

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

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

1983

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.

ACKNOWLEDGEMENTS

I wish to acknowledge the support, advice and assistance of the following people who contributed to the production of this thesis.

Dr. Nancy Kinross, my supervisor, whose continued support and advice have been the motivating factor in this undertaking.

Mrs Rayma Marquis, whose typing ability and ability to anticipate my wishes have been invaluable.

Dr. John Monin, for his advice and direction.

Mr. Richard Patson, for his advice and direction.

Mr. Brian Vickers, for the illustrations he provided.

To the staff of the Ngaio Hospital Board who provided data, made comments which were invaluable, and so willingly gave of their time.

To my executive colleagues at the Taranaki Hosital Board who supported me through this undertaking, especially Mr. D.H. King and Mr. J. Eaddy.

To all my friends who wouldn't let me give up.

Finally, to the late Russell Bernstone who provided the initial motivation by saying 'I think you can'.

vii

TABLE OF CONTENTS

	PAGE	
Abstract	ii	
Acknowledgements	iv	
Content	vii	
List of Figures	ix	
List of Tables	xi	
Glossary	xii	
 CHAPTER		
1	AN INTRODUCTION TO INFORMATION SYSTEMS	1
	A Definition of Information	2
	Information Theory	4
	Information Systems	6
	The Process of Information Systems Development	12
	The Data Sub-System	12
	The Information Sub-System	13
	Problems Encountered in Information Systems Development	15
	Use of Information Systems	22
	Summary	24
2	INFORMATION SYSTEMS IN HOSPITAL HEALTH CARE	25
	The GRASP and PROMIS Systems	26
	The John Hopkins' Experience	27
	The El Camino Approach to Hospital Information Systems	29
	Strategies for Change and Development	33
	Strategies for Change	34
	Utilisation of Models for Planning and Development	36
	Application of Functional Levels of Model Development to Management Information Systems Development	42
	Summary	45
3	THE NURSING COMPONENT OF A HOSPITAL INFORMATION SYSTEM	46
	York Hospital, Ontario, Canada	47
	The Royal Children's Hospital, Melbourne - Ward Management System	49
	Ninewells Project	52
	The Texas Institute of Research and Rehabilitation	53

CHAPTER		PAGE
	The Charlotte Hospital System	59
	The Rush-Medicus Study	62
	The St. Joseph's Study, Denver	67
	Nursing Information Systems - The Staffing Sub-System	73
	Baptist Medical Centre	73
	The Use of Models as a Change Strategy	77
	Summary	83
4	FIELD STUDY : DESIGN, METHODOLOGY AND PROCEDURE	84
	The Process of Systems Analysis	84
	Methodology	86
	A Field Study Defined	89
	Objectives of the Field Study	91
	The Design of the Field Study	92
	Selection of Area in which Field Study is to be Conducted	94
	The Ngaio Hospital Board	95
	Board Administration	97
	Institutional Management	99
	Institutions of the Board	100
	Selection of Subjects for the Field Study	102
	Instruments for Data Collection	106
	Procedure	108
	Summary	111
5	A SELECTIVE ANALYSIS OF FIVE SUB- SYSTEMS OF A HOSPITAL INFORMATION SUB-SYSTEM	112
	Phase One : Problem Identification	113
	Admission/Discharge Information Sub- System	113
	Patient Care Information Sub-System	119
	Nursing Management Information Sub- System	125
	Staffing Information Sub-System	131
	Financial Information Sub-System	133
	Summary of Phase One of the Field Study	139
	Phase Two : Performance Definition	140
	Summary of Phase Two of the Field Study	144
	Discussion of the Field Study	145
	Differences between Phase One and Two	150
	Comment on the Field Study : Design and Method	152
	Special Features of each Institution	153
	Special Characteristics of Institutional Management Team	154
	Summary	156

CHAPTER	PAGE	
6	PRESCRIPTION FOR THE FUTURE	158
	Questions	159
	Why Change the Existing System?	159
	What Approach Should be Adopted in Relation to Information Systems Development?	160
	What Kind of Staff Preparation is Required?	161
	How Comprehensive Should a System Be?	163
	How Specific Should an Information System Be?	163
	Why Automate?	166
	What is the Future of Information Systems in the Health Care System	167
	A Model for Future Information Systems Development	168
	Conclusions	171
	REFERENCES	173
	BIBLIOGRAPHY	178
	APPENDICES	
	A-4.1 Information Sub-System Check Lists	182
	A-4.2 Sub-System Data Flow Charts	189
	A-4.3 In-depth Interview Schedules	194
	A-5.1 Introducing the Health Services Admission/Discharge System	200
	A-5.2 The Bradma System	201

LIST OF FIGURES

FIGURE		PAGE
1.1	Basic Systems Model for Information Systems Development	7
1.2	Information Systems Development	14
1.3	Information Systems Development Within a Macro Environment	18
2.1	Functional Levels of a System	38
2.2	Functional Levels of a System as adapted to Information Systems Analysis	39
2.3	Total Information System Concept	43
3.1	The Care Plan Functional Flow as Practised at the Texas Institute of Research and Rehabilitation	56
3.2	Factors Influencing the Evaluation of Nursing Care	72
3.3	A Model of the Information Process	79
3.4	Data Flow Chart of Nursing Information System	81
4.1	Organisational Structure of Ngaio Hospital Board	98
5.1	Data Flow Chart. Admission/Discharge Information Sub-System	118
5.2	Data Flow Chart. Patient Care Information Sub-System	123
5.3	Data Flow Chart. Nursing Management Information Sub-System	129
5.4	Data Flow Chart. Financial Information Sub-System	137
5.5	Linkage of the Five Selected Sub-Systems	157
6.1	Information Systems Development Flow Chart	162
6.2	A Nursing Information Sub-System	165
6.3	One Model which Encompasses the Concept of Information System Development	169

LIST OF TABLES

TABLE		PAGE
4.1	The Life Cycle of an Information System	87
4.2	Hospital Information for Ngaio Hospital Board	96
4.3	Subjects included in Phase One of the Field Study	102
4.4	Nursing Subjects by Hospital and Status	103
4.5	Nursing Subjects by Hospital Status and Qualification	103
4.6	Subjects Involved in Phase Two of the Field Study	104
4.7	Total Subjects Included in Field Study	105
4.8	Subjects Included in Pre-Test	108
5.1	Summary of Results of Analysis of Admission/Discharge Information Sub-System	114
5.2	Summary of Results of Analysis of Patient Care Information Sub-System	120
5.3	Summary of Results of Analysis of Nursing Management Information Sub-System	126
5.4	Summary of Results of Analysis of Staffing Information Sub-System	131
5.5	Summary of Results of Analysis of Financial Information Sub-System	135
5.6	Analysis of Data Obtained from Discussion on Data Flow Charts and In-Depth Interviews	141
5.7	Analysis of Data Obtained from In-Depth Interviews	142

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.