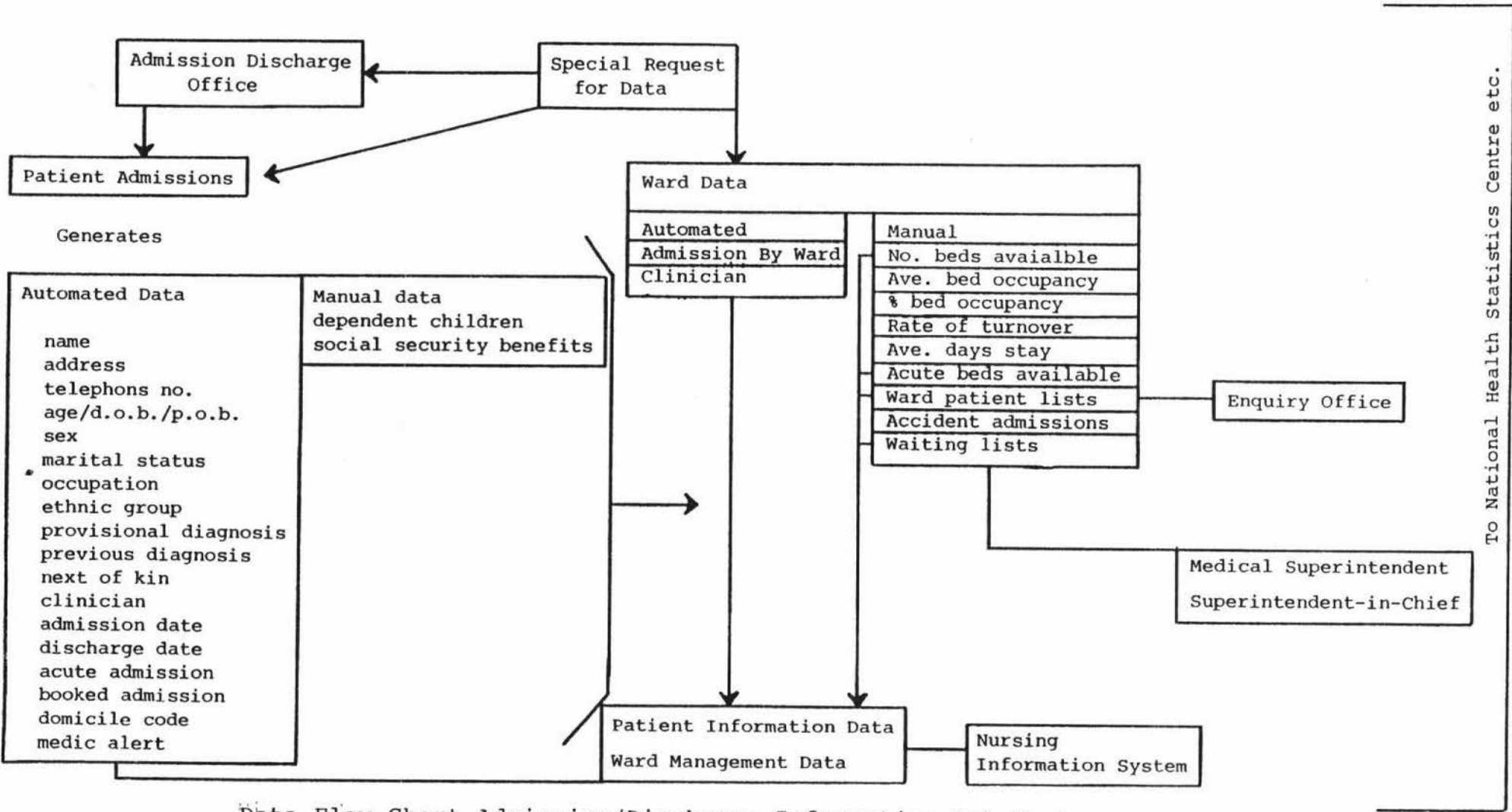
Respondent:

Status:

| | M | A | Y | N | NA |
|--|---|---|---|---|----|
| 1. Demographic Data. | | | | | |
| Patients name | | | | | |
| address | | | | | |
| telephone | | | | | |
| age | | | | | |
| sex | | | | | |
| marital status | | | | | |
| occupation | | | | | |
| race | | | | | |
| dependent children | | | | | |
| present diagnosis | | | | | |
| previous diagnosis | | | | | |
| next of kin | | | | | |
| social security benefits | | | | | |
| clinician | | | | | |
| admission data | | | | | |
| discharge date | | | | | |
| acute admission | | | | | |
| waiting list | | | | | |
| domicile code | | | | | |
| 2. Nursing history - completed within 24 hrs of admission | | | | | |
| 3. Nursing care plans Nursing dependency ratings | | | | | |
| 4. Are updated nursing orders current | | | | | |
| 5. Are medical notes current | | | | | |
| 6. Are medical orders current | | | | | |
| 7. Are Dietary orders current | | | | | |
| 8. Are Pharmacy orders current | | | | | |
| 9. Are Critical recordings current | | | | | |
| 10. Are Laboratory reports current | | | | | |
| 11. Are Radiology reports current | | | | | |
| 12. Are Patient Charts utilized for retrospective audit | | | | | |
| 13. Is patient specific information readily available | | | | | |
| 14. Is Discharge information completed after 24 hrs discharge | | | | | |
| 15. Comment | | | | | |

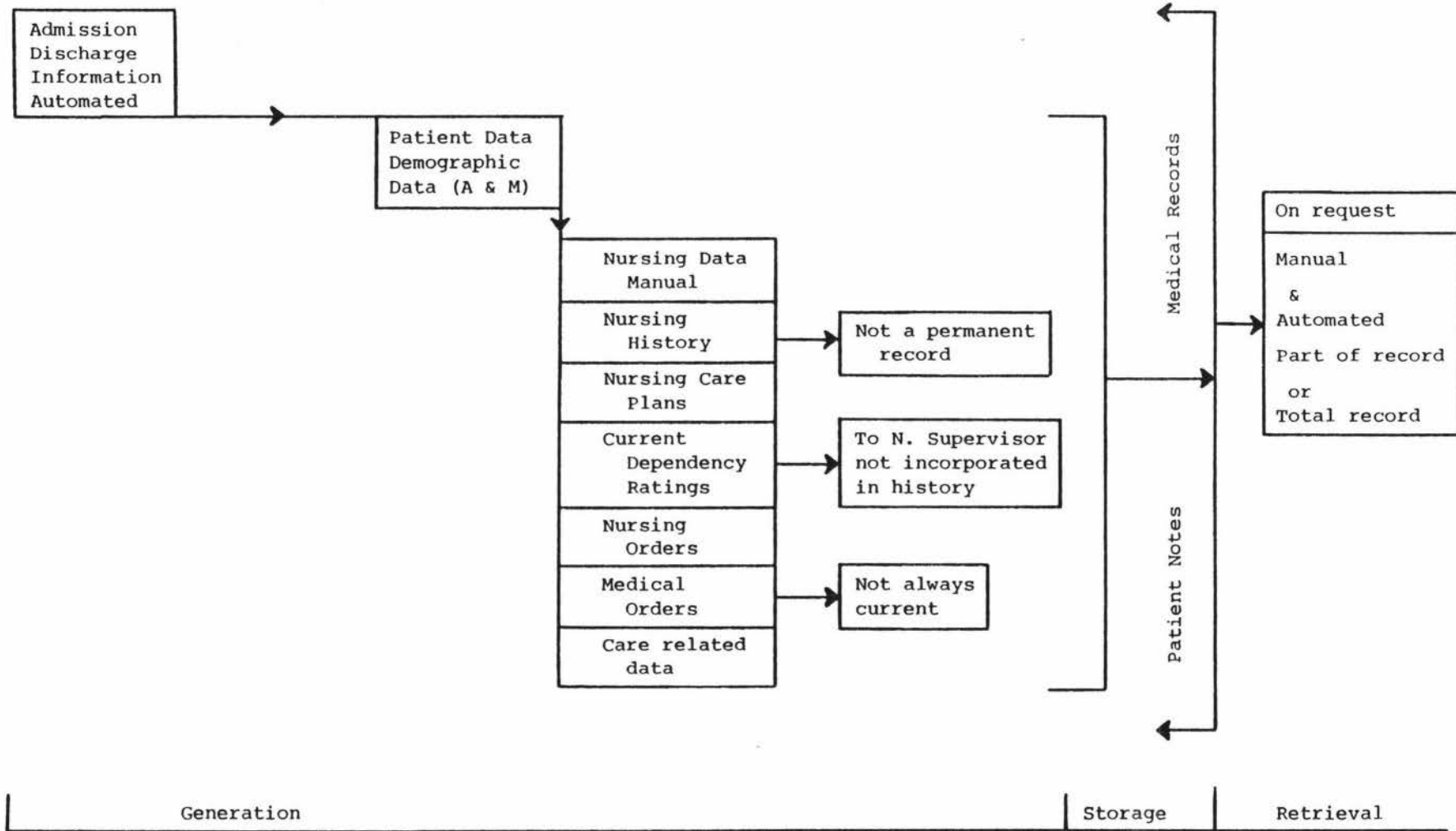
APPENDIX 4.2

SUB-SYSTEM DATA FLOW CHARTS

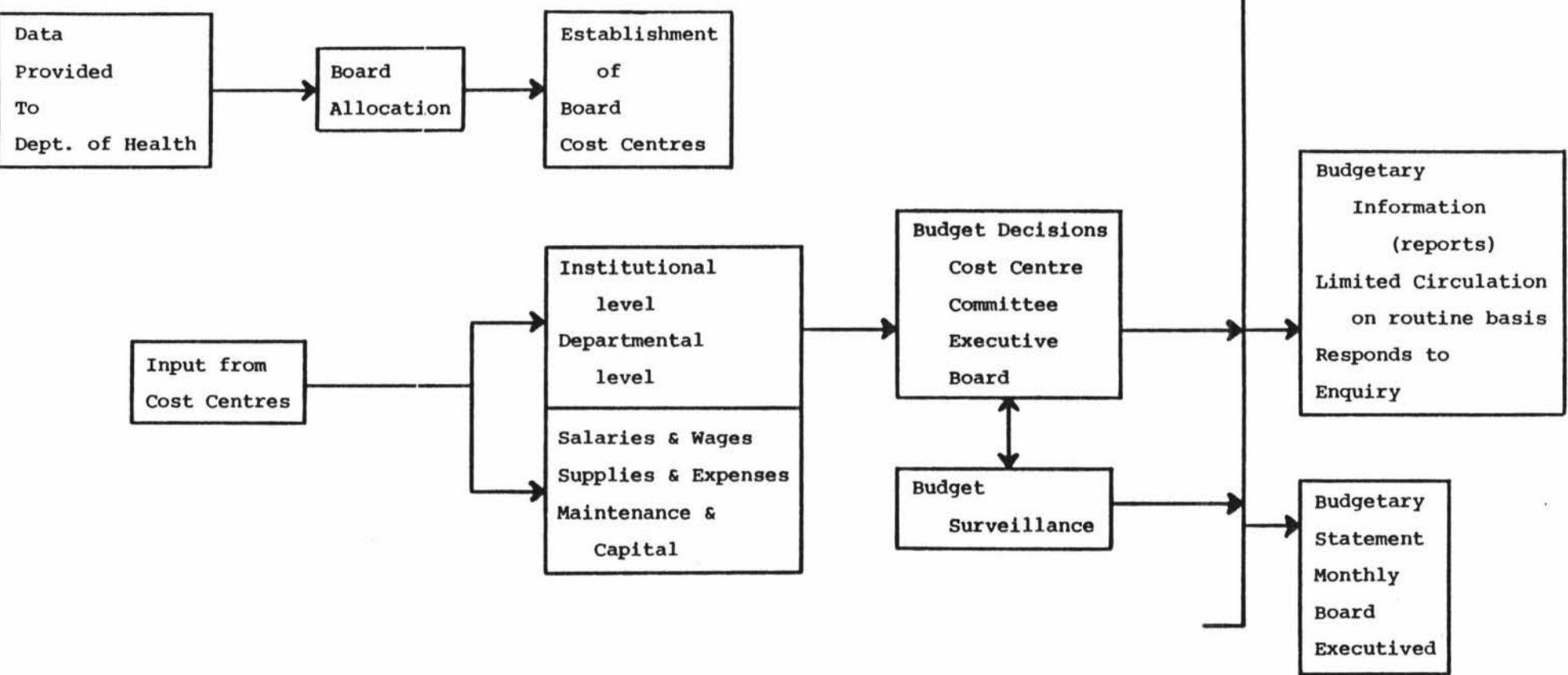


Data Flow Chart Admission/Discharge Information Sub-System.

To National Health Statistics Centre etc.



Data Flow Chart Patient Care Information Sub-System



Data Flow Chart Financial Information Sub-System

APPENDIX 4.3

IN-DEPTH INTERVIEW SCHEDULES

IN DEPTH INTERVIEW

ADMISSION/DISCHARGE INFORMATION SYSTEM

1. You have before you a simple diagram which indicates the way in which data is generated by the admission/discharge system described as being in current use in this Hospital Board.

In your view what are the positive features of the system.

In your view what are the negative features of the system.

2. Do you in your capacity of administrator use any of the admission/discharge data?

Explain to me how you use this.

3. Do you as an administrator use any ward data?

Explain to me what data you require and how you use this.

4. Ward data appears to flow in three directions;
it becomes included in patient information data;
ward management data;
and it is circulated to the medical members of executive
and management teams.

Are there any comments you wish to make about this.

5. It is possible to initiate special requests for data. Have you ever done this, if so, how often in the past year.

Describe the purpose of your request.

6. If the current system was fully automated what reports would you require on a regular basis and how frequently.

7. Which of the following do you currently regard as a problem of the Admission/Discharge data;
- inconsistency of data collection methods;
 - generation of unnecessary data;
 - storage and retrieval of data;
 - meeting special requests for data.

FINANCIAL INFORMATION SYSTEM

Q1 You have before you a simple diagram which indicates the way in which data is generated by the Financial Information System described as being in current use.

Does this interpretation appear to be correct?

What are the positive features of the system

(Cost Centres)

What are the negative features of the system

Q2 Do you as an administrator use any of the Financial Systems data.

Explain to me what data you require and how you use it

Q3 Have you any comment regarding the establishment of cost centres

Q4 Is it possible to initiate special requests for data

Have you ever done this, how frequently, and for what purpose

Q5 If the current system was fully developed and automated would you request reports on a regular basis

What reports would be useful to you

PATIENT CARE INFORMATION SYSTEM

Q1 You have before you a simple diagram which indicates the way in which data is generated by the Patient Care Information System described as being in current use. Does this interpretation appear to be correct?

What are the positive features of the system

What are the negative features of the system

Q2 Do you as an administrator use any of the Patient Care data?

Explain to me what data you require and how you use this

Q3 Are all the data retained as a permanent record?

Q4 Have you any comments you would like to make about the patients records?

Q5 If the current system was fully automated, how would you utilize the system.

What reports would you request?

How frequently would you require these?

NURSING MANAGEMENT SYSTEM

Q1 You have before you a simple diagram which indicates the way in which data is generated by the Nursing Management System described as being in current use.

Does this interpretation appear to be correct?

What are the positive features of this system?

What are the negative features of this system,?

Q2 Do you as an administrator use any of the Nursing Management System data?

Explain to me what data you require and how you use this.

Q3 Do you believe that Nursing Management in wards and departments is a planned process or is there a tendency toward crisis management?

STAFFING INFORMATION SYSTEM

Q1 It has not been possible to provide a simple diagram indicating the way in which data is generated by the Staffing Information System.

Could you describe the system for me?

What are the positive features?

What are the negative features?

Q2 Do you as an administrator use any of the Staffing data?

Explain to me what data you require and how you use this.

Q3 It is possible to initiate special requests for data.

Have you ever requested financial data?

How often in the last 12 months?

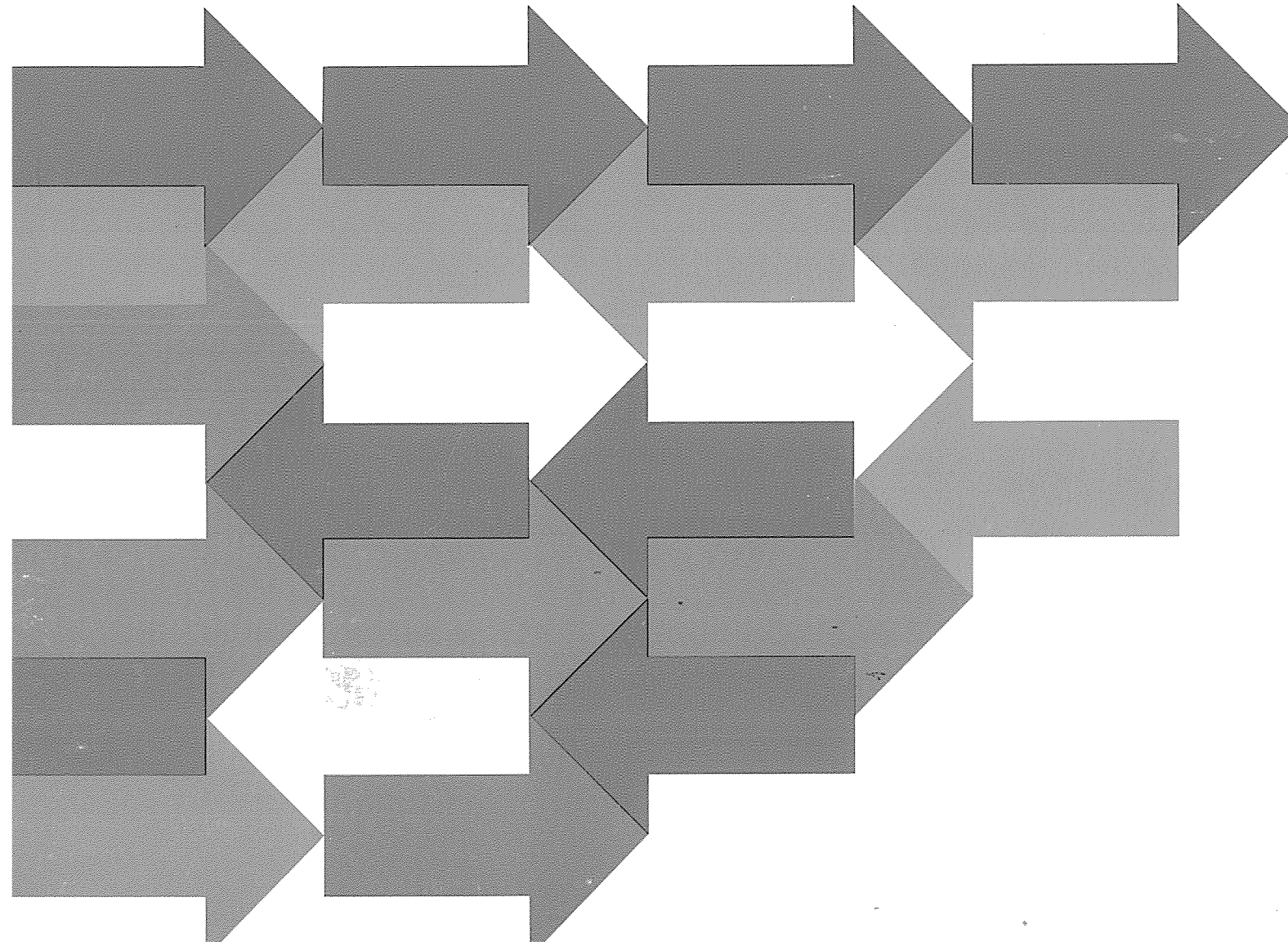
Describe how data is retrieved and how you use it.

APPENDIX 5.1

INTRODUCING THE HEALTH SERVICES
ADMISSION/DISCHARGE SYSTEM



introducing the health services admission/discharge system





Index

- PAGE 3: Background
- PAGE 5: What is the A/D System?
- PAGE 6: Does the same system operate in all hospitals?
- PAGE 7: How does the system operate?
- PAGE 8: What does the system do?
 - Patient Registration
 - Waiting List/Pre-admission
 - Admission/Inpatient
 - Post-Discharge
- PAGE 10: How is the A/D System implemented at a hospital?
- PAGE 11: Will the system work?
- PAGE 12: The Benefits
 - To Hospitals
 - To Clinicians
 - To Patients
- PAGE 14: Who has access to the system?
- PAGE 15: How much will it cost to participate in the system?
 - Future Impact



The Admission/Discharge System is one of the three major core systems being developed by the Data Processing Division of the Department of Health. The system operates using New Zealand's nationwide computerised 'health' network which is, as far as we are aware, the world's first such health computer link-up. The network now being progressively introduced has the capability to interconnect all twenty-nine hospital boards, their hospitals and the Department of Health and will allow information and systems to be shared across the health services.

The history and organised use of computers and data processing in the health service goes back less than ten years. In the late 1960's the National EDP Committee (Health) was formed to co-ordinate data processing projects and rationalise the independent efforts of hospital board personnel. Numerous projects were approved and undertaken in areas such as clinical laboratories, payroll, budget and financial systems and hospital admissions processing. By 1973 it was apparent that only limited progress was being made and that financial commitments were increasing without adequate controls. This resulted in a moratorium being placed on all further development.

Early in 1974 the Committee approved in principle the concept of engaging consultants to develop a plan to provide better managed and controlled health computer services. In October 1974 the American firm of Touche Ross & Co. was selected to conduct the review and analysis, and a report was presented to government in February 1975. The report advocated the development of a Data Processing Division within the Department of Health and the use of regional computer centres and a teleprocessing network to provide services to the end user. The report was adopted and the project to develop the organisation was begun in August 1975.

The organisation which is now in place is progressing toward completion of its initial systems projects, one of which is the Nationwide Hospital Admission/Discharge System.

background



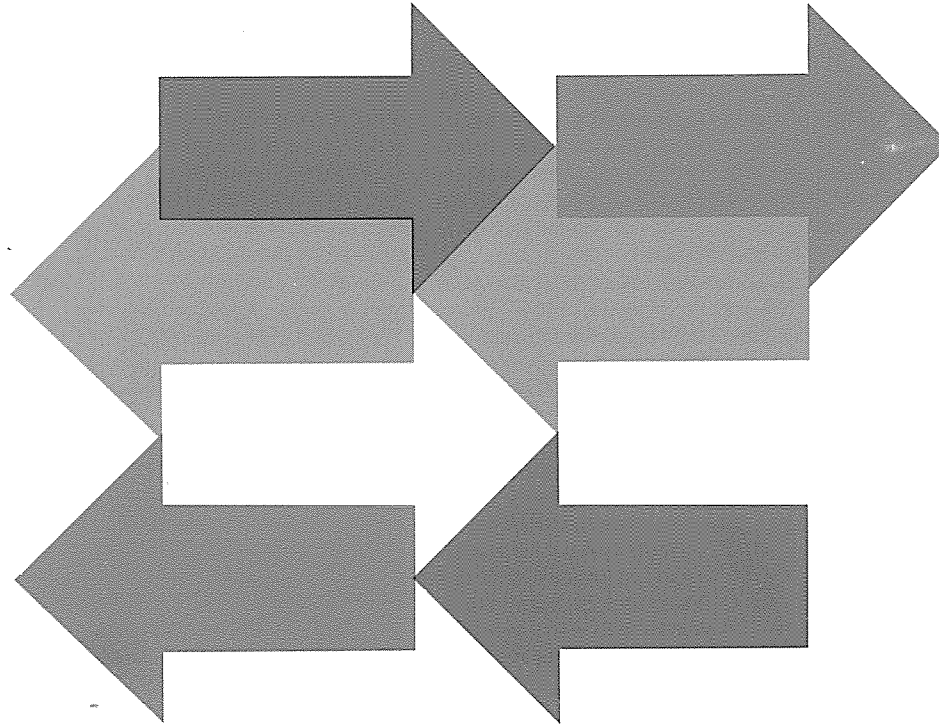
What is the Admission/Discharge System?

The Admission/Discharge Computer System is a nationwide computerised system which records patient event information on inpatients treated in general public hospitals within New Zealand.

It has been designed to operate in a wide variety of hospital environments, ranging from large urban hospitals such as Auckland and Wellington, to small rural hospitals like Dunstan and Te Puia.

The system has facilities for dealing with all special conditions that can arise on any one of the over 350,000 admissions each year. The A/D System includes a 'Medical Alert' feature which will keep track of special medical conditions such as drug allergies or diabetes and automatically notify hospital staff about these conditions when the patient is admitted.

The system also provides clinicians and hospital management with timely and accurate information about the operation of the hospital and its workload. This data will allow them to plan and coordinate hospital activities more effectively.

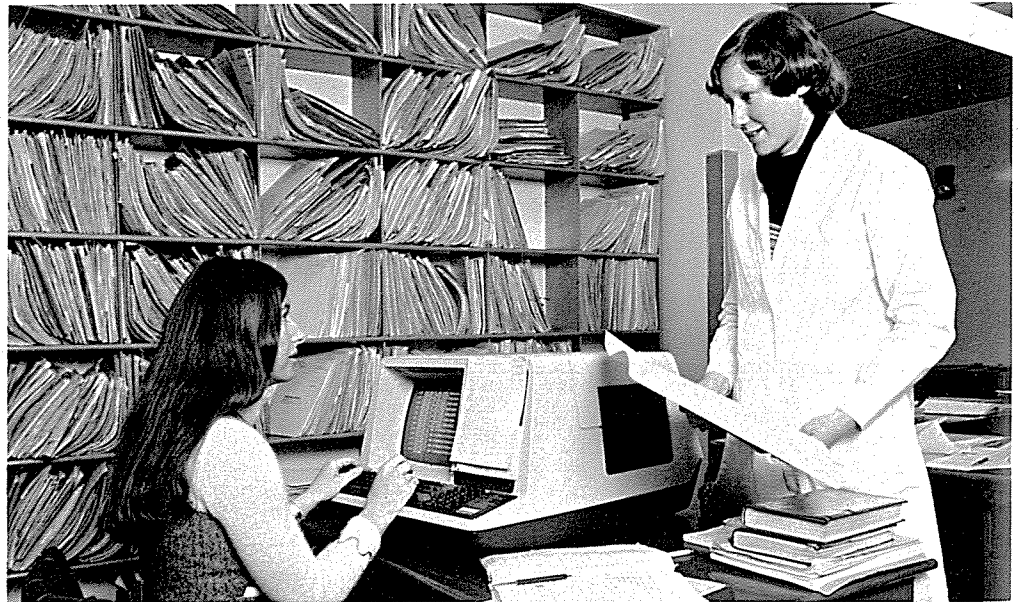


Does the same system operate in all hospitals?

Yes, but in different 'versions'. Because the size and needs of the hospitals vary so much, the system has been designed on a 'modular' basis to give it maximum flexibility. In other words, the system contains various components which can be implemented or deleted, depending on local hospital requirements.

The basic system component common to all users is called the 'minimal system' and includes two of the five phases comprising the total A/D System. These phases are Patient Registration and Post-Discharge Processing. It is expected that smaller hospitals will ask for this version of the system and other components which suit their needs.

Larger hospitals will use the 'full' or complete A/D System. At full system hospitals, patient information is first placed on the system when an individual is added to the waiting list. The system then parallels the normal hospital workflow and tracks patients through the pre-admission, inpatient, and post-discharge stages. Because patients are admitted from a number of sources, provision has also been made to first place patient information on the system at either the pre-admission or inpatient stages. For example, acute admission processing would ignore the first two system activities (waiting list and pre-admission) and begin with inpatient processing.



How does the system operate?

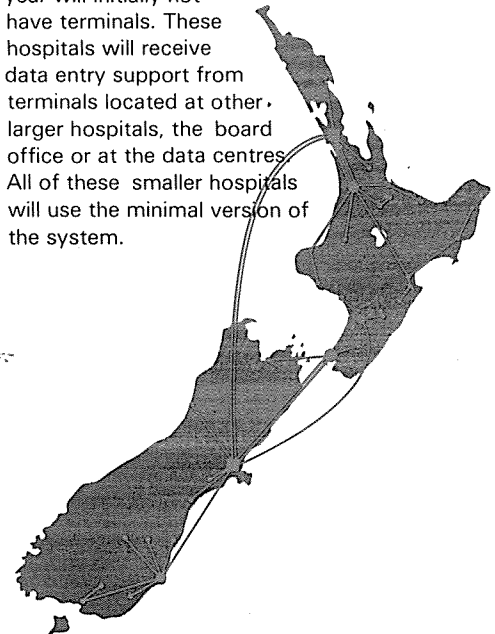


The system will be used via computer terminals that are connected through minicomputers installed at strategic locations to one of the two main computers in Auckland or Christchurch. In most cases the computer terminal will be a visual display unit (VDU) that incorporates a typewriter keyboard with a T.V.-like screen for displaying input information and computer responses. These VDU terminals will normally be operated by clerical staff in the medical records, admitting, enquiries and waiting list areas of the hospitals. Based on experience, it takes approximately one or two weeks of part-time training to teach a new employee how to operate the terminal portion of the system.

All of the terminals within the hospital will be connected to a minicomputer or TTCC (Transaction Terminal Cluster Controller). This unit will manage the local terminals, perform some processing activities, and control communications with the main computer. The equipment will look like two or three cabinets about the size of a four drawer foolscap filing cabinet. Output from the TTCC will usually be printed on a high speed printer that is attached to the unit. Local staff members will also be trained to operate the TTCC.

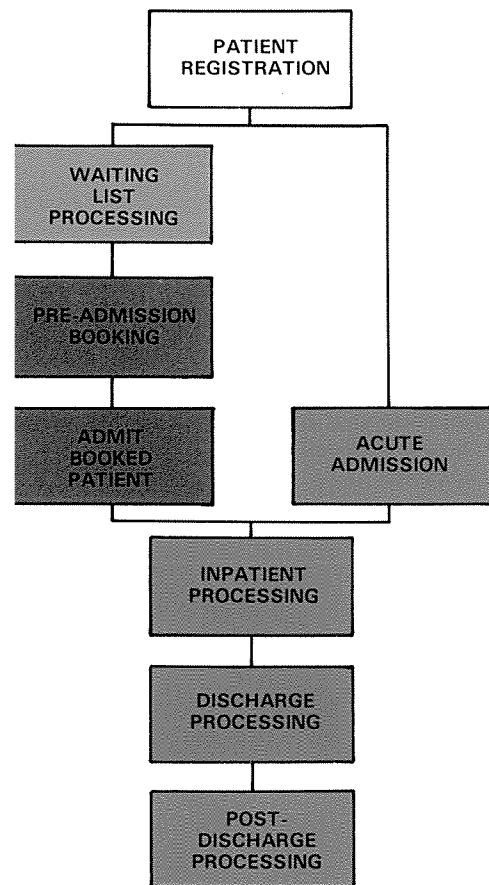
The TTCC's are connected to the DEC system-10 mainframe computers by Post Office leased data circuits. Hospital boards in the South Island and the lower one-third of the North Island, will link to the main computer in Christchurch. Other North Island boards will link to Auckland Computer Centre. The prime functions of the main computers are to perform major computations, store processed data, control the data base, and supervise the operation of the communications network.

To promote efficient use of the equipment and to minimise the overall cost of the system, hospitals with less than 2500 admissions per year will initially not have terminals. These hospitals will receive data entry support from terminals located at other larger hospitals, the board office or at the data centres. All of these smaller hospitals will use the minimal version of the system.



What does the system do?

The A/D System controls and reports on every patient contact an individual has with a hospital. The full A/D System includes five identifiable phases — Patient Registration, Waiting List, Pre-admission, Admission/Inpatient, and Post-Discharge.



Patient Registration Phase

An individual's initial contact with the system is the registration process. At present most hospitals maintain an alphabetic index of patients who have previously been treated at that location. If a patient's name is located on this file during subsequent visits to hospital, the local identifying number is obtained and the medical records are located and forwarded to the attending clinician.

The A/D System replaces the present local, manual patient index with a nationwide record of patient information. An individual can be located in this computerised index either by using the patient's unique national identifying number or by using the patient's name, sex and age. If the patient is located on the computer file the following information is available:

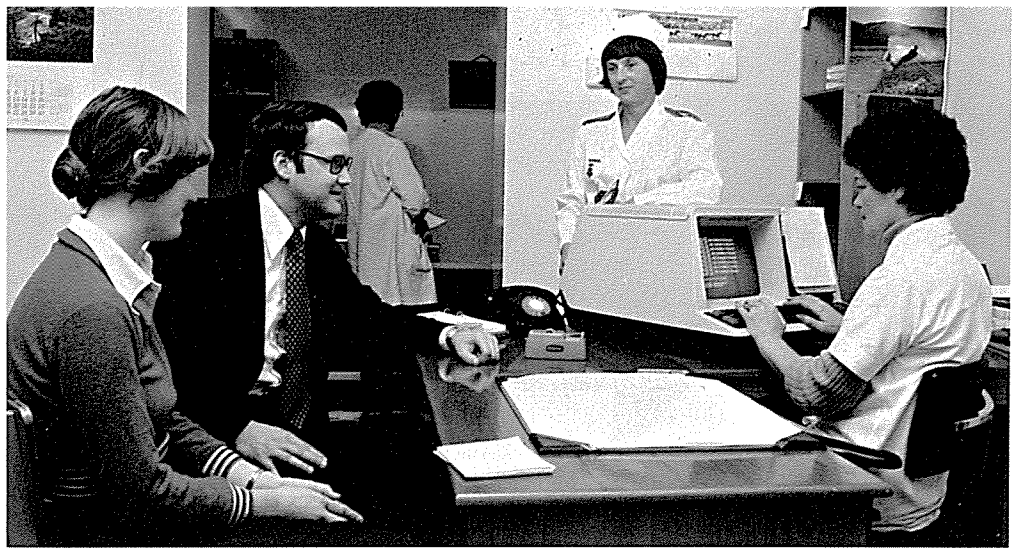
- Basic identification data (e.g., name, date of birth, place of birth, sex and present address).
- Medical history information (e.g., discharge date, primary diagnosis, treating hospital and clinician for each inpatient event that occurred at an A/D System hospital).
- Medical Alert/Warning information (e.g., drug allergy).

If, however, a patient is not located during the name search, additional data is entered and a unique national number will be assigned by the computer. The process of assigning the patient number is referred to as patient registration and it is always a patient's first contact with the system.

Waiting List Phase

After the patient has been assigned a unique patient number, system processing continues in one of several directions. At full system hospitals, for example, the patient can be added to a computerised waiting list. Because demand for hospital services can exceed available resources, many hospitals are required to maintain lists of patients who are waiting for admission. The A/D System can completely replace the manual files and the maintenance activities associated with the present approach to waiting list management.

After assembling the key information required to place the patient on the appropriate waiting list (e.g., name, department, provisional diagnosis and operation, etc.) the system will produce management reports which provide cumulative changes since the last weekly report, a complete weekly list of waiting list patients, and the quarterly summary reports required by the Department of Health. Individual reports will also be distributed to appropriate department heads and clinicians within the hospital to advise them of their waiting list status. Implementation of the mechanised system should reduce the staff effort required in the waiting list office by replacing the manual preparation of waiting list files and reports with a single data entry requirement.



Pre-admission Phase ■

Pre-admission processing, or patient booking, occurs after a patient has been selected for admission from a waiting list, or a clinician has arranged a direct admission for a patient. To book a patient for admission the system requires hospital personnel to enter the expected admission date, ward (if known), bed type required, primary clinician, provisional diagnosis or operation (if known) and the pre-admission clinic date.

If the patient is being admitted from a waiting list, the system will automatically remove the patient from the appropriate waiting list maintained on the system. The system also produces a series of reports that provide arranged admission information to various hospital departments:

- A daily list of expected admissions is provided to the ward.
- A list of new, cancelled or changed bookings is provided to the admissions office.
- A bed state report which identifies anticipated available beds for the next week is provided to the admissions office.

In addition to providing these summary reports the system also produces a printed pre-admission form for all non-acute admissions (e.g., waiting list or booked). This form contains all patient information known to the system and can be mailed to the patient when time allows. If the patient intends to accept the booking, missing information is completed, incorrect entries are changed and the signed form is returned to the hospital. Receipt of this form at the hospital will confirm the booking and provide accurate patient information for system updates.

Admission/Inpatient Phase ■

Patients can either be admitted through the pre-admission process, or directly as acute admissions. In either case, after the admission the system maintains a detailed event record for each patient:

- Admission date, time and source
- Ward, bed type and bed responsibility
- Patient condition
- Primary and secondary clinicians
- Provisional diagnosis and operations
- Discharge type and date

This record is initiated at admission, updated while the patient is in hospital, and deleted during post-discharge processing.

The information entered during inpatient processing is primarily used to prepare a series of reports. The first group includes the control and audit reports required to monitor the flow of data into the system and to control its accuracy. For example, this category includes a movement report which identifies all hospital admissions, discharges and transfers that occurred within the previous twenty-four hours. The second major group of reports are informational and replace existing hospital documentation. Included in this category, for example, are patient frontsheets and an alphabetic inpatient list for the entire hospital. The third major report category includes summary level management information for use by hospital and board administrators. For example, the system produces a series of monthly management reports that identify utilisation-related statistics by ward, bed type and responsible clinician.

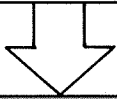
Post-Discharge Phase ■

The final step, post-discharge processing, begins after a patient has been discharged from hospital and involves the development of patient statistics for the National Health Statistics Centre (NHSC). Patient discharge data is placed on the system by the hospital, reviewed by the NHSC, and queries are returned over the network to the hospital for correction. This interactive process continues until the discharge records are correct and accepted by the NHSC.

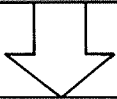
Once the records have been approved, selected information is moved to a series of archive registers which will be available to the NHSC and hospital boards for statistical and research purposes.

How is the A/D System implemented at a hospital?

review



initial training



implementation

Due to the complexity of the system and the number of staff members and operating procedures that may be affected, the A/D System implementation approach contains several stages that occur over a number of months. The initial activity is a pre-implementation review of hospital policy, procedures and staffing patterns. This review provides the DP Division personnel involved in the implementation with a detailed understanding of how the hospital functions today, and what operational changes will be required to support the A/D System.

The initial fact finding activity is then replaced with a concentrated period of developing and documenting new hospital procedures. Simultaneously, one or more hospital employees are given extensive system training with the goal of creating a 'local expert' who has an in-depth understanding of the A/D System.

At the completion of this preparation phase, procedure and terminal training occur and the initial phases of the system are implemented, normally registration and post-discharge functions. These activities are then allowed to 'settle in' before the next implementation stage is initiated. This step-by-step approach is repeated until the full system is operational. The number of steps and the time between steps is variable and strictly dependent on the local situation. Implementation assistance by DP Division personnel is available on an 'as required' basis throughout this period.



Will the system work?

Yes. A great amount of planning and operational checking has been undertaken to ensure that the system is both efficient and practical.

To assist in the development of the system and to ensure that the user's requirements were fully understood and satisfied, the design process included the establishment of an A/D User Project Team and System Review Group. The User Project Team was set up to assist in the design and testing of the A/D System. Since the project team's organisation in late 1975, representatives from all related hospital disciplines (medicine, nursing and administration) have been involved at one time or another.

The System Review Group has consisted of over forty representatives from hospitals, universities and medical research institutions. The Group meets on an 'as required' basis to review project activities and to provide overall direction.

In addition to having extensive user involvement during the initial design process, the feasibility of the system was also monitored during the initial hospital implementations. Three prototype hospitals (Masterton, Christchurch and Dunedin) were used to test the system in a live hospital environment. Due to its size and complexity the system was split into five development and implementation stages. This approach has allowed pieces of the system to function in a hospital environment at the earliest opportunity. Following several months operation of each system component, a formal post-implementation review has been conducted and the feedback used to revise the existing components and to modify the future phases where appropriate.

Based on the record of successful implementations to date, this carefully planned approach has created a modular system that can function successfully in a wide range of hospitals.



The Benefits

TO HOSPITALS

The information provided by the system will give local hospital management the ability to set objectives or target levels for each of their management responsibilities. If management objectives are specified, the reports will automatically calculate variances and allow local management to identify those areas where performance significantly varies from planned levels. Thus management should be able to focus their attention on those areas that are not meeting the plan, identify contributing factors, and determine remedial actions required to resolve the situation.

It is the heart of the system's philosophy that if responsible individuals are provided with timely and accurate information, resource management will improve at local hospital, board and national levels. As requested by the users, the system provides very comprehensive management reporting. The illustration at the bottom shows an example quarterly management report that summarises bed utilisation by ward. Among the other reports produced by the A/D System are:

Waiting List Reports

- Weekly updating of waiting lists.
- Cumulative weekly changes to waiting lists.
- Quarterly waiting list summaries automatically produced for the Department of Health.

Pre-admission Reports

- Automatic transfer of patient from waiting list to pre-admission.
- A list of each day's expected admissions is provided for each ward.
- A list of new, cancelled, or changed bookings or 'no shows' is produced for the admissions office.
- A bed state report identifying anticipated bed availabilities for the next week is available for the admissions office.
- A printed pre-admission form containing all the patient information known to the system is automatically produced. Patient information missing on the form can be provided at admission, updating the information known to the system.

Admission/Inpatient Processing Reports

- Detailed event record for each patient which is up-dated while the patient is in hospital.
- Daily movement report identifying all admissions, discharges and transfers which occurred during the previous twenty-four hours.
- Patient front sheets and an alphabetic inpatient and location list for the entire hospital.
- Monthly management reports identifying utilisation-related statistics by ward, bed type and responsible clinician.

| ADR14A 270778 | | AOTEAROA HOSPITAL BOARD GREENWOOD HOSPITAL | | |
|------------------|------------------|---|--------------------|-----------------------------------|
| | | MONTHLY MANAGEMENT SUMMARY BED UTILISATION BY WARD | | |
| WARD TYPE | WARD MED/SURG | BED RESP 25 | BED TYPE | ACTUAL MANAGEMENT OBJECTIVE |
| TOTAL FOR WARD | | | | |
| | | | BED AVAILABILITY | 30.00 |
| | | | AVERAGE UNAVAIL | 0.0 |
| | | | BED OCCUPANCY | 25.00 |
| | | | AVG % | 83.33 |
| | | | MINIMUM | 22 |
| | | | MAXIMUM | 30 |
| | | | NO OF PATIENT DAYS | 2250 |
| | | | BED TURNOVER | 6.25 |
| | | | TURNOVER INTERVAL | 2.40 |
| | | | LENGTH OF STAY | 12.00 |
| | | | | 30.00 |
| | | | | 90.00 |
| | | | | 6.00 |
| | | | | 1.50 |
| | | | | 11.00 |



Post-Discharge Processing Reports

- Disease indices.
- Other research oriented reports that are produced on special request.

While the system is capable of improving hospital management and research, these benefits will not be fully realised without a corresponding training and management development effort. The Department of Health has recognised this and in conjunction with hospital boards, intends offering to hospital personnel training assistance which will help users take the computer-produced information and translate it into management actions and decision making.

TO THE CLINICIAN

- Availability of more complete, timely, and accurate patient information than is presently available.
- Nationwide scope ensures accurate, swift provision of patient information from outside the local hospital board area. This is particularly important in the case of accidents occurring to visitors in an area. (Provision of drug allergy information, patient history, etc.)
- Up-to-date information about waiting list status.
- Automatic, accurate provision and maintenance of patient front sheets which are then included in the medical record.
- Research reporting which will enable authorised medical researchers to examine thousands of cases in a fraction of the time currently required, including the capability of conducting a truly national survey.

TO PATIENTS

Computer assisted treatment is not even contemplated; however, several ideas have been proposed which would extend the A/D System into additional patient-related areas. But apart from almost instant access to the Medical Alert information, it cannot be claimed that there are direct patient benefits.

Indirectly though, patients are helped by the ability to locate records in other hospitals. In one case, a patient from an A/D System hospital was admitted in an emergency to another hospital over 125 kilometers away. The admitting hospital using its A/D terminal was able to provide the clinicians with information about the previous hospital stay almost immediately. Other detailed data not available in the computer system was then obtained by phone.

In addition there are a number of other important indirect benefits. More accurate and timely health data will assist health professionals both in the care of individual patients and in the study of disease trends for the development of improved health services.

There are also benefits arising from improved management. The quality of health care available to the community depends not only on the skills of those in immediate personal contact with patients, but also equally on the skills of the senior managers. Management must ensure that the right staff are in the right place at the right time, and with the right facilities and information available to them.

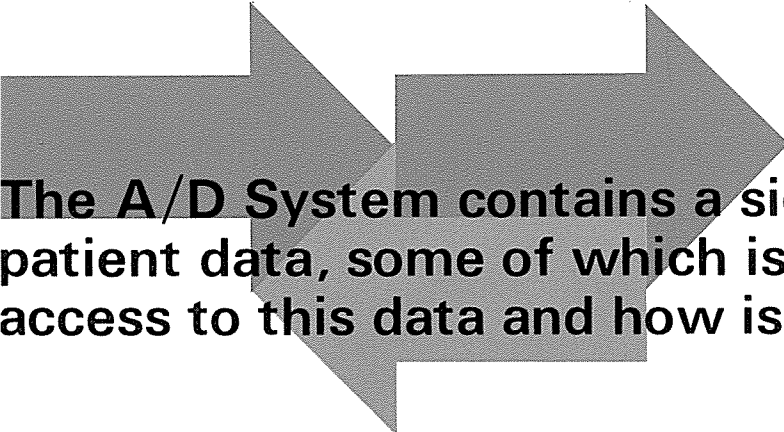
PAGE 2
 PERIOD BEGINNING 01/07/78
 PERIOD ENDING 31/07/78

VARIANCE

0.00 DATE CREATED 10/12/78

(6.67)

0.25
 (0.90)
 (1.00)



The A/D System contains a significant amount of patient data, some of which is confidential. Who has access to this data and how is it controlled?

From the initial design of the A/D System, all parties involved have been aware of, and sensitive to, the confidentiality of all patient information maintained on the system. Consequently, to ensure that dissemination of patient information is restricted to authorised individuals, extensive and comprehensive security procedures have been developed by the Department to control issuance of passwords and to train the users in proper security precautions. Each hospital board will be asked to appoint a Security Officer who will have primary local responsibility for password control and user training and follow-up.

The following features have been included in the system and the communications network:

- System access through a terminal is controlled by means of a confidential password that is assigned to each system user. The user must correctly enter this password prior to using the system and accessing patient information. If a password is incorrectly entered three times the terminal is automatically disconnected from the computer and security personnel are notified.

As a further safeguard passwords are changed periodically and are only valid for a specified group of terminals. For example, if an Auckland Hospital staff member with a valid password attempted to use a terminal in Christchurch, the security system would not allow the individual to use the A/D System.

- Diagnostic information available on the A/D System includes:
 - Treating board number and hospital name
 - Description of primary diagnosis as reported to the National Health Statistics Centre (NHSC)
 - Treating clinician name
 - Discharge date

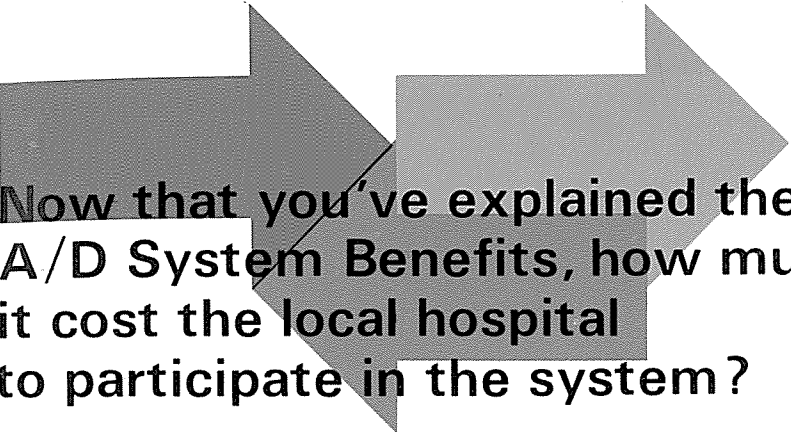
This information is maintained 'on-line' and can generally be viewed by system users at all participating hospitals. However, the local hospital does have the option on a patient-by-patient basis of suppressing 'sensitive' diagnostic information.

If the suppression indicator is set:

- The diagnosis description cannot be viewed by any user outside of the entering board (e.g., the Dunedin Hospital Medical Records Officer could not obtain diagnostic information that was entered and suppressed by Wellington Hospital).
- Within the board, the suppressed information can only be viewed by senior hospital personnel who have been assigned appropriate passwords.

It should be emphasised, however, that the determination of what constituted 'sensitive' diagnostic data is a local decision that resides with the individual hospital board. For example, board 'A' may suppress diagnostic data on psychiatric inpatient admissions while board 'B' may choose not to do so.

The security and confidentiality safeguards outlined were reviewed during the first half of 1978 by a special Security Advisory Committee to the Minister of Health. In the conclusion to their report this Committee stated "that the security of the Department of Health computer system is of a much higher order than the manual record systems in conjunction with which it will be used".



Now that you've explained the A/D System Benefits, how much will it cost the local hospital to participate in the system?

The cost of using the A/D System is composed of local staff, supply and operating expenses, and the A/D System usage charge levied by the Data Processing Division.

Although the system contains several labour saving features, experience has indicated that the level of staff resources required to operate the system (data collection, input and control) will usually offset any potential reductions that may occur because existing functions have been mechanised.

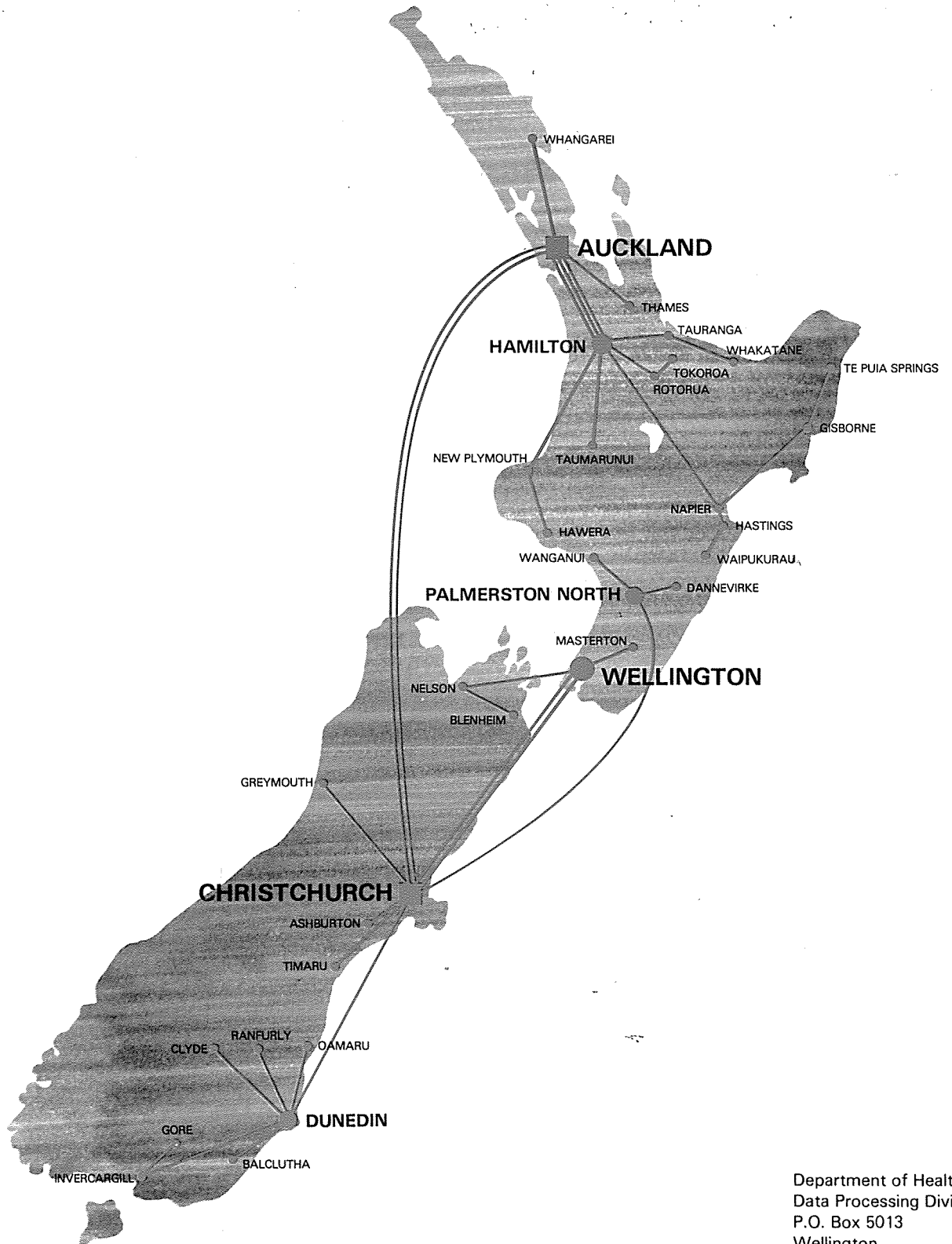
Aside from this general statement, the final staffing impact for a specific hospital depends on many factors, and can only be developed from an analysis of the local situation. The other local costs are relatively minor and are related to such items as paper for the printer and electrical power to drive the terminals and minicomputer.

The remaining cost component, the A/D System usage charge, depends on how much of the system the hospital uses (from 'minimal' to 'full' system) and is directly related to admission volume. These charges have been established to help offset the system operating cost.

FUTURE IMPACT

The major impact results from the core system concept. The A/D System is a large system that has taken a significant commitment of manpower and funding resources to develop. A major end-product of the system is a national data base of patient identification and event information. Because this record exists, it will be available for all future patient-oriented systems. Consequently it should be possible to develop new patient-based systems for special purpose groups within the user population at lower cost than would otherwise be possible. For example, the system could expand in the direction of providing a computerised medical record by adding X-ray or pathology results to the patient files. No decision, however, has yet been made on the direction of future activities.

The Department of Health Data Processing Division has initiated a Systems Development Planning activity to allow end users to incorporate their ideas into the planning for future health computer services. This co-operative and co-ordinated planning activity is seen as the last step in the achievement of the objectives set out in 1975 when the Data Processing Division was formed.



Department of Health
 Data Processing Division
 P.O. Box 5013
 Wellington

APPENDIX 5.2

THE BRADMA SYSTEM

THE 'BRADMA' SYSTEM

This system of generating patient labels and lists is not new. It was originally introduced into the Ngaio Hospital in 1964 after many months of investigation. At this time the original installation was a Dorchester Embosser with a rotary wheel keyboard. This provided excellent full time coverage until 1973 when a further 'Bradma' machine was purchased. This system operated from the Admission Office.

In 1981 this machine was replaced but is still known within the hospital as the 'Bradma' system. It consists of a microcomputer with a Visual Display Unit, 25½" Floppy Disc Drivers, and a Keyboard, driving a Data South DS180 fast printer for labels and an Epsom MX80 for production of Ward Listings. The programme is written specifically for hospital needs.

The equipment prints 44 labels for each ward admission. A daily ward census is published for ward management purposes. The system compliments Phase I and II of the National Health Computer's Admission/Discharge System

The only retrieval component relates to obtaining lists of in-patients who remain hospitalised after fifty-eight days. This data is required by the Department of Social Welfare.