THE DESIGN AND CONSTRUCTION OF A DECISION-SUPPORT SYSTEM FOR PLANNING LOCAL HOSPITAL SERVICES

by Richard Brough BA MSc

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at the University of Warwick in the Department
of Operational Research.

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SUMMARY

This research addressed a major and widespread problem in the NHS: information for operational planning. The approach has been to analyse the needs of management in this field in a particular health district and to develop a system in response to these needs of use in the particular District and generally in the NHS. The emphasis had been on the identification and quantification of relationships between elements of the District important to corporate planning, so that the feasibility and effects of planning choices can be assessed. Particular attention has been paid to the attitudes, values and concerns of senior managers and doctors in the NHS throughout the project.

Research began in October 1979 on the development of a database and model of the former North East District of KCWAHA. This health district contained a large undergraduate teaching hospital (The Middlesex), two large psychiatric hospitals, and several smaller specialist hospitals.

The purpose of the decision-support system is to enable management to explore rapidly the implications of operational planning options over several years. It does not recommend which option should be followed. Plans are tested in terms of the bed capacity of general wards and specialist units. The revenue costs of an option are estimated using a detailed analysis of which types of change cause which types of cost to vary within the District.

The model then assesses the non-financial consequences for the operating theatres and service departments, and the effects on nurse training. The research has shown that it is feasible to build and

maintain such a model and database with very limited clerical support. The output from the system has been found useful by management. This development has generated considerable support for further research.

The assumptions of the model and the procedures for updating the database are fully documented. Procedures for implementing the system in another health district are also available. The model runs on the computer at Imperial College, University of London. The research programme continues with the extension of the model to cover the whole of the new Bloomsbury District (including University College Hospital), where the use of the system has had a substantial impact on decision-making at the most senior level.

ABBREVIATIONS

AHA	:	Area Health Authority
BOC	:	Balance of Care
CASPE	:	Clinical Accountability Service Planning and Evaluation
CAT	:	Clinically Accountable Team
CCU	:	Coronary Care Unit
CSSD	:	Central Sterile Supplies Department
DFO	:	District Finance Officer
DHA	:	District Health Authority
DHSS	:	Department of Health and Social Security
DHW	:	Domestic Hot Water
DivNO	:	Divisional Nursing Officer
DMT	:	District Management Team
EN	:	Enrolled Nurse
ENT	:	Ear, Nose and Throat
FIP	:	Financial Information Project
HAA	:	Hospital Activity Analysis
HSPI	:	Health Services Prices Index
ITU	:	Intensive Therapy Unit
KCWAHA	:	Kensington, Chelsea and Westminster Area Health Authority
LAG	:	London Advisory Group
LHPC	:	London Health Planning Consortium
MSSE	:	Medical and Surgical Supplies and Equipment
NA	:	Nursing assistant/auxiliary
N E District	:	North East District
NHS	:	National Health Service
NO	:	Nursing Officer
OR	:	Operational Research

PACT	:	Planning Agreements with Clinical Teams
RAWP	:	Resource Allocation Working Party
RHA	:	Regional Health Authority
SAS	:	Standard Accounting System
SEN	:	Senior Enrolled Nurse
SHQ	:	Statistics Hospitals Quarterly
SH3	:	Statistics Hospitals (annual)
SNO	:	Senior Nursing Officer
STD	:	Sexually Transmitted Diseases
UCH	:	University College Hospital
WMRHA	:	West Midlands Regional Health Authority

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NOTE

In 1979 research began on the construction of a decision-support system for operational planning purposes in the North East District of KCWAHA. This District formed part of the North West Thames Regional Health Authority (RHA).

In April 1982 the NHS was reorganised. The North East District and the South Camden District were amalgamated to form the Bloomsbury District Health Authority (DHA). This authority forms part of the North East Thames RHA. The model is currently being extended to cover the whole of the Bloomsbury DHA. Reference is made to both Districts throughout the thesis.

"Managers" include medical, nursing and other staff besides administrators. "Planners" cover all those involved in planning and not just specialist planning administrators.

For background information about the NHS the reader is primarily referred to the recent publication "The Politics of the National Health Service" (Klein, 1983).

CHAPTER ONE: INTRODUCTION AND OVERVIEW

This research project began with the aim of improving the methods and techniques available to senior management in the NHS when grappling with problems of planning at health district level, so that they can understand better the way the organisation works and how it responds to change. This research constituted the first phase of a two part doctoral research programme, the product of which has now been incorporated within the NHS. The general method adopted was to address the problem of information for planning in a particular district with a view to developing techniques which would be generally applicable in the NHS (see Chapter 2). It was thought that health districts were unlikely to adopt new methods unless they have been proved to be effective in at least one district over a substantial period of time. An individual district was identified where there were senior managers and doctors who were dissatisfied with the methods then in use and were interested to see whether an OR modelling approach might produce better information for, in particular, corporate planning. A "naturalistic" research method was adopted with the student learning about the problems of planning and what might be done to alleviate them by actually exploring the difficulties in a specific district and trying to produce a model or method of use to senior management trying to cope with these problems (see Chapter 2). The researcher spent three years based in a London health district. the NE District of KCWAHA which contained The Middlesex Hospital. The project was controlled by means of regular meetings of a steering group which included senior NHS managers and an academic supervisor.

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The background of the researcher was important. Prior to this research project he had spent a year developing a discrete stochastic simulation model of a health district for use in training senior managers and doctors in corporate planning (Brough, Burdett, Waller:1980 and 1984). This training model projected a catchment population of a certain size and profile which generated patients of various types who then passed as entities through a cycle of hospital activities, waiting at certain points if necessary, using a variety of services and generating costs, and finall returning to the community. Those using the model could change the configuration of services over time to see if they could provide a better service within certain resource constraints. The researcher had operated the simulation on numerous courses, and had explained and discussed the model and the results with managers from many different professions, but especially hospital consultants. He had modified and developed the model in response to criticism received. He had also become increasingly aware of the important planning problems facing a wide range of districts and th likely usefulness of a modelling approach to the better solution of some of these problems. During corporate management courses the researcher had frequently been asked by doctors and managers, who found the system attractive, whether a model similar to the training model could be built to provide similar information about their own health districts.

The knowledge derived from such exposure to the opinions and values of doctors and managers in the NHS was a most valuable asset with which to begin the research. For example, the researcher was well aware of how difficult it can be for staff treating sick individuals on a day-to-day basis to think in terms of the "average case" for planning purposes, or to talk objectively about "cutting caseloads" when they know this may mea

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The researcher had also learnt a considerable amount about the theory of planning health services through his involvement with training models. Planning in the NHS is an evolving process and the theory of how it should be done is likewise developing. But the sort of general principles that the researcher had in mind when he began this research project were that planning should ideally begin with an assessment of the current and future catchment population, how its structure may change, what are its current needs or demands and what these are likely to be in the future. Managers should ideally consider how the district might meet such needs or demands by the provision of hospital or community services (given current provision that people who they think need treatment do not get it. He knew the difficulty staff have in understanding that the provision of health care will always involve choices, that supply is unlikely ever to meet demand, and that those managing the service have to make general decisions about which sorts of patients should receive the scarce resources available. The researcher understood the prestigious and powerful position held by the hospital consultants, how prejudiced they can be against managers in other functions, but also how amenable they usually are to soundly-based argument. The researcher became aware of the difficult position of managers of service and supply departments, such as the district pharmacist, who may be responsible for managing budgets over which they have limited control. He also discovered what a strong element of idealism exists in almost all health service functions. This sort of knowledge of how doctors and managers think, what their chief concerns and worries are, and how they would like to see the NHS develop, largely enabled the researcher to avoid any catastrophic pitfalls particularly in the early stages of the project.

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Having spent a year thinking about the ideal planning system, building a simulation model for training, and talking to health service staff, the researcher was very keen to try to build systems to help with real-life planning rather than simply training models. The model he had built had been based on data from a real district in East Anglia so he already had some notion of the limitations to the data available which he would be likely to face. In the course of this year agreement was reached with a health district (the NE District) on the doctoral research to be undertaken and the researcher devoted much thought to how the problem of information for operational planning could be tackled in that district. He considered which data would probably be available, what sort of model might be appropriate, whether it would be a discrete simulation, whether it would be deterministic or stochastic, whether mathematical programming techniques might be appropriate for at least part of the model, whether and buildings), they should assess a variety of options over time before they make their choice, and once implemented they should monitor the effectiveness of their plans. Such broad ideas clearly beg many questions some of which are discussed later in the thesis (see Chapter 13), but they did give the researcher a coherent view of the planning operation when he began work. Above all he well understood that planning should be about the planning of services ideally to meet need, rather than the planning of buildings as it has tended to be in the past. The researcher originally hoped to build a model for planning to provide information at several of the main stages of the planning process, but he found this not to be feasible (see Chapters 4 and 6) and so decided to focus on a particular and important part of the problem, namely the assessment of a variety of options over time.

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As a result of his experiences with training models, the researcher entered the particular district with clear ideas in general terms of how he meant to approach the work. He intended to see how far he could follow the planning principles outlined above in real life, to identify problems and shortcomings of current planning and data, and to build some sort of system to enable management to take a more corporate, comprehensive view of their planning problems over time. He well recognised that there was likely to be a gulf between planning practice and the ideal, but he hoped to fuse elements of the two to produce a system which would represent an advance on current methods and which would be of general use in the NHS.

There are many serious planning problems to be tackled at DHSS and regional level, for example, the siting of major new hospitals or the best strategy for caring for the mentally handicapped, but the researcher considered himself best suited because of his experience to address the urgent and general problems at district level. He began the current project with both a knowledge of health planning theory (eg DHSS:1976:2) and also some understanding of the attitudes and values of senior NHS managers and doctors, both of which were most useful when it came to developing a decision-support system in a real health district (see Chapter 2).

When he began work in the District the researcher aimed to identify the needs of local management for planning information and to respond an element of computer graphics might be used in the input or output, how far the model might be interactive, and what its general scope might be. The researcher was fortunate to have such a "warming up" period before the main research began.

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When he began work in the District the researcher aimed to identify the needs of local management for planning information and to respond to these needs in a way consistent with the planning theory in which he had been trained. He intended to produce a decision-support system which would be seen as useful by managers and would also be based on a sound, logical framework. He hoped to provide managers with a system which would produce information relevant to a particular planning problem, in an appropriate form, at low cost, and at the right time to contribute to the decision-making process. The researcher had originally intended to build a model similar to that which he had built for training purposes, but was forced to modify his ideas in the light of experience (see Chapter 6). Senior management in the particular district studied simply directed him to produce a "comprehensive" model, that could be maintained with very limited clerical support and from which capital costs were excluded (see Chapter 6:3).

As the researcher began to clarify these information needs (see Chapter 4) it soon became apparent that he would have to modify considerably his original intentions. It seemed virtually impossible to identify and analyse, let alone predict, the size and profile of the catchment population of the District (see Chapter 4 and 6:4). Given these problems, the needs or demands of the catchment population in response to which the district management should provide services could not be identified. It is suggested in Chapter 13 that this analysis should be performed at a level above that of health district (certainly in London). Since it seemed impossible to build a local model of the future population to be served and its likely needs or demands, senior local management and the analyst were driven to making assumptions about future demand and then assessing what pattern of services over time would best meet this demand, bearing in mind the District's to these needs in a way consistent with the planning theory in which he had been trained. He intended to produce a decision-support system which would be seen as useful by managers and would also be based on a sound, logical framework. He hoped to provide managers with a system which would produce information relevant to a particular planning problem, in an appropriate form, at low cost, and at the right time to contribute to the decision-making process. The researcher had originally intended to build a model similar to that which he had built for training purposes, but was forced to modify his ideas in the light of experience (see Chapter 6). Senior management in the particular district studied simply directed him to produce a "comprehensive" model, that could be maintained with very limited clerical support and from which capital costs were excluded (see Chapter 6:3).

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The researcher then considered by what method this need might be met given the data available and the limitations on clerical support. He identified the elements important to planning in the District (see Chapter 6:4) and considered how they could be related to each other to answer pressing management questions. At this stage he still had hopes of building a discrete simulation model on the basis of the relationships. However, as the researcher began to explore such relationships and to quantify them it rapidly became apparent that this work, the basis of a other responsibilities such as teaching, and at what cost. The researcher found that senior management were constantly faced with this problem of how to estimate the likely effects of planning options and they seemed to lack a suitable framework for tackling this recurring problem. Also the production of relevant information was hampered by the dislocation of the information systems in key areas, for example, finance and patient activity by specialty (see Chapter 4:4). So he began to concentrate his attention on this part of the planning process where it appeared he might be able to make a significant contribution. He conducted a survey of the methods and models developed by others which related directly to this problem in the hope of discovering a useful tool to use as part of his system (see Chapter 5). Unfortunately he found that while most of the other systems produced useful information for various purposes, and especially financial information, they could not be used to answer many of the questions being posed by doctors and managers when considering planning choices. He identified a need for some way of linking up various aspects of the service to provide guidance to senior management on the corporate effects of planning options.

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As these relationships were being investigated and the data collection methods implemented, the researcher was also considering what sort of computer model he would build and what standard OR methods might be applicable. He considered mathematical programming unsuitable because of the difficulty in specifying an objective function which would be generally acceptable and, much more importantly, the apparent impossibility of formulating the problem in a way which would allow a mathematical programming solution (see Chapter 6:1). A stochastic simulation or a deterministic model seemed much more appropriate at this stage to the researcher and senior managers. As mentioned above, the analyst had hoped to develop a stochastic simulation model of the District along the lines of that which he had constructed for training purposes. However, for various reasons, for example, the problems associated with identifying and quantifying fairly straightforward relationships and the need to keep the mechanics of the model as simple as possible to facilitate initial implementation (see Chapter 10), it was decided that at this stage a stochastic simulation model would have little advantage over a more costs associated with specialties or specialty groups, none of them covered such a range of elements and none of the costing and budgeting systems concentrated on the important problem of disintangling fixed and variable costs (see Chapter 6:6). Once the relationships to be included in the model had been chosen (see Chapter 7) the researcher turned to the problem of which data should be collected and how they should be analysed to quantify these relationships (see Chapter 8). The researcher himself collected and analysed the data for the first two years with some assistance during the second year from NHS finance staff).

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By the end of the research project the data collection and analysis procedures were being operated for the third time (see Chapter 8), the model had been programmed and tested (see Chapter 9), and initial use of the system in response to real planning problems had begun (see Chapter 10). The system is intended for use primarily by the District Management Team (DMT) and specialist planning groups, and the initial reactions by senior managers and doctors to the data and the results from the model are encouraging (see Chapter 10). The system seems to be capable of addressing important planning questions being asked in the District and elsewhere in the NHS and of providing information which management see as relevant and timely.

The overall method adopted, as outlined above, was to develop a consistent and logically structured response to general problems in the NHS in a particular district, with the intention of producing a system of general value to the NHS. What then is generalisable from this research project? Firstly, it is to be made clear that the Fortran program written by the researcher was designed for use in the NE District alone, although it has formed the basis of a generalisable version written during the second phase of the research programme and which itself is currently being superceded by a third version. What is of relevance to other health districts from the first phase of the research programme, however, is the framework of connections between elements important to planning in a simple, deterministic model and so the latter course was adopted (see Chapter 6:1). After a brief consideration of modelling packages available (see Chapter 6:1) the researcher decided to program in Fortran because of the flexibility offered and the researcher's knowledge of the language.

By the end of the research project the data collection and analysis procedures were being operated for the third time (see Chapter 8), the model had been programmed and tested (see Chapter 9), and initial use of the system in response to real planning problems had begun (see Chapter 10). The system is intended for use primarily by the District Management Team (DMT) and specialist planning groups, and the initial reactions by senior managers and doctors to the data and the results from the model are encouraging (see Chapter 10). The system seems to be capable of addressing important planning questions being asked in the District and elsewhere in the NHS and of providing information which management see as relevant and timely.

The overall method adopted, as outlined above, was to develop a consistent and logically structured response to general problems in the NHS in a particular district, with the intention of producing a system of general value to the NHS. What then is generalisable from this research project? Firstly, it is to be made clear that the Fortran program written by the researcher was designed for use in the NE District alone, although it has formed the basis of a generalisable version written during the second phase of the research programme and which itself is currently being superceded by a third version. What is of relevance to other health districts from the first phase of the research programme, however, is the framework of connections between elements important to planning in a health district and the practical data collection system to quantify most of these relationships which underly the fairly straightforward computer program. It is this analysis of the health services for the purposes of planning which was unavailable when the research began and which is the product of the first phase of this research programme which is directly of general interest to the NHS (see Chapter 12).

But are these structures common to other health districts and can the data be processed in a similar way and at similar cost elsewhere? A special feasibility study, carried out under the direction of the researcher and his supervisor, was mounted to explore these questions at the John Radcliffe Hospital in Oxford (see Chapter 12:2). It was found that a set of generalisable data collection procedures could be implemented with minor modifications, and that the relationships identified in the NE District were broadly true in this other major hospital as well. While this study only lasted three months it is still felt that it gave a good indication that the decision-support system could be established in another health district. As for whether other districts are likely to find this sort of information useful and relevant to their planning problems, there are important reasons for thinking this to be true (see Chapter 12:3). For example, considerable interest has been shown by other health districts in the project at The Middlesex, the system has been used by the King's Fund College on senior management training courses, and the amount of other research in this field (see Chapter 5) suggests that better information for planning is a general and pressing problem in the NHS. The clearest indication that the system can be implemented in other districts, and that management are likely to see it as useful, was the decision to extend the model across the whole of the new Bloomsbury District incorporating health district and the practical data collection system to quantify most of these relationships which underly the fairly straightforward computer program. It is this analysis of the health services for the purposes of planning which was unavailable when the research began and which is the product of the first phase of this research programme which is directly of general interest to the NHS (see Chapter 12).

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In Chapter 13 the researcher describes the role of the system in a context of planning, resource allocation and budgeting. He explains how the system could relate to planning above the level of health district, describes how the allocation of resources should (and could) be a response to planning rather than vice-versa, and comments on developments in budgeting which might help in the implementation and control of chosen planning options. In particular he identifies the role of this decision-support system in relation to the problem of planning the hospital services in central London.

Throughout this project the researcher considered how OR can secure a more significant role in the minds of senior managers in large and complicated organisations like the NHS. So far OR does not seem to have realised its great potential to contribute to the understanding of major NHS problems and the identification of acceptable courses of action to cope with such problems. It is suggested that the discipline must be prepared to become more involved in ill-defined, but important and pressing problems in the eyes of senior management, if it is to gain serious recognition what was formerly the South Camden District which included another major London teaching hospital, University College Hospital. This development has successfully taken place under the control of another research student, Roger Beech, during the second phase of the research programme. By mid-1984 there had been about 30 significant applications of the system some of which involved the likely effects of large changes, such as the closure of a major post-graduate teaching hospital, with considerable revenue consequences (see Chapter 12:3). The future developments of the system both within and outside the Bloomsbury District are discussed in Chapter 11.

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In such fields the OR contribution may lie primarily in the development of an improved way of thinking about a whole problem area (backed by the appropriate tools) rather than the application of "highly **technical**" methods to the parts of the problem where they can be used, which may be what the OR analyst would rather be doing. The researcher began this project with the idea of applying what a general manager would consider "highly technical" tools, namely stochastic simulation and perhaps mathematical programming, to a common NHS problem: information for planning. He knew how effective simulation could be for training purposes and he hoped to have the same success in real-life. However, when he became aware of how little was known in a particular district, and in the NHS in general, about the relationships and data on which such a model would be based he decided to abandon at least temporarily his more technical OR tools to tackle this difficult and more fundamental problem. The focus of the research shifted from the application of the technique of simulation in a new way in the major field of NHS planning, to an attempt to find useful structures and data in order to set up a logical and practical framework within which to consider the effects of planning options. He found that much of his time was spent talking to people and studying documents and records to find out how a health district works. He had to develop an understanding of the politics of the organisation and the main concerns of senior staff and to discover what precise contribution the researcher could most usefully make (see Mitchell:1980). This contrasted with what he thought he would have been doing which was developing and refining the technique of computer simulation in relation to corporate planning in the NHS. As a result of (see Eilon:1980). Assessing the likely effects of planning options in the NHS is such a problem. In such fields the OR contribution may lie primarily in the development of an improved way of thinking about a whole problem area (backed by the appropriate tools) rather than the application of "highly technical" methods to the parts of the problem where they can be used, which may be what the OR analyst would rather be doing. The researcher began this project with the idea of applying what a general manager would consider "highly technical" tools, namely stochastic simulation and perhaps mathematical programming, to a common NHS problem: information for planning. He knew how effective simulation could be for training purposes and he hoped to have the same success in real-life. However, when he became aware of how little was known in a particular district, and in the NHS in general, about the relationships and data on which such a model would be based he decided to abandon at least temporarily his more technical OR tools to tackle this difficult and more fundamental problem. 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As a result of this reappraisal the scope of the analysis was narrowed to a particular part of the planning problem of a health district: the "messy" problem of the likely consequences of plans (see Chapter 6), and the OR tool employed was not that of discrete stochastic simulation, but instead a large, relatively straightforward deterministic model was built. This flexibility on the part of the researcher and the shift of emphasis during the project meant that the result of the research was a new and useful tool for management and one which formed a secure structure for further development. If the researcher had singlemindedly pursued his original intention of using a particular technique in a particular way he would probably have produced a sophisticated system which on application would have met increasing resistance as weaknesses in its assumptions, structure and data were exposed.

In addition to a willingness to address such ill-defined areas of management concern with an open mind as to the appropriate approach or tool to use, it is further suggested that unless OR analysts fix their attention on what management want at a particular time then their efforts are unlikely to have much real impact on decision-making. This is not to say that OR workers should tackle piece-meal the particular week-to-week or month-to-month preoccupations of management. Rather, as has been attempted in this research project, they should try to understand the real and expressed needs of management, in this case in the field of local NHS planning, and try to identify the general need in the host of particular needs. The result may then be a system or model which accepts common questions asked by managers, but answers them with reference to a consistent and logical structure which may not have existed before. Such an approach, which is likely to involve considerable in-house study of an organisation this reappraisal the scope of the analysis was narrowed to a particular part of the planning problem of a health district: the "messy" problem of the likely consequences of plans (see Chapter 6), and the OR tool employed was not that of discrete stochastic simulation, but instead a large, relatively straightforward deterministic model was built. This flexibility on the part of the researcher and the shift of emphasis during the project meant that the result of the research was a new and useful tool for management and one which formed a secure structure for further development. If the researcher had singlemindedly pursued his original intention of using a particular technique in a particular way he would probably have produced a sophisticated system which on application would have met increasing resistance as weaknesses in its assumptions, structure and data were exposed.

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CHAPTER TWO: OR AND THE NHS; THE PROBLEM OF APPROACH

The NHS is one of the largest and most important organisations in the UK: employing nearly 1m people, consuming about 5% of the Gross National Product and providing a vital service. It is highly pluralistic and very complicated in structure. There seems to be enormous scope for the application of OR to many major and general problems in the NHS, especially at local level. Yet the researcher found that in general senior staff and doctors in a central London health district were giving little serious consideration to how OR might help them. Why has OR failed to secure a role in the minds of such health service professionals? Why do they not naturally turn to the OR analyst for help with important problems where his skills may be of value? Are they unaware of what these skills are? Or are they unclear about what sort of problems can usefully be explored through OR, and what sort of practical, effective contribution to decision-making they can expect from such work?

The difficulty may be partly due to a lack of awareness of the availability of OR analysts, despite the existence of the OR Service at the DHSS. Also, prior to 1982, there existed a specialist NHS OR Unit at Reading University. In that year it ceased to exist as a separate entity with its professional staff of four being reduced to two (two being made redundant). Furthermore, many university and polytechnic OR departments conduct important research on NHS problems, and management consultants are showing a growing interest in the area.

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Another reason may be to do with the image of OR and the attitudes of OR analysts in the NHS and elsewhere. They may be seen as highly-trained and highly-numerate individuals whose effective role is mainly limited to the "solution" of well-quantified and well-defined problems, and OR analysts may regard only such problems as within their professional domain. The difficulty then in the NHS is that most of the major concerns of senior management at district level are not of this type. Certainly in the field of planning the objectives often defy clear and precise definition, for example, a DMT may aim "to improve services for the elderly" as that section of the population is growing. Data relating to the ways such an objective might be achieved are often not readily available, for example, how might the cost of improved day care facilities compare with the cost of building extra geriatric wards. Given these uncertainties, managers may feel that OR cannot contribute usefully in such an area, and OR analysts may be disinclined to try.

The public image of OR seems in danger of becoming one in which the role of the OR analyst may be seen as that of a specialist who is given a clearly defined problem, who applies a technique, and who does not feel responsible for whether the managers use the results, or, perhaps, for the long-term solution of, or approach to, the problem. The public image of OR was discussed by Mitchell in his Inaugural Address as President of the OR Society where he suggests that this image is that of "an expert, someone who brings a particular bag of tools rather than a wide-ranging methodology" (Mitchell: 1980). The most easily generalised aspects of OR dominate this image in Mitchell's view; these are "the ones that are most easily abstracted, the ones which are most easily put into mathematical form or into the form of some other relatively esoteric language" (Mitchell: 1980). An image of the OR value system forms part and highly-numerate individuals whose effective role is mainly limited to the "solution" of well-quantified and well-defined problems, and OR analysts may regard only such problems as within their professional domain. The difficulty then in the NHS is that most of the major concerns of senior management at district level are not of this type. Certainly in the field of planning the objectives often defy clear and precise definition, for example, a DMT may aim "to improve services for the elderly" as that section of the population is growing. Data relating to the ways such an objective might be achieved are often not readily available, for example, how might the cost of improved day care facilities compare with the cost of building extra geriatric wards. Given these uncertainties, managers may feel that OR cannot contribute usefully in such an area, and OR analysts may be disinclined to try.

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This public image of OR is contrasted by Mitchell with a private image of a successful OR group: defined as "the image which an OR group might present to its employing group" (Mitchell: 1980). Mitchell identifies four elements in this private image of OR: political sensitivity, responsiveness to the values and concerns of management, stability and durability of the research programme, and other competences (for example: clarity of thought, technical competence, ability to communicate, holistic thinking, knowledge of the employing organisation). The research student accepts this view of what is important for successful OR. This address was published after the current research had begun, but gave the researcher encouragement to continue with the approach he had adopted. How far he succeeded in developing such an image is discussed in Chapter 14.

The public image of OR may also lead managers to think that problems such as that of providing information for planning in the NHS are too "messy" to be a fit subject for OR study. Ackoff has defined managerial "messes" as "dynamic situations that consist of complex systems of changing problems that interact with each other" and sees a willingness to of this picture; it may be seen as "one which prizes abstraction and one which seems perhaps to reflect a naive self-concern, to the point of valuing our own (OR analysts') problems and their resolution before the problems of other people and their resolution" (Mitchell: 1980). It is not clear how far such a public image of OR was responsible for the absence of such analysis in the NE District, but it seems plausible that managers did have this idea of what constitutes OR in their heads. This may make managers feel that the involvement of OR analysts may create more work for the managers than is likely to be justified by the fruits of the analysis.

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An additional reason for the absence of a strong OR input to NHS decision-making may be the types of approach adopted by OR analysts to the important problems of local management in the NHS as a whole as well as in specific health districts. One way of tackling problems common in the NHS is to build general models using national data at a higher organisational level, such as the DHSS, and then to try to implement these in particular districts. An example of this approach is the continuing Balance of Care (BOC) project (see Chapter 5:2:a). This project began with the development of models for use by planners in the DHSS. After some success at this level, attempts were made to use the models to tackle corporate planning problems at local level. Severe problems were encountered, the models were radically become involved with such "messes" as crucially important if OR is to play an important role in management in the future (Ackoff:1979:1 and 2). A central London health district, such as the NE District, certainly seemed to meet this definition of a "mess": constantly changing, highly complicated, and with many interdependencies. Eilon supports Ackoff's view as he contracts the puzzle-solver with the problem-solver, the technician with the adviser, and notes that "a commitment to tackle strategic, ill-defined, messy problems" may lead to a solution, or perhaps approach, "which is more likely to have a significant and lasting impact on the system that the solution of tactical problems" (Eilon:1980). The researcher agrees with such attitudes expressed by leading figures in OR and through the development of the decision-support system in the NE District attempted to structure and quantify an important "mess" which urgently required attention. The role of the OR analyst is further discussed in Chapter .

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On the other hand many applications of OR in health services are concerned with small-scale, tactical problems, such as studies of out-patient departments (Williams et al:1967; Rising et al:1973; Stafford, Aggarwal:1979), or X-ray departments (Evans et al:1974), or pathology laboratories (Vaanamen et al:1974), or the management of a particular ward (Blewett et al:1972). This may be considered the micro approach: developing OR in the district or region by concentrating on reasonably well-defined and manageable problems. These problems may lend themselves fairly readily to the application of quantitative methods, but they are not generally among the most pressing and continuing concerns of senior management. It would seem to be damaging to the growth of OR in the NHS if such applications were seen as the primary contribution from the discipline.

The approach taken in this research project contrasts with both the macro and the micro approaches outlined above. The macro approach generally tackles problems of information central to the NHS, but the difficulty arises of how to implement the fruits of such an approach at local level. The micro methods on the other hand tend to have greater impact on particular problems at local level, but these problems tend to be small-scale and there may be limited scope for generalising the methods restructured and simplified, and are now undergoing further tests. This might be considered as the macro approach to district management problems: working from the general to the particular. The statistical modelling methods discussed in Chapter 5:1 are further attempts to create models using general data for use, amongst other purposes, in particular health districts.

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The research approach adopted in this project has been to address an important and recurring concern of senior management in health districts, namely, information for planning, by studying the problem in a particular district and attempting to provide management with a system to cope with at least part of the problem, with a view to this product being of general use in the NHS. The approach has parallels in the field of accountancy, for example, the CASPE projects and the Magee system (see Chapter 5:2), but these projects have largely different aims associated, for example, with budgeting and monitoring. This research has concentrated on the aspect of information for planning which appeared to be most urgently requiring attention both in the particular district and elsewhere, and which seemed reasonably amenable to improvement by the application of OR methods and philosophy (see Chapters 4 and 6): this was information about the feasibility and implications of planning options (and combinations of options) over time in a health district.

The researcher could have analysed the nationally available data, for example SH3 (patient activity) and hospital expenditure data, in an effort to produce information of value to district managers faced with planning problems. He could have followed the macro approach. But he thought that since much research effort had already been spent on such analysis, regression analysis being the prime example (see Chapter 5:1), adopted. Both these approaches can provide management in districts with useful information and guidance, but so far both have failed to bring OR into the main decision-making arena at district level in the NHS.

The research approach adopted in this project has been to address an important and recurring concern of senior management in health districts, namely, information for planning, by studying the problem in a particular district and attempting to provide management with a system to cope with at least part of the problem, with a view to this product being of general use in the NHS. The approach has parallels in the field of accountancy, for example, the CASPE projects and the Magee system (see Chapter 5:2), but these projects have largely different aims associated, for example, with budgeting and monitoring. This research has concentrated on the aspect of information for planning which appeared to be most urgently requiring attention both in the particular district and elsewhere, and which seemed reasonably amenable to improvement by the application of OR methods and philosophy (see Chapters 4 and 6): this was information about the feasibility and implications of planning options (and combinations of options) over time in a health district.

The researcher could have analysed the nationally available data, for example SH3 (patient activity) and hospital expenditure data, in an effort to produce information of value to district managers faced with planning problems. He could have followed the macro approach. But he thought that since much research effort had already been spent on such analysis, regression analysis being the prime example (see Chapter 5:1), further efforts might not be profitable for those at district level. He also felt that there might be major problems of implementation of models constructed in this way in particular districts, judging from the experience with the BOC models. However, the main positive reasons why the researcher decided to devel p a system in a particular district with a view to it being of general use in the NHS were that he thought that this would be the best way of properly understanding the problem and management needs, and that the success of a system in a particular district would constitute the best springbroad for its wider application. He thought that managers of other health districts would be far more inclined to implement a system which had been shown to be successful in another district than one which had not. He considered this to be the key to the successful dissemination of a new decision-support system.

Having decided to work at district level, the researcher could have perhaps looked at part of the service in relation to the problem of information for planning over several health districts. Perhaps he could have considered a particular specialty or specialty group, or a department such as the operating theatres. However, he felt that it would be best to concentrate his efforts in a particular district in view of the many comments that he had received while running training models about the value of comprehensive information to local managers even if this meant a sacrifice of detail. Also managers in the particular district contacted were most keen that the system developed should be comprehensive. The word "comprehensive" could be understood in various ways and while, of course, all aspects of the health district have not been covered by the system, the researcher has attempted to include most of the major elements with which management are concerned when planning the hospital services and to show how further efforts might not be profitable for those at district level. He also felt that there might be major problems of implementation of models constructed in this way in particular districts, judging from the experience with the BOC models. However, the main positive reasons why the researcher decided to devel p a system in a particular district with a view to it being of general use in the NHS were that he thought that this would be the best way of properly understanding the problem and management needs, and that the success of a system in a particular district would constitute the best springbroad for its wider application. He thought that managers of other health districts would be far more inclined to implement a system which had been shown to be successful in another district than one which had not. He considered this to be the key to the successful dissemination of a new decision-support system.

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Having decided on this general approach to the problem in the NHS, to work from the particular to the general, it was then necessary to decide on the research method to adopt in the specific district. It was fortunate that a particular health district was available with a District Finance Officer (DFO) (later to become the Regional Treasurer of North West Thames RHA) and an Area Treasurer (later to become the Regional Treasurer of South West Thames RHA) who were willing to support a long term OR project on this problem of information for planning (see Chapter 6:2). With such a base the researcher could have attempted to set up a hypothesis or series of hypothesis in the field and then tried to prove it or them true in the manner of classical scientific research, especially in the natural sciences. This did not seem an approach which would be likely to be particularly fruitful either for the District or the NHS generally. It was felt that too much time would be taken up with trying to establish a suitable hypothesis which would be reasonably likely to prove true, and then it might well be too general for proper validation or to be of much use to the NHS. Alternatively if a more specific and limited hypothesis were set up then the researcher might lose the vital support of local senior management who above all wanted the researcher to think about the problem holistically (a view with which the researcher concurred).

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Since such a classical approach to the research problem did not seem sensible the researcher decided to adopt a more "naturalistic" method: to approach the subject for study with a trained but open mind with the intention of learning about the problem and of identifying important and general points while trying to solve it, or at least illuminate it. So this research project proceeded by the researcher becoming part of the NHS organisation to study the problem of information for planning and to gain insights into it by trying to alleviate it. No initial hypothesis was set up, rather the aim was to discover an effective and generalisable response to the problem of how to assess the effects of planning options by initially trying to provide methods and tools for management grappling constantly with the problem in a specific district: to learn about the problem and possible solutions by actually tackling it in practice. This approach may be likened to the "action research" undertaken by the National Coal Board OR scientists (Tomlinson: 1980; Boothroyd:1978). Such an approach naturally exposes a researcher to many pressures and difficulties not normally experienced during a library- or laboratory-based project. The researcher was fortunate in that he was permitted a great deal of academic freedom by the project steering group (see Chapter 6:3). Nevertheless he knew that he had to produce something useful in the eyes of the district management, as well as to the NHS in general, during the few years of the project in order that he might satisfactorily complete his own research and that the research programme might be allowed to continue. It was envisaged that this programme would comprise at least two doctoral projects: the first being that conducted by Richard Brough.

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The researcher soon found that this method of research: learning by doing, is as much a test of the character as the intellect. He was conducting the research at a time of considerable uncertainty in the NHS and especially in central London where the rationalisation of services was under constant discussion (see Chapter 3). The NHS was largely reorganised half-way through the research project with the "area" level of management (that between district and region) ceasing to exist and the boundaries of many health districts being altered. These changes caused considerable turmoil within the service and a climate of insecurity. Many people changed jobs (including the three most senior managers connected with this research project) and many people had to apply again for their own jobs as the number of managers was reduced. Such uncertainty and change, both actual and potential, meant that senior managers and doctors were especially concerned with better information for planning, but also that many staff felt vaguely or directly threatened and instinctively opposed to research on the effects of change to the system. Perhaps some felt that they might be providing information which could be used against them. The researcher was in daily contact with doctors, nurses, managers and staff from all hospital functions throughout the research. He constantly had to explain what he was doing and why, and to defend himself against, at times, hostile criticism. For example, while with proper authority he was examining records in the X-ray department he was approached by an aggressive consultant radiologist who demanded that he explain exactly what data he was collecting, how he was going to analyse them and for what purpose. This the researcher managed to do and the particular consultant eventually gave considerable help to the project, but the initial reaction was one of opposition. Another example of such

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Given that a "naturalistic" approach was to be adopted the question of how the research was to be monitored and controlled was most important. Naturally the research student frequently met his academic supervisor, but formally the project was controlled by means of regular review meetings with the project steering group. The importance attached to this project by senior management is shown by the composition of this group which included the DFO, the acting District Administrator, and the District Community Physician. At these meetings the researcher presented a paper resistance was the behaviour of a professor in the department of haematology who on being told the purpose of his enquiries ordered the researcher out of his department, however he subsequently relented and agreed to the analysis continuing. On the other hand many staff were constructive from the start, and some exceptionally so, for example, a doctor in the department of chemical pathology wrote a special program which analysed his raw data to produce information in a form suitable for the model. Many staff were openly critical of the attempt to construct a permanent and general system to answer questions about the effects of plans; many said that it was not possible. While collecting and analysing the data the researcher often discussed the system he was developing with staff at all levels and it was largely as a result of such continual interaction (which was fully documented) that the system emerged as a practical tool for senior management, but the stress on a researcher in such an exposed and isolated position is considerable. It is important to note, however, that the researcher was never blocked when seeking information (although obstacles were put in his way) because staff were aware that although he was "just a research student" the project was strongly backed by the DMT and senior consultants.

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A grasp of how planning should ideally be done was most important given the research method which was chosen: the researcher becoming directly involved in the NHS in an attempt to explore its planning problems and provide useful ways of tackling some of these problems. This exploration took the form of attending planning meetings, studying planning documents and current methods and data, and discussing the problems with a wide range of staff. A knowledge of the theory gave the researcher a framework within which to begin his enquiries and helped him to keep the various aspects of the research in perspective. It enabled him to resist being swamped by the mass of local data available and the many and widely differing views about planning expressed to him, and helped him to identify and structure the key data which seemed most relevant to the planning of services. Also an awareness of how planning should be done, from projections of the size and profile of the catchment population to final implementation, monitoring and control, helped to ensure that the product of the research, which concentrated on the effects of planning options, would readily fit into a more general planning context (see Chapter 13). With these principles in mind, the researcher approached the problem of providing better information for planning by trying to find out the sort of information management needed to help them with their planning.

As was expected, many managers were **unclear about what they wanted**, let alone needed. On the other hand they were well aware of existing shortcomings and that much time was wasted in discussions because of poor, inappropriate or inconsistent information (see Chapter 4) and that important decisions were sometimes taken on the basis of such information. They were understandably unhappy with this situation. Given this general sense of bafflement amongst managers at the complexity (which is increasing) of the system for which they must plan, the researcher decided to concentrate on

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The system was designed to enable managers to ask their usual questions, but the structure of the model and the form of the output would be likely to encourage them to reconsider the way they plan. In this way the researcher hoped to fuse the two elements which formed the basis of the research: an analysis of the questions and needs of senior managers, and the general principles of coherent health service planning. Throughout the research the student **well recognised** that his ultimate aim was to improve managers' understanding of the services for which they are responsible and by means of a decision-support system to enable them to learn more about such services and as a result to take more soundly-based decisions. He also understood that the real success of any such system in improving decision-making must depend on managers adjusting their thinking, or at least suspending their judgment for a while, to accept and use the output from the system, but the system in turn should be so designed as to be easily accessible by managers with their current way of thought. The researcher has tried to meet information needs in a particular health district while at the same time developing a general and logical method which accorded with the way planning should ideally be done. The result of the research has been a combination of current need and planning theory. If the researcher had ignored current needs in favour of the theory then the research would have been most unlikely to have provided useful tools and methods, and the project would probably have been curtailed. If on the other hand the researcher had simply responded to what particular managers in a particular district wanted without reference to a wider framework then the result might have been internally inconsistent and unlikely to have been of general use. The researcher believes that attempting to meet a mix of needs in a health district with a logical method has resulted in the development of an approach of general, practical use to the NHS (see Chapter 12).

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CHAPTER THREE: THE GENERAL PROBLEM; FINANCIAL PRESSURES AND THE DEMAND FOR BETTER PLANNING

This research project began in October 1979 and lasted for three years. Important developments in the NHS have taken place since that time, but many of the major problems associated with information and planning remain. The NHS is experiencing continuing financial difficulties given the prospects of limited (if any) real growth in its total allocation of resources (see Appendix 1 for the effects in one region). Yet at the same time demographic change is putting greater pressure on the services currently provided. At district level managers try to perform a delicate financial balancing act as they seek to maintain or improve the service within the resources available. The current information systems on which they rely are fragmented so that it is difficult to get information relevant to managing services in a climate of financial restraint. The Report of the Royal Commission on the NHS notes with regard to finance: "Much of the information required for effective management is not produced, or is inaccurate, or too late to be of value" (Royal Commission:1979). This research project is an attempt to establish a system to provide useful information, especially the financial implications of changes in services, for operation planning in a health district.

How have the financial pressures developed? A brief survey of the resource history of the NHS can shed useful light on the current position. In the early years of the NHS although spending was originally expected to be stable and cash ceilings were imposed, the real costs tended to increase each year. From 1957 until 1976 Government policy accepted the need to finance increases in costs and the real resources allocated to the NHS rose by about four per cent a year; inflation was fully funded. This policy ended in 1976 and until 1982 the money available to the NHS was planned to

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During the financial year 1981-82 the NHS was instructed to make savings through the more efficient use of resources. These savings amounted to 0.4 per cent of the revenue allocation. This cut is cumulative: the cash withheld in one year is also withheld in subsequent years (see Appendix 1). Additional "efficiency savings" of 0.2 per cent were imposed for the year 1982-83 and a further 0.5 per cent reduction was planned for 1983-84. A system of cash planning was also introduced in 1982-83. This established cash limits on total NHS expenditure not only for the current year, but for two forward years as well. This means that the Government is not committed to compensating for any underfunding of inflation in the following year (similarly any overfunding of inflation will remain with the health authority). The assumed rates of inflation on which recent cash plans were calculated were five per cent in 1984-85 six per cent in 1985-86, and four per cent in 1986-87, and the assumed rates of real growth of inputs during each year was around one per cent.

grow in real terms by one to two per cent each year. During this period, as now, the Government recognised that an increase of about 1 per cent is required to maintain existing services for the expanding elderly population and to meet the escalating cost of medical technology. The cash limits system was introduced in 1976 and, with the exception of one year when inflation was overfunded, brought with it a squeeze on resources of up to three per cent each year through the underfunding of inflation. This squeeze was not cumulative because the estimates for each year were revised using data on actual movements in prices. This allowed the planned growth of inputs to continue until 1982.

During the financial year 1981-82 the NHS was instructed to make savings through the more efficient use of resources. These savings amounted to 0.4 per cent of the revenue allocation. This cut is cumulative: the cash withheld in one year is also withheld in subsequent years (see Appendix 1). Additional "efficiency savings" of 0.2 per cent were imposed for the year 1982-83 and a further 0.5 per cent reduction was planned for 1983-84. A system of cash planning was also introduced in 1982-83. This established cash limits on total NHS expenditure not only for the current year, but for two forward years as well. This means that the Government is not committed to compensating for any underfunding of inflation in the following year (similarly any overfunding of inflation will remain with the health authority). The assumed rates of inflation on which recent cash plans were calculated were five per cent in 1984-85 six per cent in 1985-86, and four per cent in 1986-87, and the assumed rates of real growth of inputs during each year was around one per cent.

This brief summary of the resource history of the NHS shows that after a long period of considerable growth, a combination of changes is taking place which is resulting in a prospect of no "growth money" available to finance developments of the service. How does this change in total expenditure on the NHS feed through to managers at district level?

Health care is and always has been rationed. The Resource Allocation Working Party (RAWP) noted that there is "ample evidence to demonstrate that demand for health care throughout the world is rising inexorably" and "because it can also be shown that supply of health care actually fuels further demand, it is inevitable that the supply of health care services can never keep pace with the rising demands placed upon them" (DHSS:1976:1). Also, "Maxwell (1981) notes, advances in medicine create more demands as more people survive to greater ages and suffer diseases which are progressively more difficult to cure or treat" (Carter:1983:1). Before 1948 health care was largely rationed by price. Since the establishment of the NHS the equitable geographical distribution of resources has been recognised as a problem and various methods of allocation have been used. These have "tended to increment the historic basis for the supply of real resources (eg facilities and manpower); and, by responding comparatively slowly and marginally to changes in demography and morbidity, have also tended to perpetuate the historic situation" (DHSS:1976:1). In 1970 Mr Crossman, as Secretary of State for Health and Social Security, proposed a formula (not mentioned in the RAWP report) for the more fair allocation of money to regional hospital boards: "half the money allocated was based on the population served, and a quarter each on the number of beds and the number of cases treated" (Royal Commission:1979). However, the adoption of

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These estimates use a combination of factors including the size of the population served, the age and sex structure of this population, and its mortality and fertility: mortality data in the form of Standardised Mortality Ratios are used as surrogate measures of morbidity. Allowance is made for cross-boundary flows of patients. In 1974 the teaching hospitals were incorporated within the RHA structure and an attempt is made to take into account the costs of clinical medical and dental training. As a result of the application of the principles contained in the RAWP report several regions, including the four Thames regions and Oxford, found their "development money" severely cut from 1976. Regions have generally followed the RAWP methods (with some modifications) to guide their allocations to areas, and many have continued the practice with districts from 1982-83. Some districts fall within a region with little "growth money" and also suffer through being relatively well provided for in comparison with other districts in the same region, according to the region's formula. Such districts have found their "development money" reduced to a level intended only to cover the cost of caring for the increasing elderly population and meeting, to a very limited extent, the costs of changes in medical technology. In the future these districts in particular may face cuts in real resources. RHAs have now to consider the extent to which they can finance redistribution by making significant cuts in the allocations to these districts.

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While the NHS as a whole has less money for development than in the past because of government policy and the state of the economy, the "growth money" available to particular regions and districts varies greatly because of the application, both nationally and regionally, of the methods suggested by the RAWP. In such a situation, with little hope of improvement, those managing districts with little money for developments, or with cuts in prospect, might consider whether their current systems give them the support they need to the very careful planning that needs to be done. Managers of districts with "growth money" may feel satisfied with the information produced at present because they think the system will cope even if their assessments of the consequences of plans are incomplete or not very accurate. Such complacency may be short-sighted. The RAWP report emphasised that "supply of facilities has an important influence on demand in the locality in which they are provided" (DHSS:1976:1). So health authorities may feel they have met the need or demand for health care of the population they serve, only to find themselves under more pressure through having met these demands or needs, and with less or no "growth money" available. The NHS planning system is intended to help management grappling with problems such as these.

The planning system introduced in 1976 was envisaged as an integral part of the reorganised NHS (DHSS:1976:2). A central purpose of the system was to change people's view of the nature of NHS planning to encourage the planning of services rather than the planning of buildings. In the NE District of KCWAHA the planning of parts of the service such as the services for the mentally ill, seemed broadly in accord with the

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Over recent years there has been growing concern about the inadequacy of current systems to provide district management with information about the likely consequences or opportunity costs of planning options. The authors of a research report for the Royal Commission on the NHS note that the financial control systems in the NHS are "little used for planning and decision-making in any positive sense of resource allocation or conscious testing of alternatives" (Perrin et al:1978). In the past, accurate financial planning at district level has had a fairly low priority to those managing the districts because of: the substantial money for growth, the willingness of regions to fund the revenue consequences of capital schemes, incremental budgeting (rather than the RAWP mechanism), and index-linked allocations (rather than the systems of cash limits and cash planning). As the changes described above have occurred, they have brought pressure to bear on the need to improve the quality of information available to management.

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If changes are to occur with no "development money" available then management must be able to forecast the financial effects of planned changes to patient activity and facilities: both expansions and contractions. The current, uncoordinated information systems do not enable managers to do this (see Chapter 4:4). At present hospital data are drawn together at hospital level, but this is too high a level of aggregation to be useful for most district operational planning. The changing financial climate means that those managing the Bloomsbury District urgently require the data to be integrated differently. The aim of this research project has been to identify the information requirements of a DMT for operational planning and to devise a feasible system by which they may be met at low cost. The exercise has involved the identification of elements which seem to be important for planning and the integration of these elements so that the effects of change to one part of the system on the rest of the system can be shown. A set of procedures has been produced for the collection and analysis of data; and a computer model has been built to integrate the data over time to explore the effects of planning options.

One of the chief distinguishing features of the successful application of OR is concentration on the "new" problems of an organisation. If a recurring problem has been "solved" for many years the implementation of an for "muddling through". Until now local management seem to have given little thought to their information needs, but faced with these new pressures they are becoming increasingly aware of the inadequacies of the current information systems.

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OR technique may be futile because managers do not recognise that the problem is important (and it may not be). Also the see-ngly more logical OR solution may well be only a slight improvement on the current solution which may be based on considerable experience. Management may have been aware of a problem area for some time, but it is only when the solution or better solution of the problem becomes a high priority, or the symptoms attract particular attention, that the OR analyst should intervene. An important task for the analyst may be just to identify the problem(s) given the symptoms. The problem of how to assess the likely consequences of operational planning options in the NE District was just becoming a major management concern when the research project began. This had become a pressing problem because of the changing financial conditions (as outlined above) which necessitated better financial planning. The organisation had to respond to a change in the environment. This concern has intensified since that time and a new financial planning function is to be established in the Bloomsbury District. Because of their structure the standard information systems were unable to provide information relevant to this problem. Management needed the structure of these systems to be fundamentally reassessed for this "new" purpose. This task involved the integration of a variety of data from separate systems covering many parts of the service. This required detailed analysis of links between the components of an organisation structured to enable a view to be taken on the entire organisation. This exemplifies another key characteristic of OR: the holistic approach. This perspective seems especially valuable in the pluralistic NHS which comprises so many related functions. Management are not particularly interested in very accurate and full information about part of the problem, they want fairly reliable

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CHAPTER FOUR: THE PARTICULAR PROBLEM; PLANNING AND A SPECIFIC HEALTH DISTRICT

1. DESCRIPTION OF THE NORTH EAST DISTRICT

The NE District of KCWAHA was the smallest health district in England both in terms of size and resident population, but with a large revenue budget (£48m in 1981-82). It lay entirely within the City of Westminster and covers St John's Wood, Regents Park, St Marylebone, Mayfair, Soho and Covent Garden (see Figure 1). The population of the District was steadily declining and stood at 63,600 in 1981 (see Figure 2). The proportion of elderly within this population was rising. In addition there was a massive transient population of commuters, shoppers and tourists.

A wide range of health care facilities were managed by the DMT of the NE District. The Middlesex Hospital is one of 12 London undergraduate teaching hospitals. It has 686 acute beds, 10 operating theatres, and a staff of about 2,400 (see Figure 3). Doctors in 23 specialties at the hospital treat 25,000 inpatients and see 240,000 outpatients each year. There are also day hospital facilities and a casualty department. There are five regional specialties at The Middlesex. Doctors, nurses, physiotherapists, radiographers and radiotherapists are trained there. Many specialist courses are run. The Hospital for Women, Soho has 54 beds and one theatre and specialises in gynaecology. The Marlborough Day Hospital is a small psychiatric unit for family therapy. The remaining four hospitals were all located outside the boundaries of the District. St Luke's Hospital in Muswell Hill comprises an 80-bedded acute psychiatric hospital, with 10 beds for adolescent psychiatry, and a psychiatric day hospital. Athlone House in Highgate has 94 beds for geriatric and psychogeriatric patients and a geriatric day hospital. Horton and Banstead are large, long-stay psychiatric institutions in Surrey. Community services within the District comprised GPs, community nurses, health visitors, five health centres, and a very large family planning clinic.

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FIGURE 1

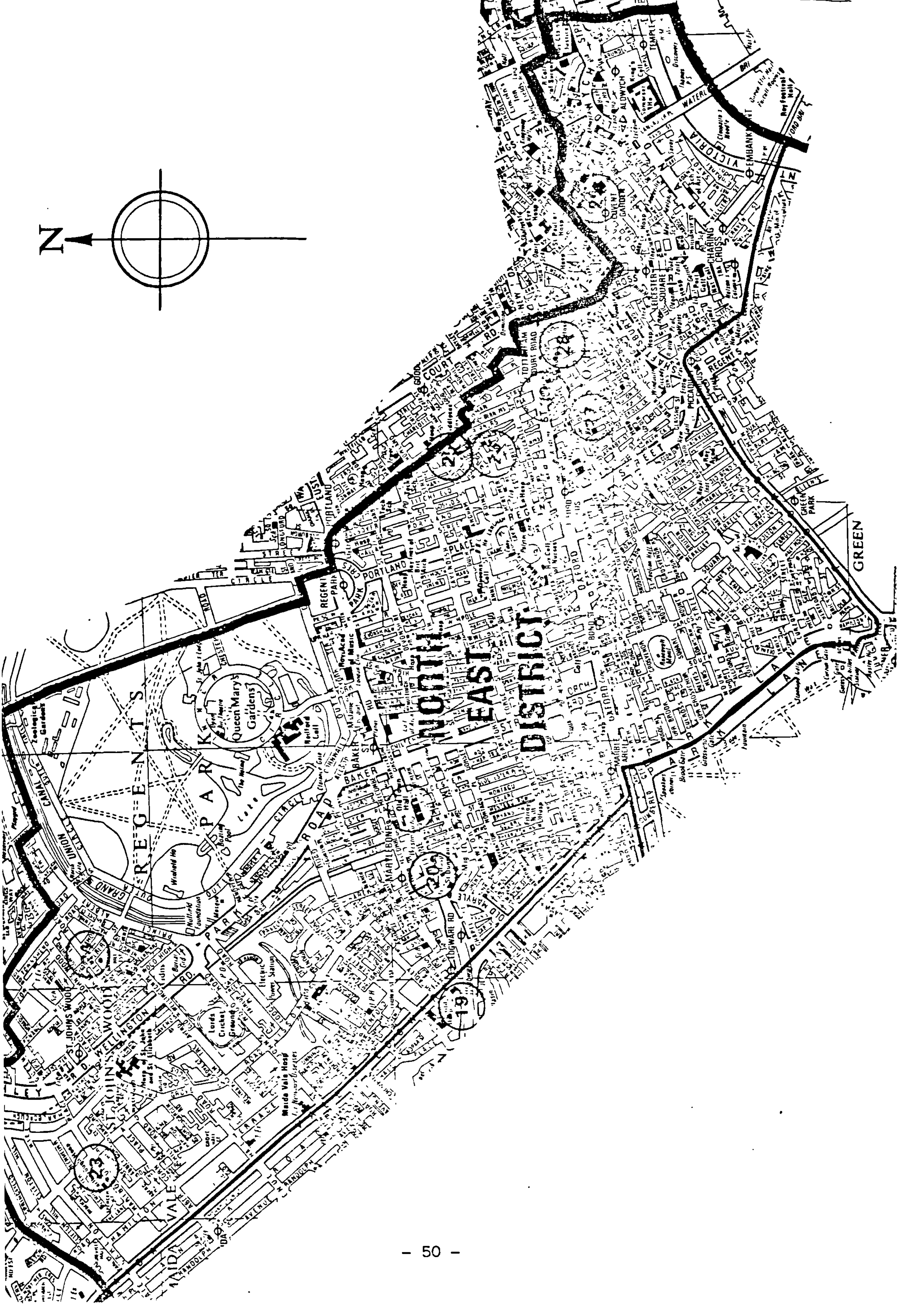
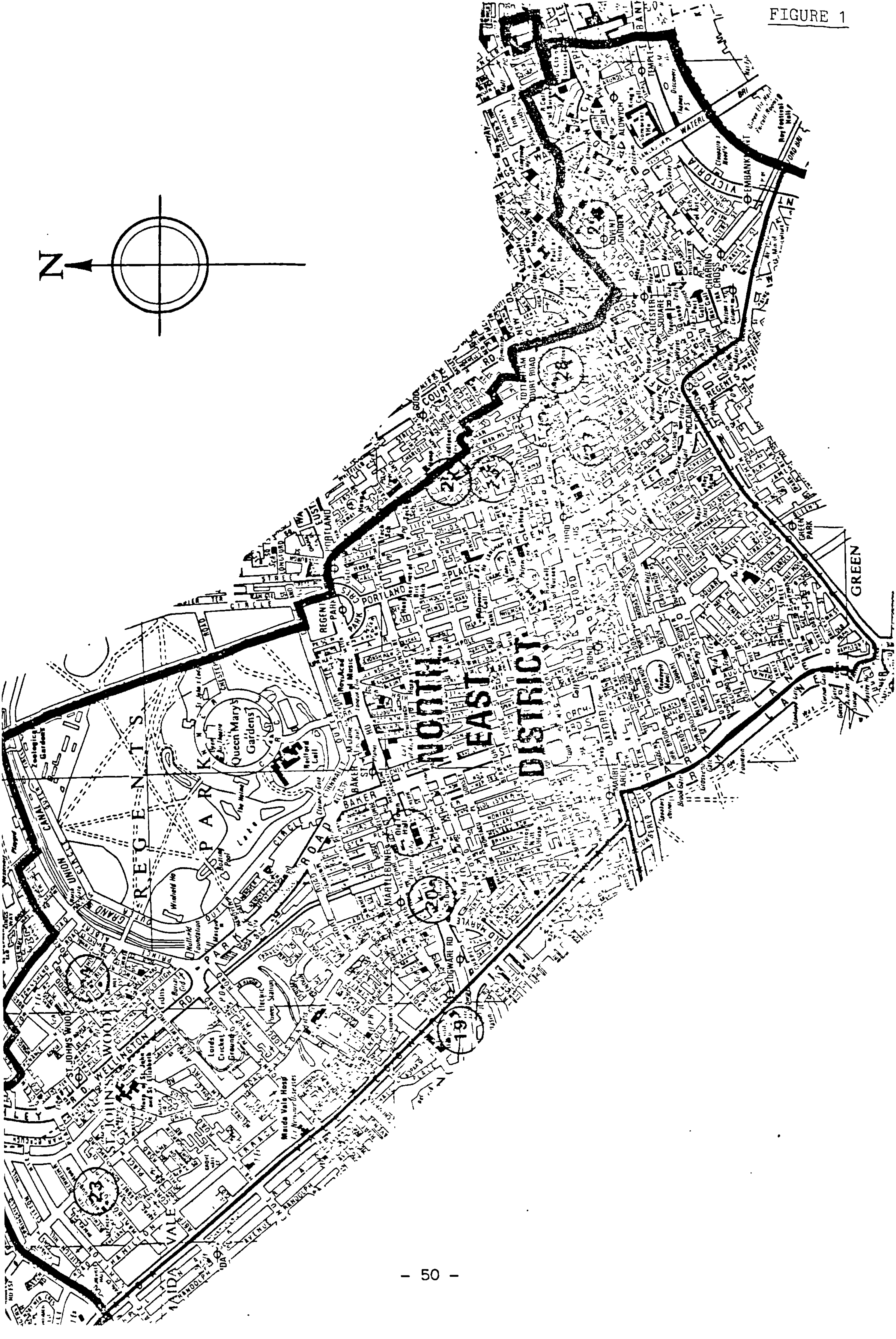

N
NORTH EAST DISTRICT
REGENTS PARK
Queen Mary's Gardens
OXFORD
PICCADILLY
COVENT GARDEN
CHARING CROSS
LEICESTER SQUARE
GREEN PARK
MARYLEBONE
ST JOHNS WOOD
GRAND UNION CANAL
VICTORIA EMBANKMENT
ALDWYCH

FIGURE 1


N
NORTH EAST DISTRICT
REGENTS PARK
Queen Marys Gardens
Lords Cricket Ground
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GREEN PARK
ALDWYCH
EMBANKMENT
VICTORIA
OXFORD
PORTLAND PLACE
BAKER ST
MARYLEBONE
ST JOHNS WOOD
MAIDA VALE
HAMILTON
GROSVENOR
PARK LANE
GREEN

NORTH-EAST DISTRICT

POPULATION

		Yearly rate of decrease
Mid - 1974 estimate	81,700	
Mid - 1975 estimate	81,800	
Mid - 1976 estimate	77,700	5%
Mid - 1977 estimate	74,900	4%
Mid - 1978 estimate	73,600	2%
Mid - 1979 estimate	72,200	2%
Mid - 1980 estimate	70,300	3%
Provisional census figure	63,600	

Population by age-group. Mid - 1980 estimate

Age	Number	% of total	Comparable % England & Wales
0 - 4	1500	2.1%	6%
5 - 14	3100	4.4%	14.9%
15 - 29	12600	17.9%	22.3%
30 - 44	14700	20.9%	19.3%
45 - 64	20900	29.7%	22.4%
65 - 74	10200	14.5%	9.4%
75+	7300	10.4%	5.7%

Population by Electorial Ward

	1971 Census	1981 Census	% decrease
Hamilton Terrace	6966	5419	- 23%
Lords	7211	5966	- 17%
Church St.	7140	9377	+ 31%
Regents Park	11852	9363	- 21%
Bryanston	8703	5876	- 32%
Baker St.	8717	6478	- 26%
Cavendish	12051	9440	- 22%
West End	15713	8968	- 43%
St. James (part)*	6192	2723	- 56%
TOTAL	84575	63610	- 25%

* estimate only

NORTH-EAST DISTRICT

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NORTH EAST DISTRICT

Bed Allocation 30.6.81

	Middlesex	Soho	Athlone	St. Lukes	Horton	Banstead	TOTAL
General Medicine	115						115
Paediatrics	26						26
Dermatology	9						9
Neurology	20						20
Cardiology	16						16
C.C.U.	3						3
Rheumatology	10						10
Geriatrics	33		60				93
General Surgery	114						114
E.N.T.	34						34
Trau. & Orth Surgery	31						31
Opthalmology	10						10
Radiotherapy	54	5					59
Urology	30						30
Thoracic Surgery	15						15
Dental Surgery	4						4
Neurosurgery	9						9
Gynaecology	20	49					69
Obstetrics	38[a]						38
SC baby Unit	10						10
Mental Illness	15			70	1024	878	1987
Adolescent Psychiatry				10			10
Psycho-geriatric			(34[b])				(34)
Unallocated/Staff	11				7	4	22
I.T.U.	9						9
Private	50[c]						50
TOTAL	686	54	(94)	80	103	882	28[illegible]7[d]

NORTH EAST DISTRICT

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Trau. & Orth Surgery	31						31
Opthalmology	10						10
Radiotherapy	54	5					59
Urology	30						30
Thoracic Surgery	15						15
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SC baby Unit	10						10
Mental Illness	15			70	1024	878	1987
Adolescent Psychiatry				10			10
Psycho-geriatric			(34[b])				(34)
Unallocated/Staff	11				7	4	22
I.T.U.	9						9
Private	50[c]						50
TOTAL	686	54	(94)	80	103	882	2[illegible]7[d]

2. PLANNING PROBLEMS OF THE DISTRICT

The problems of the District were of two types. Firstly, there were the tight constraints on resources and negligible money for developments. This problem was shared with many other districts and especially inner London teaching districts (see Chapter 3). Secondly, there were the major changes being considered by the management of the District, especially in connection with psychiatric and acute care. The NHS planning system (DHSS:1976:2) is intended to help management handle such problems, but there are great difficulties in using this framework, because the care groups proposed are so broad that they have little meaning for much practical operational planning (see Chapter 5:1:2). Many of the planning decisions in the NE District involved choices between service options within particular care groups; for example, a choice between expanding or contracting particular specialties within the "acute care" group.

Over recent years there has been a shift of emphasis in the treatment of psychiatric illness away from care in large, long-stay institutions to treating the patient while he or she remains at home or near home. This change has been largely due to the discovery of new drugs. One result had been a reduction in the population of the two large psychiatric hospitals in the NE District. This reduction was expected to continue and lead to the eventual closure of one of the two hospitals with the transfer of residual long-stay patients from the hospital which is closing to the one which is to remain open. This scheme will only be accomplished over many years as local psychiatric services are expanded in the catchment areas of these institutions. Current information can give little guidance about the implications of these plans over time; for example, the effect on medical staff. The Bloomsbury District which has incorporated most of the former NE District does not include either of these psychiatric hospitals and so is relieved of their associated problems. Nevertheless, important developments of local psychiatric services are likely in the Bloomsbury

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District and management will have difficulty forecasting their effects using information available at present.

In acute care it seemed, and still seems, likely that regional centres for cardiology and cardiac surgery, and radiotherapy and oncology will be located at The Middlesex. The revenue consequences of these very expensive specialties will only partly be funded by the Region, so other specialties will have to be removed or have their inpatient caseload severely cut to make way for these developments both physically and financially. Many complex interactions are involved in such a radical change to the services and the district information systems were incapable of showing management and likely results of such change in sufficient detail.

3. DIFFICULTIES WITH USING THE NHS PLANNING SYSTEM IN A PARTICULAR DISTRICT

The NHS planning manual issued by the DHSS (DHSS:1976:2) suggests that management should try to answer four questions when planning;

Where are we now?

Where do we want to be?

How do we get there?

How are we doing?

This is an idealised and simplified paradigm for planning, but the main stages in the process are clear. An attempt to anser these questions may expose serious inadequacies in the management information systems. The systems in the NE District could inform management about the services provided in terms of facilities, such as beds and operating theatres, and staff. Little information about the costs of these services was available, however, and the links between information on services and resources were weak. There were also severe difficulties in defining and assessing current and likely future needs or demands for services in defining and measuring the true output of the service, District and management will have difficulty forecasting their effects using information available at present.

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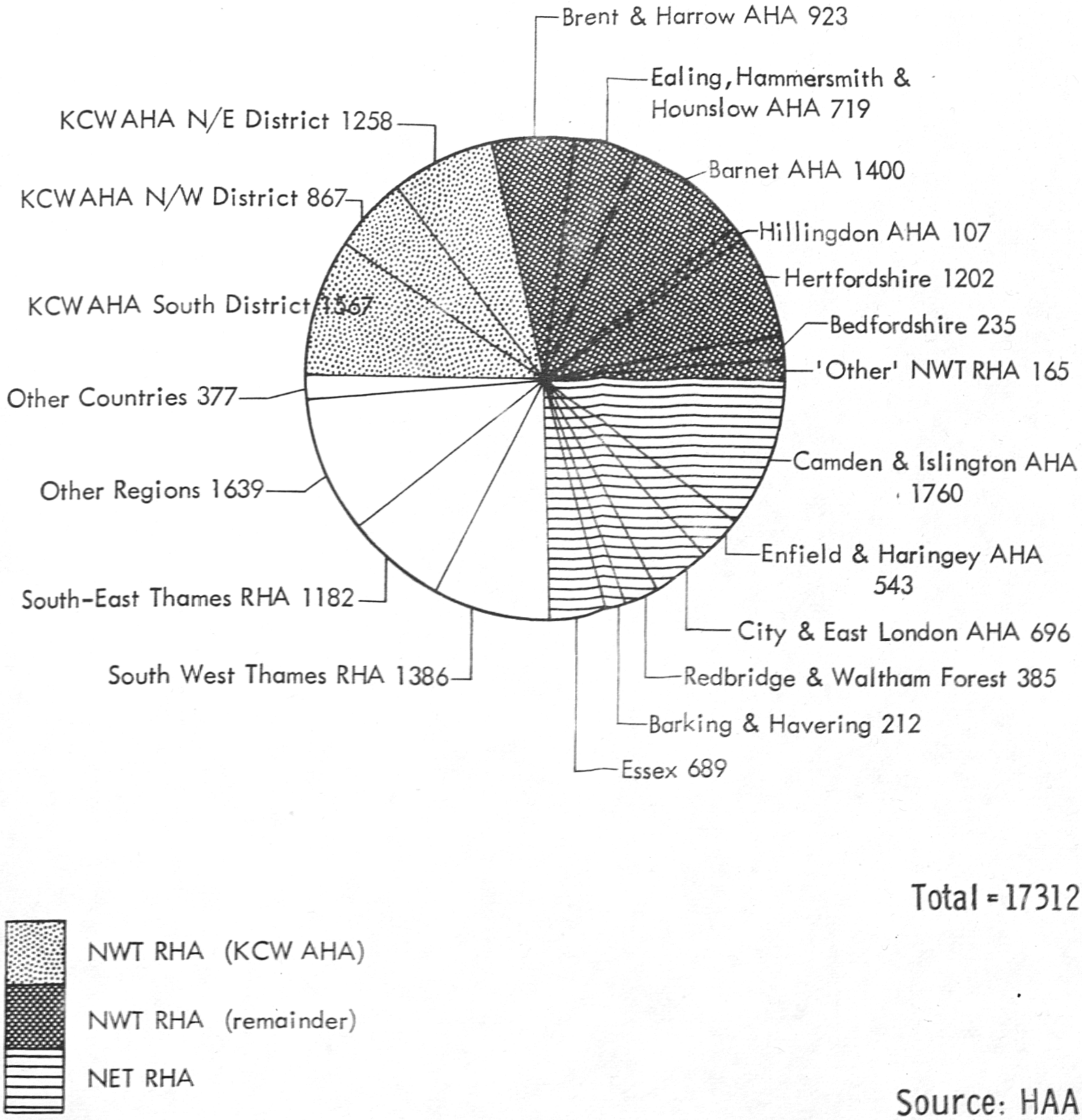
DISCHARGES AND DEATHS 1980 BY AREA OF RESIDENCE

THE MIDDLESEX HOSPITAL

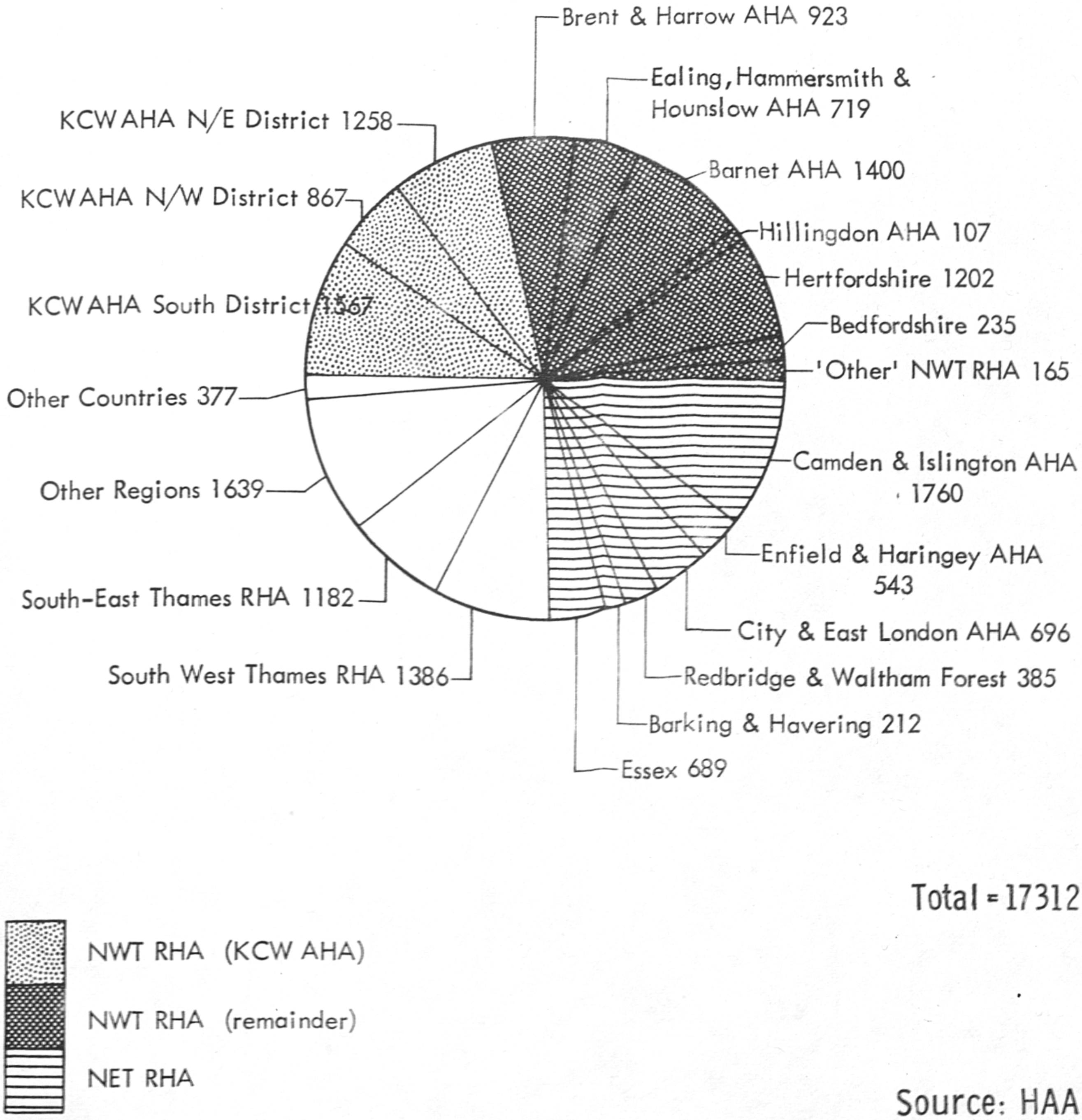


Total = 17312

Source: HAA

DISCHARGES AND DEATHS 1980 BY AREA OF RESIDENCE

THE MIDDLESEX HOSPITAL



Total = 17312

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although intermediate outputs were available. Each of the above planning steps is considered in general and the specific characteristics of the NE District are discussed.

Where are we now? In order to answer this question, management should ideally identify the size, nature and needs of the current catchment population. The catchment population of the NE District was widely dispersed (see Figure 4). The District provided general and very specialised treatment for the small resident population of the District as well as for people from many other districts, especially in north London. About 20 per cent of inpatients at The Middlesex are admitted through the casualty department. Some people in the NE District did not use the services provided in the District, but were treated elsewhere. The definition of the population served by the NE District seemed to depend largely on the GP referral patterns which are continually shifting as individual consultants and GPs change and as the hospital and community services provided by districts alter. The catchment population of the NE District was most atypical. Management should ideally be aware of the services currently provided by the District in terms of facilities and staff, the use of the facilities by patients, the effectiveness of the treatment, and how far the current demands and needs of the catchment population are being met. The resources used by these services should be identified. Also management should be informed about any developments currently in progress. The information systems in the NE District could provide some information to answer the question: Where are we now? But by no means all of it. Management could find out something about the throughput of patients by specialty and the resources at their disposal in terms of staff, facilities and money. Such information is useful for some management purposes, but it is not integrated in a way appropriate for operational planning decisions, which is perhaps the most serious failing of current information systems in relation to planning.

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Where do we want to be? Management should ideally attempt to forecast the likely size and characteristics of the catchment population for which the district provides services, estimate the likely need or demand for health care by this catchment population, and then identify the services by which these may be best met (bearing in mind other responsibilities such as teaching and specialist services). The modelling of GP referral patterns was briefly considered, but all the consultants and senior staff with whom this was discussed thought that such an exercise would be very unlikely to produce useful results. GPs refer patients to particular hospitals for many varied reasons such as the length of the waiting list, their knowledge of the consultants, and previous contacts with the hospital. In the case of a relatively self-sufficient district with small cross-boundary flows or where these flows affect only a few specialties it might be reasonable to expect the district planners to estimate the likely future demand for services bearing in mind the effect on patient flows of likely developments in neighbouring districts. The aim should be to provide services to meet need rather than demand, but since there are so many unresolved problems associated with the measurement of need, perhaps it is only reasonable at present to expect planners to approach the problem in general in terms of demand. In the case of the NE District the planners could not forecast the likely demand for most of the services provided because so many of the patients came from outside the NE District. Many districts in London are in a similar position. Such health districts cannot coherently plan their own futures in isolation and for each to attempt to do so would result in wasteful duplication of effort and serve no useful purpose. These districts can do little strategic planning since the district staff cannot analyse the full context of their planning decisions. Yet the latest guidance from the DHSS on

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planning in the reorganised NHS suggests that districts are mainly responsible for producing their own strategic plans (DHSS:1982). This problem is further considered and the proper role of the district discussed in Chapter 13. The contributions of such bodies as the London Health Planning Consortium (LHPC) (LHPC:1980) and the London Advisory Group (LAG) which considered the health problems of London as a whole seem to show the way forward, but unfortunately no standing group exists to perform this function. The management of the NE District received little clear and useful guidance on strategy from the higher tiers of management. Those planning the NE District tried to follow what national guidance existed, but such guidance was of no avail in deciding the future of the acute services in the district which consumed most of the resources. National guidance is largely in terms of health care groups (see Chapter 5:1:a) and virtually all acute services fall in one group: "acute care".

Districts with large cross-boundary flows require a context for planning: without such a context and the appropriate information, it is easier for forceful individuals to apply pressure to achieve their aims. A combination of such objectives may well not constitute a sound corporate plan for the health district and may even lead to planning inconsistencies. Even in isolation such individual initiatives should always be evaluated in the light of the demand or need which they meet and, if acceptable by one of those criteria, the options foregone should be considered. A district providing new and highly specialised services, as does the Bloomsbury District, may also wish to promote schemes which are not based on an assessment of the needs of demands of a defined population, because such an assessment is virtually impossible.

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How do we get there? Management ideally should then choose the patterns of service over the planning period by which they consider they best meet all or some of their objectives. There will be a number of constraints on this choice such as: the services currently provided, the capital stock, the time to construct new facilities or alter old ones, and the demands of any training programmes. The choice involves an assessment of the feasibility, effects and likely benefits of each option and then the identification of the preferred option(s).

Managers of health districts often have difficulty in assessing whether a planning option is feasible and in estimating the consequences of particular planning decisions, even in the short term. The current information systems of the NHS where not designed to help them to do this. When making a plan senior staff should ideally be mainly concerned with the product of the system. The product of health services should be the maintenance or improvement of the health of the community. The World Health Organisation's definition of health is as follows: "The state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity". Management should try to decide how best to deploy their limited resources to secure the best possible state of health of the community they serve (although other factors such as housing, education and Local Authority provision also have a great effect on the health of the community). Since the output of the health services cannot at present be measured in terms of a change in the state of health of the population such a change (or the maintenance of the current position) cannot be used as the quantifiable aim of a plan. However, the number of patients treated by specialty is recorded and this represents an intermediate output which can be used for setting some planning objectives. Current information systems do not even enable management to assess the feasibility and implications of a change in this crude measure of production. District management does

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How are we doing? Management should monitor the progress of their plans. Some attempts were made to do so in the NE District, using the information on patient activity and finance currently available.

4. PROBLEMS WITH CURRENT INFORMATION SYSTEMS AND PLANNING METHODS

The management information systems in the NHS cannot provide those responsible for taking decisions about the future of a district with clear and comprehensive information about the implications of planning options. The production of such information is difficult in an unusual organisation like the NHS. Most people in the health service, including the most powerful and eminent, are primarily concerned with treating and caring for individual patients. But this activity must take place within resource constraints. It is the responsibility of the staff of the finance department to ensure that these constraints are met, although the demand for and use of resources may be largely beyond their control. There are considerable tensions between the finance function, relatively remote from the patients, seeking to control the expenditure and other hospital professions in direct contact with sick people.

In a hospital such as The Middlesex, a large number of inpatients are treated each year for a very wide range of conditions. These vary from minor Ear, Nose and Throat (ENT) operations to major open-heart surgery. The periods spent by patients in hospital vary greatly from a few days to several months. Their treatment and care involve many professions. They not have the time or resources to design and mount detailed studies of a range of planning options. Also it may not be possible to gather the information required for the study over a short time, because the period may be thought atypical, and historical data may not be available.

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a. Information systems in the North East District

Patient activity and facilities. Information about the total inpatients and outpatients treated is available by specialty by quarter from a form called the Statistics Hospitals Quarterly (SHQ). The specialties recognised by the DHSS are shown on this form. Patients are associated with specialties in the following manner according to the DHSS: "Patients should be strictly classified according to the department of the consultant or GP under whose care they were immediately before discharge" (DHSS:1977). The SHQ contains data by specialty under the following heads: staffed beds allocated, average available beds, average occupied beds, discharges and deaths, waiting list at the end of the quarter, day case attendances, outpatient clinics held, new outpatient attendances, total outpatient attendances, and the delay in weeks before the first routine outpatient appointment. The data concerning inpatients is derived from the daily bed statements produced by each ward. The outpatient data comes in a variety of forms from the main outpatient department and the clinics. A statistical return to the DHSS entitled Statistics Hospitals (SH3) contains data for each calendar year very similar to those shown on form SHQ. Data which only appear on form SH3 cover attendances at service departments, day patient attendances, and extra details all require the standard "hotel" services, but they place very different demands on the service departments, such as the pathology services, and consume widely varying types and amounts of resources, such as drugs. Managers need information in all these areas if they are to assess properly the consequences of a planning decision. The information which was available in key areas of the NE District is summarised below.

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More detailed information about inpatients and their treatment is available by consultant for any period from the Hospital Activity Analysis (HAA) system. These data cover personal details of the patient, source of admission, consultant responsible, type of discharge or death, diagnoses, and details of any operations. They are collected independently of those which appear on the SHQ and SH3 forms.

A return is completed for each patient partly by a doctor and partly by his or her secretary. The HAA input forms are often incomplete: about 25% of the returns do not include medical data. Some of the data are comparable to those of the SHQ/SH3 forms and so can be checked: there is approximately a 5% shortfall in HAA death and discharge data compared with the SHQ returns. The omissions tend to be associated with a few specialties. At present consultants generally have little faith in HAA data. There seem to be problems with HAA data in many districts: the authors of one of the research reports for the Royal Commission note that "because people did not feel that these statistics were useful or used in any important way... they were relegated to a low priority for the assignment of staff time for collection, and for concern for accuracy" (Perrin et al:1978). However since so many patients treated in the Bloomsbury District live outside this District and the NE Thames Region, and since allocations of resources based on cross-boundary flows are now calculated using HAA data alone, there is considerable pressure to ensure that all cases are recorded.

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Only very detailed data about individual patients are available routinely from the theatres. These data comprise some details about the patient, the type and time of the operation, and the time spent in the recovery area. An operations' list is produced each day which shows the operations due to take place in each theatre. The operating sessions allocated to each consultant are also available. The data kept in the ITU also relate to individual patients only. The record book in the ITU shows each patient's name, age and illness, the admitting consultant, and the ward from which the patient came and to which he or she was discharged. Information in similar detail is available from the following service departments: imaging services, pathology services, drugs and patient appliances.

The beds allocated to specialty by ward were not readily available when the research began. A rough picture was produced (after some delay) by the admissions' officer. Although she was interested in the research project and wanted to provide the information, day-to-day pressures prevented her from providing these basic planning data at once. Since then the appointment of a new district information officer and pressure from those taking planning decisions has led to much clearer information becoming available (see Figure 5).

Staff. Data about the establishments of trained and untrained nurses are routinely available by groups of wards known as "units" or "wings" (see Figure 6). Since the DMT rarely produces an operational plan concerned with an entire nursing 'unit" such information is of little value for planning purposes. Ward nurse establishments were

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BED ALLOCATION BY WARD

(On completion of G.I. Unit on Princess Alice)

WARD	BED ALLOCATION BY WARD	COMPLEMENT
Sandhurst	General Medicine 14 Geriatrics 3	17
Essex Wynter	General Medicine 16 Geriatrics 4	20
King George V	General Medicine 15 Rheum. 3 Geriatrics 5	23
Northumberland	General Medicine 14 Geriatrics 5	19
Prince Arthur	General Medicine 15 Geriatrics 3	18
Queen Alexandra	General Medicine 16 Geriatrics 4	20
Vaughan Morgan	General Medicine 4 Cardiology 9 Geriatrics 2	15
Meyerstein	General Medicine 9 Cardiology 7 Geriatrics 2	18
C.C.C.	Coronary Care 3	3
Hardy Roberts	Ophthalmology 8 Rheum. 7 Metabolic Medicine 3	18
Charles Bell	General Surgery 19	19
Broderip	General Surgery 20	20
Bland Sutton	General Surgery 24	24
Lord Athlone	General Surgery 17	17
John Astor	Urology 15 General Surgery 8	23
Webb Johnson	Urology 15 General Surgery 4	19
Cavendish Bentinck	General Surgery 21	21
Holmes Sellers	Thoracic Surgery 15 General Surgery 1	16
Princess Alice	Gastro-Intestinal Medicine 9	9
Queen Mary	Geriatrics 10	10
Latyme	Neurology 5 Dermatology 4 Unallocated / Staff 8	17
Dressmakers	Orthopaedic 13	13
Bond Street	Orthopaedic 18	18
Bernhard Baron) Princess May) Campbell Thompson)	Paediatrics 26 (25)	26 (25)
Jack Hambro) McAlpine)	Neurology 15 Neurosurgery 9	24
Strathcona	E.N.T. 17 Dental Surgery 2	19
Berners	E.N.T. 13 Dental Surgery 2	15
Maternity	Maternity 44 (including Lord Ludlow 4)	44
S.B.C.U.	S.B.C.U. 10	10
Rosalind Chetwynd	Gynaecology 20	20
Laffan	Mental Illness 15	5
I.T.U.	I.T.U. 9	9
Whitbread	Radiotherapy 20 (19	20 (9)
Greenhow	Radiotherapy 14	4
Prince Francis	Radiotherapy 20	20
Woolavington	Private Wing 50 (including E Floor)	50

BED ALLOCATION BY WARD

(On completion of G.I. Unit on Princess Alice)

WARD	BED ALLOCATION BY WARD	COMPLEMENT
Sandhurst	General Medicine 14 Geriatrics 3	17
Essex Wynter	General Medicine 16 Geriatrics 4	20
King George V	General Medicine 15 Rheum. 3 Geriatrics 5	23
Northumberland	General Medicine 14 Geriatrics 5	19
Prince Arthur	General Medicine 15 Geriatrics 3	18
Queen Alexandra	General Medicine 16 Geriatrics 4	20
Vaughan Morgan	General Medicine 4 Cardiology 9 Geriatrics 2	15
Meyerstein	General Medicine 9 Cardiology 7 Geriatrics 2	18
C.C.C.	Coronary Care 3	3
Hardy Roberts	Ophthalmology 8 Rheum. 7 Metabolic Medicine 3	18
Charles Bell	General Surgery 19	19
Broderip	General Surgery 20	20
Bland Sutton	General Surgery 24	24
Lord Athlone	General Surgery 17	17
John Astor	Urology 15 General Surgery 8	23
Webb Johnson	Urology 15 General Surgery 4	19
Cavendish Bentinck	General Surgery 21	21
Holmes Sellers	Thoracic Surgery 15 General Surgery 1	16
Princess Alice	Gastro-Intestinal Medicine 9	9
Queen Mary	Geriatrics 10	10
Latyme	Neurology 5 Dermatology 4 Unallocated/Staff 8	17
Dressmakers	Orthopaedic 13	13
Bond Street	Orthopaedic 18	18
Bernhard Baron) Princess May) Campbell Thompson)	Paediatrics 26 (25)	26 (25)
Jack Hambro) McAlpine)	Neurology 15 Neurosurgery 9	24
Strathcona	E.N.T. 17 Dental Surgery 2	19
Berners	E.N.T. 13 Dental Surgery 2	15
Maternity	Maternity 44 (including Lord Ludlow 4)	44
S.B.C.U.	S.B.C.U. 10	10
Rosalind Chetwynd	Gynaecology 20	20
Laffan	Mental Illness 15	5
I.T.U.	I.T.U. 9	9
Whitbread	Radiotherapy 20 (19	20 (9)
Greenhow	Radiotherapy 14	4
Prince Francis	Radiotherapy 20	20
Woolavington	Private Wing 50 (including E Floor)	50

FIGURE 6

Nursing Establishment & Points Value.

Division

Grade	Special Surgery	East Wing	Wool Wing	West Wing	B-J Wing	Nights	Theatres
PNO							
SNO Days							1·0
SNO Nights						1·0	
NO Days	1·0	1·0	1·0	1·0	1·0		2·0
NO Nights						2·0	
CN Days	5·0	8·0	9·0	9·0	10·0		12·0
CN Nights						15·0	
Staff Nurse Days	21·0	31·0	38·8	29·0	33·5		15·5
Staff Nurse Nights						20·5	
Staff Midwife							
SEN Days			9·0				
EN Days	4·0		2·0		1·0		
EN Nights						1·0	
Nursery Nurse							
NA Days	2·0				1·0		
NA Nights						2·0	
Establishment	33·0	40·0	59·8	39·0	46·5	41·5	30·5
Leads: VD							
Psychiatric					5·0		
Geriatric					11·5		
Points per unit	457·82	575·13	836·53	567·64	674·07	775·54	487·98

Establishment adjustments for:

1. Special Surgery
   - Decrease charge nurses −1·0
   - " nursing auxiliaries −1·0
   - Increase staff nurses 1·0
   - " enrolled nurses 1·0

2. East Wing
   - Increase staff nurses 4·3

3. West Wing
   - Decrease enrolled nurses −1·0
   - Increase staff nurses 9·0

4. Barnato Joel Wing
   - Decrease enrolled nurses −1·0
   - " nursing auxiliaries −1·0
   - Increase staff nurses 3·0

5. School & Relief
   - Decrease St

6. Nights
   - Decrease St

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Nursing Establishment & Points Value. Divisi

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PNO							
SNO Days							1.0
SNO Nights						1.0	
NO Days	1.0	1.0	1.0	1.0	1.0		2.0
NO Nights						2.0	
CN Days	5.0	8.0	9.0	9.0	10.0		12.0
CN Nights						15.0	
Staff Nurse Days	21.0	31.0	38.8	29.0	33.5		15.5
Staff Nurse Nights						20.5	
Staff Midwife							
SEN Days			9.0				
EN Days	4.0		2.0		1.0		
EN Nights						1.0	
Nursery Nurse							
NA Days	2.0				1.0		
NA Nights						2.0	
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   - Decrease St

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Finance. Financial information is organised by function, for example, nurses, domestic services, estate management and medical staff. Functional budgeting was universally introduced with the reorganisation of the NHS in 1974, with the intention of improving financial control. The system "offers aggregate costs classified by the departments providing goods or services", but, "it offers no information on where and how the real resources are consumed, or their volume and costs used in or on behalf of the separate hospital specialties providing the ward and theatre level contact with patients" (Bevan et al. 1980). The degree of detail recorded varies from function to function to meet particular needs.

While the expenditure on items ordered by the instrument curator is shown by type of instrument each month, the expenditure on dressings is given for the same period as a single figure for several hospitals. The nursing costs are available by nursing "unit", the domestic costs by "wing" (a group of wards), and the costs of doctors by hospital and some departments within a hospital.

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FIGURE 7

ROTA NO	OPERATOR	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	TOTAL HOURS	GRADE
10	ORDERLY	DAY OFF	REST DAY	X.2 0800-1700	X.2 0800-1700	X.2 0800-1700	X.2 0800-1700	X.2 0800-1700	40	3 2
11	DOMESTIC	E.3 0700-1500	E.3 0700-1500	E.3 0700-1500	E.3 0700-1500	E.3 0700-1500	DAY OFF	REST DAY	35	1
12	DOMESTIC	E.3 0730-1630	E.3 0730-1630	DAY OFF	REST DAY	E.3 0730-1630	E.3 0700-1245 1700-1930	E.3 0700-1245 1700-1930	40	1
13	ORDERLY	E.3 0800-1700	E.3 0800-1700	E.3 0800-1700	E.3 0800-1700	DAY OFF	E.3 0800-1700	REST DAY	40	3 2
14	DOMESTIC	E.3+X2 1730-2000 19.30	E.3+X2 1730-2000 19.30	E.3+X2 1730-2000 19.30	E.3+X2 1730-2000 19.30	E.3+X2 1730-2000 19.30	DAY OFF	E.3 0800-1330	17.75 ~~19.25~~ ~~17.75~~	1
15	DOMESTIC	E.4 0700-1500	E.4 0700-1500	E.4 0700-1500	E.4 0700-1500	E.4 0700-1500	DAY OFF	REST DAY	35	1
16	DOMESTIC	DAY OFF	REST DAY	E.4 0730-1630	E.4 0730-1630	E.4 0730-1630	E.4 0700-1245 1700-1930	E.4 0700-1245 1700-1930	40	1
17	ORDERLY	DAY OFF	E.4 0800-1700	E.4 0800-1700	E.4 0800-1700	E.4 0800-1700	E.4 0800-1700	REST DAY	40	3 2
18	DOMESTIC	E.4 1730-2000	E.4 1730-2000	E.4 1730-2000	E.4 1730-2000	E.4 1730-2000	E.4 0800-1330	REST DAY	15.25 17.75	1

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10	ORDERLY	DAY OFF	REST DAY	X.2 0800-1700	X.2 0800-1700	X.2 0800-1700	X.2 0800-1700	X.2 0800-1700	40	3 ~~2~~
11	DOMESTIC	E.3 0700-1500	E.3 0700-1500	E.3 0700-1500	E.3 0700-1500	E.3 0700-1500	DAY OFF	REST DAY	35	1
12	DOMESTIC	E.3 0730-1630	E.3 0730-1630	DAY OFF	REST DAY	E.3 0730-1630	E.3 0700-1245 1700-1930	E.3 0700-1245 1700-1930	40	1
13	ORDERLY	E.3 0800-1700	E.3 0800-1700	E.3 0800-1700	E.3 0800-1700	DAY OFF	E.3 0800-1700	REST DAY	40	3 2
14	DOMESTIC	E.3+X2 1730-2000 19.30	E.3+X2 1730-2000 19.30	E.3+X2 1730-~~2000~~ 19.30	E.3+X2 1730-~~2000~~ 19.30	E.3+X2 1730-2000 19.30	DAY OFF	E.3 0800-1330	17.75 ~~15.25~~ ~~17.75~~	1
15	DOMESTIC	E.4 0700-1500	E.4 0700-1500	E.4 0700-1500	E.4 0700-1500	E.4 0700-1500	DAY OFF	REST DAY	35	1
16	DOMESTIC	DAY OFF	REST DAY	E.4 0730-1630	E.4 0730-1630	E.4 0730-1630	E.4 0700-1245 1700-1930	E.4 0700-1245 1700-1930	40	1
17	ORDERLY	DAY OFF	E.4 0800-1700	E.4 0800-1700	E.4 0800-1700	E.4 0800-1700	E.4 0800-1700	REST DAY	40	3 ~~2~~
18	DOMESTIC	E.4 1730-2000	E.4 1730-2000	E.4 1730-2000	E.4 1730-2000	E.4 1730-2000	E.4 0800-1330	REST DAY	15.25 17.75	1

Nurse training. Information about nurse training comprises details of the course programmes, a list of the learners and the wards to which they are assigned (see Figure 8), and the total learner establishment of each ward. It is difficult to use this information to see how changes to the service affect the nurse training programme and vice-versa.

b. How the effects of plans are assessed

The feasibility of a plan or combination of plans in terms of patients and beds was generally assessed, if the problem was considered at all, using data about patient activity and facilities which are routinely available, ad hoc studies, and the views of experienced staff. The costs of savings associated with what may be a complex set of plans stretching over several years were estimated in similar fashion, using financial data by function. Appendix 2 shows the financial analysis produced in support of a plan to change the use of Princess Alice Ward from inpatient to day care treatment. The non-financial implications of plans were usually explored through discussion with staff.

The assessment of the "patient variable" costs (ie the costs which vary with the number of patients) likely to be generated by a planning option was recognised as a recurrent problem in the management accounts department at The Middlesex.

The staff felt that they should be able to provide such information, that it is part of their function, but that they did not have the necessary information systems. When a request for such cost analysis was received, the reaction was usually to find out whether any of the current cost codes were relevant, for example the theatre code, and then to contact a few doctors, nurses and managers in what were thought to be relevant service and supply departments for advice. The researcher

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Spring 79

Gavin C M	John Astor 6	Princess Alice 5 Wed A/E
MacDonald L K	Princess Alice 5	Essex Wynter 8
Maidment A	Orthopaedics 7	Prince Arthur 6 not n.o.
Martin S L	Orthopaedics 6	Queen Alexandra 6
Messervy S J	Soho Queen Mary 7	Northumberland 7
Mitchell E J C	Queen Alexandra 5	Soho Annie Zunz 5
Moores H E	Queen Alexandra 6	Orthopaedics 7 Wed A/E not Night Duty week of 10.11.79
Nutt J E	Prince Arthur 6	Holmes Sellors 5 Wed A/E
Opertowska B E	Soho Annie Zunz 5	Vaughan Morgan 5
Parsons N L	Prince Arthur 8	Soho Annie Zunz 8
Roach S	Orthopaedics 5	Vaughan Morgan 8
Robison E M L	Berners 5	Queen Alexandra 5
Roche M C	Holmes Sellors 5	Northumberland 8
Selway R J	Rosalind Chetwynd 6	Meyerstein 6
Smith C A	Northumberland 8	Soho Queen Mary 8
Stephens K M	Soho Annie Zunz 8	Sandhurst 6 not n.o.
Still A J	Vaughan Morgan 8	Berners 5
Taylor A B	Prince Arthur 5	Orthopaedics 5
Thomas L M	Essex Wynter 8	Holmes Sellors 8
Trim C B	Northumberland 7	Soho Queen Mary 7
Wadkin J E	Vaughan Morgan 5	Soho Queen Alexandra 5
Wilding P A	Meyerstein 6	Soho Annie Zunz 7 Wed A/E not Night Duty week of 10.11.79
Williams S L	Sandhurst 6	Rosalind Chetwynd 6
Morrison S H	Soho Queen Alexandra 5	Prince Arthur 5

July 79 Pupils

From Block to the following wards: Onto non-Night Duty rotas.

Cook L E	Prince Francis
Gibbens E L	Berners
Hollands A S	Whitbread
Martin P W	Hardy Roberts
Russell C A	Greenhow
Stockley A H	Strathcona
Vahid S	Orthopaedics

SRN/DN 77

From annual leave to the following wards:

Affleck J A	Athlone House Geriatrics
Banks K E	Woodside
Culpin F A	Athlone House Geriatrics
Greene J E	Woodside
Harding D J	"
Laird D	Athlone House Geriatrics
Nottingham H M	"
Rees M E	"
Small J M	Woodside
Spong D A	"
Tapley E	"

June 79

Feather J M	Orthopaedics	Block

Spring 79

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MacDonald L M	Princess Alice 5	Essex Wynter 8
Maidment A	Orthopaedics 7	Prince Arthur 6 not n.o.
Martin S L	Orthopaedics 6	Queen Alexandra 6
Messervy S J	Soho Queen Mary 7	Northumberland 7
Mitchell E J C	Queen Alexandra 5	Soho Annie Zunz 5
Moores H E	Queen Alexandra 6	Orthopaedics 7 Wed A/E not Night Duty week of 10.11.79
Nutt J E	Prince Arthur 6	Holmes Sellors 5 Wed A/E
Opertowska B E	Soho Annie Zunz 5	Vaughan Morgan 5
Parsons N L	Prince Arthur 8	Soho Annie Zunz 8
Roach S	Orthopaedics 5	Vaughan Morgan 8
Robison E M L	Berners 5	Queen Alexandra 5
Roche M C	Holmes Sellors 5	Northumberland 8
Selway R J	Rosalind Chetwynd 6	Meyerstein 6
Smith C A	Northumberland 8	Soho Queen Mary 8
Stephens K M	Soho Annie Zunz 8	Sandhurst 6 not n.o.
Still A J	Vaughan Morgan 8	Berners 5
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June 79

Feather J M	Orthopaedics	Block

began his enquiries in such departments by asking if the manager or doctor in charge could tell him roughly the costs generated by individual specialties in his department; he found that this information was not available in any departments. Some managers, for example the district pharmacist and the superintendent radiographer, felt they could not even make a reasonable guess at such financial consequences of planning options.

Uncertainty about the costs linked directly with patients sometimes results in unrealistic savings being claimed by the proponents of a plan. The size of the estimated savings may depend more on the view of the most powerful person in the group preparing the plan, usually a consultant, rather than on proper financial analysis. At a planning team meeting in November 1981, a consultant wanted the costs of a plan he favoured to appear less and arbitrarily reduced the non-staff costs per year as estimated by the assistant district finance officer by £5,000. The results from the decision-support system developed are only ever intended to be used as a guide by a planning or management team. They should be tempered by professional experience and knowledge, for the results will usually rest on contentious and explicit assumptions, but it seems important that a logical if limited appraisal, with assumptions clearly specified, constitutes the first step in thinking about the costs of a planning option.

There is no clear system for estimating the feasibility and consequences of planning decisions, which is supposed to be done by the planning teams in their particular and related areas and by the DMT overall. The absence of such guidance and planning tools seems to result in those doing the planning having to think about how to do it began his enquiries in such departments by asking if the manager or doctor in charge could tell him roughly the costs generated by individual specialties in his department; he found that this information was not available in any departments. Some managers, for example the district pharmacist and the superintendent radiographer, felt they could not even make a reasonable guess at such financial consequences of planning options.

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There is a clear, useful role here for specialists in planning to guide or even lead those trying to plan. At present they cannot play such a role because of the inadequate training such specialists receive, the absence of useful planning tools, the low status of the job in the NHS, and the failure of senior management to support properly this function.

Planning teams are composed of a range of disciplines, but the researcher found that they tended to be sectarian. A team may see its role as presenting the plan in a most favourable light and as only each time they produce a plan; this was a view expressed to the researcher by, amongst others, the divisional nursing officer at The Middlesex. This leads to wasteful repetition of effort in structuring what is broadly the same problem. The people in the planning group, usually competent senior managers and doctors, tackle the problem in what seems to them the best way in the time available and with the information they think is available. But problems seem to arise: in following a logical method, for example, considering future caseload before planning facilities; in identifying what the plan will affect and how, for example, the impact of extra orthopaedic patients on the surgical appliances' department; in clarifying the timing of the implementation of different parts of the plan to fit in with other changes taking place, for example, so that the closure of a ward does not occur just as a new theatre is opened. But perhaps the greatest danger to successful planning lies in planners not recognising at all that a major part of the system is affected by a plan: for example the ITU or nurse training, which may cause severe and costly problems at implementation.

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The DMT and the DMT Planning Group (the DMT plus about eight consultants) of the NE District also suffered from the lack of a clear, agreed planning method. However the DMT did produce an important planning report using reasonably sound methods in Septermber 1980 on the future of two large long-stay psychiatric hospitals. They attempted to explore the effects of a range of planning options using various assumptions. The result was a compilation of special studies by senior District officers and a research assistant with an analysis being concerned with the most immediate effects of the changes to be made. For example, at a meeting of a planning team concerned with high-cost developments in cardio-thoracic surgery a consultant said that the effects of their plan on other specialties was not something for them to consider. This may be partly due to the dominant part played by consultant staff who may see the activity of the planning team as simply a stage in the realisation of a particular plan they have in mind. Consultant staff have the intelligence and prestige to dominate the meetings of such teams. Planning teams tend to produce reports which support their case without perhaps fairly presenting opposing views or adverse consequences of the scheme. They are inclined to play the bargaining role rather than that of producing a detached, objective analysis. A team may estimate the financial consequences of a scheme as high-cost, if they believe considerable funds are available and they will be beaten down by the DMT to a satisfactory budget, or low-cost or creating savings, if they believe little money is available and the DMT are looking for "efficiency" savings. These comments are based on observations by the researcher at a series of meetings of planning teams.

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Having broadly described the information systems in the NE District and the way the likely effects of plans were assessed, the deficiences of current planning methods and information are now analysed in two ways. There are data problems even if one accepts the current approach to planning as reasonable. But there are more important conceptual difficulties in accepting some of the current planning methods at all.

c. Data problems

Much hospital planning is done in terms of patients, classified by consultant or specialty, and facilities, such as beds and theatres. Other important elements in planning are staff by type and grade, service and supply departments such as X-ray and the pharmacy, and costs. Current problems with planning information cover the classification and consistency of the data, identification of constraints and "knock on" effects, costs, and data on training.

Classification and consistency. There are fundamental problems with even the most basic data about patients and beds. The data on patient activity shown on the SHQ and SH3 returns cover both private and NHS patients; but the DMT needs to plan for each type of patient separately and the analysis supporting plans for NHS and private patient activity should be quite different. There are 50 beds for private patients at The Middlesex, so for those planning the NE District of likely demand for hospital beds from the Area Health Information Unit. The effort to produce the report was enormous and highlights the need for planning tools which save time and enable senior staff to concentrate on the important assumptions and value judgements.

Having broadly described the information systems in the NE District and the way the likely effects of plans were assessed, the deficiences of current planning methods and information are now analysed in two ways. There are data problems even if one accepts the current approach to planning as reasonable. But there are more important conceptual difficulties in accepting some of the current planning methods at all.

c. Data problems

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There is considerable uncertainty about whether some cases are outpatients or day cases; the definitions available are far from clear.

The average available beds shown against "Unclassified", ie private beds, and "Other specialist units", ie the ITU, are calculated differently from the rest of these data by specialty, which causes confusion.

Constraints and "knock on" effects. The feasibility of a plan in terms of patient activity and bed capacity can be assessed using current data, but these data have to be refined and integrated. The NHS and private patient caseloads and lengths of stay by specialty have to be identified and the capacity calculated of appropriate pools of beds shared between various specialties. The total bed-days available in a pool can be calculated for a given period and compared with the total required for that period. Demands on service departments such as the ITU and the children's wards also need to be estimated and the differentiation between private and NHS patients was important. The number and type of private patients treated must be largely determined by market forces, so plans for these patients and the facilities they use should be made with such forces in mind. Plans for NHS patients on the other hand should be based on the likely needs or demands of a catchment population. The catchment population of the NE District was very ill-defined (see Chapter 4:3). A consultant paediatrician at The Middlesex thought that a type of market operated for NHS patients too, with consultants attracting NHS patients by their ability or specialisations. Nevertheless the private and NHS "markets" are very different.

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It is also virtually impossible to estimate the effects on the theatres of a change to one or more surgical specialties. There is no record by specialty of the time spent by patients in the operating theatres, or the anaesthetic rooms and recovery area.

<u>Costs for planning</u>. If management can identify the part of the organisation likely to be affected by a change, in principle the staff costs should often be obtainable using the present systems. In practice, however, they may only be accessible with some sort of research effort. For example, the nursing staff establishments of wards were supposed to be available, but because the data from the recording system were not used regularly, the records were not kept up-to-date. Since these data were unreliable the ward establishments were checked with various members of staff and sometimes opinions differed as to the true establishment of a particular ward. Eventually a figure would be agreed upon. Since staff costs amounted to around 75% of the revenue costs of the NE District and a sizeable proportion of these could be directly associated with some planned changes, for example, the costs of nurses, doctors, and domestics, it is apparent that if the correct staff costs are linked with a change then an important part of the costs of a plan can be accurately estimated using current information systems. Some costs of wards or theatres cannot be estimated from current systems, for example, the costs of heating, hot water, and electricity.

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The costs of resources consumed in the service departments and provided by the supply departments cannot be associated with decisions on change to patient throughput by specialty using information currently produced. Annual costs are available for most of these departments split between in-patients and out-patients by hospital often in a fairly arbitrary manner. Such specialty costs cannot be derived without a comprehensive analysis. This is because if any sampling method is used, as it almost invariably will be, the estimated annual total must be checked against the actual annual total and specialty estimates adjusted accordingly. These costs form a relatively small part of the expenditure of a hospital, but they are important to operational planning because they often vary with the number and type of cases treated.

Number training and service planning. The nursing schools produce information relating individual nurses to particular wards. It is impossible to use such data to assess the effect of the opening or the closure of a ward either on the overall nurse training programme or the service the learners provide for the hospital. This is because the data do not show which wards are used for which type of training or the learner "establishment" by ward or the maximum number of learners who can be trained on particular wards. Also the expected number of learners at each stage of training if the overall learner establishment were altered cannot be calculated. So management cannot tell whether there will be enough wards of the right type to provide the range of experience the learners require or whether there will be enough learners on all wards to maintain the service. The establishment of a ward at The Middlesex typically includes ten learners, so they are a

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d. Conceptual problems

The planning in the NE District did not only suffer from inadequate data to support the methods used, but some of the methods themselves seemed unsatisfactory. Although the senior staff of the NE District were almost all high-calibre, the development of clear, rational planning methods seems to have been slow. In the past planning seems to have largely comprised decisions about how to spend the piecemeal incremental growth of resources (apart from major capital schemes). During the 1970s the financial environment changed dramatically, but there was no parallel change in the way planning was done. Along with major changes in resource allocations, managers in the NE District had to respond to pressures for a drastic rationalisation of the health services of central London. They need to have a good grasp of the interactions within the service if such changes are to take place within the resources allocated and without disruption caused by major unforeseen consequences. If the managers try to follow the planning system as proposed by the DHSS (DHSS:1976:2) they encounter severe problems with analysis and data. For example, the care group framework is not relevant to most operational planning decisions, and unit costs by care group are not precise enough (see Chapter 5:1:a). This leads to disillusionment with the planning system, the persistence of the current unsatisfactory methods, and a failure of management to learn more about their organisation and its context. Developing such very important part of the workforce. There is considerable tension at a large training hospital such as The Middlesex between the needs of the training programme and the requirements of the service.

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The problems associated with the analytical methods used to inform the DMT and others about planning options under consideration can be summarised under five heads: feasibility, type of effects, scale of effects, costs, and assumptions.

Management cannot find answers to the most basic questions of feasibility. At The Middlesex, questions of the feasibility of a scheme are often not addressed, partly because the relevant data may not be available. A more cogent reason, however, is that those proposing the plan may wish the matter to remain unclear; they may not want the drawbacks of a development to be spelt out. The service then somehow "muddles through" when the change is made. The thinking of the planners seems to be that once the DMT has approved a plan and the change has been made, and especially if capital costs have been incurred, then the plan is most unlikely to be reversed and the rest of the hospital must simply accommodate the consequences. Assuming that a planning option is feasible, current information systems cannot tell management which parts of the service are likely to be affected by the change. The absence of such guidance may lead to managers closing a ward and expecting to make savings from those costs generated by patient activity on that ward, only to find that this activity is absorbed elsewhere and the savings do not materialise. The decisions to close a ward and to reduce the patient throughput are separate and have different consequences. The difference between "patient" and "ward variable" costs (see Chapter 7) is often not understanding is one of the main purposes of the planning system (DHSS:1976:2). This is an unsurprising result when a planning system is introduced unsupported by clear methods of analysis, appropriate data, and trained staff.

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From the point of view of planning, there are deficiences of the data within particular areas such as patient activity or finance. But much more important are the difficulties of integrating different types of data, most notably data about patients or facilities and obvious to senior management. In 1981 a plan was devised which involved the closure of a ward. The main "ward variable" staff costs were recognised, although there was confusion about the learners, but "patient variable" costs were also associated with the ward closure. No changes to inpatient caseload formed part of the plan. The implicit assumption was that if the beds are reduced, the number of patients is reduced. In a hospital such as The Middlesex with a very flexible policy for allocating patients to beds this assumption may not hold in practice. At present there are insufficient data to determine the effect in this particular case. The important point is that the issue of likely future caseloads and the relevant marginal costs was hardly raised during the planning of this development. Since no decision or view was taken about patient activity in the future, this important matter may by default be left in the hands of a junior administrator: the admissions officer, who will be put under pressure by consultants. Perhaps the problems of the effect of a plan on specialty throughput are not brought into the open because they are sure to arouse controversy. So key assumptions may remain implicit. The opening or closure of a ward and the increase or reduction of patient throughput by specialty are separate, but related decisions. The consequences and costs of each should be analysed separately and then drawn together (see Chapter 7).

From the point of view of planning, there are deficiences of the data within particular areas such as patient activity or finance. But much more important are the difficulties of integrating different types of data, most notably data about patients or facilities and cost data. The problem with the "patient variable" costs is simply due to the incompatibility of the NHS information systems: the organisation of patient activity data by specialty and the cost data which such activity affects by function. If there is little reliable information as to what such costs are by specialty, then the estimates included in planning reports may be, and have been, distorted to suit the purposes of those writing the report (see Chapter 4:3:b). This may result in bad financial planning and subsequent problems for management.

If planned savings are not achieved, then unplanned cuts may have to be made to meet the cash limit. Fortunately many of the staff costs associated with a plan can usually be calculated fairly accurately; such costs normally form the bulk of the costs of a scheme. The inadequacy of the current data for planning, coupled with ignorance of the techniques of planning and a failure of management to ensure a sound planning method is followed, has often resulted in unclear planning proposals based on even less clear assumptions. The clarification of assumptions is hard work, but central to good planning. The researcher came to the conclusion during the initial implementation of the decision-support system that the production of better information for planning means fewer assumptions are ncessary, but because the clarification of key assumptions forms part of the better information for planning, those doing the planning tend to question the assumptions more closely than in the past.

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5. CONCLUSION

Having considered some of the planning problems of the NHS as a whole and having closely examined the situation in a particular health district, the researcher felt in a position to specify more clearly the problem he was going to tackle. He felt that he could not usefully contribute to the assessment of the demand or need for services which those managing the NE District should try to meet because of the ill-defined catchment population (see Chapter 4:3). For the same reason he felt unable to provide useful tools or methods for the specification of broad strategic objectives. However he did feel that he could usefully contribute to the next stage of the planning process: the consideration of options for achieving the strategic aims. He thought it was technically possible for him to provide sound information for such operational planning and this was also an important and pressing problem in the NE District and many other health districts, especially as regards financial information. The Report of the Royal Commission states:

> "We have urged the importance of improving the information available to decision-makers in the NHS in a number of places in our report .... In particular we feel that it is essential that information on costs must be improved and costed options considered if the best use is to be made of the services' resources" (Royal Commission:1979).

Although the scope of the decision-support system in the NE District is considerably wider than a cost model, this is a central element in the system.

Having decided that the part of the planning problem to be addressed was information for operational planning options, a further key decision was whether a model should cover both hospital and community services. The

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Having decided that the part of the planning problem to be addressed was information for operational planning options, a further key decision was whether a model should cover both hospital and community services. The catchment population of the NE District was so dispersed that it was virtually impossible to explore the important relationships which undoubtedly exist between inpatient care in the NE District and community care. For example, how the opening of a day centre for the elderly in the broad catchment area of the NE District might reduce pressure on geriatric beds at The Middlesex, or how new clinics performing day surgery might have a similar effect on demand for surgical beds. Or how a reduction in maternity length of stay might result in additional work for GPs or community nurses. The links between hospital and community services in the NE District were considered too tenuous to warrant investigation at this stage (or even at all). The only specialties in the NE District with connections with the community within the boundaries of the District and for which such analysis might have been worthwhile in further work were geriatrics and mental illness. Also the costs of the community services managed by the NE District were relatively small compared with the costs of the hospital services and were not a major concern of the DMT in the early 1980s. While recognising the importance of the community services and their significant links with the hospital services, for the reasons above, the researcher (with the approval of the project steering group) decided to concentrate on the hospital services. DMT planning attention was mainly focused on these services, largely for financial reasons. To refer again to the Report of the Royal Commission: "The big spenders in the NHS are hospitals and they account for over 70% of NHS spending" (Royal Commission:1979) and the dominance of hospital costs is much greater in a health district like the NE District with a small population within its territorial boundaries.

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So, the outcome of an initial investigation of the planning problems of the NHS and of a particular district was a decision to design and build a system which aimed to provide "comprehensive" information about a particular part of the planning problem: namely the effects of planning options in relation to the hospital services. Such a decision-support system was thought likely to be found useful in the NE District and, at least the structure and data analysis for the system, to be relevant to other health districts.

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CHAPTER FIVE: SURVEY OF MODELS AND METHODS OF OTHER ATTEMPTS AT SIMILAR PROBLEMS

The aim of this research project was to identify the basic information required by district management in the NHS faced with evaluating a range of planning options, and to devise and implement a decision-support system to provide this information with very limited clerical support. Having described planning problems common to the NHS and having highlighted the difficulties in a particular health district, attention is now turned to what may be done to alleviate these problems. Naturally the researcher cast about to discover what others had done faced with similar problems. The models and methods contained in this survey are restricted to those for which the authors explicitly claim or imply that the product or approach can provide useful information for those grappling with the problem of NHS operational planning. The aims of these projects often cover several related fields such as resource allocation, budgeting and monitoring, but they have been selected because they all touch on the problem of information for operational planning.

Having identified the literature to be considered, and having grouped it according to whether fresh data were collected for analysis or whether only the currently available data were used, the researcher then considered how far the models and methods could be used in a particular district, the NE District, to produce the planning information management required. The researcher bore in mind a particular question: could he confidently defend the results from a particular system before the DMT and a group of consultants when they were discussing the effects of planning options and deciding on changes? This prompted further

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However successful and useful the results from the systems studied might be in other areas, and at other levels of management, the researcher was solely concerned with how well they achieved the stated or implied purpose of providing sound information for local NHS planning. He approached the survey not in a negatively critical state of mind, but rather in one of keen enquiry for useful tools and methods to incorporate in the decision-support system he was designing. It seems to be generally agreed that the NHS is not an easy organisation to analyse for many reasons, for example, the difficulty in defining objectives and the numerous points of view which must be considered when planning, and the researcher well recognised this when investigating other models and methods.

1. SYSTEMS FOR PRODUCING INFORMATION FOR OPERATIONAL PLANNING USING DATA CURRENTLY AVAILABLE

While most of the information about systems and models which have been developed elsewhere comes from documentary sources, visits were made to the following organisations: St Thomas' Hospital, Brent District (CASPE), DHSS Operational Research Section (Care groups, Regression analysis, Balance of Care), Exeter University (Regression analysis, Balance of Care), University College Hospital, London, and the Cromwell private hospital. Several visits were also received from other research groups. Such an exchange of visits, and the opportunities questions. Would they accept the way patients had been grouped in the analysis? Would they find the data used satisfactory? How far would they question the basic assumptions of the approach? Are the type of costs produced satisfactorily tailored to the purpose? Would the information produced justify the costs of production? Would the information be sufficiently accurate and up-to-date?

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a. Care groups

The DHSS has proposed that services be classified by care group for planning purposes (DHSS:1976:2). These groups are:

General and acute hospital services

Primary care services

Services mainly for the elderly and physically handicapped

Services for the mentally ill

Services for the mentally handicapped

Services mainly for children

Maternity services

Other

The authors of a Financial Information Project (FIP) report note that: "The present client group classification is based on three axes:

i. services consumed (eg general and acute hospital services)

ii. age (eg children and elderly) and

iii. type of disability (eg mentally ill, physically handicapped)...

Any one individual patient will have attributes lying along each of these axes" (FIP:1979). This suggests there are likely to be problems associating patients with services. The DHSS admit that these groups represent "a compromise between those required to facilitate study of the service outputs to the community, and those to discuss common problems with others working in similar or related fields, was found most useful by the researcher and helped him to view his work in a wider perspective.

a. Care groups

The DHSS has proposed that services be classified by care group for planning purposes (DHSS:1976:2). These groups are:

General and acute hospital services

Primary care services

Services mainly for the elderly and physically handicapped

Services for the mentally ill

Services for the mentally handicapped

Services mainly for children

Maternity services

Other

The authors of a Financial Information Project (FIP) report note that: "The present client group classification is based on three axes:

i. services consumed (eg general and acute hospital services)

ii. age (eg children and elderly) and

iii. type of disability (eg mentally ill, physically handicapped)...

Any one individual patient will have attributes lying along each of these axes" (FIP:1979). This suggests there are likely to be problems associating patients with services. The DHSS admit that these groups represent "a compromise between those required to facilitate study of the service outputs to the community, and those groups for which quantified information can be obtained" (DHSS:1978). But are these groups useful to those doing operational planning?

A serious problem with this approach is the very varied forms of treatment covered by some of the care groups. Patients receiving acute care place very different demands on the system in terms of the use of facilities and service departments, and requisitions from supply departments. All are reflected in costs. For example, surgical patients use the theatres whereas medical patients do not, and on average radiotherapy patients generate much higher drug costs than rheumatology patients. The authors of the financial research report to the Royal Commission on the NHS state that "there is no framework for planning within acute care" and recommend that "research take place into how the acute care group can be most usefully disaggregated to aid decision-making by Health Authorities" (Perrin et al:1978). This is one of the main questions considered by this research project (see Chapter 6:2).

Most of the costs of any health district are associated with the "general and acute services". It would not make sense for a DMT to produce an operational plan using such general terms, since they are forced to consider, however superficially, the implications of proposed changes. In order to do so they need a more detailed classification of services than that provided by the care group framework. In the NE District the acute services were planned by specialty or sub-specialty. This problem also exists for services for the mentally ill. Again the costs of different sorts of care and treatment vary enormously. The number of staff required for a psycho-geriatric or acute locked ward may be five times as many as for a minimum care ward. So if a change in groups for which quantified information can be obtained" (DHSS:1978). But are these groups useful to those doing operational planning?

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A further problem is the overlap of the elderly and acute care groups. At The Middlesex many patients aged over 65 are admitted by consultants in acute specialties other than geriatrics. So, should the district management seek to improve care for the elderly at the expense of acute care, they might find they have withdrawn acute resources from the elderly to expand other services for old people. There is a similar, but less severe, problem with children.

An apparent advantage of the care group approach is that costs can be estimated for each group with no alteration to current financial systems. Costs are reported by hospital at present and hospitals are classified by the DHSS under some of the care group heads. If a hospital provides services for more than one type of care group, then the DHSS recommend the use of costs from single specialty hospitals to apportion the costs of such a hospital to the different care groups (DHSS:1978).

It is assumed that the costs associated with, say the mentally ill are similar whether patients are treated in a ward in a general hospital or in a specialist unit. The DHSS claim that "comparison of single specialty hospital costs with results from regression studies and analysis of ward costings suggested that the assumption was reasonably valid for mental illness, mental handicap, and maternity services at a national level. It is less satisfactory. for geriatric medicine where the cost per bed-day in acute hospitals appears to be between the cost in single specialty services for the mentally ill is planned, some sort of average cost of the provisions of such services would be of little use to the DMT.

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While such care group costs can be derived using the current information systems, it is difficult to see how they can be used for operational planning at district level. Most operational planning decisions involve changes at the margin. Average costs have little relevance to such decisions. The DMT wants to know whether a particular change or combination of changes will break the cash limit and average costs usually provide a poor guide because costs are included which may or may not vary with the proposed change.

In conclusion it seems that while the care group approach may have some value for strategic planning and monitoring, most of the categories, and especially acute care, seem too broad and ambiguous to be of use in operational planning. Also the average costs derived using this system do not seem relevant to the operational planning decisions of a DMT since they in no way take account of whether particular costs will be fixed or variable given a proposed change.

The Planning Working Party of the Treasurers Joint Accounting Committee came to a similar conclusion: "The development of client group costs may aid strategic processes though with more benefit to regions and DHSS than to districts. Client group costs could. provide improved information, but with limited usefulness" (Association of Health Service Treasurers: 1981). Members of the geriatric hospitals and the average cost per bed-day for all patients in acute hospitals" (DHSS:1978). It is not possible to comment on the validity of this assumption because the DHSS method seems to produce average costs of services, whereas marginal costs are used in the NE District planning model.

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b. Regression analysis

Considerable efforts have been made to apply regression analysis to hospital cost and activity data in order to break down hospital average cost per case into various cost components, to derive specialty cost estimates, and to estimate the teaching component of hospital costs: (Deeble:1965), (Feldstein:1967), (Hurst:1977), (Culyer, Wiseman, Drummond, West:1978) and (Straf:1981). In this section two applications of regression analysis to NHS cost and activity data published recently are considered from the point of view of the usefulness of the results to operational planning at district level. Both models produce specialty costs and both have high coefficients of determination compared with earlier specialty cost models. These models are largely developments of the earlier ideas and the criticisms made below apply broadly to the other approaches as well. The results from both models seem to be intended, amongst other purposes, for use in operational planning.

The models produced by Coverdale, Gibbs and Nurse (Coverdale, Gibbs, Nurse:1981) assume that there are up to three components of hospital cost: overhead, hotel and treatment costs. The overhead costs are related directly to the floor area of the hospital, the hotel costs to occupied beds, and the treatment costs to the caseload by specialty.

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In a modified version of the model the overhead costs are "absorbed in the hotel and treatment costs, enabling costs per case to be calculated" (Coverdale, Gibbs, Nurse:1981). The data cover all non-psychiatric, non-teaching hospitals outside the Thames regions. However, only inpatient data are included in models for regression analysis; no specialty costs for outpatients, day patients or day cases are produced. The problem of how each district apportions costs between these groups of patients is not discussed, yet standard methods are not used. Certainly in the NE District the bases of apportionment of costs were often crude. This may mean that total inpatient cost in different hospitals differs both because of the different types of patient treated, but also partly because of the different methods of apportionment used. The paper does not make it clear whether the model is intended as an aid to operational planning. It has been used by the DHSS for policy analysis on the effects of the size and age of hospitals on their cost and for determining the cost of cross-boundary flows for RAWP. It is intended for use by "health authorities" faced with the problem of closing acute beds. Such authorities presumably include those at "area" (now district) and regional level. The authors also state that "the relative cost of different specialties is important in a whole range of planning activities" (Coverdale, Gibbs, Nurse:1981). In 1978 the DHSS issued a warning about the use of specialty costs derived from regression analysis for costing strategic plans: "regression analysis has been used at a national level, but the analyses are complex, and the interpretation open to discussion" (DHSS:1978). This statement seems to imply that the DHSS do not know whether the results from regression analysis are useful or not for planning.

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If the managers of a district did try to use the results from the model for operational planning they would probably encounter difficulties with what is meant by a "specialty" and a "cost". The paper contains tables showing specialty cost estimates per case (see Figure 9). A large sample of hospitals is required in order to derive satisfactory estimates of such costs. The first problem here is that the patients classified under a particular specialty may differ considerably from one hospital to another: for example, the proportion of general medical admissions who are geriatrics; and patients treated by a cardiologist in one hospital may be under the care of a general physician in another.

The treatment cost for each specialty produced by the analysis is an "average" across the country for that specialty. But since the case-mix within a specialty may vary, how do those managing a particular district know whether the cost of a specialty they are considering is close to the average, and if it is not, what the difference in cost is likely to be? There are likely to be similar problems with respect to the hotel and overhead costs. The authors recognise that different hospitals have "differing overhead, hotel and treatment cost rates for a whole variety of reasons", but that, "for modelling purposes these differences will be viewed as random variations from the underlying cost model" (Coverdale, Gibbs, Nurse:1981). While this approach may be acceptable at national or regional level, it would not have been satisfactory to those planning the services in the NE District, although thiis was admittedly a central London teaching district.

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FIGURE 9

SPECIALTY COSTS PRODUCED USING REGRESSION ANALYSIS

(COVERDALE, GIBBS, NURSE: 1981)

TABLE 5. ESTIMATES OF COST PER CASE USING A MODEL WITH NO OVERHEAD COMPONENT (1976 FIGURES)

Specialty	Treatment cost (£)	Length of stay	Hotel cost (£)	Estimated cost per case (£)	Number of cases	Estimated inpatient cost of the specialty (£m)
Rehabilitation	22	30.8	410	432	11,753	5.1
Preconvalescent	22	18.9	251	273	50,77[illegible]	13.9
Convalescent	22	14.5	193	215	18,823	4.0
Staff wards	22	5.6	74	96	5811	0.6
General medicine	179	12.2	162	341	751,442	256.2
Infectious diseases	179	11.3	150	329	36,813	12.1
Chest diseases	179	21.4	285	464	77,283	35.9
Dermatology	179	21.7	289	468	20,317	9.5
Sexually transmitted diseases	179	12.0	160	339	274	.
Rheumatology	179	23.8	317	496	15,707	7.8
Other specialist units	179	11.2	149	328	7[illegible]5	24.2
Gynaecology	89	5.6	74	163	476,614	77.9
Paediatrics	128	6.1	81	209	246,038	51.4
Obstetrics	128	7.1	94	222	578,539	128.4
Special care baby units	128	8.2	109	237	101,687	24.0
GP maternity	128	5.0	67	195	118,[illegible]42	23.2
General surgery	132	8.6	114	246	970,580	238.8
Ear, nose and throat	132	4.3	57	189	244,64[illegible]	46.2
Ophthalmology	132	7.4	98	230	120,169	27.6
Dental surgery	132	2.7	36	168	64,054	10.8
Orthodontics	132	8.2	109	241	628	0.2
GP Dental	132	1.7	23	155	861	0.1
Traumatic & orthopaedic	223	14.0	186	409	432,060	176.7
Radiotherapy	223	12.1	161	384	52,239	20.1
Urology	223	8.3	110	333	9[illegible],649	30.2
Plastic surgery	223	9.6	128	351	45,[illegible]78	15.9
Neurology	491	14.7	196	[illegible]7	36,181	24.9
Cardiology	491	10.6	141	[illegible]2	31,089	19.6
Thoracic surgery	491	13.0	173	664	38,105	25.3
Neurosurgery	491	13.5	180	671	29,400	19.7
Geriatrics	137	84.9	1129	1266	220,[illegible]63	279.7
Units for the younger disabled	137	200.4	2665	2802	2261	6.3
GP Other	65	18.3	243	308	91,693	28.2
Psychiatry children*	3[illegible]9	114.0	1516	18[illegible]5	547	2.8
Mental handicap*	319	1041.9	13,857	14,176	17,107	142.5
Mental illness*	319	169.4	2253	2572	178,843	46[illegible].0
Adolescent psychiatry units*	319	130.4	1734	2053	23	1.7

* These are poor estimates as purely psychiatric hospitals were omitted from the regression sample

(ASHFORD, BUTTS, BAILEY: 1981)

TABLE 2. ESTIMATES OF PARAMETERS OF A B MODEL (SAMPLE OF 1035 HOSPITALS)

Component	Specialty group	Estimate (£ per annum)
Available beds	Medical	74[illegible] (450)
	Surgical	8250 (150)
	Regional	14 300 (550)
	Geriatrics	[illegible]550 (80)
	Psychiatric	4350 (350)
Occupied beds	Maternity	13 100 (550)
(Available beds)^2	Medical	6 (3)
	Psychiatric	−0.5 (0.5)
(Occupied beds)^2	Maternity	−35 (6)
Excess patients	Acute	154* (7)

* Cost per patient.

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The output from the regression analysis should be in a form and at a level of aggregation acceptable and useful to management. For the DHSS national average treatment costs by specialty group may be adequate, but it is unlikely that they will provide a credible basis for deciding on changes to services within a district. For example, consultants in the NE District would be critical of a system which produced identical treatment costs for urology and radiotherapy.

The model produces treatment, hotel, and overhead costs by specialty, but because of the way regression analysis works it is not possible to tell a manager which real costs are included under each head. These costs represent notional, national averages. Typical operational planning decisions are expanding the caseload of a specialty or opening a new ward. It would appear from the

This problem is compounded by the way the specialties have been grouped for the estimation of the treatment costs. They have to be grouped because when costs for individual specialties were calculated "unacceptably wide standard errors were obtained... because some specialties are very small and others tend to occur together". So "specialties with similar treatment costs or which were correlated were grouped together to yield 10 reasonably sized groups" (Coverdale, Gibbs, Nurse:1981). There is then the problem of how do you know that the costs of the specialties are similar before you have performed the analysis. Dr Gibbs informed the research student that the costs from the initial regression with all the specialties treated separately despite the wide standard errors were used for guidance, along with the views of doctors in the DHSS. He thought that they had not been checked with practising clinicians, yet this would seem to be advisable.

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The model produces treatment, hotel, and overhead costs by specialty, but because of the way regression analysis works it is not possible to tell a manager which real costs are included under each head. These costs represent notional, national averages. Typical operational planning decisions are expanding the caseload of a specialty or opening a new ward. It would appear from the way hotel and treatment costs are defined that changes in caseload can be costed using the sum of these costs for each case in each specialty. But the estimates of these costs account for about 60% of the expenditure of a district. In terms of real costs such a percentage of the costs would have to include the costs of medical and nursing staff. It seems likely that some costs under these heads would not change with a change in the number of patients admitted. The costs of consumables would vary, but medical and nursing staff costs for example might easily not. Since no breakdown of cost beyond "treatment" and "hotel" is available the issue cannot be explored further. A common complaint from consultants at The Middlesex is that they are given costs which they can accept or reject, but cannot discuss because they do not know the components of the costs. As an illustration of the inadequacy of national averages when applied to a local situation there is the case of the recent changes in cardiology throughput at The Middlesex. The replacement of one consultant by another in this specialty resulted in a 50% increase in the total cardiology throughput with no increase in the medical or nursing staff costs. No extra wards were opened (if this had occurred there would have been an inevitable rise in the nursing establishment), no extra doctors were employed, and there was no increase in the staff of the service departments. This shows that there may be considerable flexibility in the system and some hotel and treatment costs may simply not alter as the number of in-patients change in a particular district. This central problem is recognised by the authors with regard to a change in the number of beds: "In practice the amount of savings will depend on the way in which the number of beds is reduced. If whole wards or wings of the main building are closed the savings will be more substantial than way hotel and treatment costs are defined that changes in caseload can be costed using the sum of these costs for each case in each specialty. But the estimates of these costs account for about 60% of the expenditure of a district. In terms of real costs such a percentage of the costs would have to include the costs of medical and nursing staff. It seems likely that some costs under these heads would not change with a change in the number of patients admitted. The costs of consumables would vary, but medical and nursing staff costs for example might easily not. Since no breakdown of cost beyond "treatment" and "hotel" is available the issue cannot be explored further. A common complaint from consultants at The Middlesex is that they are given costs which they can accept or reject, but cannot discuss because they do not know the components of the costs. As an illustration of the inadequacy of national averages when applied to a local situation there is the case of the recent changes in cardiology throughput at The Middlesex. The replacement of one consultant by another in this specialty resulted in a 50% increase in the total cardiology throughput with no increase in the medical or nursing staff costs. No extra wards were opened (if this had occurred there would have been an inevitable rise in the nursing establishment), no extra doctors were employed, and there was no increase in the staff of the service departments. This shows that there may be considerable flexibility in the system and some hotel and treatment costs may simply not alter as the number of in-patients change in a particular district. This central problem is recognised by the authors with regard to a change in the number of beds: "In practice the amount of savings will depend on the way in which the number of beds is reduced. If whole wards or wings of the main building are closed the savings will be more substantial than merely removing beds in each ward" (Coverdale, Gibbs, Nurse:1981). But this difficulty, which underlies the problem of interpreting the specialty costs produced by this regression model, and which would be of great importance to a DMT, is barely discussed by the authors.

The regression model produced by Ashford, Butts and Bailey (1981), the "A-B model", uses available/occupied beds by specialty, available/occupied beds by specialty squared, and "excess" acute patients as explanatory variables of total hospital cost. The specialty costs derived by this regression model are intended for use at various levels in the health service from the estimation of the cost of flows of patients between regions to "the comparison of actual and expected expenditures at particular hospitals in order to identify anomalies" which the authors suggest is "particularly important to the managers of the local health services (Ashford, Butts, Bailey:1981). They further suggest that the model "may be applied for planning purposes to examine the financial consequences of proposed changes in resources provision" (Ashford, Butts, Bailey:1981). During a course entitled "Approaches to special costing in the NHS" in September 1981 Professor Ashford made it quite clear that the results from the model are intended for use at district level.

In attempting to use this model for planning in a district, managers are likely to encounter similar problems to those described above in connection with the Coverdale, Gibbs and Nurse model. The problem of the different nature and cost of specialties with the same name in different hospitals is not addressed. Nor is the problem of how far the split of costs over the explanatory variables by specialty is likely to correspond with the real division of costs.

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The A-B model calculates total costs by specialty group (see Figure 9), But no clear explanation is given for the way the specialties have been grouped or the reason for doing so. There is simply the bald statement: "For the A-B model, the 40 specialties are divided into 4 (acute) groups (medical, surgical, regional and maternity) and 2 (long-stay) groups (psychiatric and geriatric)" (Ashford, Butts, Bailey:1981). The contents of these groups in terms of the specialties as they appear on the SH3 return are not given. Presumably the specialties are grouped to reduce the problems of multicollinearity.

The authors envisage the results being used to estimate the costs of cross-boundary flows between health authorities, both regionally and sub-regionally. But they regard the use of the costs "to assess the financial implications of health service plans" as "potentially more important" (Ashford, Butts, Bailey:1981). In the NE District cost information by specialty group would have been of little use to those trying to estimate the cost implications of operational planning options. Even if information about patient acitivity organised in this way were useful at district level there is still a problem with the type of costs the model produces.

As is recognised by notes distributed during the above mentioned course: "total and average costs are unsuitable for short-term planning as they include expenditure on those inputs which are fixed in the short run. Average costs have limited meaning unless related to levels of output and are unsuitable for long-run planning if there are economies or diseconomies of scale" (Whitt:1981). The authors state that the model can produce marginal costs for patients and available beds: "the effects of marginal change in throughput for a given number of beds may be estimated directly in terms of

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It is not clear from this article whether the results from the model have been used by management at any level of the health service. It did not seem possible to use such a model to assess the financial implications of operational plans in the NE District because the categories of patient activity are too broad and the marginal costs do not take into account important cost "steps" (see Figure 18) when fixed costs become variable. Such "steps" include the staff and other costs or savings which are incurred or saved when a change in the number of patients treated means that a ward or theatre must be opened or closed.

As part of the FIP, a model has been developed as an aid to the planning of a new district general hospital which "is featured in the Region's ten-year capital plan" (Whitt:1981). The model comprises 3 linked modules covering revenue availability, service cost per "excess" patient. The effects of marginal changes in bed provision may be estimated directly in terms of the cost per available bed and the corresponding quadratic terms where appropriate" (Ashford, Butts, Bailey:1981). But the cost of an "excess" patient is the same for all acute patients. This means that, for example, the cost of an extra patient in dental surgery and cardiology would be estimated to be the same; research in the NE District indicates that this would be most unlikely to be true and that such cost data would be unacceptable to consultants. The system produces the cost of an extra "available" bed by specialty, but most planning in the NE District was done in terms of "allocated" not "available" beds. It is difficult to plan by "available" beds because, if a system of "bed borrowing" exists, then the number of beds available to one specialty varies with the caseload not only of that specialty, but of others as well.

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The regrettable conclusion, based on long term research in the NE District, is that despite the hopes of the modellers it seems unlikely that the results from either of these regression models will prove useful to those facing operational planning decisions at district level. Both models seek to relate costs and patient activity. The information produced seems to be intended for managers in the DHSS and at all levels of the NHS, but there is little discussion in either article about the needs of the users in districts, how they were identified, and how they are met by the results from the models. There are no detailed descriptions of actual applications and any problems encountered in health districts.

It seems likely that should the information be used routinely in particular health districts and be exposed to a wide range of professional opinion considerable insight would be gained into the strengths and weaknesses of the models. And especially as to how far costs derived using national "averages" of case-mix by specialty are acceptable to consultants, and how far the national "average" split of these costs over various explanatory variables is grounded levels (resources/activity) and associated staffing requirements, and manpower supply. Parts of this model have been computerised including the component which calculates the revenue consequences of capital schemes which draws heavily upon the results of regression analysis. This appears to be a reasonable application of specialty costs derived by regression analysis. The managers responsible for the scheme can quickly and cheaply be given a rough idea of the likely revenue costs of the development which they can explore in various ways. They will no doubt try to improve the estimates as the date of commissioning approaches, and may then demand a more sensitive, localised model.

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c. Miscellaneous

Two other methods have been proposed for relating cost and patient activity using the data available at present. One of these was singled out by the DHSS in "Revenue costing in strategic planning: further guidance on completion of the summary analysis of strategic plan tables" (DHSS:1978). This procedure, used by at least one region, is "first to identify direct costs, then to apportion the remaining treatment costs on the basis of the combined direct medical and nursing staff costs, and finally to apportion hotel costs on the basis of occupied beds" (DHSS:1978). Even from this brief and broad description it can be seen that this system could not be introduced at The Middlesex without modification to current information systems. Patients from more than one specialty are treated on most wards so the nursing costs of those wards would have to be apportioned. While this approach is not strictly designed for operational planning it has been included because it is distinctive, and allied to other methods considered. It is not clear how patients are to be grouped, but certainly the smaller the groupings with this method the fewer the direct costs it is likely to be possible to associate with them using current financial systems, and so the greater the reliance on the above method of apportionment. This system, admittedly for strategic planning, does not seem to address the problem of costs at the margin which in reality in a particular district. While the results may be useful for the broad costing of strategic plans in the DHSS and at regional level and perhaps for estimating, again broadly, the revenue consequences of capital schemes, the models do not seem sensitive enough for operational planning purposes at district level.

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Another approach is described by Hurst in a paper, the main purpose of which is "to demonstrate that the use of conventional average costs per day of hospital stay, as a basis for estimating the likely magnitude of savings in hospital expenditure, will be seriously misleading, since they will substantially over-estimate true marginal costs, even in a longer run context in which capital costs have to be treated as variable" (Hurst:1977). He makes ingenious use of the data routinely available to suggest a way of isolating the treatment costs of acute hospitals. The method works by making the simplifying assumption that the average cost per day of convalescent hospitals is the same as the average non-treatment cost per day of a patient in an acute hospital. But Hurst recognises that these are only roughly estimates. And Coverdale, Gibbs and Nurse point out that a major difficulty with this approach is that "it relies upon the untested assumption that the care given in convalescent hospitals equates to the non-treatment activities of acute hospitals" (Coverdale, Gibbs, Nurse:1981). If this assumption were valid, specialty treatment costs could only be derived from single specialty hospitals. There seem to be further difficulties in attempting to use this approach for planning: if these costs were to be used to estimate the treatment costs of speicalties in mixed specialty hospitals, then a further assumption must be made that such costs are broadly similar in single and mixed specialty hospitals. There is also a problem with the completeness of these data because "there are single specialty non-teaching hospitals for only 18 of the 30+ specialties to be found on the would inevitably arise in the course of operational planning. However, as a means of apportioning average costs for strategic planning purposes it might well be a cheap and reasonably effective method.

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"SH3" form" (Hurst:1977). Finally, if such treatment costs were to be used for operational planning similar problems would arise with respect to what is meant by a "specialty" and a "cost" as are described above in connection with multiple linear regression analysis.

2. SYSTEMS FOR PRODUCING INFORMATION FOR OPERATIONAL PLANNING BY SUPPLEMENTING DATA CURRENTLY AVAILABLE WITH FRESH DATA

a. The Balance of Care models

This series of models began to be developed in the DHSS OR Service in the early 1970's. In 1974 the aim was to "illustrate the likely consequences of different sets of policy options in terms of balance, both between different resources provided and between various groups of patient cared for at a strategic level" (MacDonald, Cuddeford, Beale:1974).

The structure of the original model has been described as follows:

> "This model used the current amounts of resources allocated to different categories of clients to infer the value judgements of the professional workers in the field. It then used these value judgements to estimate (using a technique of non-linear mathematical programming) both how the field-workers would allocate any given set of resources that the planners might provide and also what would be the "best" set of resources for the planners to provide. (In the context the inferred value judgements of the fieldworkers were used to define "best")" (Klemperer, McClenahan:1981).

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The model was initially developed for national planning by the DHSS. An attempt was made to use the original model on "the problems of joint strategic planning for the provision of non-acute health and personal social services care" (DHSS:1979) - this was seen to be its prime value. There seem to have been problems, however, especially at local level for users in understanding the way this complicated model works: "the impact of the model has been limited by planners' reluctance to use a tool that only operational research specialists can understand" (Klemperer, McClenahan:1981). In 1979 management consultants were employed by the DHSS to produce a revised version of the model intended for use at local level. The model was considerably simplified. It is currently being tested in several locations (Borley, Taylor, East:1981; and Nicholls:1981). Although these models are intended as aids to strategic planning, they are included in this survey of research because, not surprisingly, the approach "has been found incidentally to provide some valuable information for operational planning purposes" (Borley, Taylor, East:1981). The model has been run covering a wide range of client groups, but the most promising local applications at present seem to involve only one group: the elderly.

The model needs to be supported by an extensive database much of which is not readily available and part of which must be specified by a professional advisory group. This suggests that establishing a reliable database on a major scale, involving many different professions is a difficult and expensive task.

The early BOC approach has been criticised, in a clearly hostile review, for attempting to use optimisation techniques in an unsuitable context: "With our current level of knowledge we have no satisfactory objective methods for evaluating these packages. This lack of basic knowledge effectively rules out a mathematical programming approach based on maximising some measure of health care output" (Duncan and Curnow:1978).

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This seems fair comment to the research student, although optimisation techniques play a much smaller part in the later models. The same authors level the further criticism that: "the models developed by DHSS OR Unit imply that 'caring patterns' can be prescribed from 'on high', an approach which has been rejected as presumptuous by health professionals and should be rejected as unscientific, given the present state of basic knowledge, by operational researchers" (Duncan and Curnow:1978).

This comment may have been true when it was made of the use of the model at national level, but does not apply when the models are run at local level (as they increasingly are, it seems), when local staff set the parameters of the model.

The revised aim of producing a tool to help integrate the planning of the variety of services available for particular non-acute client groups and combinations of such groups seems most useful.

The model was used in setting national objectives for the NHS planning system (Graham:1978) and despite technical difficulties has been of value in providing an analytic basis developed in anticipation of the rationing problems the NHS faced from the mid-1970's. In its original form it does not appear to have been similarly useful at local level. The revised model, however, seems much more suitable for application in a health district and a social services department. The heart of the model is now a simulation: the "inferred worth" component has been removed and the optimisation sections rendered optional. Yet this simplified model still "demands a substantial commitment from the area in terms of effort and manpower" (DHSS:1981) if it is to be implemented. Descriptions of

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b. Magee and Osmolski: specialty costing

In "A manual for the introduction of specialty costing" (Magee Osmolski:1976) the authors state that "specialty costing has a role to play in budgeting, financial control and planning" and later that a major aim of the approach is "to produce financial information which will assist in planning the development of the service and the distribution of funds". The system is intended "to forecast the costs that are likely to be incurred in the course of implementing new or changed patient care procedures or introducing a new type of medical treatment" (Magee, Osmolski:1976). Although it is not made altogether clear in this manual how the costs produced by the system are to be used as an aid to planning one can infer that they are to be used to provide the revenue implications of changes to the service. In an appendix to the manual there is a short, inconclusive discussion of marginal costs. The limitations of using average specialty costs for planning are recognised, but no clear guidance local applications seem encouraging, but there does seem to be a problem in the analysis of services for the elderly since the use of acute, non-geriatric beds by the elderly is excluded. This seems a major omission, for example, the problem of these beds being blocked could be ignored yet "in 1974 patients over 65 occupied 50 per cent of beds in general medicine and 39 per cent in general surgery" (Bevan, Copeman, Perrin, Rosser:1980). Nevertheless, the revised model seems likely to be useful for joint operational planning - in the words of one involved in local implementation: "despite its undoubted imperfections, BOC is the most useful tool yet developed to aid policy-makers in the health and personal social services with their joint planning" (Nicholls:1981).

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Such financial information must be based on much more sensitive cost data than average specialty costs. Without a clear framework showing which costs are associated with what sort of change it seems difficult to apply the cost data to operational planning let alone the problem of meeting cash limits.

The results from this specialty costing system may be useful for monitoring and comparing specialty costs in different districts - although there may be severe problems in checking that the services provided by specialties with the same name in different hospitals at a particular time, or in the same hospital at different times, are strictly comparable. The authors of "Accounting for Health" (a report of a King's Fund Working Party on the application of economic principles to health service management) thought that only costs by diagnostic group have "any real value for comparative purposes ... between hospitals" (King's Fund:1973). They further state: "Just as difference in "case-mix" make inter-hospital comparisons invalid, so they would also make invalid comparisons between specialties of the same type in different hospitals" (King's Fund:1973). The members of the FIP team after much consultation have commented on monitoring: "It was almost unanimously held that there is no potential use for specialty costs in monitoring local expenditure; the reasons cited is given as to how to use the costs produced by the analysis in connection with operational planning. Since the objective of the system is further described as "to ensure that what is spent is properly authorised and that the total is within approved cash limits" (Magee, Osmolski:1976), presumably the costs are envisaged as being used to check whether a planned change will result in the district overspending.

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c. Preston District: specialty costing

This study was a " 'one-off' and limited exercise" which "aimed to relate the hospital budget for 1980-1, by direct allocation and apportionment (sharing), to the three supraspecialties of neurology, neurosurgery, and plastic surgery" (Edwards, Strudwick, Thompson: 1981)in three hospitals. The specialty costing methods appear unremarkable and the authors list a variety of uses to which the specialty costs can be put. One of these uses is concerned with the cost of change to the level of patient activity: "What will be the cost of increasing the capacity of a given service by a certain percentage?" (Edwards, Strudwick, Thompson:1982). But the problem of marginal specialty costing is not mentioned. The authors do not discuss the different sorts of costs required for different management applications; this is a major omission. If the information described in this study were produced regularly it might be useful for monitoring or broad-brush planning purposes.

d. CASPE: incentives and clinical budgeting

The main thrust of the Clinical Accountability, Service Planning and Evaluation (CASPE) research programme seems to be to secure the active involvement of health professionals and especially doctors in planning and budgeting. This is done by establishing Planning Agreements with Clinical Teams (PACTS) with were the imprecision of the cost estimates and the variation in case-mix within the specialty groups, and indeed the specialties themselves" (FIP:1979). These specialty costs may be of value for the rough costing of strategic schemes, but because of the lack of a clear method for relating the cost data to the sort of planning decisions a DMT is likely to take, the system seems to have severe limitations as a tool for operational planning.

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Clinically Accountable Teams (CATS). The aim is to make those responsible for generating costs closely associated with the patient in some way accountable for those costs. This raises the problem of clinical autonomy: if a team breaks even or makes savings all is well, but, given that the budgets can be flexed to allow for changes in demand which may be beyond the control of the clinical team, what happens if a team becomes seriously overspent? This question is not clearly answered. The problems of clinical budgeting are further discussed in Chapter 13.

During 1973-74 a clinical budgeting project was mounted at Westminster Hospital. It seems to have been reasonably successful. The budgets were managed by teams incorporating various professions: doctors, nurses, social workers, pharmacists and administrators. The teams were given some freedom to redeploy savings they made. It is not clear what the scale of savings made was; it seems that the money available for redeployment may have been only a few thousand pounds (Coles, Davidson, Wickings:1976). These savings were achieved by five firms in the first year of operation of such a system. It might be expected that the major efficiency savings would be made in the first year or two and that thereafter they would become increasingly difficult to find. This then raises the question of whether the savings and other benefits justify the cost of running the budgeting system permanently. Further research has taken place in Brent District and the programme continues with work in various other locations.

Much of the information produced by the system would probably be useful for the costing of operational plans, although no clear structure seems to exist which relates planned change to the service to fixed and variable costs, yet this system is centrally

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Much of the information produced by the system would probably be useful for the costing of operational plans, although no clear structure seems to exist which relates planned change to the service to fixed and variable costs, yet this system is centrally concerned with "service planning". In discussion of the Westminster Hospital study, the pathology costs are cited as an example of the nature of the costs used. The cost of a test "included the appropriate share of a technician's time, the consumable materials and equipment and any other items likely to be employed in some close relationship with changes in the number of tests required" (Coles, Davidson, Wickings:1976), so the cost is "closer to a commercial price than it is to a "run-up", or marginal cost" (Coles, Davidson, Wickings:1976). Estimates of savings based on such costs will always be debatable because of the staff element. Extra or fewer members of staff may or may not be employed if change occurs. Such difficulties may lead to conflict between the team claiming savings and the head of the service or supply department concerned. Describing a project in Oldham an Area Treasurer writes: "It may well be that some early savings will be more apparent than real" (Harrison:1982).

The CASPE approach seems a brave initiative which tackles directly a very difficult and important problem, but there seems to be important questions with respect to planning not fully answered as yet. The costs used may be too controversial for budgeting purposes and savings may be too small alone to justify the operating costs of the system (which may be justified simply on the grounds of encouraging doctors to take part in planning and resource management). Finally the administrative problem of organising, controlling and servicing many CATS in a large hospital appears severe. It will be interesting to see whether these issues are resolved satisfactorily in the pilot schemes.

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e. St Thomas' Hospital: specialty budgeting

Work began on the construction of a system of specialty budgets at St Thomas' in 1976. What is the purpose of the system? Originally the project team were intending to introduce a "user-related" financial information and budgeting system into the District, but with general applicability to other Districts" (St Thomas' Hospital:1978). The team then came to the further conclusion that "the main purpose of the new budgeting system must be to provide a framework within which plans could be formulated and discussed in financial terms and detailed resources could be allocated for the implementation of agreed plans" and that the budget finally produced is "the detailed financial expression of the first year of a longer term plan" (St Thomas' Hospital:1978). An admirable series of working papers has chronicled the development of the system and clearly described the methods adopted. What has been especially valuable to others doing research in this field has been the honesty and fullness with which achievements and mistakes have been described. The procedures will not be analysed in detail; but comment here is restricted to the usefulness of the system to those involved in operational planning.

Of particular concern is the relationship of planning to the nature of the budgets as developed in this system. When deciding which costs should be included in the budgets the project team "has taken Accounting for Health as its principal guide, from which it is clear that the authors intended all costs to be accounted for in terms of the end-user ("total costs" are also required for planning purposes, in many instances). However, for some purposes, such as detailed control at Cost Centre level, it may well be appropriate to omit certain apportioned costs" (St Thomas' Hospital:1978).

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But how are total costs useful for planning and especially district planning? And how is it decided which apportioned costs are appropriate for omission? This problem needs further discussion and clarification. From the reports produced it appears no attempt has been made to identify which changes are likely to cause which costs to vary. The team clearly states that a major aim of the system is to "support District management in its planning activities and decisions, by setting out and highlighting the financial consequences of these activities and decisions" (St Thomas' Hospital:1978). If this is to be done then a system which more or less apportions total costs to specialty or firm is too insensitive. An analysis of variable costs within a health district is not easy, but the results of even a relatively crude approach can substantially improve upon total costs as planning information for management. To take an example: if a plan involves the expansion of the case-load of a specialty by 20%, then using the St Thomas' system it would appear that most if not all the costs in the specialty budget would be increased by 20% and this would, in theory, be the information supplied to the DMT. But the theatre staff might not be increased and the ward nurses might be able to cope with the extra patients and there might be no need for extra physiotherapists. Yet all these costs might be included in the overall cost of the scheme sent to the DMT and later in the budgets as the plan is put into effect. The approach at St Thomas' provides no framework for disentangling these costs.

In conclusion, it is clear that considerable effort and thought has been devoted to the research at St Thomas' (and the project is as yet incomplete). The results so far might well be useful for monitoring and control purposes, and perhaps for the broad costing

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In conclusion, it is clear that considerable effort and thought has been devoted to the research at St Thomas' (and the project is as yet incomplete). The results so far might well be useful for monitoring and control purposes, and perhaps for the broad costing of strategic developments. However, for the reasons given above it seems difficult to use them to assess the financial implications of operational plans. Both the savings and the extra costs associated with changes are likely to be over-estimated. The team stress with refreshing candour that the emphasis of their work is "on people making better decisions and that budgeting systems per se do not improve anything" (St Thomas' Hospital: 1978). It seems that this system has considerable potential as an aid to planning and the setting of budgets which result from agreed plans, if the costs can be linked more closely to the decisions which generate them.

f. Manchester: clinical budgeting

A system has been developed in the Central District of Manchester for "identifying the direct medical and para medical costs over various specialties" (Manchester AHA:1978). There are separate costs for staff and some consumables.

It seems that these budgets are for planning and control purposes: "annual programmes of activity are agreed with the appropriate consultants at the beginning of the financial year" (Manchester AHA:1978). This appears to be a well-designed system which produces some of the cost data relevant to operational planning. However, when the researcher contacted the Central District for further information, he was informed that the system was being discontinued.

g. East Cumbria: pilot study for specialty budgeting

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h. University Hospital of Wales: a computer model of oral surgery

The main purpose of this small scale study was "to demonstrate the feasibility of building computer models of care systems such that the effects of changes in those systems can be theoretically analysed" (Rees, Dunstan, Foster, Lewis:1982). This model has been used to "measure the contribution made by an existing day case unit to cost and bed saving, and to analyse alternative day case arrangements that could be used in the future" (Rees, Dunstan, Foster, Lewis:1982); but there is no indication of what use has been made of the results. There is no mention of the model (or similar models) being maintained and used routinely to assist management with planning. The cost data are briefly described and only cover those costs thought to vary between day case and in-patient service options. This exercise seems to have achieved its narrowly defined aims, but there has been little attempt to place evaluate the role of clinicians and other members of the Department as well as the administration in monitoring costs" (Chin, Chatterjee, Denham, Ridley:1981). The purpose was simply to monitor not to control costs. The exercise resulted in some minor savings because "only a very small part of the two budgets was found to be amenable to manipulation, the bulk of expenditure being in the possibly inviolable personnel sector" (Chin, Chatterjee, Denham, Ridley:1981). The authors recognise that specialty costing "is likely to develop as a planning tool" and that specialty budgeting is concerned rather with financial control. But the authors do not attempt to place the study in a planning context: the important links between specialty budgeting and costing, and planning, are not explored. Nevertheless this very limited, short-term study seems to have achieved its aims.

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i. <u>Standard Accounting System (SAS)</u>

SAS is intended eventually to "provide comprehensive financial information for NHS planning" (West Midlands RHA:1977). Sample output shows costs by in-patient specialty for medical staff, nursing staff, medical and surgical equipment, and drugs. The system is designed to be flexible so that each Treasurer can construct a framework of costs for his own requirements.

A District Finance Officer has commented: "A great help to specialty costing will be development of the Standard Accounting System with built in computer facility to apportion suspense accounts in accordance with pre-determined formulae obtained from samples" (Osborne:1978). But the finance manager is left with the problem of organising a structure that will report the costs he needs for operational planning. If we take the sample output, for example, the costs of equipment and drugs can be directly related to patient activity by specialty and are useful for operational planning. It is less clear how the specialty costs of doctors and nurses could be applied to likely planning decisions, particularly at district level. If a manager tries to use the system to produce information for operational planning he has to decide which cost centres to establish and which costs to associate with which centre. For example, should the costs of imaging or pathology services be linked with wards or specialties, or should the salaries of theatre nurses be shown under a theatre or a specialty budget. The creators of the system perhaps do not see their job as giving guidance because a it in a practical planning context or to show how the results would be used by doctors and managers taking planning decisions and what problems might arise.

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j. University College Hospital: specialty budgeting

A specialty budgeting system was introduced at University College Hospital, London, in 1978-79 (Secker Walker:1980). The system currently covers over 30 specialties and includes the following costs: medical and surgical supplies and equipment, patients' appliances, medical staff, technicians, medical secretaries, and study leave. It is being enlarged to incorporate costs generated in the pharmacy and the Central Sterile Supplies Department (CSSD). An anaesthetist at the hospital has commented on the small variable non-staff element in his budget: "staff salaries account for 95% whereas equipment and study leave comprise a total of 4.2%. These figures show clearly that room for manoeuvre is extremely limited when it comes to saving money unless fewer people are employed" (Secker Walker:1980). This system is being developed by gradual extension as experience is gained in its use by doctors as well as financial staff. It seems to provide relevant information about some of the costs which are important in planning and monitoring the expenditure generated by clinicians; costs beyond the control of doctors have been rightly excluded.

k. Patient costing systems

In 1979 the Area Treasurer's Office of Hampshire AHA produced a document entitled "Development of computer systems for finance" (Hampshire AHA:1979) which describes the framework of a system to provide comprehensive management information. The costing of plans is to be based on average costs of individual patients which can then be summed to the appropriate level of aggregation. This central aim of the system is to give managers complete control over the nature of their budgets.

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A similar system is proposed by Prowle who envisages the information being used for planning, resource allocation and monitoring. His approach "was to ensure that cost data was recorded in such a way as to ensure maximum flexibility, without worrying too much about how such information might be used" (Prowle:1981). However, the researcher agrees strongly with the comment in the RAWP report that "data collected is useless unless it is guided by a clear understanding of the uses for which the information is required" (DHSS:1976:1). Prowle does address the problem of fixed and variable costs in relation to planning and suggests a separation of "those costs which are almost definitely marginal from those costs which may be fixed or marginal depending on circumstances" (Prowle: 1981) and he gives some examples. Such a distinction may be of limited use to managers and there is no discussion of how variable costs are different **for** different levels of change.

The objectives of the FIP are "to conduct research into the financial information required in support of health care planning and by clinicians in the organisation and management of their units" and "to design, develop and implement systems for the production of this financial information" (FIP:1979). The authors of the First Research Report of the FIP (FIP:1979) favour patient rather than specialty costing mainly because of the versatility of such costs which can be aggregated to various levels depending on the particular application. However, in this report it is not make clear which costs would be associated with patients and what framework straight-forward approach seems to assume a linear relationship between patient activity and average patient costs. The method does not recognise the cost "steps" associated with a change in patient activity as **fixed costs become variable.**

A similar system is proposed by Prowle who envisages the information being used for planning, resource allocation and monitoring. His approach "was to ensure that cost data was recorded in such a way as to ensure maximum flexibility, without worrying too much about how such information might be used" (Prowle:1981). However, the researcher agrees strongly with the comment in the RAWP report that "data collected is useless unless it is guided by a clear understanding of the uses for which the information is required" (DHSS:1976:1). Prowle does address the problem of fixed and variable costs in relation to planning and suggests a separation of "those costs which are almost definitely marginal from those costs which may be fixed or marginal depending on circumstances" (Prowle: 1981) and he gives some examples. Such a distinction may be of limited use to managers and there is no discussion of how variable costs are different for different levels of change.

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Several small patient costing exercises have been mounted, for example: (Harper:1979), (Piachaud, Weddell:1972), (Babson:1973), but there seems to be no evidence of successful large scale patient costing in the NHS. Patient costing has many attractions, but until a major system has been established many questions about the practicality of such an approach and the usefulness of the results will remain unanswered. The results from the experimental patient costing system introduced in Coventry in November 1981 as part of the FIP may provide some of these answers.

3. PRIVATE SECTOR SYSTEMS

From the investigation of a few private systems it appears that efficient computerised methods exist for charging patients for their would be used to relate these costs to the sort of operational planning decisions likely to be taken by a DMT. A note of caution is struck in a report by Taylor and Worsley (respectively Regional Treasurer and Principal Assistant Regional Treasurer of West Midlands RHA (WMRHA), and closely associated with the FIP). They question whether "the cost of the necessary computer systems will be justified" (Taylor, Worsley:1981) if patient costing is introduced. The Planning Working Party of the Treasurers' Joint Accounting Committee regard patient costing as logical, but report that many treasurers "considered that costs might well outweigh the benefits to be obtained" (Treasurers' Joint Accounting Committee:1981). Greenshields, an Area Treasurer, considers patient costing to be reasonable as a medium-term target, but aiming for specialty costs is preferable in the short-term, because they "give authorities some indication of resource consumption and do help members decide on priorities for cuts, rationalisation and expansion. (Greenshields: 1980).

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3. PRIVATE SECTOR SYSTEMS

From the investigation of a few private systems it appears that efficient computerised methods exist for charging patients for their treatment. However, it seems that rough estimation and the effect of market forces generally take the place of detailed costing in the setting of prices for services and procedures. After limited research of private health care the FIP team found that in the costing of "many services, crude averages are employed", and in several cases, "costs which might be considered individual are apportioned on a per diem basis" (FIP:1979). Little evidence of detailed and sound marginal costing has been found in the private sector and certainly no structures for the linking of likely management decisions with an analysis of fixed and variable costs.

This survey of the literature (up to mid-1982 when the first phase of the research programme ended) covered models and methods for providing information for planning, amongst other objectives. The researcher was seeking a tool or approach for use in assessing the effects of planning options in the NE District and elsewhere. He repeatedly visited some of the more promising projects, for example, St Thomas' twice and CASPE twice, in an effort to explore such research as fully as possible. However, as the detailed criticisms above have shown, none of the current models or methods seemed likely to prove satisfactory as a way of coping with the problems in the NE District. Some of the patient groupings seemed too broad for many practical operational planning purposes, for example, care groups and specialty groups. Some of the costing arrangements seemed to give little guide as to which costs would be variable and which would be fixed in the event of planned change, for example, the "Magee" system, the CASPE projects and the specialty budgeting system at St Thomas'. Some of the systems relied on national average data, for example, regression analysis, the use of which in relation to the detailed planning problems of particular districts seems likely to be found unacceptable by hospital consultants. In addition treatment. However, it seems that rough estimation and the effect of market forces generally take the place of detailed costing in the setting of prices for services and procedures. After limited research of private health care the FIP team found that in the costing of "many services, crude averages are employed", and in several cases, "costs which might be considered individual are apportioned on a per diem basis" (FIP:1979). Little evidence of detailed and sound marginal costing has been found in the private sector and certainly no structures for the linking of likely management decisions with an analysis of fixed and variable costs.

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The researcher thought that the corporate planning model he hoped to build needed: to group patients in a way useful for operational planning, to use data acceptable to consultants, to incorporate an analysis of fixed and variable costs, to cover all the specialties in all the hospitals of the NE District, and to include elements such as bed capacity constraints and nurse training requirements. While the researcher found the investigation of the above systems stimulating and thought-provoking, he did not discover a structure or method he could directly apply to show the effects of planning options in the NE District.

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CHAPTER SIX: THE DEVELOPMENT OF THE DECISION-SUPPORT SYSTEM IN THE NE DISTRICT

1. JUSTIFICATION FOR GENERATING A SPECIAL PURPOSE APPROACH RATHER THAN ADOPTING STANDARD METHODS

The researcher adopted a special purpose approach (see Chapter 6:5 for outline) mainly because he thought it gave him the flexibility he required to organise in the most straightforward and appropriate way the relationships and data he intended to include in the model. He wanted to keep the structure and internal workings of the model as clear as possible so that interested senior managers and doctors could follow how the inputs are transformed into the outputs. These managers and doctors had generally very little knowledge or experience of models for management decision-making, and the researcher thought them unlikely to trust an information system which appeared to them as a "black box", the output from which they could either choose to believe or disbelieve, but the technical workings and assumptions of which could not be explained to them in the time likely to be available. One of the researcher's prime aims was to enable managers and doctors to understand the basic ingredients of the system and to see how they are combined in the model so that such users can form an opinion about how far they can rely on the results. An advantage of the method adopted is that any figure produced by the system can be justified in non-technical language both as to why it is there and how it comes to be what it is. The researcher can track back through the relationships in the model to the data input by the user and from the database. If further pressed, as he has been by senior doctors, he can trace how the data in the database has been derived. The success of the implementation of the system (see Chapters 10 and 11) seems to have been partly due to the fact that although the model is quite powerful in that it can respond to a wide

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The researcher thought that once experience was gained by both analysts and users with a deterministic model then more technically advanced methods could be introduced. The initial fate of the BOC models when introduced at health district level (see Chapter 5:2:a) is an example of what is likely to happen when unprepared and inexperienced users are exposed to sophisticated models. If such users are senior staff taking important decisions which may have far-reaching effects, it seemed to the researcher, that they are most unlikely to trust the results from a model which they cannot understand or the assumptions of which are unclear. It seems equally important that the sources of any data are available and that important assumptions made during data collection and analysis are clarified. Users may accept models that they do not understand if such models have been shown to be right in the past and there is no reason to think that the models will be inaccurate in the future. But such complete validation is not possible with models such as that built in the NE District (see Chapter 9) because so many of the elements and relationships in the complex real NHS system are not included, and the "actual" capacity, cost and training data are not usually readily available for checking. The results from the model should only ever constitute guidance to decision-makers since many of the factors in NHS decision-making, for example industrial relations, are excluded. And what has been included rests on assumptions, some of which are contentious, for example, that staff savings from a ward closure materialise as soon as the ward is closed. This means that users must understand and accept the data, the model, and the assumptions, as well as the results so that they can place the appropriate trust in them and use them accordingly, as they consider all the information and range of inputs, the blocks out of which it is built are relatively simple and can be understood by general managers and doctors. The researcher thought that once experience was gained by both analysts and users with a deterministic model then more technically advanced methods could be introduced. The initial fate of the BOC models when introduced at health district level (see Chapter 5:2:a) is an example of what is likely to happen when unprepared and inexperienced users are exposed to sophisticated models. 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The BOC models seem to have been markedly more successful at local level once they had been simplified and their assumptions rendered less obscure to the user.

The researcher also thought a deterministic model to be appropriate given the current crudity of some of the assumptions, relationships and data of the model. For example, it is assumed that an increase in the caseload of a particular specialty will lead to a proportional increase in the demands by that specialty on the ITU; an assumption made on the advice of a hospital consultant. The assumptions, relationships and data have been checked and validated, and the scope for error limited, in various ways (see Chapters 8:2 and 9:2), but much still remains to be done (see Chapter 11) before the system could be considered complete or polished. It seemed to the researcher that the use of more sophisticated OR techniques, such as discrete simulation or mathematical programming, might distract managers and doctors and make it more difficult for them clearly to perceive and consider the fundamentals on which the model is based. The researcher considers that severe problems would have been met during the second phase of this research programme if he had not largely concentrated his effort on clarifying assumptions and relationships and devising means of obtaining data required. The research student who undertook the second phase concurs in this opinion. It seems important that a "highly technical" edifice should not be built upon foundations that are insecure; rather a balance should be struck, as the researcher opinion available. It is not suggested that all users must understand fully the techniques they are using, that seems quite impractical. But for successful implementations at senior level in the NHS it is suggested that gradual introduction of the "highly technical" tools in the OR kit may be the best approach. The BOC models seem to have been markedly more successful at local level once they had been simplified and their assumptions rendered less obscure to the user.

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As described in Chapter 2, the main area of the research was changed when it became clear how little of the basic data for a model was available or reliable in the District. The researcher had hoped to build a discrete simulation model for corporate planning, but found himself forced to spend much of the research identifying the relationships and data to be included in such a model. The deterministic computer model that was built did constitute a special purpose approach and one which enabled the researcher to present clearly to management the likely results of planning options using an analysis which made fair and defensible use of the data. It was thought that a more sophisticated technique might give a misleading impression and the researcher was concerned not to make, or hint at, any claims for the model which were not solidly based: a deterministic model seemed the best way of doing this at the time. He decided to program such a model in Fortran himself because: he had used the language before, it allowed him to format the input and output exactly as he wanted, and above all it gave him the flexibility he required to program a system covering resource, capacity, finance, and manpower modelling. The researcher considered using modelling packages, and in particular the Visicalc system which he found insufficiently powerful for the relationships he wished to include. He also made considerable efforts, with the encouragement of the DFO, to use on IBM modelling package available at the Middlesex, but found it too constricting.

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For example, no study has been made of how and when the patients in different specialties arrive at the hospitals in the District for treatment: the proportion of emergency admissions or the fluctuations in the daily admission rate or whether if refused admission they are likely to be treated at another NHS or private hospital. No detailed study was made of the scheduling problem in the operating theatres or how the length of stay of patients in the ITU might vary in response to pressure on that ward. The researcher thought that much more needed to be known about the hospital services before such a model should be built. The alternative would be to construct such a model making very many and very detailed assumptions. If such a model were built prematurely and major problems encountered during implementation or data collection senior managers and doctors might discount this useful technique for the future. In an organisation like the NHS which is complicated, pluralistic, and involves choices between services valued very differently by different people, simulation seems to offer a major means of improving decision-making. But the researcher found that much of the groundwork for the development of such a technique has not been done in the NHS. This project attempted to establish a framework, both useful now in the form of a deterministic computer model, and useful for future developments. The current model adopting simulation rather than mathematical techniques. A health district is undoubtedly a very complicated system. The idea of a simulation was explored and dropped mainly because the researcher thought that the relationships and data he had identified were not yet sufficiently refined to support such a method. 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Almost all the elements in the deterministic model could be included in a simulation model, but it appears that more basic research is needed before a general district simulation model could be built and successfully implemented. When deciding on the form of the decision-support system, and while abandoning the idea of a discrete simulation model for the present, the researcher bore in mind DHSS advice on the financial aspects of such systems:

> "... what is needed is a means of estimating costs which is quick and simple, so that many alternatives can be explored; which is related to levels of service provision or "output" ... but which is nevertheless accurate enough to avoid unrealistic planning" (DHSS:1978:1)

The decision-support system developed seems to meet their requirements.

The researcher also considered the technique of mathematical programming as a means of providing the DMT with useful information about the effects of planning options. The major difficulties seemed to lie in the formulation of the problem and in the setting of an objective function suitable for corporate planning and acceptable to a range of senior staff and doctors. The objective function might well have been to minimise cost given certain capacity constraints or case-load, although it is hard to see how the bed borrowing problem could be formulated as a constraint without introducing too many variables. Also the identification of genuine constraints in for example, the imaging services department and the operating theatres would have required much detailed investigation. The researcher could not have included many of the cost "steps" he had identified as important in such a model, for example, "ward variable" costs, nor could the nurse training component seems to the researcher to be a stage in the development of a full simulation model for corporate planning. Almost all the elements in the deterministic model could be included in a simulation model, but it appears that more basic research is needed before a general district simulation model could be built and successfully implemented. When deciding on the form of the decision-support system, and while abandoning the idea of a discrete simulation model for the present, the researcher bore in mind DHSS advice on the financial aspects of such systems:

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Also senior clinicians might (however misguidedly) see a crude mathematical programming approach as a threat to their clinical autonomy. They might feel as if they were being told what to do by a very limited model of a complicated and many sided problem, however much the researcher had intended the technique only to be used to provide information about planning options and not to point management in any particular direction. Mathematical programming models can be used in similar ways to "what if" models, but the researcher thought that the objective function might easily be misunderstood by users and cause problems at implementation.

For these reasons mathematical programming seemed an unpromising technique to apply at this stage as a means of providing "comprehensive" information for district operational planning. It was rejected on the grounds of difficulties in formulating the problem and in setting a generally acceptable and useful objective function. However, mathematical programming is undoubtedly a most useful OR technique and, while the researcher cannot envisage it being used to tackle the overall problems of corporate planning at health district level, he can see it being used (perhaps in conjunction with simulation) in particular problem areas such as the theatres.

The BOC models (see Chapter 5:2:a) were originally mathematical programming models for central government health planning. When they were applied to the problems of health districts, however, it was found necessary to introduce a major simulation element, render the mathematical programming sections optional, and remove entirely the "inferred worth" have been incorporated. This would have meant that the scope of the mathematical programming model would have been more limited than the current deterministic model; and the DMT Planning Group wanted a "comprehensive" model.

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2. WILLINGNESS OF MANAGEMENT IN THE DISTRICT TO SUPPORT A MODELLING APPROACH

Decisions about the future in the NHS have been made for many years with the inadequate information systems described in Chapter 4. The health service seems to function reasonably well, so why did management in the late 1970s seek urgently to improve the planning information available to them?

When the research began in the NE District in 1979 management were coping with three relatively new pressures on resources. These were: the effects of cuts in the total planned real growth of resources for the NHS, the adoption of the RAWP recommendations for resource allocation, and the cash limits system (see Chapter 3). At that stage the service had not been affected by the more recent developments of "efficiency savings" and cash planning which are intended to bring further pressures on the availability of resources. The district management also faced major service planning decisions (described in Chapter 4:2) requiring component (an attempt to model what managers think ought to happen). The researcher, after three years at The Middlesex, finds the necessity for these changes unsurprising. It seems that the interdependencies in a health district render mathematical programming unsuitable as a way of addressing or illuminating general corporate planning problems. Simulation seems much more promising although it is suggested that considerable fundamental research still needs to be carried out before "comprehensive" simulations of health distircts can be successfully built and implemented. This research project has concentrated on developing and documenting such basic understanding while at the same time producing a deterministic model of considerable practical value to senior management faced with important and pressing planning problems.

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When the research began in the NE District in 1979 management were coping with three relatively new pressures on resources. These were: the effects of cuts in the total planned real growth of resources for the NHS, the adoption of the RAWP recommendations for resource allocation, and the cash limits system (see Chapter 3). At that stage the service had not been affected by the more recent developments of "efficiency savings" and cash planning which are intended to bring further pressures on the availability of resources. The district management also faced major service planning decisions (described in Chapter 4:2) requiring information not readily available. The personal concern of the DFO was mainly based on the view that the problem of planning the service within the resource limitations was likely to become increasingly pressing.

In late 1978 the idea of a simulation model to aid operational planning was suggested to the DFO of the NE District who immediately found it attractive. He had considered constructing a model before, but had been unable to do so because suitable staff had not been available. Resource modelling was at that time an unusual development for a finance office to favour - more typically systems of costing and budgeting have been developed (see Chapter 5). We were therefore fortunate in getting an enthusiastic initial response and strong continuous support from the head of the finance department, a powerful function in the NE District. Modelling requires a different approach to that which is likely to be fostered by the DFO's traditional responsibilities such as ensuring that salaries, wages and bills are paid, budgets met, money correctly spent, and routine information produced. The modelling approach is, however, consistent with the likely necessary development of the District Treasurer's responsibilities in attempting to keep expenditure within tight cash limits against bids for resources from consultants and heads of departments for what they see as important improvements in services (or even merely sustaining services at current levels). These new burdens are more easily discharged given reliable information on the effects of changes. The model is a useful guide in the assessment of the likely costs of planning options. The DFO was prepared to take a risk and give his full support to a project, mounted by academics, which might well have failed or have caused difficulties with consultants and other senior staff. He was willing to open the workings of his department to scrutiny by outsiders, recognising that such a study was likely to expose deficiencies.

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The DMT and some senior consultants in the NE District have also recognised the planning problems associated with acute care which are likely to grow more serious in the future. They attempted to meet these difficulties through the establishment in the mid-1970s of the DMT Planning Group which includes doctors. It meets about every other month mainly to discuss how developments should take place which involve important changes to bed allocations by specialty, the opening or closure of facilities, matters of clinical policy, and other planning issues which directly affect doctors. Its chief function is to act as a forum for the resolution of problems between senior medical staff when the expansion of one part of the service may only take place through the contraction of another part. The DMT does not feel that it should, or perhaps could, impose such changes on the consultant staff and seeks to achieve consensus (difficult in itself) through the DMT Planning Group. So far, this approach has been successful. The members of this group were initially sceptical of the modelling project, but were prepared to let the research continue because the DFO saw the need for it. As the work has progressed, they have recognised its value as they have become increasingly aware of the deficiencies of information relating to planning. A striking example of such a change of heart was shown by the professor of general medicine. Originally he argued strongly against the modelling project, but once the model began to produce results which were carefully explained to him he began to give the researcher encouragement and useful advice. By the end of the first phase of the research programme he was an important supporter of the decision-support system.

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The researcher was fortunate in that very few limitations were imposed on him by management decision in the course of the project. Also since part of the research method was to try to identify and respond to management needs for information for planning, such needs could hardly constitute "limitations imposed". Naturally some managers emphasised the needs and position of their particular function or department, but the project steering group well recognised that a "comprehensive" model could only deal with each part of the system in limited depth. The researcher never felt constrained either by management decision or directed against his will to meet particular management needs.

The research project was initiated by the DMT Planning Group, the most powerful planning body in the NE District. Soon after the project began the researcher gave a presentation to this group in which he described his previous modelling experience (see Chapter 1) and explained how he hoped to develop a similar model in the NE District. This proposal was broadly accepted and the only guidance given by the group was that the system should be "comprehensive", should not address problems associated with capital and should require very limited clerical support. The group did not state in any detail what information should be provided. These conditions of the research were readily accepted by the researcher and did not constitute limitations imposed in any way against his will.

After this initial top-level sanction and direction, the project was controlled by a project steering group which met every two to three months. The academic supervisor played an important role in ensuring that the product of the research was of relevance to the NHS as a whole as well as to the particular district: this requirement was also well understood by the other members of the project steering group. At each meeting the researcher described what he had achieved since the previous meeting, what problems he had encountered, and what he hoped to do by the next meeting. At the outset of the research the management of the NE District had little the research method was to try to identify and respond to management needs for information for planning, such needs could hardly constitute "limitations imposed". Naturally some managers emphasised the needs and position of their particular function or department, but the project steering group well recognised that a "comprehensive" model could only deal with each part of the system in limited depth. The researcher never felt constrained either by management decision or directed against his will to meet particular management needs.

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Between meetings of the steering group the researcher met the DFO about every two weeks and many points were discussed and settled on these occasions. For example, when it became clear that the two large psychiatric hospitals at Horton and Banstead would soon no longer be the responsibility of the NE District the analysis of these institutions was curtailed (see Appendix 3). Also when the researcher was considering the detailed modelling of the variation of staff costs after the closure of a ward (see Chapter 7:2:b) he discussed the problem with the DFO and accepted his advice that the benefits from such modelling would probably not justify the cost. All problems resolved in this way were also considered at the next meeting of the project steering group. At the meetings with the DFO, the researcher did not feel that he was being directed against his will, but rather that he had an opportunity to discuss general problems and proposals with a senior manager. He found the views of the DFO particularly helpful in keeping the various parts of the project in proper proportion, so that the final result seems to be a balanced tool useful for corporate planning.

In conclusion, the researcher felt that when he sought guidance, this was available from the project steering group, senior managers and in particular the DFO, and from an academic supervisor, but that such guidance or advice never constituted a burdensome limitation imposed on his work.

As for the needs of management and how far they imposed limitations on the research, such limitations were unlikely to be significant because of the research method adopted (see Chapter 2). The researcher intended to construct a system to meet the information needs of the DMT for corporate planning which was also consistent with a logical approach to planning. The researcher identified many needs which he could not meet, for example, the likely future demand on hospital services by specialty, or the likely variation in medical staff costs with change in patient case-load. But he only received encouragement from the members of the project

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The researcher did not feel limited by specific management needs of the moment to consider particular areas in great detail at the expense of other parts of the analysis. This would probably have pulled and twisted the system out of shape. For example, when considerable management attention was focused on the likely development of a regional centre for cardiology and cardio-thoracic surgery at the Mdidlesex the researcher supplied certain managers with relevant data. He did not, however, concentrate his attention particularly on these costly specialties or perform a more detailed analysis in relation to them, but continued with the general development of the decision-support system. He tried to identify the general need in particular management cries for information and to respond to this rather than the management problem in hand. For example, the DMT frequently considered opening and closing particular wards and wanted to know as much about the consequences as possible. While the researcher gave informal advice on the problem he was never forced to shelve temporarily his general analyses relevant to the general problem (such as those concerned with feasibility or nurse training) in order to give management a report on the current example of the general problem using whatever tools and data might be available at the time. Once the analyses and the decision-support system were reasonably complete they were used in relation to particular problems (see Chapter 10), steering group when tackling the areas of pressing need where it seemed possible for the researcher to make some headway. The aim of the project was limited to identifying the basic information required by district management faced with evaluating a range of planning options, and to devising and implementing a decision-support system to provide this information at low cost. These limitations were set by the researcher and defined broadly what he thought he could reasonably expect to achieve, and to document in the form of a thesis, in three years.

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Overall, the researcher felt that few limitations were imposed on this research project by management decision or needs. He frequently sought the advice and guidance of senior managers, but neither they nor the project steering group tried to force the researcher down particular paths or demanded that he concentrate his study in particular areas.

4. IDENTIFICATION OF ELEMENTS IMPORTANT IN PLANNING

The research began with the identification of factors which seemed important for planning in the NE District. Planning decisions of the recent past, and those which were currently being made, were investigated by talking to the staff involved, by observation at planning meetings, and by examination of documents. A wide range of senior staff were asked both what they thought was important in the way planning was done in the NE District and what should be important. The main elements identified and also included in the model are shown in Figure 10.

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FIGUR

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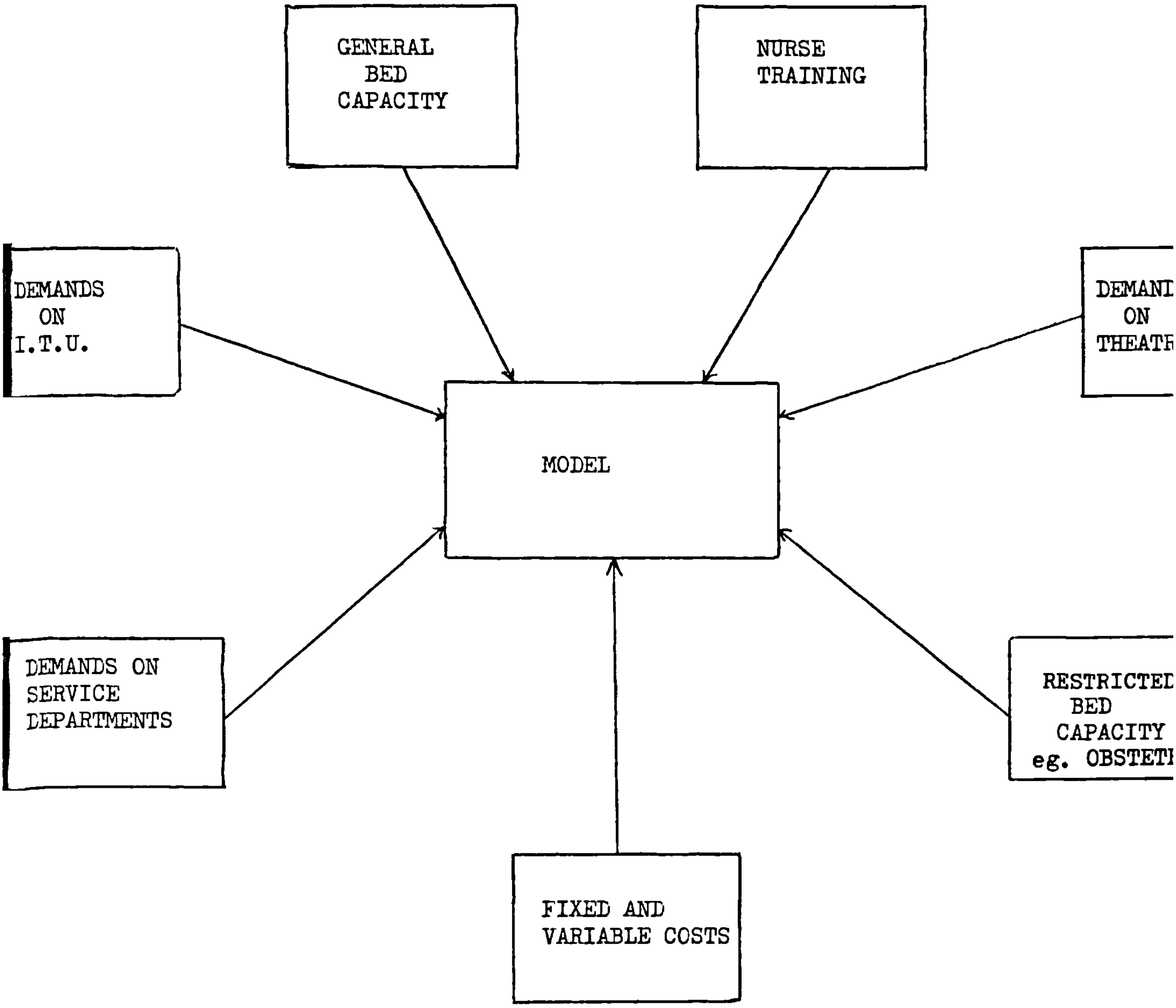
COMPONENTS OF THE MODEL



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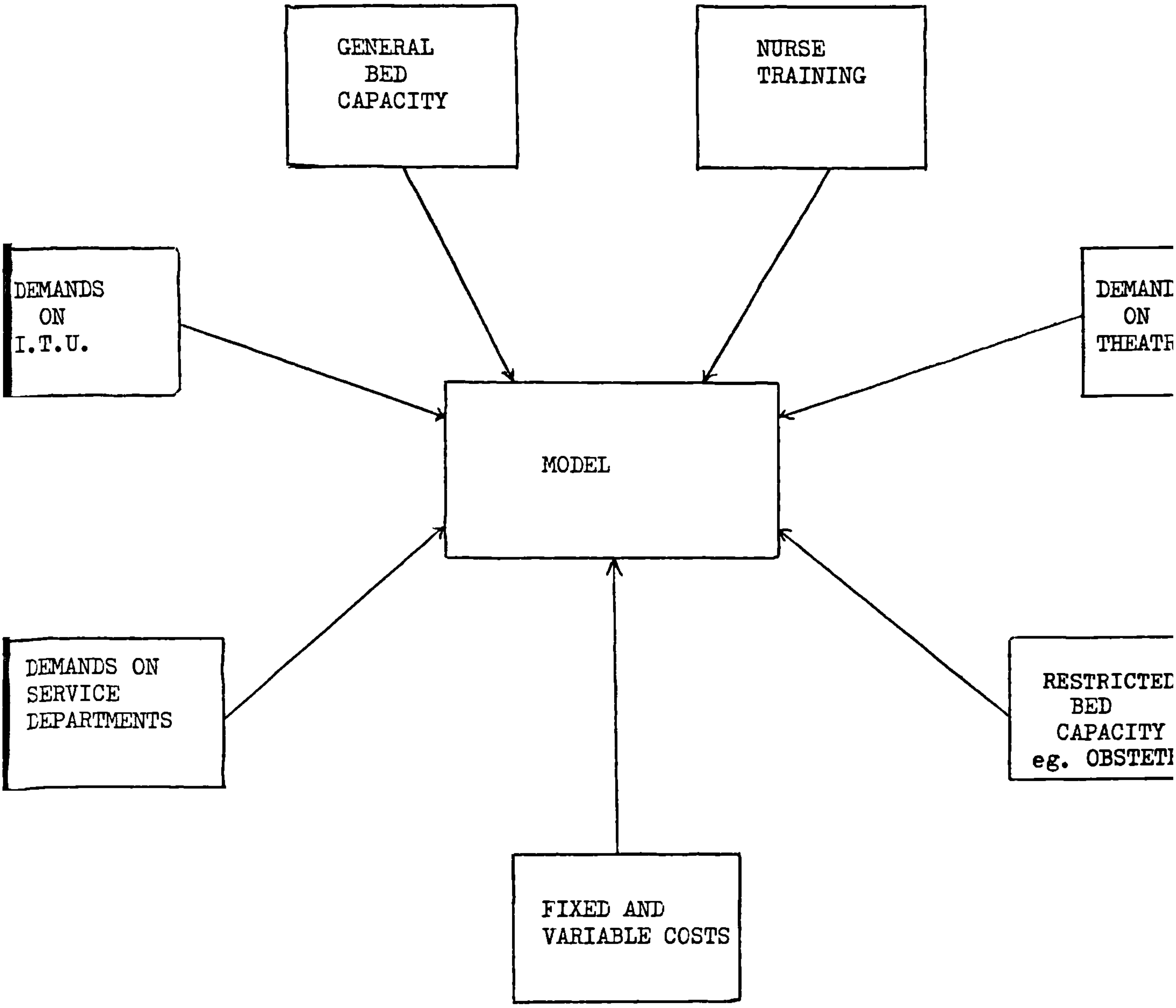

a. Population served

The population of a health district appears to be important for health service planning. However, very many of the patients treated in facilities managed by the NE District were not residents of that District. Less than 10% of the inpatients at The Middlesex came from the NE District (see Figure 4), although the proportion is higher in some of the psychiatric and geriatric hospitals. Since the population served is widely dispersed, no attempt was made to forecast its size and likely demand for health care from the NE District nor have community services been included in the decision-support system (see Chapters 4 and 13 for further discussion).

b. Patients

The people being treated by the health care system, the patients seem central to the planning of the services. The problem is how they should be organised in a district model intended to aid operational planning. The criteria used for deciding how to group patients were as follows:-

i. Relevance of the classification to operational planning as currently conducted. What terms do consultants and senior staff use to describe patients when they take short-term planning decisions?

ii. Reliability of the patient activity data available for the grouping. Are the data reasonably accurate and do those who decide the future of the District have confidence in them?

iii. Soundness of the associated data about demands on service departments and the costs generated in service and supply departments. Do the record systems in the service departments, such as radiography, accurately reflect the demands made by a group of patients and can sound costs be associated with such demands?

iv. Staff time required to collect and analyse the data. Is this excessive in relation to the value of the information provid

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Several possible arrangements of patients are assessed in relation to the criteria shown above: care groups, specialty groups, specialties, patients by consultant, disease groups, and individual patients. This is not an exhaustive list, but is intended to show the wide range of classifications of patients which might be considered. The members of the FIP have outlined the problem as follows:

> "It is obvious that, the lower the level of information required, eg specialty, consultant, diagnosis, or patient, the greater the cost of data collection, and it is important to judge whether the information derived at such a level is sufficiently robust and precise to satisfy its uses, and moreover, whether its usefulness in terms of leading to improved decision-making justifies its additional costs" (FIP:1979).

Care groups and specialty groups have been discussed in Chapter 5:1 and are rejected primarily on the ground that these classes are too broad for operational planning at district level and so fail to satisfy criterion (i).

It was decided to group patients by the specialties as they appear on the SHQ return. The chief advantage of this approach is that these were the classes most widely used in operational planning in the NE District. Also the data on patient activity are thought reasonably accurate by consultants and senior staff. There are problems, however, in that some planning is done at a level lower than specialty, especially in connection with the two large specialties of general medicine and general surgery. The resources used by firms within these specialties are known to vary considerably. The example, the drugs prescribed for diabetic outpatients (a sub-specialty of general medicine) are very expensive. Psychiatry has been treated as

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The grouping of patients by consultant has the advantage that the data can then fit almost any operational plan, but there are dis-advantages. The data on patient activity has to be drawn from the HAA system which, as mentioned above, was widely thought to be inaccurate in the NE District. Also the association of services and costs with patient activity becomes more difficult the smaller the group of patients. Resources are commonly recorded as used by a department or specialty rather than a particular consultant. Also a consultant advised that junior doctors may take little trouble over the name of the consultant they write when ordering services, or resources, but they will almost certainly get the specialty right. Demands on service departments and costs must be estimated by means an exception largely because the sub-specialties, for example, psycho-geriatrics, can be closely associated with particular wards. The analysis of costs for the different sorts of psychiatric patient is reasonably straightforward and seems worthwhile since these costs do differ greatly between the psychiatric sub-specialties. A consequence of using specialties as the basic category for operational planning is that the costs have to be estimated by sampling and detailed cost accounting (more approximate methods, for example, regression analysis, would not be credible for the reasons given in Chapter 5:1:b). This type of analysis, without careful design, can be very time-consuming and may require the use of HAA data (of which consultants are highly suspicious, see Chapter 4:4:a) to apportion some of the ward costs. Grouping patients by specialty largely meets all the criteria: for each specialty data on the demands by patients on service and supply departments and the costs generated can be collected and analysed, to a degree of accuracy acceptable for operational planning, without incurring excessive staff costs.

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Patients can also be classified by disease group: there are over 600 in the international code. In theory such data could be aggregated in a form useful for operational planning. There is, however, a severe problem of collecting reliable data about the patient activity, the resources and services used, and their cost. The staff costs of accurately estimating and regularly updating the resources and costs associated with disease groups are enormous. These problems are intensified if individual patient costing is attempted. For both categories of disease groups and individual patients only criterion (i) is probably satisfied.

c. Facilities and consumables

The following are important in the operational planning of a hospital: beds, service departments and supply departments. Beds matter simply because there must be enough to accommodate the planned patient numbers. But, that being said, it is not obvious how they should be organised. Should beds be associated with particular specialties? Are they a resource available to all patients, regardless of specialty? Or is the answer somewhere between the two? These problems are discussed in Chapter 7:1. The service departments which must be considered from the points of view of capacity and cost include the theatre suites, the ITU, the childrens' ward, the imaging services, the pathology services and many others. The supply departments such as the pharmacy, the instrument store, the CSSD, the patients' similar to those for specialties, but the greater detail means much more staff time is required. This classification of patients is rejected because although criterion (i) is satisfied, criterion (ii) is probably not satisfied, which criterion (iv) cannot be satisfied if criterion (iii) is to be satisfied.

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The following are important in the operational planning of a hospital: beds, service departments and supply departments. Beds matter simply because there must be enough to accommodate the planned patient numbers. But, that being said, it is not obvious how they should be organised. Should beds be associated with particular specialties? Are they a resource available to all patients, regardless of specialty? Or is the answer somewhere between the two? These problems are discussed in Chapter 7:1. The service departments which must be considered from the points of view of capacity and cost include the theatre suites, the ITU, the childrens' ward, the imaging services, the pathology services and many others. The supply departments such as the pharmacy, the instrument store, the CSSD, the patients' appliances office and the catering department are important because management need guidance on the likely "knock on" costs of a scheme in these areas. If planners do not consider carefully bed capacity or the probable effects in these service and supply departments (and it is difficult for them to do this given the information available to them); then a plan they produce may prove to be impossible, or cause unforeseen disruption, or generate costs which have not been budgeted for.

d. Staff

Almost all operational plans entail an increase or decrease in staff. The change of use of a ward may mean that the establishment of trained and untrained nurses and domestics is revised. The expansion of a specialty may mean more doctors are employed, and a reduction of operating sessions may mean that fewer theatre nurses are required. Each of these changes would affect costs.

e. Training

In assessing the effects of any proposed change it is essential to include the impact on training programmes and in particular nurse training. If a ward which is used for nurse training is closed, then the learners must be transferred to another similar ward, although each ward can only accept a certain number of learners. If a ward is opened, then learners may have to be drawn from other wards, on which they are gaining comparable experience, which may result in too few learners on some wards. A change in the allocation of beds to specialty on a ward can have similar affects on nurse training.

As has been mentioned, the above elements have been selected because they are those believed to be important in operational planning and are of different kinds: costs, capacity constraints, demands on supporting services, appliances office and the catering department are important because management need guidance on the likely "knock on" costs of a scheme in these areas. If planners do not consider carefully bed capacity or the probable effects in these service and supply departments (and it is difficult for them to do this given the information available to them); then a plan they produce may prove to be impossible, or cause unforeseen disruption, or generate costs which have not been budgeted for.

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As has been mentioned, the above elements have been selected because they are those believed to be important in operational planning and are of different kinds: costs, capacity constraints, demands on supporting services, nurse training. The elements are drawn together in the model on the principle of meeting the likely demands of the DMT in operational planning. These elements and the relationships between them have been organised to answer the two questions: "Is this change feasible?", and "What are the financial, service, and training implications of this change?".

5. THE MODELLING APPROACH IN THE NE DISTRICT

In Chapter 5 the researcher reviewed a wide range of models and methods developed partly in order to provide better information for NHS operational planning, although this was requently not the prime aim of such systems. These methods covered a spectrum from statistical modelling to cost accounting. While conducting this survey the researcher was keenly looking for tools to use as part of the information sytem he was developing in the NE District. But as the analysis in Chapter 5 shows, none of these approaches were found readily to produce information of the right type or to the appropriate level of detail to answer the sort of questions being posed by the DMT and its Planning Group with respect to corporate operational planning. Therefore while constantly bearing in mind the experience of others, the researcher felt that a new approach was needed to provide information for the NHS in this particular area. In this section the role of the OR analyst is discussed and the general nature of the approach adopted is described. The various aspects of the decision-support system are considered in more detail in Chapters 7, 8 and 9.

Mitchell has picked out effective roles which an OR analyst might play: expert, change agent and genuine researcher (Mitchell:1980). The role of the person expert in OR techniques has not been particularly important during the research in the NE District, although a deterministic computer model was designed, constructed, verified and is in the process of being validated. The roles of change agent and genuine researcher have been much more important.

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As a change agent the researcher in the NE District has thought of himself as an adviser to senior management who is responsible for convincing them of the usefulness of his advice on current problems. In this case the advice is based on the results from a computerised decision-support system. The prime objective of the change agent is "to change a given system not by merely studying it and proposing in a consulting role how it could be altered, but by being a part of the system (at least for a while) and helping to change it from within" (Eilon:1980). The researcher has spent three years working in the NE District with day-to-day contact with operational managers. Although the analyst in such a position is likely to develop a sound understanding of the organisation, there is a potential danger that he will lose the ability to look clearly at the organisation as a whole and at how the various parts interact. The research student has found that the discipline of building and maintaining a district model has enabled him to preserve a global view. Such a perspective seems to be especially valued by senior managers. There would seem to be a danger that the OR analyst may succumb to the values and prejudices of the department with which he is most closely connected. However, these problems will probably have to be faced if the analyst is to gain an understanding of, and put himself in a position to do something about, deep-seated and recurrent problems. It may be that in the past researchers "have given way to the temptation to develop abstract models of ... health goals based upon intellectual and speculative concepts, rather than going the route of empirical observation of existing systems in order to generalise relationships between their various parts as a necessary prerequisite to beneficial change" (Maxwell:1980). The research student in the NE District has not just been an observer and commentator, but has tried to provide management with a tool to holp them handle better the problems of operational planning and has participated in its introduction as an aid to the planning activity of the District.

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As a genuine researcher, the research student has attempted to build "an applied science of some very localised kind ... an understanding by a continuing research programme of some aspects of the operations that (he) .. is concerned with" (Mitchell:1980). Although the approach is "localised" in the sense that it has been developed in a particular health district, the structure and the data analysis which underpin the decision-support system are relevant to other health districts (see Chapter 12). The power of this approach is apparent at meetings with consultants and senior managers. On such occasions the discussion is often fairly general, but frequently a point is raised about some detail of the model or data. For example, one enquiry concerned the assumptions supporting the estimates of demand on the children's ward by specialty. The responses to such probes must display a good understanding of the way the particular health district works and an attention to detail which give managers confidence that the data have been conscientiously analysed and that there are sound reasons why elements have or have not been included in the model. The use of data and relationships derived exclusively from within the District has been particularly important in convincing consultants of the worth of the model. This applied science is necessarily inexact since an attempt has been made to address one of Ackoff's "messes" (Ackoff:1979:2).

The model and the procedures for data collection and analysis are supported by many important, and sometimes controversial, assumptions and the use of estimation in the derivation of many of the data adds to the uncertainty. However, the system can be improved and extended in response to new problems and the initiatives of managers. The applied science is continuously developing as researchers and managers learn more about modelling and planning. The area of the research, planning in the NHS, is "ill-defined" and "messy" because planning is both a wide-ranging, many faceted activity in itself in large, complex organisations, and the problems are intensified in the NHS where planning is relatively new. Health

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The concentration of the research effort on a particular problem area of management contrasts with the more diverse aims of other research projects; for example, specialty budgeting at St Thomas', specialty costing by Magee and Osmolski, and the Standard Accounting System.

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Such an approach differs markedly from the sequential path followed by Babson: "The project was intended first to ascertain whether the costing of the treatment of specific disease categories was feasible, and second - assuming the former was answered in the affirmative - to suggest the relevance of "disease costing" data both for hospital management and for higher levels of the National Health Service hierarchy" (Babson: 1973).

The decision-support system developed in the NE District has grown out of a difficult and continuing reconciliation of what is desirable and what is feasible. The research in the NE District would have probably lost its momentum and support if a sequential method had been adopted because managers and doctors would probably have seen the results as either impractical or of little value to decision-making.

The product of the research has not been simply a "cost model", but a decision-support system (see Figure 11). Given the current constraints on the resources available to central London health districts, finance is most important in DMT operational planning and so has dominated the current form of the model. But important parts of the model, for example, the analysis of patient activity and nurse training, have no direct connection with costs.

An important part of the research has been the identification of assumptions made both in the collection and processing of data and the construction of the model. Such assumptions form part of the system documentation available to managers. Also, whenever the model is run the user must specify the particular assumptions on which the run is made. This discipline ensures that the figures produced by the model are understood in a similar way by different managers. Identifying assumptions is difficult and time-consuming. The researcher has aimed to draw attention to important assumptions which might usefully be discussed by managers and

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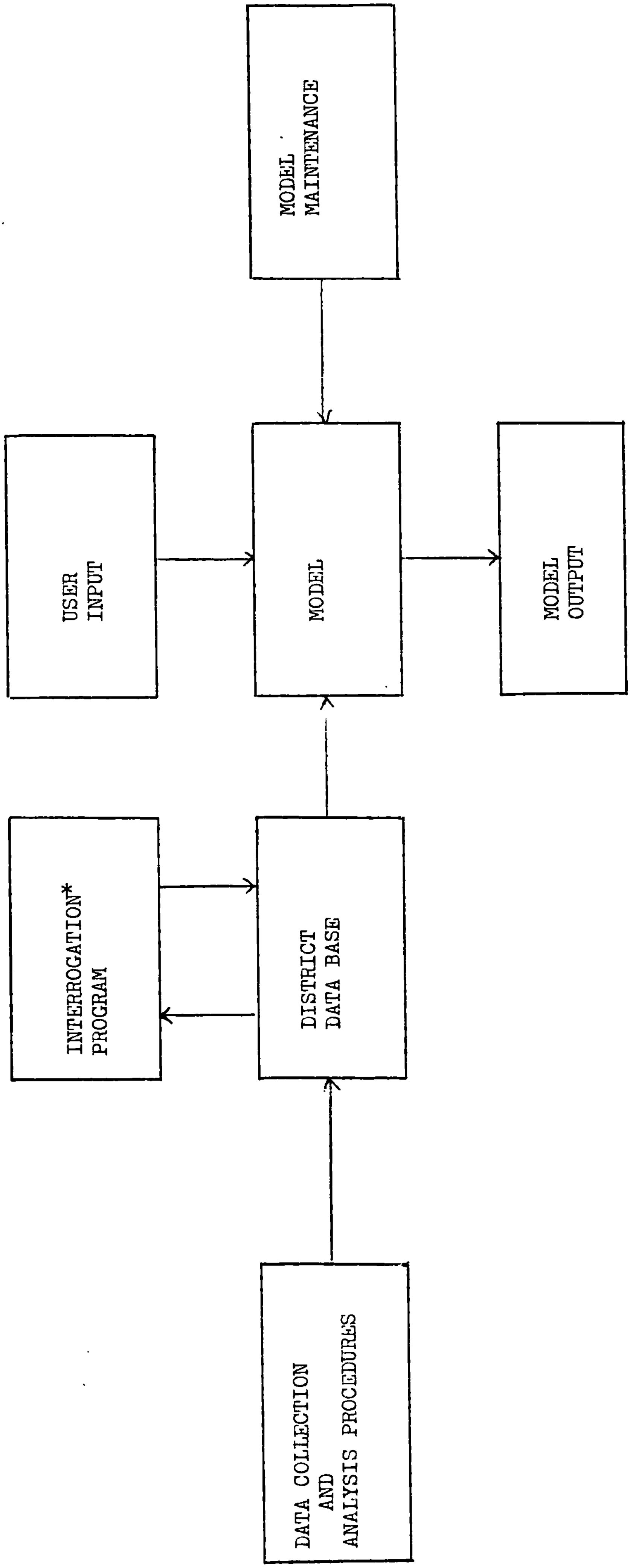

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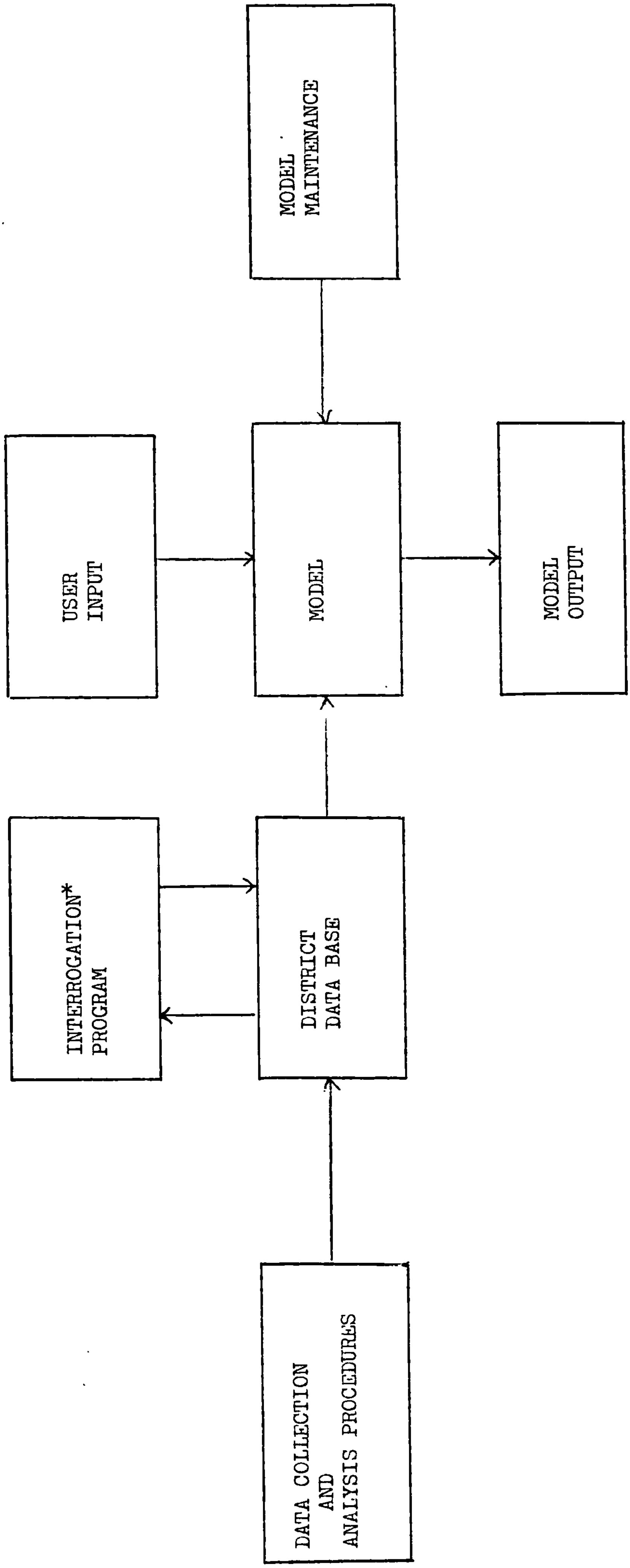

doctors during the assessment of the consequences of a planning option and which might otherwise remain implicit. Although the clear statement of assumptions has been held most important in the construction of the data base and the model, and their use, other research projects do not seem to take this approach. For example, it is difficult to be clear about the assumptions supporting the Magee and Osmolski specialty costing system or the BOC models.

The main interactions in the model are shown in Figure 12 and are fully described and discussed in Chapter 7. Given a set of assumptions about patient activity and the hospital services, the model tests the feasibility of options, or combinations of options, by examining whether there are likely to be enough beds for the patients. Allowance is made for "bed borrowing" by one specialty from another where this occurs: and the likely demand on wards, such as the ITU and the children's wards, which provide a service to other specialties is checked. The beds available act as a real constraint in the model on the throughput of patients. The model also estimates the expected demand, in terms of patient time, of a change in the throughput of surgical specialties on the theatres and the anaesthetic rooms and recovery areas. This information helps the user to judge the feasibility of a plan. Theatre time is not incorporated as a real constraint on patient throughput because of the flexibility in the operating theatre system: for example, the possibility of operating in t evening or at weekends.

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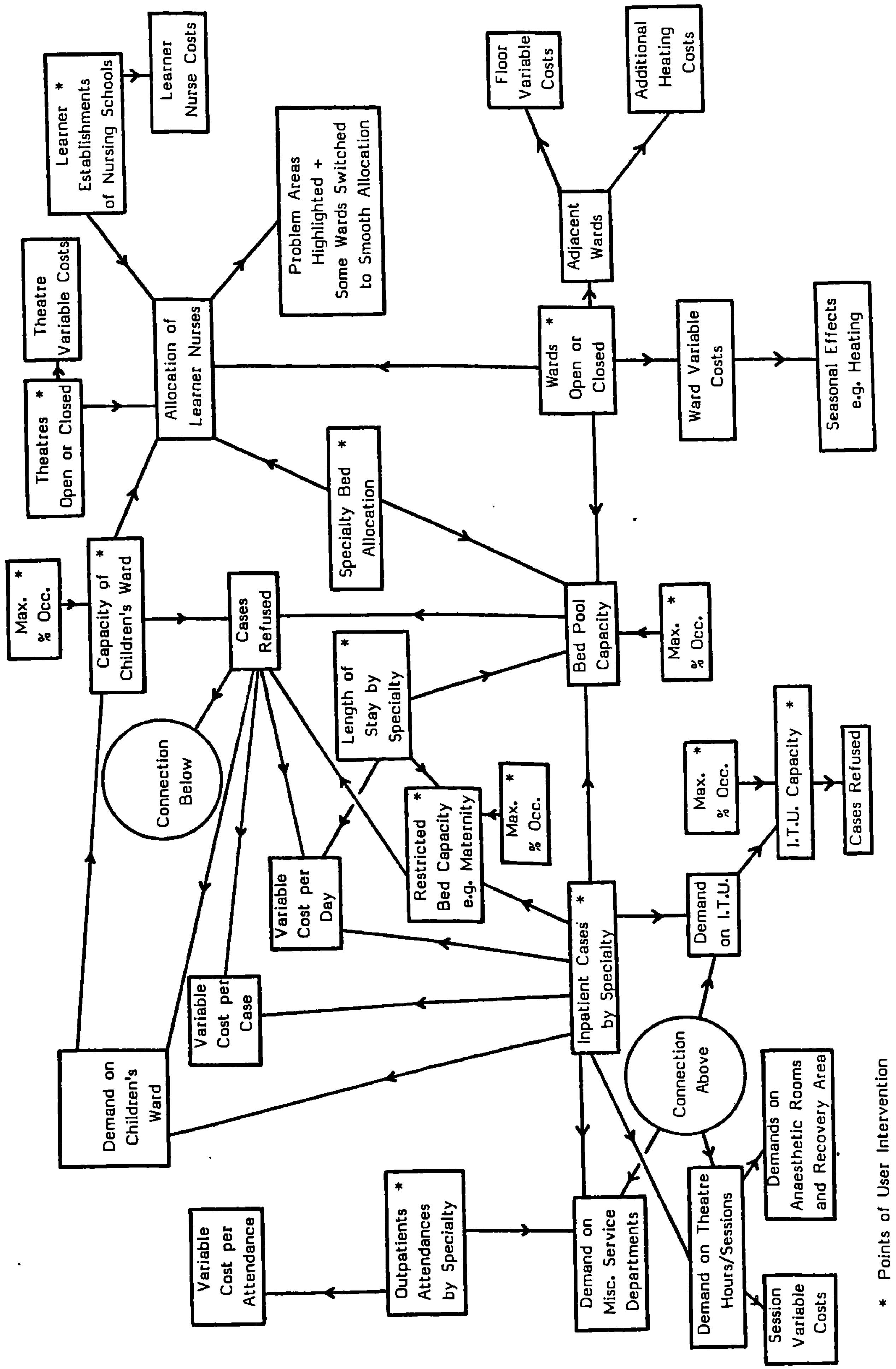

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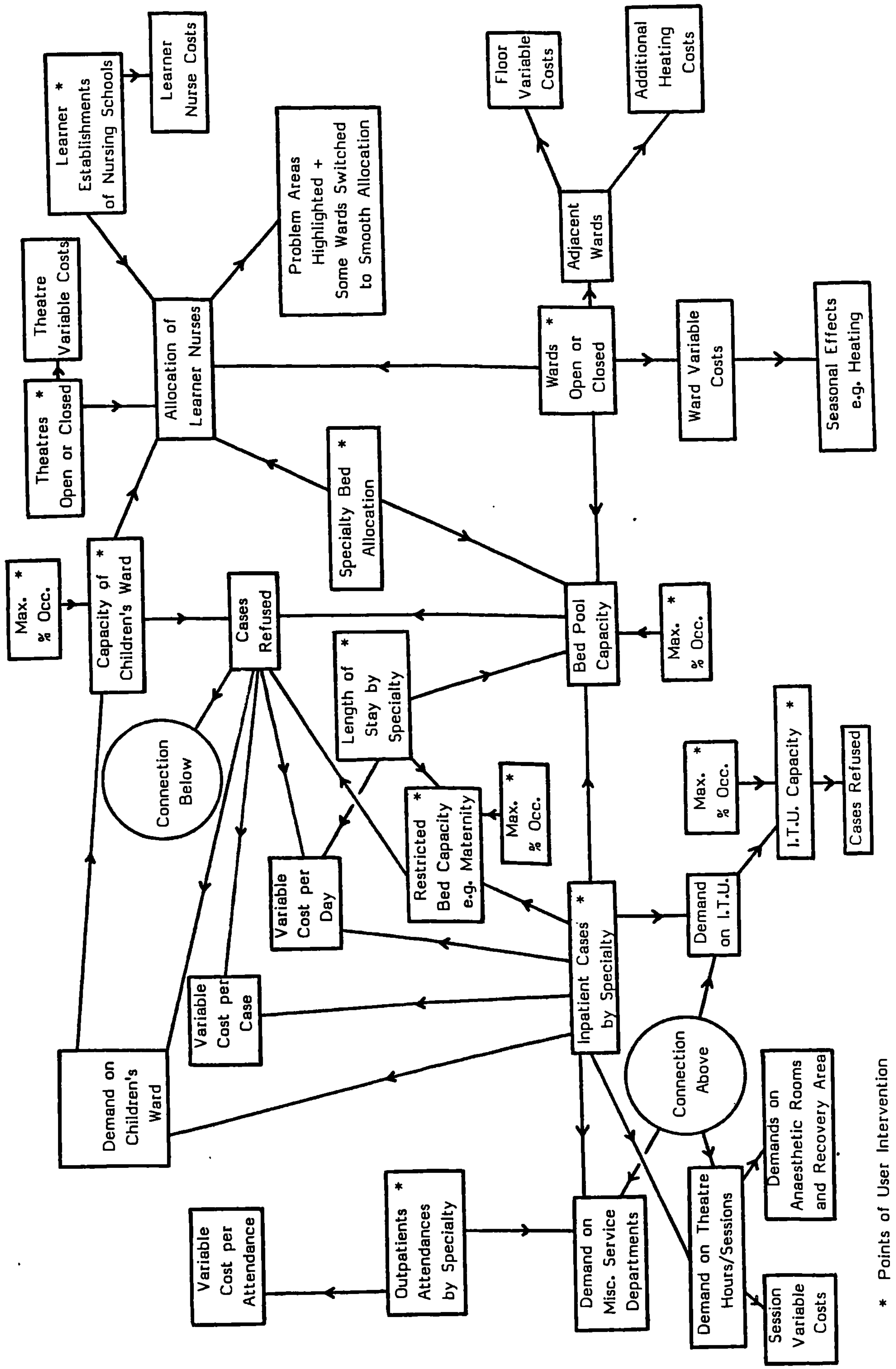

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If a DMT were to attempt to use recent research on costing for operational planning they would have difficulty in linking changes to patient activity and facilities with costs. This is because there is no framework for showing how change at various sorts of margin affects costs. Most research initiatives have recognised that allocating or apportioning all costs to specialty at district level serves little useful purpose for operational planning.

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Attempts have been made to break up the costs using a variety of heads: "individual patient", "consumables", "resource area", "shared", "hotel", and "general overheads". Such divisions of costs, while pointing the way to the sort of analysis useful for costing operational plans, do not fully address the problem since it is not clear when such costs as "hotel" or "resource area" costs are affected by change. In a recent paper senior finance staff from West Midlands RHA state: "The greatest priority is therefore to develop the ability to cost developments and options (increases or reductions in services) with some reasonable accuracy. This is, of course, an exercise in marginal costing as the overheads to be included in any particular options will depend on the extent of change of volume and the particular local circumstances" (Taylor, Worsley:1981). Although the research in the NE District has by no means full resolved this problem, it has made some headway. The aim so far has been to show the costs which will definitely be affected by a certain change and which can reasonably be estimated. The costs included are not necessarily those which senior financial managers think ought to be saved or incurred. Staff costs in most service departments in most of the hospitals have been excluded from the model because of the uncertainty attached to any estimate of their variation given the bounds of change to be input to the model (see Chapter 7).

The structure of the costs was developed by identifying the types of planning decisions likely to be considered by the DMT through discussion with staff and the analysis of past decisions. Such decisions seemed concerned with facilities such as beds, theatres and wards rather than patient caseload. The cost implications of these likely changes were then explored to establish which costs are affected by which types of change. The investigation of how key costs vary revealed that some DMT decisions took the same form as changes which cause costs to vary. For

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The resource model emerged as a result of the integration of two strands of research:

- the identification of likely planning options to be considered by the DMT:
- a detailed investigation of fixed and variable costs.

In the final form of the model this fixed/variable cost analysis is overlaid by a framework of the sort of questions which the DMT is likely to ask, so that, for example, a manager can question the model about the effects of closing a ward for a while and reducing the caseload of a particular specialty. The model can accept such enquiries and can then relate them to the analysis of fixed and variable costs and can then produce a report to show which costs have been triggered. Revenue costs at present account for about 90% of NHS expenditure. While the importance of capital and its relationship to revenue planning is fully recognised, this research project is limited to an analysis of revenue costs only.

In the NE District there was also found to be an important relationship between service planning and the needs of the nurse training programmes. A simple model was developed which shows where there are likely to be problems given a variety of changes to the service or to the establishments of the nursing schools.

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In the NE District there was also found to be an important relationship between service planning and the needs of the nurse training programmes. A simple model was developed which shows where there are likely to be problems given a variety of changes to the service or to the establishments of the nursing schools.

The decision-support system comprises procedures for data collection and analysis, a database, and a deterministic computer model. The data cover facilities, patient activity, demand on service departments, the nurse training programmes, and costs. Most data are updated once a year, although cost data are revised every six months and patient activity data every quarter. The model is programmed in Fortran and is accessed in conversational mode at a terminal. The model provides " current state" information once the area for change has been specified by the user. Change can be made in many areas at quarterly intervals up to four years ahead. The deterministic model of hospital services cycles by quarter, incorporating change(s) planned for any quarter. The model testsplans for feasibility in terms of patient throughput and bed capacity before assessing the effects of a change on the rest of the system. These effects include demands on special units such as the ITU and the children's ward, and the consequences of change to surgical specialties on the theatres. The costs of a change are estimated using a detailed analysis of "fixed" and "variable" costs within the District. Finally the implications of service changes for the nurse training programme are explored.

Many options can be set for the output from the model so that only information relevant to the current problem is produced. The output shows when bed capacity constraints have been met, but mostly takes the form of activity or cost baselines with variances over time. The results from the model cover: patient activity and bed availability, use of service departments, a wide range of costs, and information about nurse training. There is no attempt to formulate policy or to identify the "best" planning option.

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The problems of the NHS are viewed in a broader context in a 1981 study. The authors comment: "the need to consider alternative plans is no important in the NHS than in other organisations, where equivalent levels of uncertainty arise in terms of supply, demand, and production. Yet the NHS seems reluctant to contemplate the problems of uncertainty in planning and little use is made of appropriate analytical techniques (financial modelling, operational research) for the investigation of alternative options" (Butts, Irving, Whitt:1981). The researcher agrees with such views and the decision-support system he has designed, developed and initially implemented is a specialised tool to enable senior managers in the NHS to carry out such an "investigation of alternative options". The model of the NE District can be used to explore quickly: optimistic, average and pessimistic views of the future. These might concern the beds required to accommodate planned caseloads or the staff needed to man the beds or how far the planned caseload is likely to materialise. Besides the investigation of the effects of different scale of change, the model can be used to assess the implications of phasing the implementation of plans or combinations of plans in a variety of ways up to four years ahead.

A modelling approach has been found useful in giving clear direction and purpose to the gathering of data and the analysis of relationships between parts of the health system. Only data directly relevant to the estimation of the effects of planning options have been collected. The approach in the NE District differs markedly from other research efforts in the range of non-financial elements considered and in the scale of the attempt to disentangle fixed and variable costs for various types and levels of change and to relate them to likely DMT operational planning decisions.

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6. INNOVATIVE ASPECTS OF THE SYSTEM

The system draws together elements of a health district important to operational planning. The tightening of resources available to the NHS has stimulated a number of initiatives to integrate information about services and resources, for example: the projects based on work by Magee and Osmolski, the CASPE studies, and the specialty costing system constructed at St Thomas's Hospital. These are discussed above in Chapter 5. Although the claim is often made that the results from such systems can be used for planning (both strategic and operational at different levels of the service) and budgeting, Chapter 5 discusses the difficulty of trying to meet a number of different demands for different types of information. The system designed and constructed in the NE District is only concerned with providing information for operational planning at district level. The research on the form and structure of the elements in the system is solely directed at a particular decision area at a particular level of management in the NHS.

a. Scope of the model

The model is not only about financial costs, but considers various kinds of resource constraints such as: bed capacity, theatre time, and the requirements of nurse training. None of the other published models draw together so many elements of a health district which are central to operational planning. Management has great difficulty in complicated organisations such as the NHS in assessing the likely ramifications of a change. The administrators are probably best placed to do this, but they do not usually have the appropriate training or experience. Managers and doctors can contribute much more to

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b. Analysis of fixed/variable costs

Fixed and variable costs within a health district have not been investigated before on the scale of the analysis supporting the NE District model. While particular areas have been analysed in the past, it is the breadth and depth of the research in the NE District which is different. Also no previous attempt has been made to link such a cost structure with the way in which senior management take operational planning decisions at district level. These decisions may involve changes over several years. In the NE District there was often great uncertainty over the way costs are likely to vary over time, especially if several changes take place at once.

c. Decision-support system

The result of the research is a decision-support system. It is most important for district managers to be able to make quick assessments of the feasibility, cost and other implications of options or combinations of options. This system gives management the opportunity to analyse different approaches rather than just to consider whether one option is worth implementing or not. Using the system also requires management to consider the assumptions they are making: all management reports begin with a series of assumptions on which the computer output is based. The development of an effective and durable decision-support system is likely crucially to depend upon considerable understanding of the good planning if they understand how their department fits into the overall structure of the district. Gaps in current planning logic have been exposed particularly by the linkage of the various parts of the system over simulated future years.

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CHAPTER SEVEN: STRUCTURE OF THE MAIN ELEMENTS OF THE SYSTEM

Chapter 6 gave a general picture of the decision - support system developed in the NE District, its main elements, and why such a modelling approach was adopted in preference to other OR techniques. In this chapter the relationships between the parts of the model are described and discussed.

1. FEASIBILITY AND BED CAPACITY

Management want to know which planning options are feasible. The model explores this question by checking the planned caseload against the planned facilities to identify whether any capacity constraints have been reached. As a patient passes through the hospital system he may use various facilities (see Figure 13) and may meet a capacity constraint at any one of them. There may, for example, not be a bed available on an adult ward or on the children's ward; there may be insufficient operating theatre time, or the ITU may be full.

The decision as to whether there are enough beds is complicated by the flexible system for accommodating patients at The Middlesex: most specialty bed allocations in this hospital are not rigidly observed. The specialty bed allocation is important in discussion of operational plans in the NE District, for example, this was often a point raised at meetings of the DMT Planning Group. However, consultants are aware that the allocation is little more than guidance: if possible, a patient will be admitted to one of the beds allocated to his consultant; but the general policy is not to turn patients away if there are empty beds available (with a pool of beds covering most consultants in the hospital). The model follows current practice: some specialty bed allocations are

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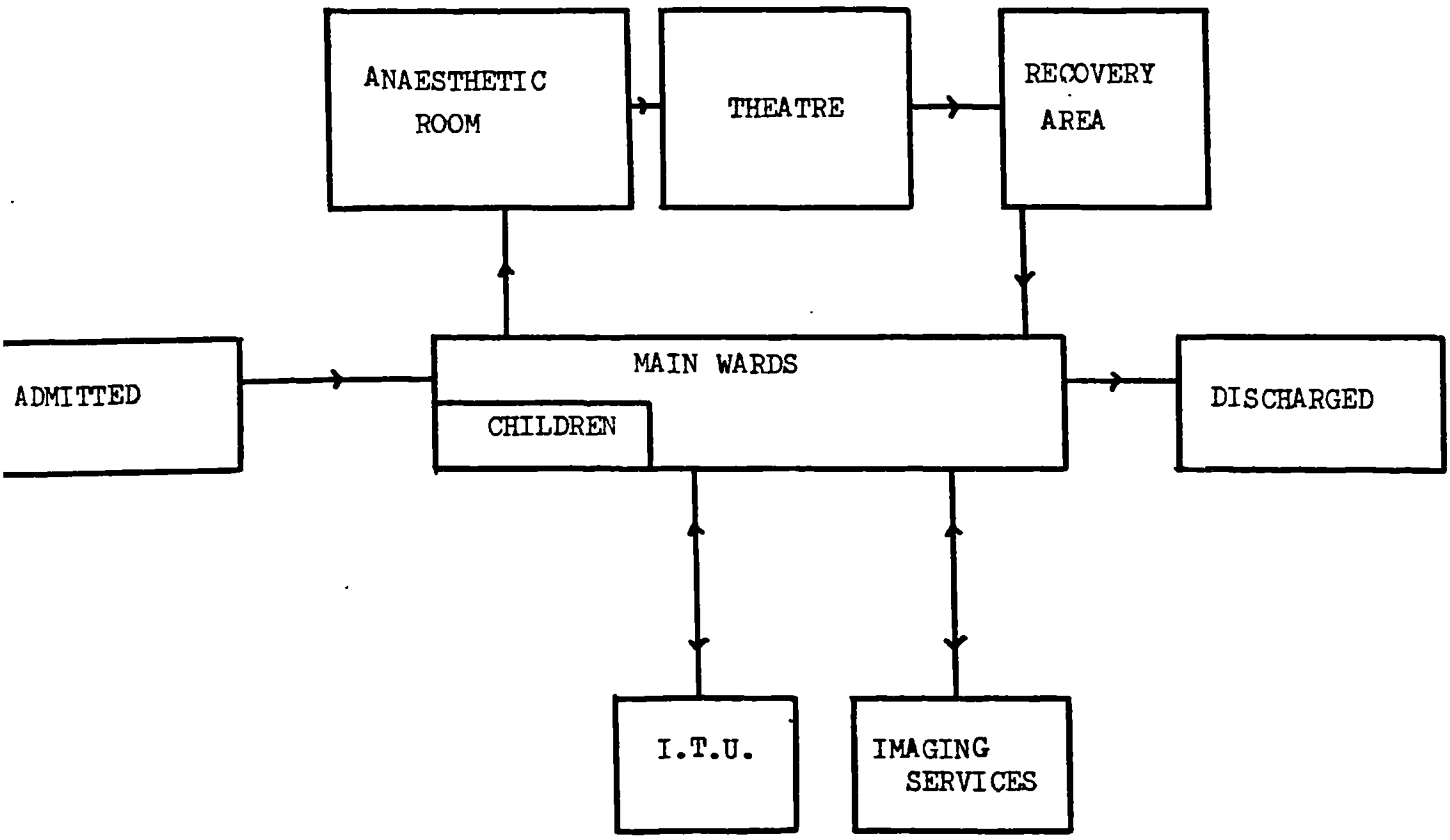
PATIENT FLOW

FOR

GENERAL SURGERY



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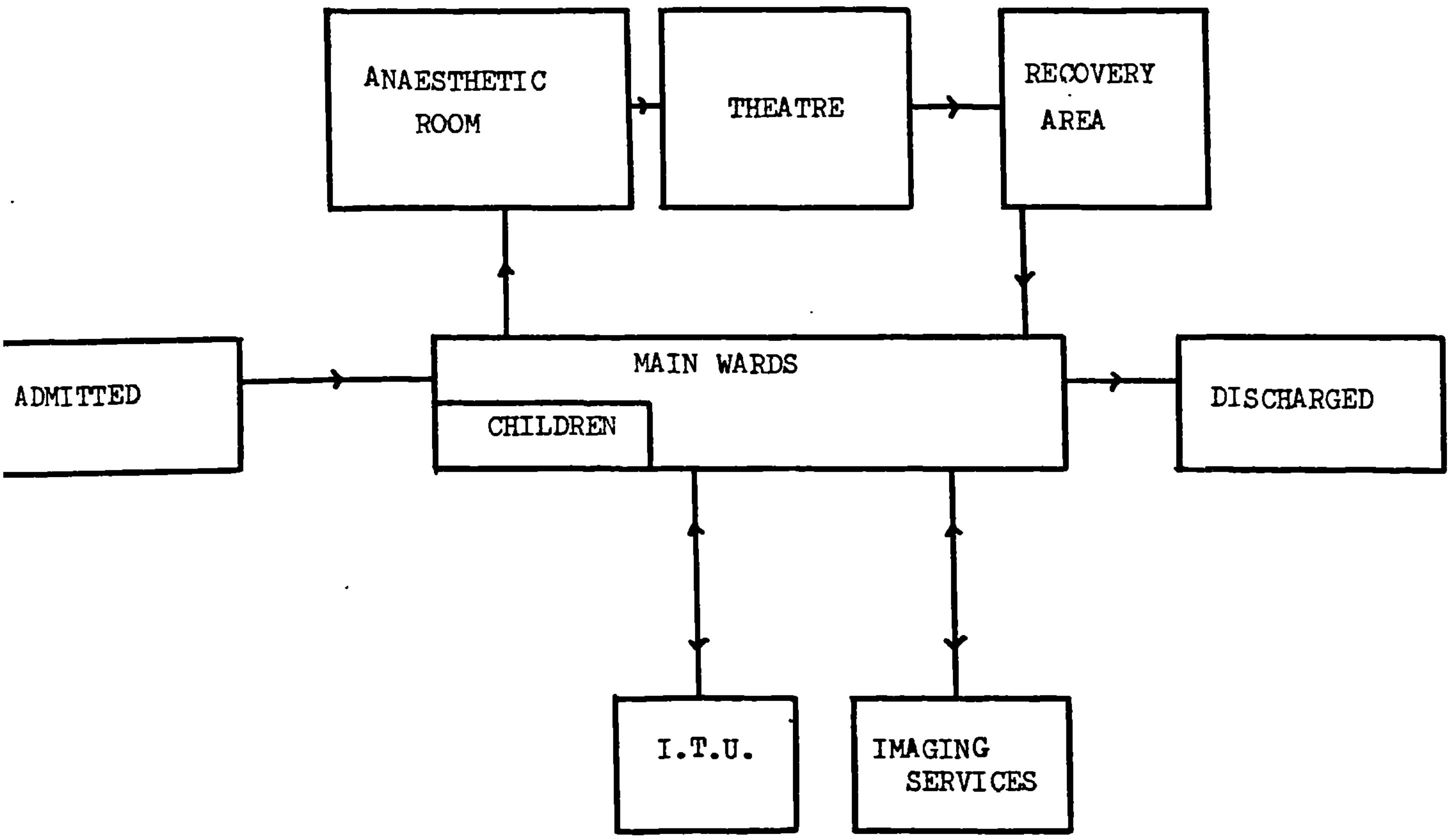

regarded as rigid, but most are not. Those individual specialty bed allocations which are modelled as genuine constraints on the caseload are: obstetrics, psychiatry, and the children's ward at The Middlesex; geriatrics and psycho-geriatrics separately at Athlone House; and the various psychiatric sub-specialties at St Luke's Hospital. If there are no allocated beds available for these patients, they cannot be transferred to other wards, so they are refused admission.

To apply the bed constraint requires a view on the likely maximum average bed occupancy rates, or the average period for a bed to remain unoccupied, for the various parts of the hospital. The specification of the maximum rates of bed occupancy necessitates value judgments on future trends and must be set by the user of the model. Such rates can be set for the following parts of the following hospitals:

The Middlesex:	main bed pool	
	obstetrics	
	acute psychiatry	
	children's ward	
	ITU	
Soho Hospital:	bed pool	
Athlone House:	geriatrics	) same maximum rate of bed
	psycho-geriatrics	) occupancy for each specialt
St Luke's Hospital:	acute psychiatry	)
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Given these bed capacity constraints, the model works by summing the occupied bed-days required by all the specialties in the pool each quarter: specialty caseload x average length of stay. If this exceeds the occupied bed-days available (beds in pool x maximum average % occupancy x days in quarter), then the caseloads of up to three specialties in the pool specified by the user are reduced. If more than one specialty has been named for reduction, then a patient from each specialty is lost in turn. If all these specialties have been emptied and there are still insufficient bed-days, then the model aborts the run. If the bed-days available to obstetrics or acute psychiatry at The Middlesex are exceeded then the planned caseload of the specialty is reduced.

Many specialties provide treatment for children: indeed most children are admitted by a consultant other than a paediatrician. It is inappropriate for children to stay in the main adult wards: they require a ward of their own with specially trained staff (ENT surgery is something of an exception: so many children are admitted by this specialty that some stay in a special part of a main ENT surgery ward). The children's ward provides a service for many of the specialties in the hospital and therefore demands on this ward need to be considered in connection with changes made to more specialties than just paediatrics. The model estimates the bed-days likely to be required by each specialty and in total on the children's ward each quarter: specialty caseload x the proportion of the specialty caseload currently admitted to the children's ward x the average length of stay of children in that specialty. It is assumed that the demand on the children's ward by specialty, if the caseload of the specialty changes, varies by the same proportion. If the bed-days required on the children's ward exceed those available, then the caseloads of up to three specialties set by the user are cut.

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There are nine beds in the ITU with a very high ratio of trained nurses per bed (approximately four). The ITU has a similar function to the children's ward in that patients from many specialties are admitted to it for special care. An important difference, however, is that while a patient is in the ITU a bed is reserved for him on a main ward. The model estimates the likely demand for bed-days in the ITU in a way very similar to that for the children's ward, and then tests whether there is sufficient capacity. If the constraint is broken, it is assumed that these very ill patients will be cared for on an ordinary ward, but the number (by specialty) of those refused admission to the ITU is printed out.

The radiotherapy department was also considered for inclusion as providing a service for other specialties, on the recommendation of a consultant. The researcher directed a special 3 month study of the department (Atkinson: 1980). This research found that while patients admitted by consultants of other specialties were treated in the radiotherapy department, the numbers were too small to warrant inclusion in a model for corporate planning. So radiotherapy is included as a hospital specialty, but not as a service department. Most of the beds at Soho Hospital are allocated to gynaecology with a few for radiotherapy; they form a bed pool. All the patients are female. The model sums the occupied bed-days required by both specialties each quarter and if the bed constraint is broken the patients of both specialties are reduced. The specialties at Athlone House and St Luke's Hospital, however, are analysed independently. There is a separate bed constraint for each specialty because, for example, patients under the specialty of behaviour therapy cannot be accommodated on the same ward as psychogeriatrics. If the caseload planned for any of these specialties requires more occupied bed-days than are available, then the number of patients to be treated by that specialty is cut.

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The health services provided in the hospitals of the NE District formed a complicated system. Even a relatively minor change, such as a moderate expansion in the caseload of a specialty, could have had implications for many parts of the system. For example, if an increase in orthopaedic surgery cases were feasible in terms of beds in the main wards and the special units, the extra cases: would place demands on the diagnostic services such as imaging and pathology, would require more theatre time, and perhaps more theatre staff, more drugs and instruments, and if beds were re-allocated could affect the nurse training programme. There might be similar implications in reverse for any specialties which had to be cut to make way for the expansion of orthopaedic surgery. The model explores the effects which seem important for operational planning. The effects of change on some parts of the service are not shown in terms of cost, but in terms of time or the changed distribution of staff in training or by comments: the non-cost implications of planning options.

2. COST IMPLICATIONS OF PLANNING OPTIONS

The estimation of the cost implications of a planning option is based on a detailed analysis of the changes which cause costs to vary in the NE District. Figure 14 shows the first page of a large file covering all the heads of annual revenue expenditure in the District. Each head is considered to be either fixed or variable, the type and scale of change which causes the cost to vary is shown, and finally the sort of output produced by the model. So, for example, in the Medical and Surgical Supplies and Equipment (MSSE) Account (A/C) all the spending on dressings is thought to be variable (£85,208), and to vary with the in-patient cases or outpatient attendances by specialty. This effect is

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N.E. DISTRICT MODEL (REAL211FIXVAR)

FINANCIAL YEAR 1980/81

ANALYSIS OF THE FIXED AND VARIABLE COSTS

(GIVEN THE BOUNDS TO CHANGE IN THE MODEL)

MIDDLESEX HOSPITAL

EXPENDITURE HEADING	TYPE OF EXPENDITURE: FIXED	TYPE OF EXPENDITURE: VARIABLE	LEVEL AND NATURE OF CHANGE WHICH CAUSE COSTS TO VARY OR COMMENTS TO BE GENERATED	NATURE OF OUTPUT
MEDICAL STAFF A/C				
INPATIENTS		1644039	+/- INPATIENT SPEC.	COST
OUTPATIENTS		1221059	+/- OUTPATIENT SPEC.	COST
TRAVEL+SUBSISTENCE	15620		****	****
NURSING STAFF A/C				
NURSING OFFICERS	179800		****	****
OTHER NURSING STAFF		3460649	+/- WARD OR DEPT.	COST
			+/- OPERATING SESS.	COST
STAFF IN TRAINING	2607235		+/- WARD OR DEPT. USED FOR TRAINING	COMMENT
TRAVEL+SUBS.+CREDITS	9347		****	****
MSSE A/C				
MSSE (IC)		300836	+/- IP OR OP BY SPEC.	COST
MSSE (DSO)	20853		****	****
MSSE (DWO)	62249		****	****
PATIENTS APPLS. (IC)		149592	+/- IP OR OP BY SPEC.	COST
PATIENTS APPLS. (OFF)		107079	+/- IP OR OP BY SPEC.	COST
MEDICAL GASES		24897	+/- IP BY SPEC.	COST
DRESSINGS		85208	+/- IP OR OP BY SPEC.	COST
CSSD (STAFF)	122698		****	****
CSSD (MATERIALS)		91387	+/- IP OR OP BY SPEC.	COST
SURGICAL GLOVES		38496	+/- IP BY SPEC.	COST
PHARMACY A/C				
STAFF,TRAVEL,INSTRS.	213169		****	****
DRUGS		889966	+/- IP OR OP BY SPEC.	COST
MISC. DIR. TREAT. A/C				

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N.E. DISTRICT MODEL (REAL211FIXVAR)

FINANCIAL YEAR 1980/81

ANALYSIS OF THE FIXED AND VARIABLE COSTS

(GIVEN THE BOUNDS TO CHANGE IN THE MODEL)

MIDDLESEX HOSPITAL

EXPENDITURE HEADING	TYPE OF EXPENDITURE		LEVEL AND NATURE OF CHANGE WHICH CAUSE COSTS TO VARY OR COMMENTS TO BE GENERATED	NATURE OF OUTPUT
	FIXED	VARIABLE		
MEDICAL STAFF A/C				
INPATIENTS		1644039	+/- INPATIENT SPEC.	COST
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NURSING STAFF A/C				
NURSING OFFICERS	179800		****	****
OTHER NURSING STAFF		3460649	+/- WARD OR DEPT.	COST
			+/- OPERATING SESS.	COST
STAFF IN TRAINING	2607235		+/- WARD OR DEPT. USED FOR TRAINING	COMMENT
TRAVEL+SUBS.+CREDITS	9347		****	****
MSSE A/C				
MSSE (IC)		300836	+/- IP OR OP BY SPEC.	COST
MSSE (DSO)	20853		****	****
MSSE (DWO)	62249		****	****
PATIENTS APPLS. (IC)		149592	+/- IP OR OP BY SPEC.	COST
PATIENTS APPLS. (OFF)		107079	+/- IP OR OP BY SPEC.	COST
MEDICAL GASES		24897	+/- IP BY SPEC.	COST
DRESSINGS		85208	+/- IP OR OP BY SPEC.	COST
CSSD (STAFF)	122698		****	****
CSSD (MATERIALS)		91387	+/- IP OR OP BY SPEC.	COST
SURGICAL GLOVES		38496	+/- IP BY SPEC.	COST
PHARMACY A/C				
STAFF,TRAVEL,INSTRS.	213169		****	****
DRUGS		889966	+/- IP OR OP BY SPEC.	COST
MISC. DIR. TREAT. A/C				

reported by the decision-support system as a cost. Although all fixed costs could vary provided that big enough changes were made, it is not worth attempting to assess the effects of all possible changes to the hospital services of the NE District. Reasonable bounds were drawn to the scale of change for which the model is designed to show the implications. These limits reflect the opinion of senior staff about the greatest changes likely to occur in the hospitals of the NE District in the foreseeable future. It became clear early in the research that questioning staff about the effects of changes which they think most unlikely in practice, simply produces wild answers and may prejudice serious answers to enquiries about likely changes. No bounds were set to changes in the specialty mix at any hospital, and it is certainly possible that if sufficient change of that type took place, then some of the costs treated as fixed would vary.

In order to understand which changes generate which costs it is necessary to find out how resources, both materials and staff, are consumed or organised in hospitals. Figure 15 shows a simplified pattern of the use of resources at The Middlesex by inpatients. The names in the boxes at the bottom of the diagram, for example "Drugs", represent heads of costs which are thought to vary with changes in patient numbers (or occupied bed-days). The diagram shows in what way resources are used. For example, drugs are supplied to wards, the ITU, and the theatres as stock drugs and they are also supplied to individuals by prescription. The resources used by the imaging services on the other hand are always consumed directly by individual patients. The diagram also shows the resources associated with facilities: for example, nurses, domestics, and estate management inputs (such as heating and electricity) are linked with wards.

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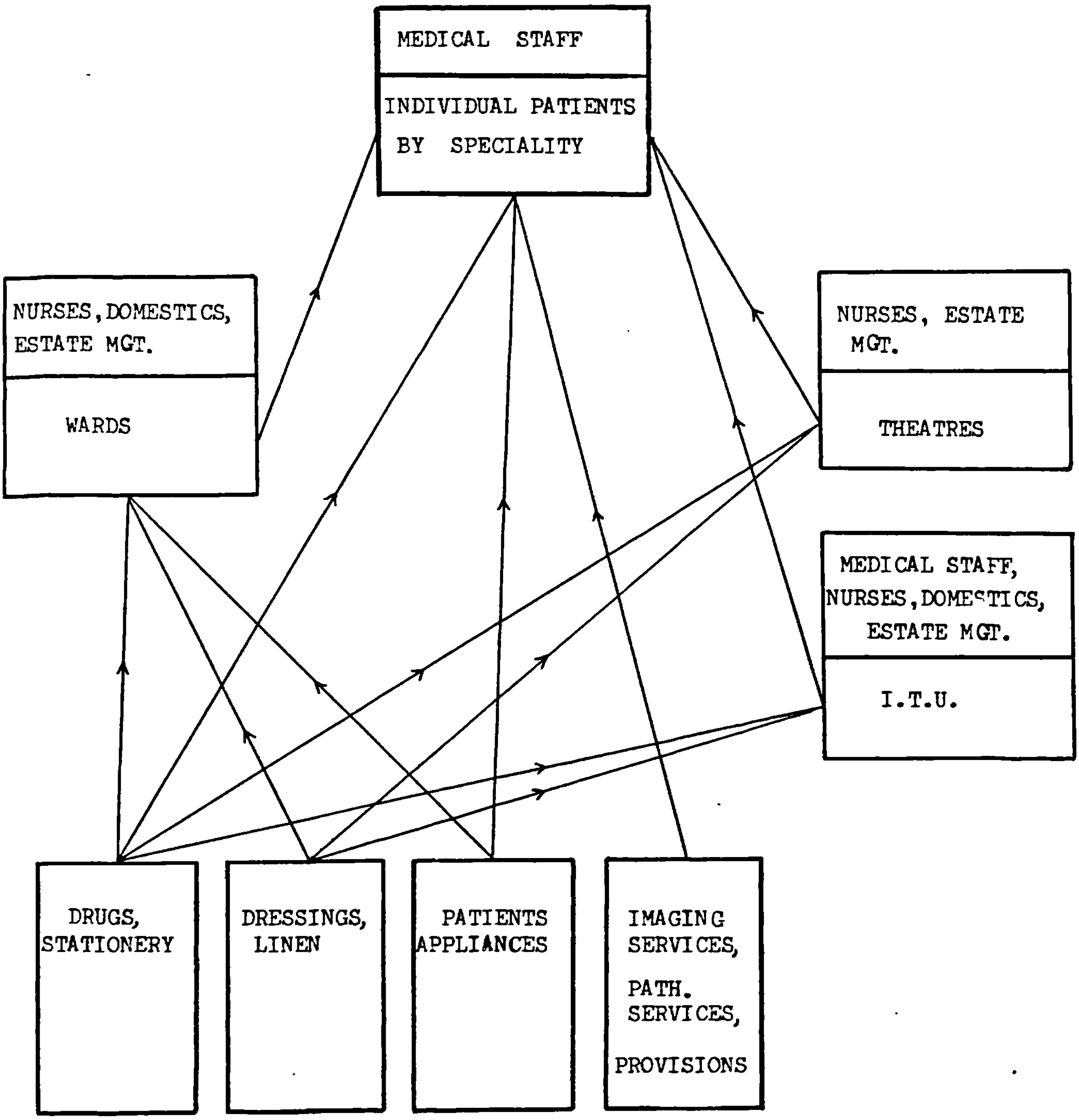
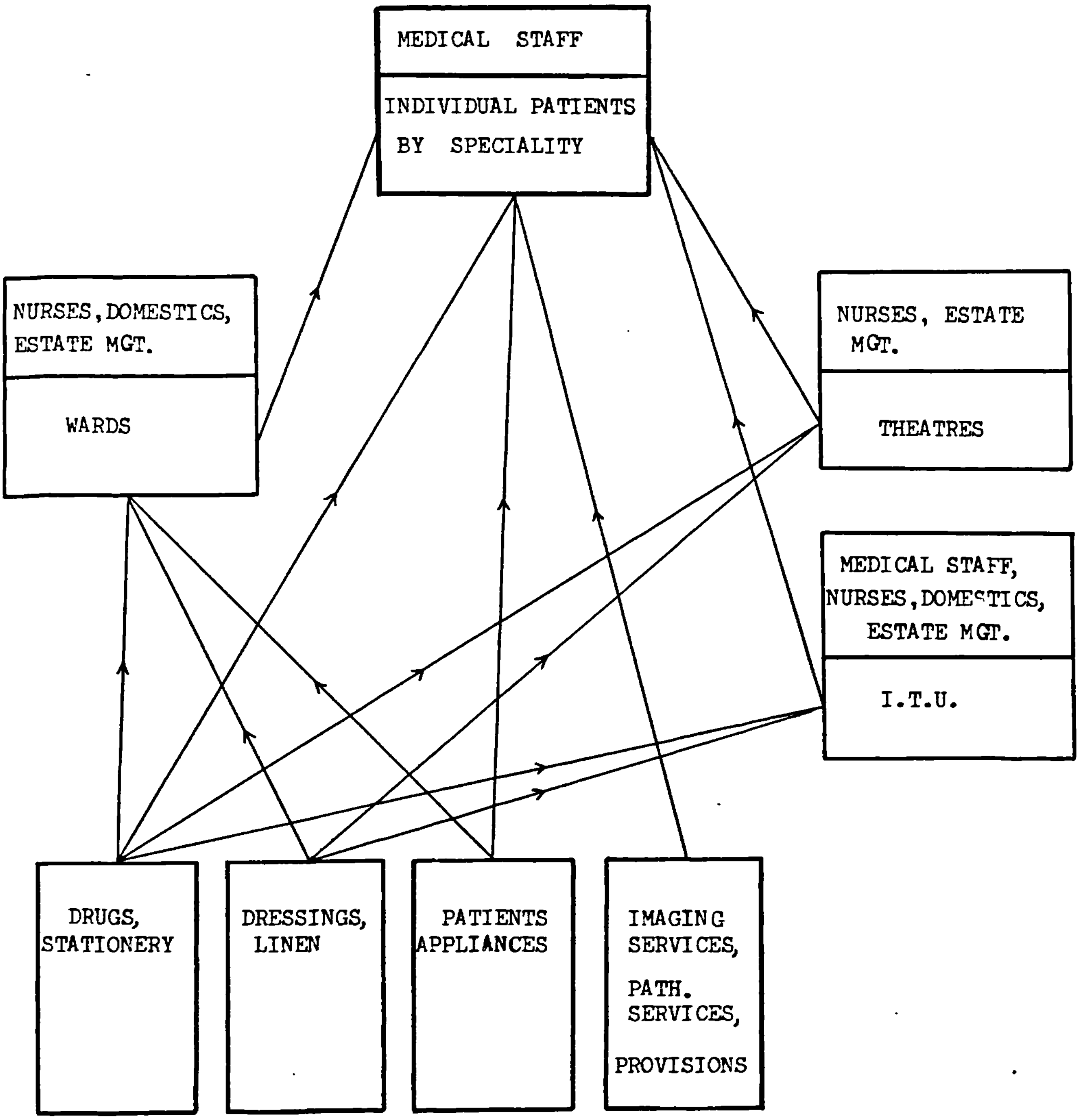
RESOURCES USED BY INPATIENTS

AT THE MIDDLESEX



RESOURCES USED BY INPATIENTS

AT THE MIDDLESEX



Given bounds to possible changes and a pattern of resource use, the next step is to identify the changes which cause different costs to vary (see Figure 16). No attempt has been made to include all the revenue costs of the NE District in the model (see Figure 14). The emphasis is on the identification of "key" variable costs: the costs important to operational planning.

FIGURE 16

N.E. DISTRICT MODEL

CHANGES WHICH TRIGGER COSTS

± IN-PATIENT DAY AND CASE BY SPECIALTY

± OUT-PATIENT ATTENDANCE BY SPECIALTY

± WARD

± FLOOR (2 WARDS)

± OPERATING SESSION

± THEATRE

± SPECIALTY

± HOSPITAL

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Figure 17 shows these costs in detail. Such costs are associated by the model with likely changes to be made by the DMT, as described in Chapter 6:5. As a plan is implemented cost "steps" occur as fixed costs become variable. An example of such sharp changes in costs is shown in Figure 18. The gentle slope represents the decrease in "patient variable" costs as the number of patients decline. The drop in costs on the closure of a theatre is, for example, accounted for by savings from the electricity costs of air-conditioning which are high. Each group of variable costs is considered in turn below.

a. <u>Costs which vary with inpatient days and cases, and outpatient attendances</u>

Many more departments than those shown in Figure 17 could have been included in this part of the analysis. The more important areas had to be separated from the rest, given the very limited staff time available to collect and analyse the data. On the advice of the senior management accountant at The Middlesex, the criterion used to decide which departments to include in the model was: if the consumables' cost of a department was less than £20,000 (about 0.05 per cent of the revenue expenditure of the District) during the financial year 1978-79 (the latest accounts available at the start of the research) and these costs were not generated by the patients in a very few specialties, then that department was excluded from the costing analysis. For example, the haematology and histopathology departments were excluded on these grounds after initial investigation.

As this model is based on specialties (see Chapter 6:4), the costs generated by marginal changes in patients by specialty ("patient variable" costs) are estimated. The costs for specialties with the same name in different hospitals are estimated separately on the advice of doctors

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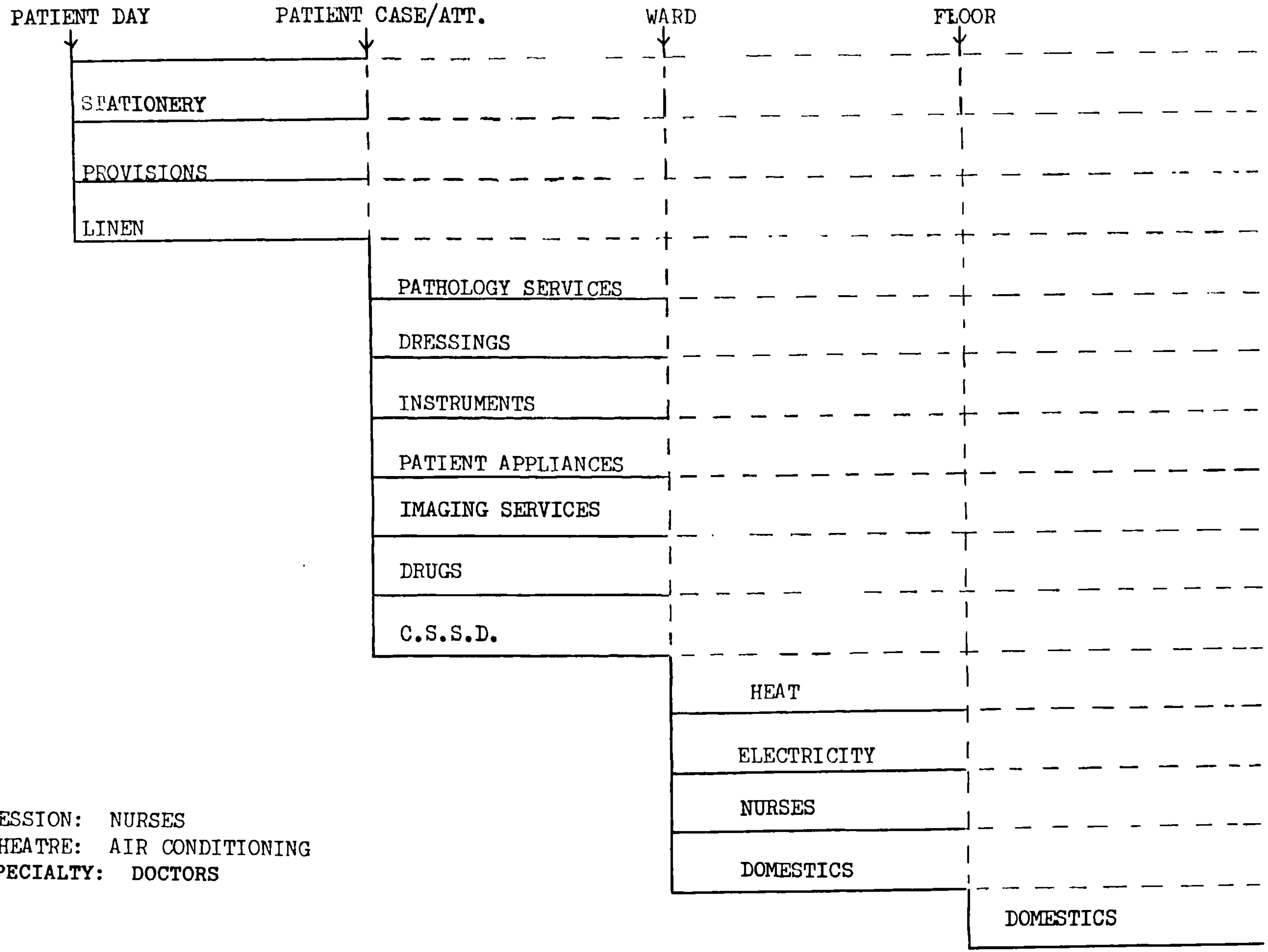
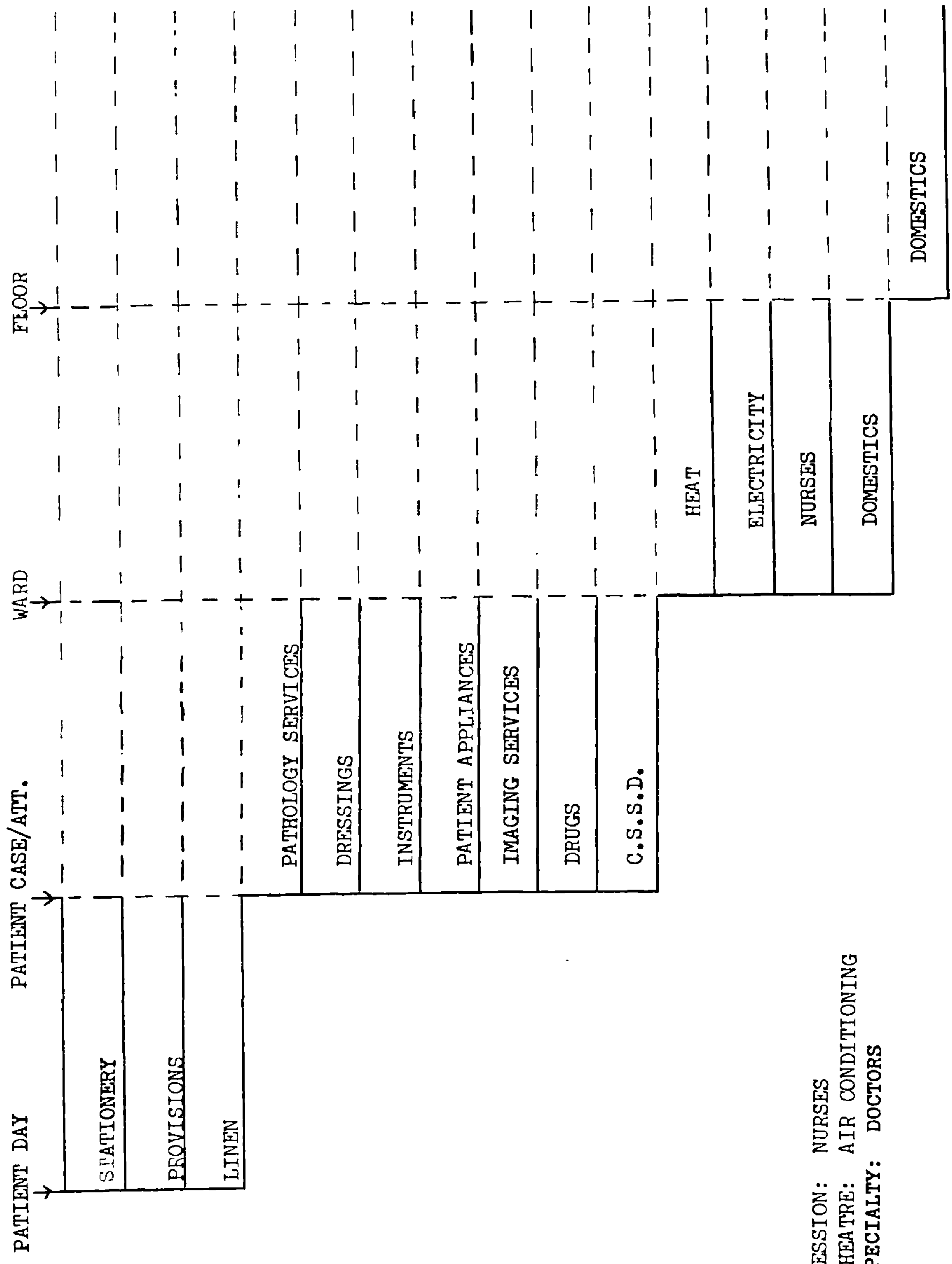
VARIABLE COSTS



OPERATING SESSION: NURSES
" THEATRE: AIR CONDITIONING
SPECIALTY: DOCTORS

VARIABLE COSTS



OPERATING SESSION: NURSES
" THEATRE: AIR CONDITIONING
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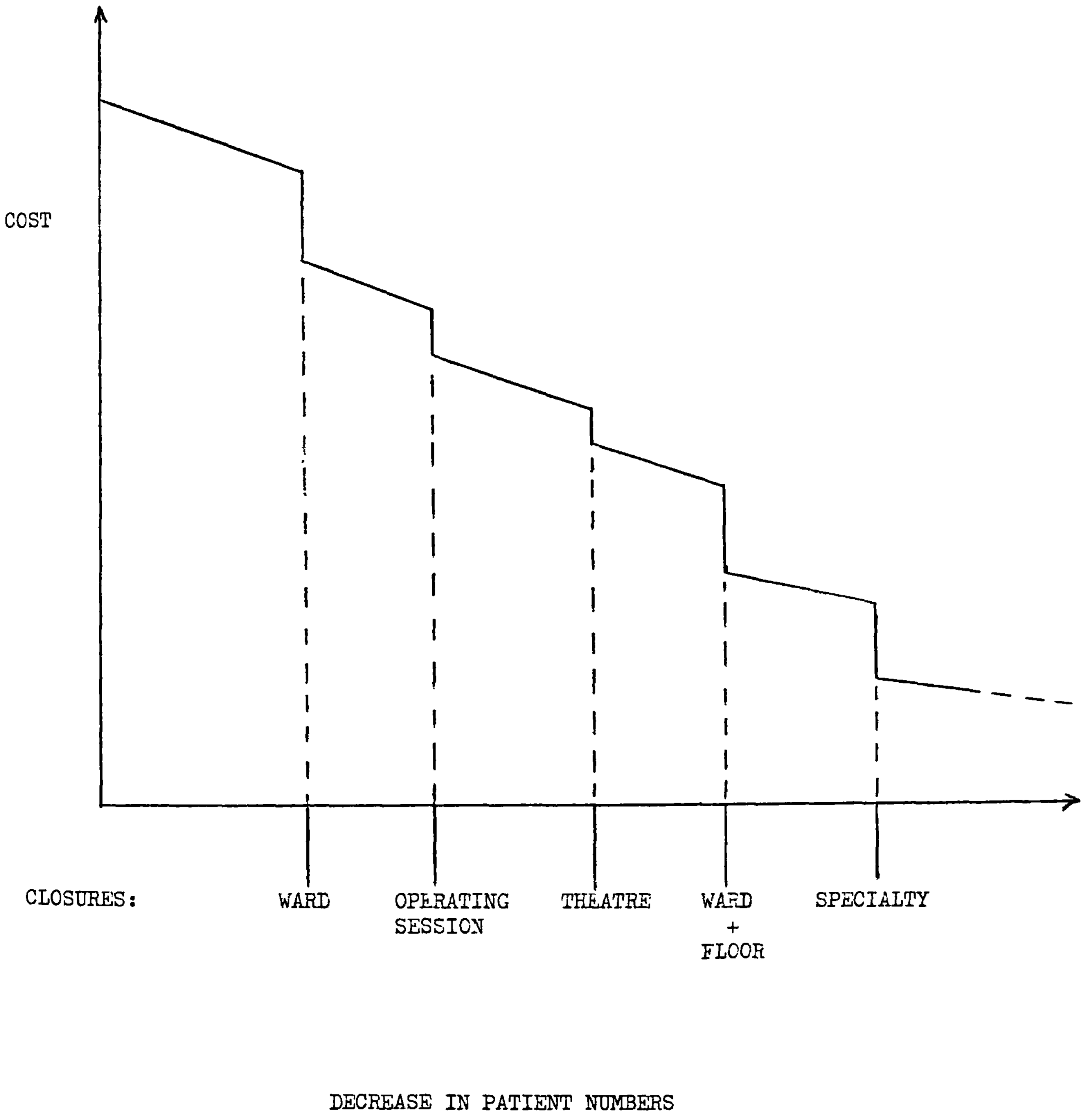
N.E. DISTRICT MODEL

FIXED/VARIABLE COST "STEPS"



N.E. DISTRICT MODEL

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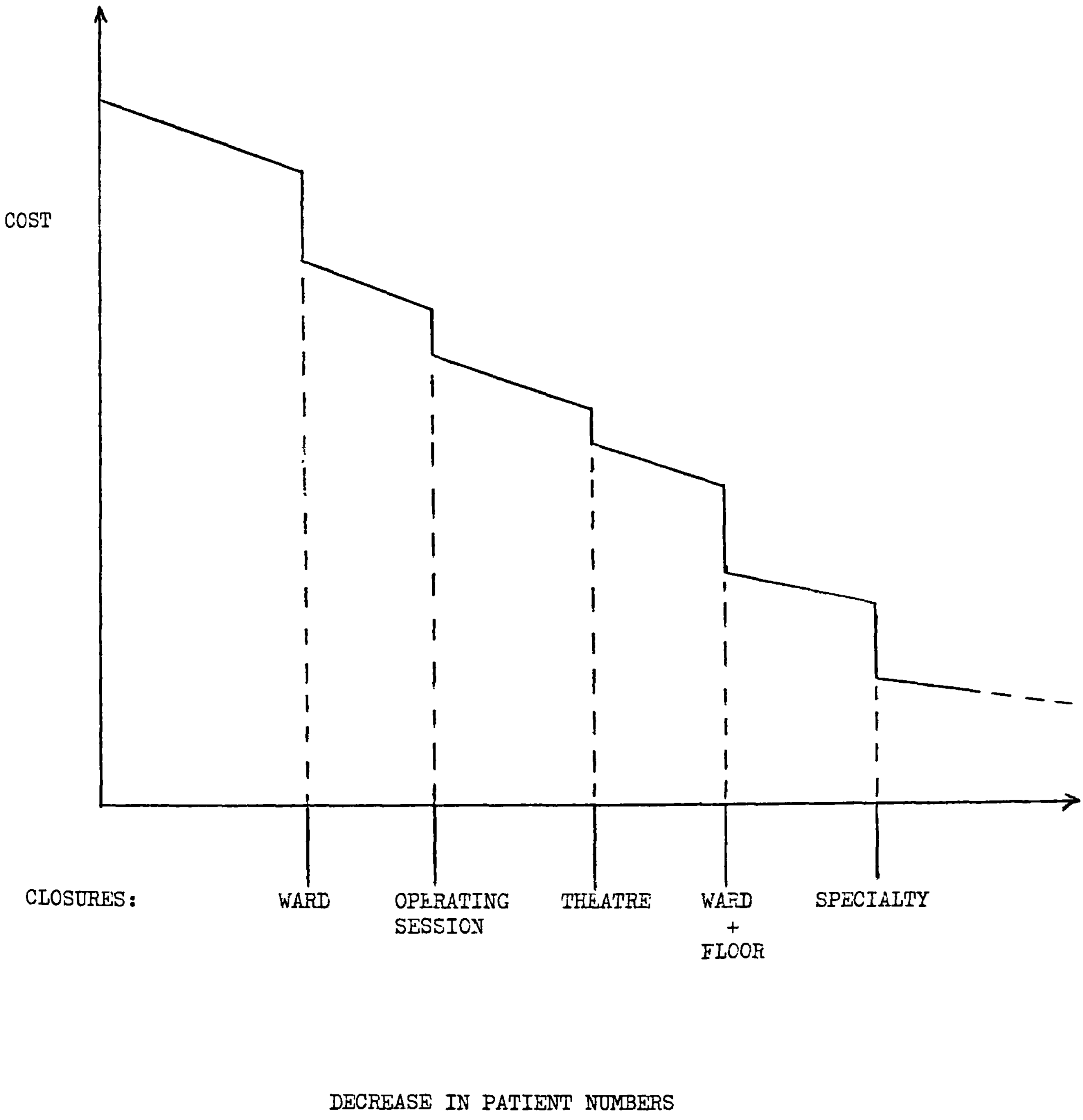

and nursing officers, since the case-mix may differ considerably between hospitals. Some "inpatient variable" costs are assumed to be generated evenly over the period a patient stays in hospital and are little affected by the type of treatment the patient is receiving. These costs, covering provisions, linen and stationery, are regarded as "inpatient day variable" costs and are the same for all specialties in each hospital. So, should the average length of stay for a specialty change, and no other change occur, then the provisions, linen and stationery would vary in the model, but none other. Some "inpatient variable" costs are assumed to be generated unevenly over a patient's stay in hospital, for example, the costs in the diagnostic departments and operating theatres which are largely incurred during the first few days a patient spends in hospital. It seems that length of stay has relatively little effect on such costs which may differ markedly between specialties. These costs are considered "inpatient case variable" costs and are estimated separately for each specialty in each hospital. A consultant advised on whether a cost is better considered "day" or "case" variable. This distinction between "day" and "case" variable costs is useful and important for most specialties, although for some costs of some specialties, such as drugs for geriatrics, it is unclear into which category they fall.

The costs generated by outpatients are included as "attendance variable" by specialty. No distinction is made between new and old attendances on the grounds of the practicality of data collection and the questionable usefulness of the results. Day cases (excluding those seen in the Gastro-Intestinal Unit: their specialised treatment makes the assumption unrealistic) are assumed to have the same costs as outpatient attendances. This is mainly because of: difficulties with the definition of a day case, the small number of and nursing officers, since the case-mix may differ considerably between hospitals. Some "inpatient variable" costs are assumed to be generated evenly over the period a patient stays in hospital and are little affected by the type of treatment the patient is receiving. These costs, covering provisions, linen and stationery, are regarded as "inpatient day variable" costs and are the same for all specialties in each hospital. So, should the average length of stay for a specialty change, and no other change occur, then the provisions, linen and stationery would vary in the model, but none other. Some "inpatient variable" costs are assumed to be generated unevenly over a patient's stay in hospital, for example, the costs in the diagnostic departments and operating theatres which are largely incurred during the first few days a patient spends in hospital. It seems that length of stay has relatively little effect on such costs which may differ markedly between specialties. These costs are considered "inpatient case variable" costs and are estimated separately for each specialty in each hospital. A consultant advised on whether a cost is better considered "day" or "case" variable. This distinction between "day" and "case" variable costs is useful and important for most specialties, although for some costs of some specialties, such as drugs for geriatrics, it is unclear into which category they fall.

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All staff costs in the following departments are thought to be fixed given the current bounds of the model: pharmacy, imaging services, pathology services, instrument store, supplies department, patients' appliances office, catering department, linen department, CSSD. This assumption was made after much discussion with senior staff in these service and supply departments. It is very difficult to find out what causes the numbers of staff in service and supply departments to change or what should cause them to change. These decisions would necessarily be subject to negotiation. The head of a large department estimated that the workload of the department might increase by 50 per cent and no extra staff might be required, provided greater delays in the provision of service were acceptable to clinicians. It is very hard to model this acceptable waiting time: different times will be acceptable to different doctors. The clearest answer came from the manager of the CSSD who said that if two hours more work per week were generated he would require an extra specialties with significant numbers of day cases, the likely scale of costs involved, and problems of data collection. The cost of the Gastro-Intestinal Unit day cases and psychiatric and geriatric day patients are not included in the model at all at present. In general, a day patient is one who attends regularly for care or treatment, whereas a day case is a person who attends for a particular treatment or operation on a single day. The costs and other characteristics of these forms of treatment and care are important to the DMT because they may offer genuine and cheaper alternatives to expensive inpatient care. It is hoped that progress will be made with the analysis of these options in the next phase of the research programme (see Chapter 11:2).

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b. "Ward variable" costs

"Ward variable" costs are those which are likely to change with opening or closing a ward. In the current version of the model, and in line with advice from doctors and senior nurses, changes to the number of beds on a ward or the allocation of the beds to specialty do not affect these costs. Most of the wards at The Middlesex have the same establishment although there is considerable variation in the number of beds on particular wards. Nursing management aim to provide safe cover for a ward and, with some exceptions, the number of beds and the type of patient has little effect on the number and mix of trained and learner nurses assigned to a ward (this may be partly due to the generally high level of staffing by ward at The Middlesex).

Nurses: Hospital nurses below the level of nursing officer are organised by ward or department. Each ward has an establishment of trained and untrained staff: at The Middlesex, for example, typically one sister and three staff nurses. In addition to trained nurses, a ward at The Middlesex expects to receive about ten learners, but there member of staff. In the future it is hoped that the model will show the likely workload to be generated in the service departments as the result of changed patient activity (see Chapter 11.2). Perhaps the DHSS "points" system will be used in the X-ray department (DHSS:1973) and the "Canadian Units" system in pathology (DHSS:1978:3). However, it is unlikely that an attempt will be made to predict likely changes in staff costs. Present system documentation covers methods of data collection, forms used, the assumptions underlying the analysis of each department and general notes to be read before using any procedure.

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If a ward is opened or closed the model assumes that the change in staff costs, which exclude learners and usually only involve a small number of nurses, will occur immediately. During the research project a more detailed approach to "ward variable" nursing costs was developed. The aim was to predict how the costs would be likely to run down after a closure. However, many contentious assumptions were necessary, especially about how and when the system would return to normal. The full savings are made when the number of staff vacancies returns to what it was before the closure, assuming that the number of vacancies by grade is always about the same with occasional (and perhaps seasonal) peaks and troughs. For example, there are usually, say, ten vacancies for a certain grade of nurse in a hospital, a ward is closed and two nurses of this grade are transferred. As a result there are only eight vacancies for a while. During that period the expenditure on that grade of staff will remain the same as before, although the budget may have been reduced following the ward closure. The real savings will only materialise in full when the number of vacancies returns to normal, about ten. It was thought may be considerable variation over time. Many operational planning decisions concern: opening or closing a ward, change to the allocation of beds by specialty on a ward, or the alteration of the ward nursing establishment. The nursing grades included in the model are: sister/charge nurse, staff nurse/senior enrolled nurse, enrolled nurse, learner, and untrained nurse. Senior enrolled nurses are linked with staff nurses because most receive the same salary as a staff nurse.

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Should a ward be opened it is assumed that staff will be employed from the date of opening. This was thought reasonable by nursing officers because the recruitment of nurses was not a problem generally in the NE District, apart from the large psychiatric hospitals. If a ward is closed, whether temporarily or permanently, the staff are assumed to transfer or leave. If in fact they do leave at once then the savings predicted by the model are made immediately. If they transfer it is more complicated. If there were more vacancies than usual at the appropriate grades at the time of closure so the staff could be absorbed immediately, with about the normal vacancies remaining, then the savings would be realised at once. This situation is quite likely to arise because positions are often held open on other wards for staff who are leaving a ward which is closing. If there were about the usual number of vacancies at the time of closure then the turn-over rate would dictate the timing of the actual savings. Nurses cannot usually transfer from general wards to the theatres, the ITU, or psychiatric wards. Most grades of staff, however, can be transferred between as well as within hospitals, but they may resist moving to another hospital and they may be unwilling to work at night or with private patients. These are just over 300 staff nurses at The Middlesex, Soho Hospital and Athlone House. The turn-over rate is high since about 25 new staff join every eight weeks as each set of learners completes it training. This means that savings on staff nurse costs are likely to be made very quickly. The better at this stage of the research programme to retain the more simple model.

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To sum up, if a ward is closed and the number of vacancies is still about average after the change has taken place, then the cost of all of the establishment of that ward is an immediate saving. If the number of vacancies always remains less than prior to the closure, then the full cost of the ward establishment is never saved. So, the accuracy of the approach adopted depends on how quickly the number of vacancies for nurses returns to normal. Given the scale of the likely changes, involving perhaps half a dozen staff out of several hundred, it seems reasonable to think, as the project steering group did, that the model gives a sufficiently accurate picture for operational planning purposes.

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Current practice in the District in costing planning options involving changes in wards usually implicitly makes the same assumptions as those of the model described above for all nurses except learners. Reports also sometimes include learners as "ward variable" costs. Such reports make the assumption that the savings associated with learner nurses from a ward closure are realised through the use of fewer agency staff on the wards to which the learners transfer. Agency staff are only employed in considerable numbers on the main Middlesex wards at night when the hospital is mainly staffed by learners. There are usually two learners on each ward at The Middlesex at night, making a total of about 70 learners on duty. There are also night sisters. About 20 agency staff are employed on the general wards at night. If a ward is closed the learners can only be transferred to a similar ward where they might be used to reduce the need for agency staff, so the effect on agency staff costs is likely to be small and probably considerably less than the cost of maintaining two learners on a ward every night. It is very difficult to quantify the relationship between the movement of learners and the costs of agency staff for inclusion in the model. The senior nursing officers with whom the research student has spoken believe that, while minor agency staff savings may result from the redeployment of learners, they have been over-estimated in the past. Senior financial managers now accept that the approach adopted to learners in the model is more realistic. The model uses data on "establishment" rather than "staff in post" and, on the advice of senior staff, assumes that agency and overtime costs are balanced by savings from under-staffing. Trained night nursing staff are not modelled

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Domestics: All wards have an establishment of one or two domestics. If a ward is opened or closed these staff costs are modelled as being immediately affected. The approach adopted and the reasoning behind it are the same as for the trained nurses.

Estate management: Staff costs - All the senior staff in the works department of the NE District thought that given the bounds to changes which may be input to the model all building and engineering staff costs would remain fixed. The research student was told that there is always maintenance work to do and that even with six wards closed at The Middlesex (the bound to such change) there would be no reduction in staff.

Estate management: Materials' costs - These costs are generated by engineers and building staff. Given the bounds to the model, no changes are envisaged in the number of staff and amount of work done, and therefore the costs of materials are assumed to be fixed.

at The Middlesex and Soho Hospital as "ward variable" costs, except in some specialist units such as the ITU, because most night sisters (the bulk of trained night nursing staff on general wards) cover about six wards each. At Athlone House and St Luke's Hospital night staff are associated with particular wards and so are considered part of the establishments of those wards. The model recognises that night staff and nurses working on psychiatric and geriatric wards are paid at a higher rate (except in specialist units at The Middlesex: an omission currently being rectified).

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Estate management: Materials' costs - These costs are generated by engineers and building staff. Given the bounds to the model, no changes are envisaged in the number of staff and amount of work done, and therefore the costs of materials are assumed to be fixed.

Estate management: Energy and utility costs - Some of these costs, such as those of gas and water, are thought by the works department staff to change with the opening and closure of wards, but are too small to justify detailed analysis. Other costs which vary likewise, such as those of electricity and fuel oil for heating and domestic hot water, are significant and are included in the model as "ward" and "theatre variable" costs again on the advice of senior staff in the works department. The small seasonal variation in electricity costs is ignored by the model, but the considerable variation in the consumption of fuel oil is included: during the summer there are no heating costs and the costs of domestic hot water are estimated to be a third less than in the winter. Senior engineers in the various hospitals in the NE District carried out special studies on particular wards at the request of the research student to identify the consumption of electricity and fuel oil (or lbs of steam) at a level which could be related to decisions about wards and theatres. The results are shown in Figure 19.

The district works officer considered electricity costs to be related to ward floor area. The wards at The Middlesex are grouped by five sizes and the electricity costs derived by finding the ratio of the floor area of a ward in each group to that of the sample ward and multiplying the result by the electricity cost of the sample ward. The costs from The Middlesex are also applied to Athlone House and Soho Hospital.

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ESTIMATED CONSUMPTION OF FUEL AND ELECTRICITY BY TYPICAL WARDS/BLOCKS

	ST LUKE'S Cambridge and Overstone Wards Combined	THE MIDDLESEX HOSPITAL Cavendish Bentinck and Holmes Sellors Wards combined	BANSTEAD HOSPITAL Block G (3 Wards)	HORTON HOSPITAL Sersale House	HORTON HOSPITAL Wards F and R combined
AVERAGE MONTHLY ELECTRICAL CONSUMPTION	3,353 KW	1,550 KW	4,968 KW	624 KW	1,146 KW
AVERAGE WINTER MONTHLY HEATING AND DHW LOAD (SIX MONTHS OCTOBER - MARCH INCLUSIVE)	6,939 litres of 35 sec. fuel oil	---	697,968 lbs. of steam	443,402 lbs. of steam	132,900 lbs. of steam
AVERAGE SUMMER MONTHLY DHW LOAD (SIX MONTHS APRIL - SEPTEMBER INCLUSIVE)	993 of 35 sec. fuel oil	---	99,708 lbs. of steam	87,320 lbs. of steam	36,300 lbs. of steam

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The domestic hot water costs for a ward at The Middlesex do not appear in Figure 19 because of an understandable, but unfortunate, omission by the engineers in the original sampling. These costs were estimated separately by the district engineer. The wards at Soho Hospital are assumed in the model to consume about the same amount of domestic hot water as the wards in the main wings at The Middlesex.

Ward heating costs at The Middlesex and Soho Hospital are not considered "ward variable" because of the physical structure of these hospitals. The Middlesex comprises three blocks of wards with seven floors and one block with five floors. If a ward is closed and the temperature reduced to the level needed to preserve the fabric of the ward, then the wards above and below it must be heated more to make up for the heat which they derived from the ward now closed. The district works officer thought this would mean that the savings on fuel oil from the closure of a ward at The Middlesex would be negligible. All the wards at Soho Hospital form a single block and similar arguments to those for The Middlesex apply. For Athlone House and St Luke's Hospital, the cost of winter domestic hot water is subtracted from the overall winter cost of heating and domestic hot water to derive the heating cost by ward. On the advice of the district works officer the cost of heating a ward is assumed to be proportional to its cubic capacity, and using this relationship the costs of those wards for which no information is available are estimated. The costs from St Luke's Hospital are used to estimate those at Athlone House. Most of the wards at these two hospitals

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c. "Floor variable" costs

A floor comprises two wards on the same level at The Middlesex or Soho Hospital. Domestic staff are shared between wards on the same floor. If one ward on the floor is closed the floor domestic staff work on the ward which remains open: floor domestic staff costs are only saved if both wards are closed.

d. "Operating session variable" costs*

Theatre nursing costs largely vary with change to the number of operating sessions. The senior nursing officer for the theatres at The Middlesex constructs the nursing establishment of the theatres by an analysis of the staff required to man each session. A session for almost all the surgical specialties requires one sister, one staff nurse and a learner. More staff are needed for: cardiac surgery, and for those sessions taking place in isolated theatres, where extra staff cannot quickly be called from other theatres if they are needed. Information on staff by grade by session was not readily available. A change of one or two sessions may involve fractions of staff. Part-time staff costs are realistic because the theatres use many agency staff who do not have to work full-time.

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e. "Theatre variable" costs*

These costs are those necessarily incurred by having a theatre open, regardless of the type or number of operations performed in it. The only important cost identified so far is that of air-conditioning. The systems in the various theatres have different costs because some are switched to half-power at night. Some of the systems supply air to more than one theatre and so both must be closed if savings are to be made. The model does not cover these complications yet.

f. "Specialty variable" costs*

All medical staff costs are considered fixed until patients in the specialty to which they belong are no longer treated at a hospital. In practice, should the caseload of a specialty be considerably increased or reduced, then the medical staff posts within that specialty might well alter. However, in the view of senior staff and consultants it is difficult to predict changes to the number of doctors by grade by specialty. This important area of variable cost may be re-explored later in the research programme. The strength of the model lies in its direct approach which has been accepted by staff, including doctors, on the subjects included, because the methods adopted can be justified. There is currently no straightforward way of extending the model to cover medical staffing and to attempt to do so runs the risk of destroying people's trust in the rest of the model.

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3. NON-COST IMPLICATIONS OF PLANNING OPTIONS

a. Operating theatre time

There are nine theatres and eleven surgical specialties at The Middlesex and one theatre for gynaecology at Soho Hospital. This is a very difficult area for the analysis of the consequences of planning options involving one or more surgical specialties. The constraints on the number of operations which can be performed are not clear, nor are the most useful measures of activity in the theatres easily identified. Patient time in the theatre could be used, or this time with the time to prepare the theatre and clear up afterwards added on. Some progress has been made with these difficulties.

If the caseload of a surgical specialty is changed the effect on the theatres is shown in terms of patient time in the anaesthetic room before the operation, in the theatre itself, and in the recovery area after the operation. Some patients go directly to the ITU rather than the recovery area after the operation. Demand on the theatres ought to be measured in terms of patient time in theatre plus the theatre time required before and after the operation takes place, Unfortunately only patient time can be derived, and this with considerable difficulty, from the current recording systems. It is necessary to link data from the operations books attached to each theatre with the records held in the recovery area. These data are sometime illegible, incomplete or inconsistent and a nurse is required to identify the operations being analysed. Even if the likely period between operations could be found for a major and minor case in each of the surgical specialties, it would still not be possible to show whether the planned caseload would break

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Patient time is also used to show the consequences of a plan for the anaesthetic rooms and recovery areas. While a patient is in the anaesthetic room he or she is attended by one nurse. A theatre nursing officer provides estimates of both the staff and patient time for a major and a minor case by specialty in the anaesthetic room. Such times cannot be derived from the theatre data recording systems. One nurse may look after several patients in the recovery area. This is a large room in the main theatre suite which serves all the four theatres on that floor. The time the constraint of available session time for a particular specialty, because of the scheduling problem: how well can the operations of varying length be fitted into the theatre time available to each specialty? It seems unlikely that patient time in the theatre, plus an allowance for inactivity between operations, would ever fit very closely with the session time. The modelling of such a problem is thought quite beyond the scope of a district operational planning model. Also, while an operating session in the model is considered to last for four hours, this period might be overrun by surgeons in a specialty with a very heavy caseload. Sessions might simply be extended into the evenings or take place at weekends. The implications of planned changes to surgical specialties for the theatres can be shown in different ways, such as the patient time in theatre or the overall time, and different constraints can be recognised such as session time available to a particular specialty or to all specialties. On balance, the research student thought it best to include patient time in theatre in the current model to indicate the likely scale of the effects of a change on the theatres. No constraints are recognised and patient time is not related to staff costs.

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b. Miscellaneous service departments*

For some service departments the materials' costs are too low to justify detailed investigation and the effects of planned changes in patient activity on the staff costs are difficult, if not impossible, to model. These departments are included in the model, with comments rather than costs being generated if such a department is likely to be affected by a plan. So if the number of inpatients or out-patients treated by a particular specialty changes then the model scans to see if any of the following departments may be affected: electrocardiography, audiology, optical services, psychology, occupational therapy, speech therapy, physiotherapy, electroencephalography or medical physics. For example, the workload of

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c. Nurse training

Operational planning decisions may have important consequences for the nurse training schools in the District. These provide both general training and several specialised courses. There were about 600 nurses in training in the NE District. The learners follow a strict pattern of training, which must be approved by the General Nursing Council. Most wards are designated for a particular type of training, for example the care of general medical or geriatric patients, but some wards may be used for either medical or surgical training. Some wards are not used for training at all.

Learners play a crucial role as ward staff in all hospitals in the District during the day, and at night The Middlesex and Soho Hospital are almost entirely manned by learner nurses supplemented by agency staff. Very few untrained nursing assistants are used at either of these hospitals, but they are employed extensively in the other hospitals in the District. If a ward is closed, either temporarily or permanently, another ward must be found where the learners can receive similar experience. There is a limit, however, to the number of learners who may work on a ward; for most wards at The Middlesex it is sixteen. If the learners cannot be transferred, either the number of learners in the nursing school must be reduced or the learners must spend part of their training outside the NE District. Until recently some learners went to the Hospital for Sick Children in Great Ormond Street for the paediatric the physiotherapists is likely to be affected by a rise or fall in the outpatients or inpatients in the following specialties: orthopaedics, rheumatology, geriatrics, neurology, neurosurgery, or cardio-thoracic surgery.

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The model calculates the average number of learners at the nursing schools of The Middlesex and St Luke's Hospital who require training on particular types of ward or in the theatres or in the community. The number of weeks spent at each stage of training is divided by the number of weeks in the whole course, and the result is multiplied by the learner establishment of the nursing school. The learners expected to be working on particular wards, the ward "establishments", used for each type of training are summed. The "maximum" learners by phase of training are calculated in similar fashion. Exception reporting is used to show the effects on nurse training: if the average number of learners who need a certain type of experience falls between the "establishment" and the "maximum" learners then no output is produced; if the average is below the "establishment" or above the "maximum" then the extent to which these bounds are broken forms part of the output. However, if there are problems with the medical, or surgical stages of training, then the model checks through the wards which may fall in either category. If the training role of such a ward can be changed without detriment to the other type of training, and will result in a more even distribution of learners, then the place of the ward in the pattern of training is altered.

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CHAPTER EIGHT: DATA COLLECTION; METHODS, LIMITATIONS AND VALIDITY

Given the problems with the current NHS information systems described in Chapter 4:4, and especially the fragmentation of the patient activity and finance systems, it is important that a clear account of the sources or bases of estimation of the data is available. The documentation of the system provides this. Figure 20 shows the first page of a file covering all the data used by the model. All data are identified by their datafile, column in that file, and section(s) in the column; and are described with their sources, and any methods of estimation used, and the date on which the data was last updated is shown. All the detailed procedures for data collection and analysis with their assumptions and appropriate forms are available. An annual timetable for data collection and analysis has been constructed. The costs of collecting, processing and checking the data have been balanced against the likely benefits for corporate planning. However, if problems with the data are discovered, because they are all derived locally, the methods of collection and analysis can be altered to meet the difficulty. This is demonstrated by a series of modifications found necessary and described in this chapter. For example, patient activity data were originally taken from the previous financial year, but this was replaced by an annual moving average updated each quarter. Also an unsuccessful attempt was made to identify the resources used by particular patients by examining their medical records. It was also found necessary to group the tests performed in the pathology laboratory in various ways to allow practical sampling. Perhaps the most important modification to data collection and analysis methods was the decision (in the light of an early trial) to sample specialty costs on an annual rather than a quarterly basis. All these changes are further explained below.

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FIGURE 20

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THE BLOOMSBURY MODEL (REAL123 : SOURCES)

SOURCES OF THE DATA

DESCRIPTION OF DATA	COLUMN CODE	SECTIONS OF COL.	LAST UPDATE	MAIN SOURCES OF DATA
		FILE S1		
AVERAGE NHS INPATIENT CASES PER QUARTER BY SPECIALTY.	IPAT	ALL(EXCL. 27,28,29, 30,31,38)	1.6.82	INPATIENT CASES FROM MONTHLY STATISTICS FOR PREVIOUS YEAR/4
AVERAGE NHS OCCUPIED BED-DAYS PER QUARTER BY SPECIALTY.	IPAT	27,28	1.6.82	OCCUPIED BED-DAYS BY SPECIALTY FROM SHQ'S FOR PREVIOUS YEAR/4
AVERAGE NHS OCCUPIED BED-DAYS PER QUARTER	IPAT	29,30, 31,38	1.6.82	ADMINISTRATOR AT ST. LUKE'S, WOODSIDE
BEDS ALLOCATED TO SPECIALTY.	BED	ALL	1.6.82	DISTRICT INFORMATION OFFICER
AVERAGE NHS LENGTH OF STAY BY SPECIALTY.	STAY	ALL(EXCL. 27,28,29, 30,31,38)	1.6.82	OCCUPIED BED-DAYS BY SPECIALTY FROM MONTHLY PATIENT STATISTICS FOR PREVIOUS YEAR/INPATIENT CASES FROM SAME SOURCE
-	STAY	27,28,29, 30,31,38.	-	-
AVERAGE OUTPATIENT ATTENDANCES PER QUARTER BY SPECIALTY.	OUTPAT	ALL	1.6.82	OUTPATIENT ATTENDANCES FROM SHQ'S FOR PREVIOUS YEAR (PLUS THE RADIOTHERAPY TREATMENT ATTENDANCES FROM THE CLOSEST CALENDAR YEAR)/4
PROPORTION OF INPATIENT CASES BY SPECIALTY WHO NEED TO ENTER THE ITU.	ITUPR	ALL	1.6.82	ADMISSIONS BY SPECIALTY TO ITU DURING PREVIOUS FINANCIAL YEAR FROM THE RECORD BOOK IN THE ITU
AVERAGE LENGTH OF STAY BY SPECIALTY IN ITU	ITUS	ALL	1.6.82	DATES OF ADMISSION/ DISCHARGE BY SPECIALTY TO/FROM THE ITU DURING THE PREVIOUS FINANCIAL

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THE BLOOMSBURY MODEL (REAL123 : SOURCES)

SOURCES OF THE DATA

DESCRIPTION OF DATA	COLUMN CODE	SECTIONS OF COL.	LAST UPDATE	MAIN SOURCES OF DATA
FILE S1				
AVERAGE NHS INPATIENT CASES PER QUARTER BY SPECIALTY.	IPAT	ALL(EXCL. 27,28,29, 30,31,38)	1.6.82	INPATIENT CASES FROM MONTHLY STATISTICS FOR PREVIOUS YEAR/4
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BEDS ALLOCATED TO SPECIALTY.	BED	ALL	1.6.82	DISTRICT INFORMATION OFFICER
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PROPORTION OF INPATIENT CASES BY SPECIALTY WHO NEED TO ENTER THE ITU.	ITUPR	ALL	1.6.82	ADMISSIONS BY SPECIALTY TO ITU DURING PREVIOUS FINANCIAL YEAR FROM THE RECORD BOOK IN THE ITU
AVERAGE LENGTH OF STAY BY SPECIALTY IN ITU	ITUS	ALL	1.6.82	DATES OF ADMISSION/ DISCHARGE BY SPECIALTY TO/FROM THE ITU DURING THE PREVIOUS FINANCIAL

A recent survey of over 200 applications of computer simulation to health care problems found that very few were "successful" and tried to discover why. The author comments:

"Many health simulation papers are not greatly concerned with data, so little information is generally given on the data collection methods employed. This very lack of interest suggests a lack of effort in that direction. This appears to be another significant difference between the 16 ("successful") studies considered here and other health simulation work. Eleven of the projects give details of data collection and not one ignores it as a part of the total simulation study" (Tunnicliffe Wilson:1981).

The collection and analysis of data with limited resources, and the documentation of the procedures used, has been considered a high priority by the research student.

1. PATIENT ACTIVITY DATA

The data about inpatient cases or days, length of stay and outpatient attendances were originally updated each year, being averages over the quarters of the previous financial year. However, this was found to produce unsatisfactory base data because of the variations in specialty and total caseload from one year to the next. If an annual average is used, it is almost certain that some facilities will have been opened or closed during that time which will affect the average caseload of particular specialties. For example during the financial year 1980-81 there were two wards closed at The Middlesex for six months which led to a reduction in the number of patients treated. On the other hand any seasonal factors will have been balanced out. If a shorter period, perhaps a quarter, is used then it may be possible to ensure that all

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The specialty bed allocations are updated every six months, or more frequently if a major change occurs, and are, or have become, accurate. The proportion of patients treated in a specialty who are admitted to the ITU or the children's ward, and their length of stay in either unit, are updated using an annual survey (these data are not thought to vary greatly with the overall specialty throughput).

The paediatric data relate only to those children admitted by a paediatrician, except for paediatric beds which include all the beds on the children's ward.

For the specialties at Athlone House and St Luke's Hospital there are no inpatient cases, only inpatient occupied bed-days, because of the very long average lengths of stay in these psychiatric and geriatric specialties. Such lengths of stay make planning by caseload impractical. Also, since the simulation model cycles by quarter the results would be distorted for specialties with average lengths of stay of over 90 days.

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2. INPATIENT AND OUTPATIENT VARIABLE SPECIALTY COSTS

"Patient variable" specialty costs are currently estimated by sampling in service and supply departments once a year, with an update using the health services prices index after six months. At the beginning of the research an attempt was made to use the information held in the patients' records department to identify what resources particular patients in particular specialties had used. Such resources could then have been costed to produce a specialty cost per case. The consultant paediatrician who advised the researcher warned that this approach might encounter problems with the records being incomplete or illegible. Nevertheless the researcher spent several days trying to get the data he required from the patients' files, but found that the problems predicted by the consultant were insurmountable and so the approach was abandoned. The method finally adopted is thought to make best use of current information systems to give results which are accurate enough for operational planning at low cost. Various methods of estimating the costs are used, ranging from sampling costs during a particular week in great detail to broader surveys of costs for the year. Figure 20 shows the first page of a file containing summaries of these methods. The procedure chosen largely depends on the information currently produced in the service or supply department. These procedures are frequently updated as data recording systems change.

Some of the sampling and cost estimation methods were originally tested during the quarter of January to March 1980. A full costing exercise was mounted during the quarter of April to June 1980. At that time the intention was to produce "key" variable cost estimates each quarter. It soon became apparent, however, that this is not practicable. The demands of the data analysis and costing would require the research student to work virtually full-time on this alone and would have placed unacceptable demands on the staff of the

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Each department in which "patient variable" costs are generated is considered in turn below. The specialty costing methods are briefly described; Figure 21 shows the most commonly used of these methods.

a. Drugs:

Inpatients - Drug costs on wards are generated by inpatients through the consumption of prescribed drugs, ward stock, and controlled drugs.

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a. <u>Drugs</u>:

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SUMMARY OF METHODS USED TO DERIVE SPECIALTY COSTS

1. Cost per inpatient case or outpatient attendance

	Period of sample/ survey	Cost heads	Method of Analysis
A	week	drugs chemical pathology* bacteriology ultra sound* general x-ray	Identify and cost the resources used by each specialty for inpatients and outpatients separately during the sample week. Divide these costs by the occupied bed-days or outpatient attendances by specialty during the sample week. Multiply these costs by the occupied bed-days or outpatient attendances by specialty during the financial year. Multiply the ward costs by the number of weeks in the year. Use method E to apportion any ward costs to specialty. Use method F to derive an estimated specialty cost per case and per outpatient attendance.
B	month	dressings patients' appliances	Identify and cost the resources used by each specialty for inpatients and outpatients separately during the sample month. Multiply these costs by number of the months in the year. Use method E to apportion any ward costs to specialty. Use method F to derive an estimated specialty cost per case and per outpatient attendance.
C	quarter	cardiac catheterisation nuclear medicine James Pringle House lab. FP10 prescriptions linen	Same method as B, but read quarter for month. A cost per specialty occupied bed-day is calculated for linen.
D	year	virology CSSD CT Scanner instruments	Identify and cost the resources used by each specialty for inpatients and outpatients separately. Use method E to apportion ward costs to specialty. Use method F to derive an estimated specialty cost per case and per outpatient attendance.
E	-	-	Apportion the annual ward costs to specialty using the proportions of ward admissions by specialty.
F	-	-	Sum all the annual specialty cost estimates for each department and divide this total by the actual cost of the department. Multiply the result by each specialty cost so that all the specialty costs sum to the actual total. Divide each of the adjusted specialty costs by the number of cases or attendances for that specialty during the financial year to derive a specialty cost per case and per attendance.

*This method is not followed exactly for this department.

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2. Cost per occupied bed-day

	Period of sample/ survey	Cost heads	Method of Analysis
G	-	provisions stationery	Divide the annual cost for a hospital by the total occupied bed-days in that hospital during the financial year to derive a cost per occupied bed-day. This cost is available directly for provisions. Multiply the cost per occupied bed-day by the average length of stay for each specialty to derive the specialty cost per inpatient case.

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All inpatient prescriptions are costed to specialty, and all stock and controlled drugs to ward. These costs are estimated by sampling over a week, which is thought to be the longest practical period. The district pharmacist thought that the stock and controlled drugs ordered during a particular week should not be closely linked with the patient activity of that week: the costs of these drugs during the sample week are multiplied by the number of weeks in the year to produce annual estimates. Cost analysis method A is used (see Figure 21) to construct estimates of prescription costs by specialty and to apportion ward stock and controlled drugs to specialties. Approximately 8,000 prescriptions and 100 order sheets for stock drugs are costed during a sample week.

Inpatients generate drug and gas costs in the operating threatres. The drugs used during a typical major operation for each surgical specialty were identified by a theatre nurse (see example in Appendix 4). Obstetrics and oral surgery are exceptions in that only one operation for each was investigated on the advice of senior nursing staff. These resources used are costed each year and the results multiplied by the proportions of major and minor operations in each specialty and by the number of operations by specialty during the year to produce a theatre drug cost by specialty for the year. Theatre gas costs are apportioned by patient time in theatre by specialty. The time for a typical major and minor operation by specialty has been derived from sampling in the theatres (see Chapter 7:3:a). These items are multiplied by the proportion of major and minor operations in each specialty and by the total operations by each specialty during the year. The times for all specialties are aggregated. The theatre time of each specialty is divided by the total and proportions which result are used to apportion the annual theatre gas cost specialty. All drugs used by the imaging services are analysed under that head (see Chapter 8:2:b).

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Outpatients consume drugs directly through prescriptions. All outpatient prescriptions and clinic requisitions are costed by specialty during a sample week. Cost analysis methods A and C are used.

b. Imaging services

Imaging services cover the X-ray, ultra-sound, CT scanner, and nuclear medicine departments. The analyses of inpatient and outpatient specialty costs are not separated for any of the following service or supply departments because the two types of patient are treated in very similar fashion.

X-ray - The resources consumed during each main X-ray procedure were identified by a special study. There are 102 such procedures using about 80 resources. These procedures are costed each year over the following heads: films, drugs, instruments and CSSD supplies. During a sample week the X-ray procedures demanded by each specialty are costed. Cost analysis method A is used for the main procedures and method C for the specialised cardiology procedures.

Ultra-sound - The scans are divided into two types and the variable cost of each is estimated by a doctor in the department. During a sample week the demand for each procedure is recorded and costed. A cost per occupied bed-day by specialty during the sample week is calculated. Unfortunately there is no annual control total of the cost of resources used in the ultra-sound department, so at present the unadjusted estimates are included in the database. Few specialties use the ultra-sound department, however, and the variable costs per case or attendance are very low, so at the moment the lack of an annual cost does not seem too serious a problem.

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CT scanner - Body and head scans are costed over the following areas of expenditure: films, drugs, tapes and maintenance. The costs of maintenance are regarded as variable because they depend on hours of use. Some scans are recorded by specialty and some by type of scan over the financial year. On the advice of the senior radiographer in the CT scanner department the scans recorded by specialty are split by type, and the scans recorded by type are split by specialty. The body and head scans for the year for each specialty are multiplied by their respective costs and hence annual specialty costs derived. The estimated sum of each type of cost is divided by the actual cost and the result multiplied by each specialty estimate to ensure that the specialty estimates sum to the actual total.

Nuclear medicine - During a sample quarter the scans performed for each inpatient and outpatient specialty are recorded. The scans which make use of three types of high-cost radio-isotope are costed individually to specialty. The costs of films, low-cost radio-isotopes and other minor consumables for the quarter are apportioned by unweighted scan to specialty. The specialty costs for the quarter are added up and the total multiplied by four to derive an estimate for the year. This total is divided by the actual cost available from the Middlesex Hospital Medical School finance office and the result used to adjust the specialty estimates so that they sum to the actual total. Nuclear medicine (and pathology) services are provided for the Middlesex Hospital by the Middlesex Hospital Medical School by contract. The financial year of the Medical School runs from August to July to fit with the academic year. This means that parts of the costs of two financial years must be used to derive a cost for the April to March

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c. Pathology services

Chemical pathology - The requests submitted by specialty are sampled for a week. A program performs this task on a mini-computer in the pathology department. Requests rather than tests are analysed because workload is recorded on the computer in terms of requests. The number and type of tests called for by a request may vary considerably, but the cost of the more detailed analysis by test was thought by senior staff in the department not to be justified by the potentially more accurate specialty costs. Requests by specialty are weighted by the cost of consumables they are estimated to generate. The weighted requests per specialty occupied bed-day are derived for the sample week. They are multiplied by the occupied bed-days by specialty during the financial year to produce the estimated weighted requests by specialty for the year. The annual consumables' cost, available from the Middlesex Hospital Medical School finance office, are apportioned to specialty on the basis of these weighted requests.

Microbiology - The tests performed in the main bacteriology laboratory are grouped under 10 heads, on the advice of senior staff, and the cost of materials for each is estimated by the chief technician. Cost anlysis method A is used. Virology tests are divided in two: chlamydia and herpes. The cost of materials for each is given by the senior technician. The consumables' cost of specialties other than financial year used by the Middlesex Hospital finance office. The existence of two finance departments with different financial years adds considerably to the complexity and difficulty of the financial analysis. The annual cost of the CSSD supplies to the nuclear medicine department is available from the management accounts department and is apportioned to specialty by number of scans.

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Microbiology - The tests performed in the main bacteriology laboratory are grouped under 10 heads, on the advice of senior staff, and the cost of materials for each is estimated by the chief technician. Cost anlysis method A is used. Virology tests are divided in two: chlamydia and herpes. The cost of materials for each is given by the senior technician. The consumables' cost of specialties other than sexually transmitted diseases are so small that they are ignored. The recording system in the department enables the total tests and the proportion of each type of test done for sextually transmitted diseases to be identified during the financial year. So the total variable costs can be estimated as well as those for sexually transmitted diseases. These costs are then adjusted to fit the actual cost derived from information from the Medical School finance office. Most of the consumables' costs of the James Pringle House laboratory are associated with sexually transmitted diseases. Requests for two types of test are sampled over a quarter. The costs of materials for each test are provided by the senior technician. Cost analysis method C is used.

d. Instruments

Instrument costs are an important and complicated area of "patient variable" cost. Instruments are requisitioned by specialties, wards, and departments. The instrument curator thought a month to be the shortest reasonable sample period, because instruments are often ordered at irregular intervals. The sampling of instrument costs by these sources of requisitions for a month proved impossible because the costing had to be done by a technician. The costs are not available from a card index, as is the case with drugs, but have to be drawn from the price lists produced by the various manufacturers. At present a technician cannot be seconded for this purpose. The annual costs of about 90 types of instruments are available from the Middlesex Hospital finance office. Some of these groups of instruments can be directly associated with particular specialties or departments because they are the sole users of certain instruments and equipment. Also some instruments are coded by ordering departments such as the theatres or the ITU. For the rest, the results of a survey conducted sexually transmitted diseases are so small that they are ignored. The recording system in the department enables the total tests and the proportion of each type of test done for sextually transmitted diseases to be identified during the financial year. So the total variable costs can be estimated as well as those for sexually transmitted diseases. These costs are then adjusted to fit the actual cost derived from information from the Medical School finance office. Most of the consumables' costs of the James Pringle House laboratory are associated with sexually transmitted diseases. Requests for two types of test are sampled over a quarter. The costs of materials for each test are provided by the senior technician. Cost analysis method C is used.

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e. Miscellaneous costs

CSSD supplies - The current CSSD information system records the value of packs supplied to many departments, groups of wards, and certain specialties, such as obstetrics or radio-therapy. The CSSD costs of the theatres are analysed in a way very similar to that for drugs. The costs associated with imaging services are discussed under that head. The CSSD costs of groups of wards, such as "the surgical wing", are apportioned to specialty by admissions during the financial year, with two specialties (geriatrics and dermatology) weighted less than the others on the advice of the CSSD manager. The CSSD costs cover the costs of the instruments and dressings sterilised as well as the cost of processing and packaging them.

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Patients' appliances - Requisitions for patients' appliances are costed for a sample month by specialty and by ward. Cost analysis method B is used.

Dressings - Dressings ordered by wards, specialties, and departments are costed during a sample month. Cost analysis method B is used. The theatre dressings' costs are apportioned by specialty by the number of (unweighted) operations.

Provisions - The cost of provisions per occupied bed-day is available each month from the management accounts department for each hospital in the District. This is the only cost readily available from the current information systems to be included in the database.

Linen - Linen requisitions for representative wards and the theatres are costed during a sample quarter. The actual costs for the financial year are apportioned to wards and theatres on the basis of this sample and are further apportioned to specialty by admissions during the financial year and numbers of (unweighted) operations. The inpatient specialty costs are then divided by the occupied bed-days by specialty to derive a cost per occupied bed-day rather than per case.

Stationery - Issues of stationery can not be sampled because of the nature of the recording systems in this department. The clerk who controls the issues to the wards and other departments estimates how much of the cost is likely to be associated with inpatients and how much with outpatients. The outpatient costs are thought too small to justify further analysis. The inpatient cost is simply divided by the total bed-days during the year to produce an estimated cost per occupied bed-day.

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f. General comments

"Patient variable" costs are always checked with senior staff in the service and supply departments. Some staff do not have to think in terms of specialties to do their routine work. But even these are able to say which wards or departments of the hospital generate high or low costs in their particular department and these observations can often be linked with specialties. The managers have views about the range of variations between specialties: they are confident that they would be able to detect any wildly inaccurate estimates. The relative scales of specialty costs have more meaning than their absolute values. As the estimated specialty costs in total always sum to the actual cost for the hospital unit for the year, this knowledge of the likely ratios between the costs of specialties is an important check.

Some of the procedures outlined above may appear excessively complicated and detailed. The scale of the costs may not seem to warrant the expenditure of the staff time. However, it is important for operational planning that the scale of costs likely to be associated with a change is known. In a particular department, the costs per case generated by most specialities may be low, but there may be a few specialities for which the costs are high, for example, the CSSD costs of neurosurgery and cardio-thoracic surgery; such information should be available to those making plans. Options considered in operational planning nearly always involve change to the numbers of patients being treated in the different specialties. The "patient variable" costs for some specialties are much higher than for others. Once the scale of a cost is known, if it is thought not to be important, there is flexibility to extend the period between the samples or simplify the procedure or both. Such changes require judgments to be made about the

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The procedures adopted to produce marginal costs for the minor hospitals in the NE District differ from those used at The Middlesex largely because many "patient variable" costs are available by hospital, although the split between inpatients and outpatients can be awkward. No sampling of costs takes place at Soho Hospital or Athlone House. Soho Hospital is a hospital for gynaecology with a very few long stay radio-therapy patients. The radio-therapy cases have problems related to gynaecology. Costs are available for inpatients and outpatients at Soho Hospital. There are no radio-therapy outpatients. Inpatient costs at the hospital are apportioned on the basis of occupied bed-days by specialty rather than cases because of the great difference in average length of stay between the gynaecology and radio-therapy patients. Similar methods are used at Athlone House where there are geriatric and psycho-geriatric inpatients, both with long average lengths of stay. At St Luke's Hospital for the mentally ill, the drug costs are sampled by specialty, but all other costs are apportioned to specialty by occupied bed-days because the costs are so small. Because patients stay so long at Athlone House and St Luke's, often for months or years, the "patient variable" costs included in the database are not costs per case, but costs per specialty occupied bed-day. The validation of "inpatient" and "outpatient variable" specialty costs is approached in three ways: the specialty costs sum to actual totals, comparison of costs over time, exposure to expert opinion.

All the specialty costs under a particular head are adjusted so that they sum to the total for that head which is available from management consequent reduction in reliability. If a cost is considered very important, the period between samples could be shortened or the period of the sample lengthened or a more detailed analysis of costs undertaken.

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All the specialty costs under a particular head are adjusted so that they sum to the total for that head which is available from management accounts. So, for example, all the drug costs per outpatient attendance by specialty at The Middlesex, multiplied by the attendances for the financial year in those specialties, sum to the annual cost of drugs for outpatients at The Middlesex. This check against "actual" totals means that sampling is only used to estimate the ratios between the specialty costs. However, there are problems here because: the "actual" costs may be derived from a fairly arbitrary split by hospital finance staff of total costs between inpatients and outpatients; and the total covering both these types of patients may itself be substantially inaccurate because of incorrect coding and inadequate stock control systems. The important advantage of the approach is that of consistency between the financial data used in the model and the accounting systems of the District.

The cost of provisions per occupied bed-day may be thought valid without further check since this is an "actual" cost calculated each month by the staff of the management accounts department. Checks on other data, and the relationships between them, can also be made by comparing the estimates for one year with those of the next (see Figure 22). A consultant paediatrician considered this a satisfactory form of validation. This check has not yet been implemented because the only data available after three years were from the financial year 1980-81.

The only other means of validation possible at that time was the exposure of the data to senior staff and consultants. Every opportunity is taken to do so and the comments were generally favourable. For example, an oral surgeon compared the costs for his specialty with those of ENT surgery and, as he expected, found them to be about the same. A neurologist expected the inpatient costs of his specialty to exceed those of general medicine by the costs of the imaging services used and the data seemed to reflect this. He also thought that the costs of neurosurgery should be accounts. So, for example, all the drug costs per outpatient attendance by specialty at The Middlesex, multiplied by the attendances for the financial year in those specialties, sum to the annual cost of drugs for outpatients at The Middlesex. This check against "actual" totals means that sampling is only used to estimate the ratios between the specialty costs. However, there are problems here because: the "actual" costs may be derived from a fairly arbitrary split by hospital finance staff of total costs between inpatients and outpatients; and the total covering both these types of patients may itself be substantially inaccurate because of incorrect coding and inadequate stock control systems. The important advantage of the approach is that of consistency between the financial data used in the model and the accounting systems of the District.

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FIGURE 22

SPECIALTY COST PER CASE MONITOR : INSTRUMENTS

	1980		1981		1982		1983		1984	
ANGE TO H.S.P.I.	–									
	ACTUAL	EXPECT.	ACTUAL	EXPECT.*	ACTUAL	EXPECT.	ACTUAL	EXPECT.	ACTUAL	EXPE
ENERAL MEDICINE	10·51			10·72						
EDIATRICS	4·15			4·23						
HEST DISEASES	-			-						
ERMATOLOGY	5·57			5·68						
EUROLOGY	8·03			8·19						
CARDIOLOGY	118·16			120·62						
S.T.O.	6·70			6·83						
RHEUMATOLOGY	8·04			8·20						
GERIATRICS (M)	8·81			8·99						
GENERAL SURGERY	22·36			22·81						
E.N.T.	9·87			10·07						
ORTHOPAEDICS	46·64			47·57						
OPHTHALMOLOGY	11·58			11·81						
RADIOTHERAPY (M)	6·74			6·87						
UROLOGY	18·38			18·75						
CARDIO-THOR. SURG.	365·36	NOT AVAILABLE		372·67						
ORAL SURGERY	22·31			22·76						
NEUROSURGERY	142·26			145·11						
GYNAECOLOGY (M)	10·04			10·24						
OBSTETRICS	10·18			10·38						
CHILD PSYCHIATRY	-			-						
PSYCHIATRY (M)	-			-						
CASUALTY	-			-						
PSY.-GER. (M)	-			-						
GYNAECOLOGY (S)	4·56			4·65						
RADIOTHERAPY (S)	30·26			30·87						
GERIATRICS (AH)	12·32			12·57						
PSY.-GER. (AH)	1·12			1·14						
PSYCHIATRY (SL)	0·14			0·14						
ADOL. PSYCHIATRY	1·00			1·02						

*USING PRICES INDEX.

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SPECIALTY COST PER CASE MONITOR : INSTRUMENTS

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PAEDIATRICS	4·15			4·23						
CHEST DISEASES	–			–						
DERMATOLOGY	5·57			5·68						
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CARDIOLOGY	118·16			120·62						
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greater than those of orthopaedic surgery, again due to the heavier demand on the imaging services, and the data were consistent with this view.

3. WARD DATA

The ward data are drawn directly from current information systems and are thought valid. However, there are often queries to be settled with the appropriate manager, for example, concerning the specialty bed allocation on a particular ward or the nursing establishment. The only data not directly available were the maximum learners by ward: these data are given by the nursing officer responsible for allocating the learners and are the guides she uses.

4. THEATRE DATA

The validity of the data on the proportion of major and minor operations by specialty in the theatres, sampled every other year, is mainly dependent on the accuracy of the judgment of nurses in identifying major and minor operations from operating lists over a sample three month period (this is clear in most cases), and how typical such a sample period is. The estimated times spent by patients in the theatre and the anaesthetic room and the recovery area are valid in so far as the theatre data recording systems are accurate and complete, and data are available about the operations chosen as representative. Omissions and inconsistencies were discovered in the theatre recording systems: for example, concerning the time at which a patient arrived at the anaesthetic room or left the theatre, but overall the data are thought sufficiently accurate for the purposes of the model. The times spent by patients in the anaesthetic room, which affect the calculation of the times spent in theatre, are estimated by a nursing officer; their validity depends on an assessment of her judgement. The theatre sessions per week by specialty are taken from a sheet used for the operational management of the theatres and so must be accurate.

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The costs of theatre air-conditioning are not currently readily available. They are the results of calculations by a senior engineer or drawn directly from them, so their validity depends on the engineer's professional judgement. The consumption of electricity for air-conditioning varies from theatre to theatre because some of the systems are turned down at night. The nursing staff required for an operating session by specialty are drawn from data used by the senior nursing officer in the theatres to fix the establishment and so they must be reasonably valid. In general, as far as possible, data are incorporated which operational managers have to ensure are accurate in order to manage their departments properly.

5. MISCELLANEOUS DATA

If a new ward is created at any hospital apart from St Luke's Hospital then a "standard" staff establishment of a ward at that hospital is listed for guidance; these data have the same validity as ward data. There are no such data for St Luke's Hospital because of the enormous variation in the staffing of psychiatric wards. The establishments of the nurse training schools and the number of weeks spent by the learners at various stages of training are accurate, operational data. The current bed occupancy rates for hospitals and parts of hospitals suffer from the same problems met when defining the general starting state for patient activity and so have broadly the same validity (see Chapter 8:1). The soundness of the estimates of consumption of electricity and fuel by ward depends on the accuracy of the original recordings and the adjustments by the engineers, and how far such costs can be used to produce estimates for other wards on the basis of floor area and cubic capacity. The costs of a kilowatt at the different hospitals are drawn from the invoices and are correct. The costs of a litre of fuel oil are supplied by hospital engineers and are accurate. The costs of the various grades of staff reflect the mid-point of the scale costs to the District and include elements for national insurance, superannuation, and London Weighting.

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The validity of all the data has only been assessed at the time of entry to the database, some of them may become less sound over the period before the next check and update, but steps are taken to minimise this risk in important areas. Also staff have been asked to tell those maintaining the model and database if a major change occurs.

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CHAPTER NINE: NATURE OF THE RESULTS

The programmed version of the model is described in Appendix 5. Figure 23 shows a summary of the input to and the output from the model. The intention has been to try to present the maximum information about planning options with as few figures as possible, so exception reporting methods have been extensively used. For example, only details of particular types of nurse training affected adversely by a plan are printed out, details of all unaffected types of nurse training do not form part of the output. Also, the emphasis has been on trying to show clearly how crucial the timing of planned change can be, especially if several changes are taking place at the same time (as is often the case). Current planning practice can lead to confusion on this point (see Chapter 4). Lastly, only information thought to be directly related to the change contemplated is given, so that while areas currently excluded from the model will often be affected by a planning option, for example, technical or medical staff, planners do not have to try to disentangle the fixed element from the variable element in the results from the model.

Sample output is considered below and the nature of the results are explained in further detail. The output discussed is only that from the computer model programmed by Richard Brough. During the last year of the first phase of the research programme (which over-lapped with the first year of the second phase) the model was reprogrammed in Pascal to cover the whole of the new Bloomsbury District. Roger Beech directed this development and was responsible for fully implementing the system in the new District.

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SUMMARY OF MODEL INPUT

Input to the model is in question-and-answer form at the terminal. The current state of the area in which change is to be made is presented to the user before the planned change is input. Changes may be made at quarterly intervals up to four years ahead in the following categories:

(i)	By specialty:	in-patient cases; out-patient attendances; average length of stay; bed occupancy rate; theatre sessions*; specialties to be reduced if necessary.
(ii)	By ward:	open/close; number of beds; specialty bed mix; staffing (domestic and nursing).
(iii)	By theatre session:*	increase/decrease.
(iv)	By theatre:	open/close
(v)	By nursing school:	learner establishment.

SUMMARY OF MODEL OUTPUT

The user can request either quarterly or annual estimates of the consequences of a plan for a period up to four years ahead. The output options available are:-

(i)	By specialty:	allocated beds; bed occupancy rate; patient activity (throughput, length of stay, attendances); "in-patient variable" cost; "out-patient variable" cost.
(ii)	By ward:	nursing and domestic staff costs; learner establishments; estate management costs.
(iii)	By theatre session:*	nursing costs.
(iv)	By theatre:*	estate management costs.
(v)	By nursing school:	effects on training.
(vi)	By hospital:	"in-patient variable" costs; "out-patient variable" costs; "ward variable" costs; "session variable" costs;* "theatre variable" costs;* learner nurse costs.
(vii)	Miscellaneous:	reductions in patient activity due to bed constraints; change to type of nurse training on ward (surgical/medical only).

* This part of the model has not been programmed by the research student.

SUMMARY OF MODEL INPUT

Input to the model is in question-and-answer form at the terminal. The current state of the area in which change is to be made is presented to the user before the planned change is input. Changes may be made at quarterly intervals up to four years ahead in the following categories:

(i)	By specialty:	in-patient cases; out-patient attendances; average length of stay; bed occupancy rate; theatre sessions*; specialties to be reduced if necessary.
(ii)	By ward:	open/close; number of beds; specialty bed mix; staffing (domestic and nursing).
(iii)	By theatre session:*	increase/decrease.
(iv)	By theatre:	open/close
(v)	By nursing school:	learner establishment.

SUMMARY OF MODEL OUTPUT

The user can request either quarterly or annual estimates of the consequences of a plan for a period up to four years ahead. The output options available are:-

(i)	By specialty:	allocated beds; bed occupancy rate; patient activity (throughput, length of stay, attendances); "in-patient variable" cost; "out-patient variable" cost.
(ii)	By ward:	nursing and domestic staff costs; learner establishments; estate management costs.
(iii)	By theatre session:*	nursing costs.
(iv)	By theatre:*	estate management costs.
(v)	By nursing school:	effects on training.
(vi)	By hospital:	"in-patient variable" costs; "out-patient variable" costs; "ward variable" costs; "session variable" costs;* "theatre variable" costs;* learner nurse costs.
(vii)	Miscellaneous:	reductions in patient activity due to bed constraints; change to type of nurse training on ward (surgical/medical only).

* This part of the model has not been programmed by the research student.

1. OUTPUT FROM THE MODEL

Inpatient specialty. The output (see Figures 24 and 25) shows a baseline describing the specialty in terms of beds, patient activity, demands on service departments, and costs; and the variation from this baseline for each quarter over several years. The output covers NHS facilities and patients only. Change to the number of beds allocated to a specialty reflects the user input; the model does not rearrange the specialty bed allocation. For example, in Figure 25 the reduction in the number of beds allocated to general medicine inthe first quarter of financial year 1983/84 perhaps reflects the closure of a ward. Variation in the cases treated may have been planned by the user, but may also include reductions from the refusal of patients because of insufficient bed capacity. Figure 24 shows a cut in the planned caseload of general medicine followed six months later by a planned reduction in the average length of stay for that specialty. The bed occupancy rate is calculated by dividing the average number of NHS beds occupied by a specialty by the NHS beds allocated to that specialty. The average rate of bed occupancy is shown throughout as a total rather than a variation from a baseline. Doctors and managers thought this the more informative figure (see further discussion below).

Likely demands on service departments are shown in two ways. Firstly, in terms of occupied bed-days in the ITU and the children's ward. Figure 24 shows that the expected change in the demand on the children's ward from a reduction of 100 cases per quarter in general medicine is only about 11 days. Secondly, if details about a surgical specialty have been selected for output (see Figure 25) the model lists the estimated variation in the hours spent by patients in theatre per quarter from the baseline. Figure 25 shows that an increase in general surgery

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FIGURE 24

QUARTERLY ESTIMATES

SPECIALTY : GENERAL MEDICINE

QUARTER	QUARTERLY BASELINE	FY 1982/83 1	2	3	4	FY 1983/84 1	2	3	4	FY 1984/85 1	2	3	4
INPATIENT ACTIVITY -													
ALLOCATED BEDS	115	0	0	0	0	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0
INPATIENT CASES	805	0	0	0	0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0
AVERAGE STAY	9.7	0	0	0	0	0	0	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2
BED OCCUPANCY		AVERAGE NUMBER OF BEDS OCCUPIED BY A SPECIALTY DIVIDED BY BEDS ALLOCATED TO THAT SPECIALTY											
	.73	.73	.73	.73	.73	.74	.74	.65	.65	.65	.65	.65	.65
ITU OCC. BED DAYS PER QUARTER -	76	0	0	0	0	-9.5	-9.5	-9.5	-9.5	-9.5	-9.5	-9.5	-9.5
OCC. BED DAYS ON CHILDRENS WARD -	85	0	0	0	0	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6
EST.INPATIENT VARIABLE COSTS -		THESE ARE COSTS OF CONSUMABLES. GIVEN THE BOUNDS OF THE MODEL, DEPARTMENTAL STAFF COSTS ARE CONSIDERED FIXED.											
	£	£	£	£	£	£	£	£	£	£	£	£	£
IMAGING SERVICES	6761	0	0	0	0	-840.	-840.	-840.	-840.	-840.	-840.	-840.	-840.
DRUGS	22942	0	0	0	0	-2850.	-2850.	-2850.	-2850.	-2850.	-2850.	-2850.	-2850.
PATH. LAB.	8211	0	0	0	0	-1020.	-1020.	-1020.	-1020.	-1020.	-1020.	-1020.	-1020.
C.S.S.D.	3380	0	0	0	0	-420.	-420.	-420.	-420.	-420.	-420.	-420.	-420.
INSTRUMENTS	9740	0	0	0	0	-1210.	-1210.	-1210.	-1210.	-1210.	-1210.	-1210.	-1210.
DRESSINGS	2897	0	0	0	0	-360.	-360.	-360.	-360.	-360.	-360.	-360.	-360.
PAT. APPLIANCES	483	0	0	0	0	-60.	-60.	-60.	-60.	-60.	-60.	-60.	-60.
PROVS/LINEN/STATN	15617	0	0	0	0	-1940.	-1940.	-3632.	-3632.	-3632.	-3632.	-3632.	-3632.
TOTAL ESTIMATED VARIABLE COSTS -	70031	0	0	0	0	-8700.	-8700.	-10392.	-10392.	-10392.	-10392.	-10392.	-10392.

FIGURE 24

QUARTERLY ESTIMATES

SPECIALTY : GENERAL MEDICINE

QUARTER	QUARTERLY BASELINE	FY 1982/83 1	2	3	4	FY 1983/84 1	2	3	4	FY 1984/85 1	2	3	4
		QUARTERLY VARIANCE FROM BASELINE											
INPATIENT ACTIVITY -													
ALLOCATED BEDS	115	0	0	0	0	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0
INPATIENT CASES	805	0	0	0	0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0
AVERAGE STAY	9.7	0	0	0	0	0	0	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2
BED OCCUPANCY		AVERAGE NUMBER OF BEDS OCCUPIED BY A SPECIALTY DIVIDED BY BEDS ALLOCATED TO THAT SPECIALTY											
	.73	.73	.73	.73	.73	.74	.74	.65	.65	.65	.65	.65	.65
ITU OCC. BED DAYS PER QUARTER -	76	0	0	0	0	-9.5	-9.5	-9.5	-9.5	-9.5	-9.5	-9.5	-9.5
OCC. BED DAYS ON CHILDRENS WARD -	85	0	0	0	0	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6
EST.INPATIENT VARIABLE COSTS -		THESE ARE COSTS OF CONSUMABLES.GIVEN THE BOUNDS OF THE MODEL,DEPARTMENTAL STAFF COSTS ARE CONSIDERED FIXED.											
	£	£	£	£	£	£	£	£	£	£	£	£	£
IMAGING SERVICES	6761	0	0	0	0	-840.	-840.	-840.	-840.	-840.	-840.	-840.	-840.
DRUGS	22942	0	0	0	0	-2850.	-2850.	-2850.	-2850.	-2850.	-2850.	-2850.	-2850.
PATH. LAB.	8211	0	0	0	0	-1020.	-1020.	-1020.	-1020.	-1020.	-1020.	-1020.	-1020.
C.S.S.D.	3380	0	0	0	0	-420.	-420.	-420.	-420.	-420.	-420.	-420.	-420.
INSTRUMENTS	9740	0	0	0	0	-1210.	-1210.	-1210.	-1210.	-1210.	-1210.	-1210.	-1210.
DRESSINGS	2897	0	0	0	0	-360.	-360.	-360.	-360.	-360.	-360.	-360.	-360.
PAT. APPLIANCES	483	0	0	0	0	-60.	-60.	-60.	-60.	-60.	-60.	-60.	-60.
PROVS/LINEN/STATN	15617	0	0	0	0	-1940.	-1940.	-3632.	-3632.	-3632.	-3632.	-3632.	-3632.
TOTAL ESTIMATED VARIABLE COSTS -	70031	0	0	0	0	-8700.	-8700.	-10392.	-10392.	-10392.	-10392.	-10392.	-10392.

FIGURE 25

QUARTERLY VARIANCE FROM BASELINE

QUARTER	QUARTERLY BASELINE	FINANCIAL YEAR 1982/83 1	2	3	4	FINANCIAL YEAR 1983/84 1	2	3	4	FINANCIAL YEAR 1984/85 1	2	3	4
INPATIENT ACTIVITY -													
ALLOCATED BEDS	114	0	0	0	0	0	0	17.0	17.0	17.0	17.0	17.0	17.0
INPATIENT CASES	821	0	0	0	0	0	0	150.0	150.0	150.0	150.0	150.0	150.0
AVERAGE STAY	9.0	0	0	0	0	0	0	0	0	0	0	0	0
BED OCCUPANCY		AVERAGE NUMBER OF BEDS OCCUPIED BY A SPECIALTY DIVIDED BY BEDS ALLOCATED TO THAT SPECIALTY											
	.69	.69	.69	.69	.69	.69	.69	.71	.71	.71	.71	.71	.71
THEATRE HOURS PER QUARTER -	925	0	0	0	0	0	0	169.0	169.0	169.0	169.0	169.0	169.0
THEATRE SESSIONS PER WEEK -	20.0	0	0	0	0	0	0	3.3	3.3	3.3	3.3	3.3	3.3
ANAES./REC. HOURS PER WEEK -	77	0	0	0	0	0	0	14.2	14.2	14.2	14.2	14.2	14.2
ITU OCC. BED DAYS PER QUARTER -	81	0	0	0	0	0	0	14.9	14.9	14.9	14.9	14.9	14.9
OCC. BED DAYS ON CHILDRENS WARD -	69	0	0	0	0	0	0	12.8	12.8	12.8	12.8	12.8	12.8
EST.INPATIENT VARIABLE COSTS -		THESE ARE COSTS OF CONSUMABLES.GIVEN THE BOUNDS OF THE MODEL,DEPARTMENTAL STAFF COSTS ARE CONSIDERED FIXED.											
	£	£	£	£	£	£	£	£	£	£	£	£	£
IMAGING SERVICES	8292	0	0	0	0	0	0	1515.	1515.	1515.	1515.	1515.	1515.
DRUGS	37191	0	0	0	0	0	0	6795.	6795.	6795.	6795.	6795.	6795.
PATH. LAB.	3366	0	0	0	0	0	0	615.	615.	615.	615.	615.	615.
C.S.S.D.	5911	0	0	0	0	0	0	1080.	1080.	1080.	1080.	1080.	1080.
INSTRUMENTS	20935	0	0	0	0	0	0	3825.	3825.	3825.	3825.	3825.	3825.
DRESSINGS	4515	0	0	0	0	0	0	825.	825.	825.	825.	825.	825.
PAT. APPLIANCES	1724	0	0	0	0	0	0	315.	315.	315.	315.	315.	315.
PROVS/LINEN/STATN	15738	0	0	0	0	0	0	2876.	2876.	2876.	2876.	2876.	2876.
TOTAL ESTIMATED VARIABLE COSTS -	97672	0	0	0	0	0	0	17846.	17846.	17846.	17846.	17846.	17846.

FIGURE 25

QUARTERLY VARIANCE FROM BASELINE

QUARTER	QUARTERLY BASELINE	FINANCIAL YEAR 1982/83 1	2	3	4	FINANCIAL YEAR 1983/84 1	2	3	4	FINANCIAL YEAR 1984/85 1	2	3	4
INPATIENT ACTIVITY -													
ALLOCATED BEDS	114	0	0	0	0	0	0	17.0	17.0	17.0	17.0	17.0	17.0
INPATIENT CASES	821	0	0	0	0	0	0	150.0	150.0	150.0	150.0	150.0	150.0
AVERAGE STAY	9.0	0	0	0	0	0	0	0	0	0	0	0	0
BED OCCUPANCY		AVERAGE NUMBER OF BEDS OCCUPIED BY A SPECIALTY DIVIDED BY BEDS ALLOCATED TO THAT SPECIALTY											
	.69	.69	.69	.69	.69	.69	.69	.71	.71	.71	.71	.71	.71
THEATRE HOURS PER QUARTER -	925	0	0	0	0	0	0	169.0	169.0	169.0	169.0	169.0	169.0
THEATRE SESSIONS PER WEEK -	20.0	0	0	0	0	0	0	3.3	3.3	3.3	3.3	3.3	3.3
ANAES./REC. HOURS PER WEEK -	77	0	0	0	0	0	0	14.2	14.2	14.2	14.2	14.2	14.2
ITU OCC. BED DAYS PER QUARTER -	81	0	0	0	0	0	0	14.9	14.9	14.9	14.9	14.9	14.9
OCC. BED DAYS ON CHILDRENS WARD -	69	0	0	0	0	0	0	12.8	12.8	12.8	12.8	12.8	12.8
EST. INPATIENT VARIABLE COSTS -		THESE ARE COSTS OF CONSUMABLES. GIVEN THE BOUNDS OF THE MODEL, DEPARTMENTAL STAFF COSTS ARE CONSIDERED FIXED.											
	£	£	£	£	£	£	£	£	£	£	£	£	£
IMAGING SERVICES	8292	0	0	0	0	0	0	1515.	1515.	1515.	1515.	1515.	1515.
DRUGS	37191	0	0	0	0	0	0	6795.	6795.	6795.	6795.	6795.	6795.
PATH. LAB.	3366	0	0	0	0	0	0	615.	615.	615.	615.	615.	615.
C.S.S.D.	5911	0	0	0	0	0	0	1080.	1080.	1080.	1080.	1080.	1080.
INSTRUMENTS	20935	0	0	0	0	0	0	3825.	3825.	3825.	3825.	3825.	3825.
DRESSINGS	4515	0	0	0	0	0	0	825.	825.	825.	825.	825.	825.
PAT. APPLIANCES	1724	0	0	0	0	0	0	315.	315.	315.	315.	315.	315.
PROVS/LINEN/STATN	15738	0	0	0	0	0	0	2876.	2876.	2876.	2876.	2876.	2876.
TOTAL ESTIMATED VARIABLE COSTS -	97672	0	0	0	0	0	0	17846.	17846.	17846.	17846.	17846.	17846.

caseload of 150 cases per quarter is likely to require about 169 extra hours of patient time in theatre. The figures are divided by the number of weeks in a quarter (13) and the hours in a session (4) to show the same information in terms of sessions per week. (In Figure 25: $169 \div 13 \div 4 = 3.3$). (These figures do not purport to show the actual theatre sessions that will be required given a certain change in the caseload of a surgical specialty, since they only show patient time in theatre. The intention in producing both these sets of figures is to show the scale of the effect of change in a form which those working in the theatres can readily understand. Surgeons and theatre nurses generally think of theatre activity on a weekly rather than a quarterly basis.) The effects of a plan on the patient time in the anaesthetic rooms and recovery area are shown only in terms of hours per week.

Finally the costs which vary with the number of inpatient cases by specialty and those which vary with the occupied bed-days by specialty are listed: the baseline costs and any variations over time. In Figure 24 a cut of 100 general medicine cases per quarter leads to a reduction in "patient variable" costs of £8,700 per quarter which is shown broken down over various heads. However, when the average length of stay for that specialty is reduced six months later, there is a further reduction in costs considered to vary with occupied bed-days rather than cases. So, the savings per quarter become £10,392.

A major difficulty with this section of the output was how to report usefully bed occupancy by specialty. Senior managers wanted the model to show how the bed occupancy rate by specialty would be likely to be affected by planned changes. However, it was not clear whether the beds associated with a specialty should include beds borrowed from other caseload of 150 cases per quarter is likely to require about 169 extra hours of patient time in theatre. The figures are divided by the number of weeks in a quarter (13) and the hours in a session (4) to show the same information in terms of sessions per week. (In Figure 25: $169 \div 13 \div 4 = 3.3$). (These figures do not purport to show the actual theatre sessions that will be required given a certain change in the caseload of a surgical specialty, since they only show patient time in theatre. The intention in producing both these sets of figures is to show the scale of the effect of change in a form which those working in the theatres can readily understand. Surgeons and theatre nurses generally think of theatre activity on a weekly rather than a quarterly basis.) The effects of a plan on the patient time in the anaesthetic rooms and recovery area are shown only in terms of hours per week.

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Specialty bed allocations seemed more important generally than specialty caseload in operational planning in the NE District. At planning meetings attended by consultants and senior staff the number of beds allocated to each specialty and their location was always discussed at length. Those beds recognised in the model as forming the "bed pool" are input as beds on particular wards allocated to particular specialties. If the bed allocation of particular specialties at The Middlesex is thought important for planning, then it seems clear that the model should show some sort of relationship between the NHS patients treated by a specialty and the NHS beds which they use, in theory, while in hospital. This is what the bed occupancy statistic produced by the model shows. It is not intended to reflect efficiency, but simply to show the extent to which the beds allocated to a specialty are used. It is recognised that a consultant can increase his bed occupancy rate merely by keeping his patients a few days longer in hospital. Members of planning groups, such as the DMT planning group, often seem implicity to assume that when they plan for extra or fewer beds, they are in fact planning for extra or fewer occupied beds. This assumption does not form part of the model. It seems clear that planning changes in bed numbers and planning changes in caseload by specialty should be recognised as separate parts of the same problem. The two areas of decision are handled quite separately in the model, but the connection between them is shown by the version of the bed occupancy rate included. This seems useful information when assessing specialties. The method used by the model (described above) may result in rates of bed occupancy of over 100 per cent: this is almost always the case with geriatrics at The Middlesex. In this hospital there is great flexibility in the use of beds which means that in practice for most specialties the bed allocation is only a guide as to where patients should stay. This policy is reflected in the model.

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It is difficult to derive useful information about specialty bed occupancy for planning from the SHQ and SH3 returns. These returns report: staffed beds allocated, average available beds and average occupied beds. If the average occupied beds are divided by the staffed beds allocated the result is unsuitable for NHS planning because the average occupied beds include those used by private patients while private beds are not included in the staffed beds allocated to specialty. If the average occupied beds are divided by the average available beds, the bed occupancy rate which results is not useful for NHS planning because the average available beds include beds borrowed from other specialties, private beds used, and are reduced by the number of beds lent to other specialties. There is a clear technical problem here: if a bed has been borrowed on a multi-specialty ward, whose bed was it? These problems with the information currently available cause confusion. The more simple approach used in the model produces clear results which can be more easily intepreted.

Outpatient specialty. The form is similar to that for inpatients, but no patient activity in service departments is included. All costs are based on the estimated cost per attendance. Figure 26 shows the effects of a small reduction in the planned outpatient attendances for general medicine. The cost heads are the same as for inpatients except that the costs which vary with occupied bed-days are excluded.

Ward. Typical ward output is shown in Figure 27. A baseline in terms of cost, and Whole Time Equivalents (WTE) for staff, is followed by any cost variations at quarterly intervals. In this case the costs of a temporary closure in the financial year 1983/84 are shown. The domestic floor staff are shown as well as the domestic ward staff, but the extent to which resources designated to specialties are used.

It is difficult to derive useful information about specialty bed occupancy for planning from the SHQ and SH3 returns. These returns report: staffed beds allocated, average available beds and average occupied beds. If the average occupied beds are divided by the staffed beds allocated the result is unsuitable for NHS planning because the average occupied beds include those used by private patients while private beds are not included in the staffed beds allocated to specialty. If the average occupied beds are divided by the average available beds, the bed occupancy rate which results is not useful for NHS planning because the average available beds include beds borrowed from other specialties, private beds used, and are reduced by the number of beds lent to other specialties. There is a clear technical problem here: if a bed has been borrowed on a multi-specialty ward, whose bed was it? These problems with the information currently available cause confusion. The more simple approach used in the model produces clear results which can be more easily intepreted.

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Ward. Typical ward output is shown in Figure 27. A baseline in terms of cost, and Whole Time Equivalents (WTE) for staff, is followed by any cost variations at quarterly intervals. In this case the costs of a temporary closure in the financial year 1983/84 are shown. The domestic floor staff are shown as well as the domestic ward staff, but

FIGURE 26

SPECIALTY : GENERAL MEDICINE

QUARTER	QUARTERLY BASELINE	QUARTERLY VARIANCE FROM BASELINE											
		FINANCIAL YEAR 1982/83				FINANCIAL YEAR 1983/84				FINANCIAL YEAR 1984/85			
		1	2	3	4	1	2	3	4	1	2	3	4
OUTPATIENT ACTIVITY -													
OUTPATIENT ATTS.	4572	0	0	0	0	-200.	-200.	-200.	-200.	-200.	-200.	-200.	-200.
EST. OUTPATIENT VARIABLE COSTS -	THESE ARE COSTS OF CONSUMABLES. GIVEN THE BOUNDS OF THE MODEL, DEPARTMENTAL STAFF COSTS ARE CONSIDERED FIXED.												
	£	£	£	£	£	£	£	£	£	£	£	£	£
IMAGING SERVICES	3657	0	0	0	0	-160.	-160.	-160.	-160.	-160.	-160.	-160.	-160.
DRUGS	14904	0	0	0	0	-652.	-652.	-652.	-652.	-652.	-652.	-652.	-652.
PATH. LAB.	2057	0	0	0	0	-90.	-90.	-90.	-90.	-90.	-90.	-90.	-90.
C.S.S.D.	0	0	0	0	0	0	0	0	0	0	0	0	0
INSTRUMENTS	0	0	0	0	0	0	0	0	0	0	0	0	0
DRESSINGS	0	0	0	0	0	0	0	0	0	0	0	0	0
PAT. APPLIANCES	45	0	0	0	0	-2.	-2.	-2.	-2.	-2.	-2.	-2.	-2.
TOTAL ESTIMATED VARIABLE COSTS -	20663	0	0	0	0	-904.	-904.	-904.	-904.	-904.	-904.	-904.	-904.

FIGURE 26

SPECIALTY : GENERAL MEDICINE

QUARTER	QUARTERLY BASELINE	FY 1982/83 1	2	3	4	FY 1983/84 1	2	3	4	FY 1984/85 1	2	3	4
OUTPATIENT ACTIVITY -													
OUTPATIENT ATTS.	4572	0	0	0	0	-200.	-200.	-200.	-200.	-200.	-200.	-200.	-200.
EST. OUTPATIENT VARIABLE COSTS -	THESE ARE COSTS OF CONSUMABLES. GIVEN THE BOUNDS OF THE MODEL, DEPARTMENTAL STAFF COSTS ARE CONSIDERED FIXED.												
	£	£	£	£	£	£	£	£	£	£	£	£	£
IMAGING SERVICES	3657	0	0	0	0	-160.	-160.	-160.	-160.	-160.	-160.	-160.	-160.
DRUGS	14904	0	0	0	0	-652.	-652.	-652.	-652.	-652.	-652.	-652.	-652.
PATH. LAB.	2057	0	0	0	0	-90.	-90.	-90.	-90.	-90.	-90.	-90.	-90.
C.S.S.D.	0	0	0	0	0	0	0	0	0	0	0	0	0
INSTRUMENTS	0	0	0	0	0	0	0	0	0	0	0	0	0
DRESSINGS	0	0	0	0	0	0	0	0	0	0	0	0	0
PAT. APPLIANCES	45	0	0	0	0	-2.	-2.	-2.	-2.	-2.	-2.	-2.	-2.
TOTAL ESTIMATED VARIABLE COSTS -	20663	0	0	0	0	-904.	-904.	-904.	-904.	-904.	-904.	-904.	-904.

FIGURE 27

WARD : SANDHURST

	QUARTERLY BASELINE		QUARTERLY VARIANCE FROM BASELINE											
			FINANCIAL YEAR 1982/83				FINANCIAL YEAR 1983/84				FINANCIAL YEAR 1984/85			
	EST. WTE	£	1 £	2 £	3 £	4 £	1 £	2 £	3 £	4 £	1 £	2 £	3 £	4 £
SISTER	1.0	2451	0	0	0	0	-2451.	-2451.	0	0	0	0	0	0
STAFF NURSE/SEN	3.0	5145	0	0	0	0	-5145.	-5145.	0	0	0	0	0	0
ENROLLED NURSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNTRAINED STAFF	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DOM. WARD STAFF	.9	1192	0	0	0	0	-1193.	-1193.	0	0	0	0	0	0
DOM. FLOOR STAFF		1364	0	0	0	0	0	0	0	0	0	0	0	0
ELECTRICITY		93	0	0	0	0	-93.	-93.	0	0	0	0	0	0
HOT WATER AND HEATING -		359	0	0	0	0	-288.	-288.	0	0	0	0	0	0
WARD TOTAL		10604	0	0	0	0	-9168.	-9168.	0	0	0	0	0	0
NON-FINANCIAL :														
LEARNER NURSES	10.0		0	0	0	0	-10.	-10.	0	0	0	0	0	0

FIGURE 27

WARD : SANDHURST

QUARTERLY VARIANCE FROM BASELINE

	QUARTERLY BASELINE		FINANCIAL YEAR 1982/83				FINANCIAL YEAR 1983/84				FINANCIAL YEAR 1984/85			
	EST. WTE	£	1 £	2 £	3 £	4 £	1 £	2 £	3 £	4 £	1 £	2 £	3 £	4 £
SISTER	1.0	2451	0	0	0	0	-2451.	-2451.	0	0	0	0	0	0
STAFF NURSE/SEN	3.0	5145	0	0	0	0	-5145.	-5145.	0	0	0	0	0	0
ENROLLED NURSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNTRAINED STAFF	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DOM. WARD STAFF	.9	1192	0	0	0	0	-1193.	-1193.	0	0	0	0	0	0
DOM. FLOOR STAFF		1364	0	0	0	0	0	0	0	0	0	0	0	0
ELECTRICITY		93	0	0	0	0	-93.	-93.	0	0	0	0	0	0
HOT WATER AND HEATING -		359	0	0	0	0	-288.	-288.	0	0	0	0	0	0
WARD TOTAL		10604	0	0	0	0	-9168.	-9168.	0	0	0	0	0	0
NON-FINANCIAL :														
LEARNER NURSES	10.0		0	0	0	0	-10.	-10.	0	0	0	0	0	0

their costs only change if two linked wards are closed. In the example only one ward is closed and so the costs of the domestic floor staff shared with another ward are not saved. The domestic floor staff are assumed from then on to work full-time on the ward which remains open (on the advice of the district domestic manager). The costs of electricity and heating and domestic hot water are followed by the total variable cost of the ward. The learner nurses associated with a ward are shown simply in terms of "establishment", with no costs. The 10 learners on Sandhurst ward are assumed to transfer to other wards for the duration of the closure.

Hospital. The costs which vary with different types of change to the system can be summed by hospital (see Figure 28). This output shows the main types of change which trigger costs with baselines and variations from them, as well as a total of all variable costs. No costs are shown against "Theatre" because this part of the analysis was not programmed by Richard Brough. It is at this level that the costs of learner nurses are shown (although not in this sample output); variations in such costs only derive from planned change to the establishment of the nursing school associated with the hospital.

Learner nurses. The method of exception reporting for nurses in training gives details of the variances in the average number of learners at any stage of training below the "establishment" or above the "maximum" during any of the simulated quarters (see Figure 29). The figures for the "establishment" and the "maximum" only alter if a ward is opened or closed, or if a medical or surgical ward which may be used for either of these types of training is switched from one to the other. In the example, the variation "-21" shown against "MIDDX: MEDICAL" in quarter 1 of 1982/83 means that the number of learner nurses at the medical stage in their training is 21 less than the establishment figure of 150 for all their costs only change if two linked wards are closed. In the example only one ward is closed and so the costs of the domestic floor staff shared with another ward are not saved. The domestic floor staff are assumed from then on to work full-time on the ward which remains open (on the advice of the district domestic manager). The costs of electricity and heating and domestic hot water are followed by the total variable cost of the ward. The learner nurses associated with a ward are shown simply in terms of "establishment", with no costs. The 10 learners on Sandhurst ward are assumed to transfer to other wards for the duration of the closure.

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UNIT : MIDDLESEX HOSPITAL

VARIABLE COST HEADS	QUARTERLY BASELINE	QUARTERLY VARIANCE FROM BASELINE											
		FINANCIAL YEAR 1982/83				FINANCIAL YEAR 1983/84				FINANCIAL YEAR 1984/85			
		1	2	3	4	1	2	3	4	1	2	3	4
	£	£	£	£	£	£	£	£	£	£	£	£	£
INPATIENT	510290	0	0	0	0	-8700.	-8700.	7454.	7454.	7454.	7454.	7454.	7454.
OUTPATIENT	138485	0	0	0	0	-904.	-904.	-358.	-358.	-358.	-358.	-358.	-358.
WARD (FLOOR/BLOCK)	537963	0	0	0	0	-9168.	-9168.	0	0	0	0	0	0
THEATRE	0	0	0	0	0	0	0	0	0	0	0	0	0
LEARNER NURSES	753596	0	0	0	0	0	0	0	0	0	0	0	0
UNIT TOTAL	1940336	0	0	0	0	-18772.	-18772.	7096.	7096.	7096.	7096.	7096.	7096.

FIGURE 28

FIGURE 28

UNIT : MIDDLESEX HOSPITAL

VARIABLE COST HEADS	QUARTERLY BASELINE	QUARTERLY VARIANCE FROM BASELINE											
		FINANCIAL YEAR 1982/83				FINANCIAL YEAR 1983/84				FINANCIAL YEAR 1984/85			
		1	2	3	4	1	2	3	4	1	2	3	4
	£	£	£	£	£	£	£	£	£	£	£	£	£
INPATIENT	510290	0	0	0	0	-8700.	-8700.	7454.	7454.	7454.	7454.	7454.	7454.
OUTPATIENT	138485	0	0	0	0	-904.	-904.	-358.	-358.	-358.	-358.	-358.	-358.
WARD (FLOOR/BLOCK)	537963	0	0	0	0	-9168.	-9168.	0	0	0	0	0	0
THEATRE	0	0	0	0	0	0	0	0	0	0	0	0	0
LEARNER NURSES	753596	0	0	0	0	0	0	0	0	0	0	0	0
UNIT TOTAL	1940336	0	0	0	0	-18772.	-18772.	7096.	7096.	7096.	7096.	7096.	7096.

FIGURE 29

NURSE TRAINING

LEARNERS BELOW ESTABLISHMENT OR ABOVE MAXIMUM ON WARDS FOR STAGE OF TRAINING

FINANCIAL YEAR 1982/83

STAGE OF TRAINING	QUARTER 1 EST.	QUARTER 1 MAX.	QUARTER 1 VAR.	QUARTER 2 EST.	QUARTER 2 MAX.	QUARTER 2 VAR.	QUARTER 3 EST.	QUARTER 3 MAX.	QUARTER 3 VAR.	QUARTER 4 EST.	QUARTER 4 MAX.	QUARTER 4 VAR.
MIDDX : MEDICAL	150.	234.	-21.	150.	234.	-21.	150.	234.	-21.	150.	234.	-21.
MIDDX : SURGICAL	130.	204.	-1.	130.	204.	-1.	130.	204.	-1.	130.	204.	-1.
MIDDX : GYNAECOLOGY	25.	27.	1.	25.	27.	1.	25.	27.	1.	25.	27.	1.
ST LUKES : WARDS	19.	25.	-2.	19.	25.	-2.	19.	25.	-2.	19.	25.	-2.

FINANCIAL YEAR 1983/84

STAGE OF TRAINING	QUARTER 1 EST.	QUARTER 1 MAX.	QUARTER 1 VAR.	QUARTER 2 EST.	QUARTER 2 MAX.	QUARTER 2 VAR.	QUARTER 3 EST.	QUARTER 3 MAX.	QUARTER 3 VAR.	QUARTER 4 EST.	QUARTER 4 MAX.	QUARTER 4 VAR.
MIDDX : MEDICAL	140.	218.	-11.	140.	218.	-11.	140.	218.	-11.	140.	218.	-11.
MIDDX : SURGICAL	130.	204.	-1.	130.	204.	-1.	140.	220.	-11.	140.	220.	-11.
MIDDX : GYNAECOLOGY	25.	27.	1.	25.	27.	1.	25.	27.	1.	25.	27.	1.
ST LUKES : WARDS	19.	25.	-2.	19.	25.	-2.	19.	25.	-2.	19.	25.	-2.

FIGURE 29

NURSE TRAINING

LEARNERS BELOW ESTABLISHMENT OR ABOVE MAXIMUM ON WARDS FOR STAGE OF TRAINING

FINANCIAL YEAR 1982/83

	QUARTER 1			QUARTER 2			QUARTER 3			QUARTER 4		
STAGE OF TRAINING	EST.	MAX.	VAR.	EST.	MAX.	VAR.	EST.	MAX.	VAR.	EST.	MAX.	VAR.
MIDDX : MEDICAL	150.	234.	-21.	150.	234.	-21.	150.	234.	-21.	150.	234.	-21.
MIDDX : SURGICAL	130.	204.	-1.	130.	204.	-1.	130.	204.	-1.	130.	204.	-1.
MIDDX : GYNAECOLOGY	25.	27.	1.	25.	27.	1.	25.	27.	1.	25.	27.	1.
ST LUKES : WARDS	19.	25.	-2.	19.	25.	-2.	19.	25.	-2.	19.	25.	-2.

FINANCIAL YEAR 1983/84

	QUARTER 1			QUARTER 2			QUARTER 3			QUARTER 4		
STAGE OF TRAINING	EST.	MAX.	VAR.	EST.	MAX.	VAR.	EST.	MAX.	VAR.	EST.	MAX.	VAR.
MIDDX : MEDICAL	140.	218.	-11.	140.	218.	-11.	140.	218.	-11.	140.	218.	-11.
MIDDX : SURGICAL	130.	204.	-1.	130.	204.	-1.	140.	220.	-11.	140.	220.	-11.
MIDDX : GYNAECOLOGY	25.	27.	1.	25.	27.	1.	25.	27.	1.	25.	27.	1.
ST LUKES : WARDS	19.	25.	-2.	19.	25.	-2.	19.	25.	-2.	19.	25.	-2.

wards which are used for medical nursing training. The variation "1" shown against "MIDDX: GYNAECOLOGY" in quarter 1 of 1982/82 means that the number of nurses at the gynaecology stage in their training is 1 more than the maximum figure of 25 for all wards which are used for gynaecology nurse training. In quarter 1 of 1983/84 a medical ward has been shut which has resulted in the learner understaffing on medical wards being reduced from "21" to "11" (there were 10 learners on the ward closed). This ward is reopened as a surgical ward in quarter 3 of 1983/84 with the result that while the improvement on the medical wards continues, the understaffing on the surgical wards becomes worse: it grows from "-1" to "-11". This non-financial analyses of nurse training and its relationship with changes in the health services has been found particularly useful by senior management.

Annual output. All output may be shown by year rather than by quarter. Exceptions are the effects of a plan on nurse training and the output of the bed occupancy rate by specialty. Unlike financial information, the effects on the nurse training programme cannot be treated cumulatively, and an average over the year would not be useful since changes can be made by quarter. An average would not then highlight likely problem areas which is the prime purpose of this output. It does not seem sensible to print a bed occupancy rate for a year when the number of beds and the specialty caseload (and so the bed occupancy rate) can be changed by quarter.

The output from the model has been designed with a view to producing as few figures as possible. By choosing output options a manager can select detailed information about a particular problem area or aggregated information to show the scale of costs and other implications of, perhaps, a broad change of policy.

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2. VALIDITY OF THE RESULTS

The validation of the model and the base data which it draws upon is difficult largely because the actual effects of a change in terms of patient activity and costs cannot normally be drawn from information routinely available. Most information provided by the current systems is at a level of aggregation that is insensitive to changes of the scale being considered in planning options which the model is designed to explore. It is not usually possible to link a particular change, or series of changes, confidently with a change to non-staff costs aggregated annually by hospital. Changes in such costs may be due to planned changes which conform part of the input to the model, but they may be due to variations in prices or technology or clinical policies which it may be impossible to plan for or to include in the model input. The staff costs predicted by the model, which are produced each month, are amenable to more precise validation. However, if problems with the model are discovered during implementation and validation, the clear structure should permit relatively straightforward modification. The various parts of the output from the model can be validated to varying degrees. Each section is considered in turn.

Inpatient and outpatient activity by specialty. The allocated beds, the planned changes to inpatient cases, and the average length of stay do not require validation since they are also inputs. However, the effect of the bed constraint in terms of inpatients refused admission should be validated. The best data to use for this purpose are the records of daily bed occupancy by specialty. These data are constructed using the daily bed statements from the wards. Patients admitted to and discharged from a ward are added to or subtracted from the total for the specialty to which they belong. This means that errors can accumulate.

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The position can only be rectified by a bed census. These were carried out irregularly and were not always free from error. This weakness in the hospital information system, drawn to the attention of management by the research student, has now been largely rectified through the institution of regular quarterly bed censuses. Despite these problems with the "actual" figures for patient activity, it is still useful to check whether the assumed maximum bed occupancy rate for a pool of beds, or a specialist area, has been exceeded and if so by how much for how long. There remain further problems, however, because even if output from the model checked in this way the result may be due to a shift in the baseline rather than a planned change. As explained in Chapter 8:1 there is no guarantee that the starting state of the model will match reality. The bed occupancy rate produced by the model can be validated internally.

The consequences of a change to the caseload of a surgical specialty on the theatre suite is difficult to validate because only patient time is concerned: not staff time or the time a facility is in use. Initially it is validated by exposure to consultants and senior staff for their views and criticisms. Thereafter such output could be validated precisely by inspecting the data records in the theatres and the recovery area: since the model has been constructed using local data and relationships drawn from the NE District, it is possible for all output to be validated using the procedures by which the data were collected. This would be very time-consuming, so such validation should be highly selective. Normally, as in the case of data collection, judgement must be used as to whether the likely errors justify the effort of validation. It appears best at present to check the implications of plans for the theatres with surgeons and other senior staff, and only perform the more detailed validation if doubts and problems arise.

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The output showing demand on the ITU and the children's ward can be validated directly from the record book in the ITU and from a sheet, as Figure 30, showing occupied bed-days by specialty by ward. The same arguments apply about the cost and value of validation as for the theatres. The outpatient activity by specialty need not be validated since it is also an input.

Inpatient and outpatient costs by specialty. These costs are hard to validate. Departmental expenditure is generally available each month and departmental costs each year (see previous discussion in Chapter 7:2:a). If a change is made to caseload, either the departmental expenditure of the succeeding months, or the costs of the financial year in which the change occurs, can be examined to validate the predicted change in costs. The advantages of using the expenditure figure are that if a short period is examined then it is likely that no other major change will have happened and that the effect of inflation in relation to the costs in the model will be reasonably predictable. The major disadvantage is that variations in expenditure over a fairly short period may be due simply to the buying policy of the department and especially payments for bulk purchases. This problem renders short term expenditure figures unreliable for the purposes of validation. The advantage of using the costs for the financial year in which the change occurs are that they do purport to relate to the patient activity for that year. Serious problems arise however because of the changes which may well have occurred during the year which have not been included in the model, but which affect the annual costs. Also it is difficult to estimate how far the costs in the model should be adjusted for inflation.

One is driven to the conclusion that it is simply not possible to validate these costs at present by comparison of estimated and actual

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One is driven to the conclusion that it is simply not possible to validate these costs at present by comparison of estimated and actual

FIGURE 30

DAILY RECORD OF PATIENTS BY SPECIALTY BY WARD

2nd JUNE 1980 WARD	GEN. MED.	PAEDIATRICS	DERMATOL.	NEUROL.	CARDIOL.	RHEUMATOL.	GERIATRICS	GEN. SURG.	ENT	ORTHO.	OPHTHAL.	RADIO.	UROLOGY	THORACIC	DENTISTRY	NEUROSURG.	GYNAE.	OBSTETRICS	MENTAL ILLNESS	STD	PRIVATE	UNASSIGNED	TOTAL
SANDHURST	11						1																12
GEORGE V	12						3						1	1									17
P. ARTHUR	11						2									1							14
MEYERSTEIN	6				10		1									1							18
ESSEX WYNTER	13						5									1							19
NORTHUMB.	14				1		3																18
QUEEN ALEX.	11			2	1		6																20
VAUGN. MORGAN	4		1		7		3																15
C.C.U.					2																		2
HARDY ROBERTS	1			8			1									9							19
PRINCESS A.						10	1			2	5												18
CHARLES BELL	1						1	9		1						1							13
CAV. B.								11		1						1				1			14

FIGURE 30

DAILY RECORD OF PATIENTS BY SPECIALTY BY WARD

2nd JUNE 1980 WARD	SANDHURST	GEORGE V	P. ARTHUR	MEYERSTEIN	ESSEX WYNTER	NORTHUMB.	QUEEN ALEX.	VAUGN. MORGAN	C.C.U.	HARDY ROBERTS	PRINCESS A.	CHARLES BELL	CAV. B.
GEN. MED.	11	12	11	6	13	14	11	4		1		1	
PAEDIATRICS													
DERMATOL.								1					
NEUROL.							2			8			
CARDIOL.				10		1	1	7	2				
RHEUMATOL.											10		
GERIATRICS	1	3	2	1	5	3	6	3		1	1	1	
GEN. SURG.												9	11
ENT													
ORTHO.											2	1	1
OPHTHAL.											5		
RADIO.													
UROLOGY		1											
THORACIC		1											
DENTISTRY													
NEUROSURG.			1	1	1					9		1	1
GYNAE.													
OBSTETRICS													
MENTAL ILLNESS													
STD													1
PRIVATE													
UNASSIGNED													
TOTAL	12	17	14	18	19	18	20	15	2	19	18	13	14

results because the current financial systems do not produce suitable, reliable costs. So the only means of gauging the soundness of the results from the model is to show the predicted costs of change to senior staff for their opinion. In a pluralistic organisation like the NHS, the results from the model and the assumptions on which they are based must be acceptable to a wide range of professional groups, since consensus is particularly important in NHS planning and management.

Ward costs. The ward staff costs (including domestic floor staff) can be validated in theory by checking the expenditure on nurses and domestics before and after the change. This is relatively straightforward at the smaller hospitals, but becomes very complicated at The Middlesex because of the size of the budgets. All the likely causes of variation in expenditure would have to be explored to see how far the difference is due to the effects of the planned change being analysed and how far due to other factors. The staff of the management accounts department at The Middlesex believe this to be impractical. Another way to attempt to validate the costs would be to monitor the number of vacancies by grade of staff before and after the change, as explained in Chapter 7:2:b. The costs could be reckoned to be saved when the number of vacancies returned to roughly what it had been before the change. This approach does not appear promising because of difficulties in identifying the "average" number of vacancies before the closure and in checking how variations in the number of vacancies after the planned change relate to that change. Also the current systems only show the staff in post as "learners" or "trained" so no analysis by grade is possible. A further means of testing the results is simply to ask nursing officers what happened to nurses affected by a change, and if they transferred to other wards or departments whether the posts to which they moved would have been easily filled. If so, then each transfer can be considered as creating a saving.

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It seems impossible to test the validity of the non-staff ward costs because of the scale and insensitivity of the actual costs. The ward electricity and fuel cost estimates are small in relation to the other ward costs. The ITU is an exception because its air-conditioning generates a high ward electricity cost.* The only available "actual" fuel and electricity costs are aggregated by hospital, cover many areas other than wards or theatres, and are very large. The same problems associated with annual costs and monthly expenditure apply as for the "patient variable" specialty costs outlined above. It does not seem practical to trace the costs from the opening or closure of a few wards to the aggregate expenditure or cost by hospital.

During the first few months of this research project two wards were closed in the NE District and the savings associated with this change had been predicted by an ad hoc study by the management accounts department. When asked how accurate these predicted savings had proved to be, the DFO said that since the books for the District had balanced at the end of the year, for which purpose the change had been made, he felt that the savings must have been achieved. There was no more sensitive check. He could not tell whether the cash limit had been met because of the closures or for other reasons. There is a danger that the model may start to make self-fulfilling prophecies if budgets are set in line with its predictions. The costs may be as forecast because of the planned change, but if they are not, pressure to meet the budget, or spend all the money available, may lead to the costs being as predicted, but this may not be due to the changes made. This is one of the questions explored in the second phase of the research programme.

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Learner nurses. The output showing the effects of a real plan on the nurse training programme has been validated by showing the results to the nursing officers responsible for allocating learner nurses and checking whether the types of wards shown as over- or under-staffed accords with the position in the hospitals.

There are clearly many problems associated with validating a model such as that developed in the NE District mainly because of the dearth of reliable "actual" data; but all practical steps were taken to check the results from the decision-support system with what data were available. Also the results from the model and the data which support the model were exposed to as wide a range of professional opinion as possible. Most managers and doctors thought the results reasonable, or at least plausible, and the DMT of the Bloomsbury District certainly thought the system likely to be sufficiently accurate for the purposes of operational planning when they decided that the system should be extended to cover what was virtually another district.

3. SENSITIVITY ANALYSIS

The sensitivity of the model is analysed to demonstrate the scale of variation of the model outputs to varying inputs. Management need to know whether a small change to particular inputs is likely to have large effects on the model output and vice-versa.

a. Patient activity

Bed capacity: If the bed capacity is exceeded the model reduces the planned caseload. This may occur if change has been made in any of the following areas: beds, caseload, length of stay, and the assumed maximum average bed occupancy rate. The effect of the bed constraint on patient activity ultimately feeds

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Bed capacity: If the bed capacity is exceeded the model reduces the planned caseload. This may occur if change has been made in any of the following areas: beds, caseload, length of stay, and the assumed maximum average bed occupancy rate. The effect of the bed constraint on patient activity ultimately feeds through to the "patient variable" costs. The sensitivity of the patient activity and "patient variable" costs output from the model to the input to the model varies with the characteristics of the specialties which have been altered and especially on change to the average length of stay. A small change to the average length of stay of a specialty with a large caseload can have a dramatic effect on these model outputs. All the outputs are clear linear functions of the inputs, so the relationships between the inputs and the outputs are stable. It is noted, however, that a small change to the assumed maximum average bed occupancy rate of the main bed pool at The Middlesex can have very substantial effects on patient activity. A one per cent change in the average bed occupancy rate equates to 73 rheumatology cases or 357 gynaecology cases. It is recommended that the model be run with a range of assumptions (perhaps 3) as to the assumed maximum bed occupancy rate so that management are aware of the critical nature of this assumption.

Service departments: The likely demands by specialty on the ITU and the children's ward are also linear functions of the patient activity. The proportion of patients in most specialties who use these facilities is very small, but there are some exceptions such as the demand by cardio-thoracic surgery on the ITU and the demand by ENT surgery on the children's ward. So while this part of the model is considered stable, care must be taken with particular specialties such as those mentioned above. The likely demands by surgical specialty on time in the theatres and the anaesthetic rooms and recovery areas varies considerably between specialties, but is directly proportional to patient throughput.

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b. Costs

In the programmed version of the model of The Middlesex the variable costs amount to about a third of the total revenue expenditure. Staff costs account for roughly two thirds of these variable costs. Staff costs cover nurses and domestics associated with wards, floors and training schools. They are known to be accurate and are directly related to user inputs. The remaining third of the variable costs are linked with inpatient or outpatient activity by specialty and are mainly estimates based on samples of costs. There is a linear relationship between these costs and patient activity. The costs per inpatient case or per outpatient attendance range considerably from one specialty to another. The user may be less clear about the likely level of patient activity in the future than about the wards which will be open or closed. He may wish to explore a range of assumptions about future specialty caseloads. So, to what level of change is the output sensitive and how trustworthy are the results? Since the costs are a linear function of patient activity, the output is uniformly sensitive to any level of change. The results are based on data largely derived by sampling. These data do not have the reliability of the ward costs, but they are unlikely to be the major variable costs associated with a planned change.

In conclusion, it seems that the assessment of the sensitivity of the results from the model to changes in the input data is relatively straightforward. Most of the variable costs are staff costs which can be accurately identified and clearly linked with particular facilities. The remaining cost and non-cost results have linear relationships with patient activity. Since this is an

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In conclusion, it seems that the assessment of the sensitivity of the results from the model to changes in the input data is relatively straightforward. Most of the variable costs are staff costs which can be accurately identified and clearly linked with particular facilities. The remaining cost and non-cost results have linear relationships with patient activity. Since this is an "open" model rather than a "black box", if a manager is puzzled by the results produced by particular inputs he can follow up the implications of planning options by demanding progressively more detailed output; he is not trapped by ignorance of the way the model works. Furthermore, the manager does not use the model directly. The input and output is currently filtered by a research modeller who can comment on the sensitivity of the model output and the advisability of further runs.

4. MODIFICATIONS TO THE MODEL

The model only became fully operational towards the end of the first phase of the research programme, so there was little opportunity to make modifications in the light of experience. This is largely the responsibility of the research student who conducted the second phase of the research programme.

The computer model programmed by Richard Brough was not altered at all because, following the decision by the DMT that the model should be extended to include UCH and various other hospitals, it became clear that a new program would have to be written for various technical reasons. For example, the first version only included: the bed pools in the NE District (there are many more in the Bloomsbury District), one ITU and one children's ward (there are more in the new District), and the database was not big enough to include all the extra specialties. The modifications which were suggested by the initial implementation of the first version were incorporated into the generalisable second version.

When the model was used to explore the consequences of the change of use of Princess Alice (see Chapter 10:3) from an inpatient ward to a gastro-intestinal day case unit it became clear that an analysis of "open" model rather than a "black box", if a manager is puzzled by the results produced by particular inputs he can follow up the implications of planning options by demanding progressively more detailed output; he is not trapped by ignorance of the way the model works. Furthermore, the manager does not use the model directly. The input and output is currently filtered by a research modeller who can comment on the sensitivity of the model output and the advisability of further runs.

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When the model was used to explore the consequences of the change of use of Princess Alice (see Chapter 10:3) from an inpatient ward to a gastro-intestinal day case unit it became clear that an analysis of day cases would be a useful development. Such an analysis might cover capacity constraints on day case treatment, the variable costs of such treatment, and whether patients treated in this way significantly reduced demand for inpatient beds. Day cases and their costs have been introduced into the structure of the revised version (Beech:1984).

The model was also used to assess the revenue costs of a new psycho-geriatric ward. This exercise suggested that night staff on wards should be included in the model as distinct from day staff because of their different costs. This had not been a problem in most hospitals in the NE District because the wards were almost entirely manned by learners at night and learners' costs are not considered "ward variable". However, certain psychiatric wards, including psycho-geriatric, have considerable night staff establishments which should be considered "ward variable". In the first version of the model these staff were amalgamated with the day staff, but this application suggested that they should be treated separately. Night and day ward staff are separated in the second version and different costs are linked with each group. Managers and doctors were also considering the expansion of psycho-geriatric day patient care, but the model could give no guidance on this option. An analysis such as that proposed for day cases above might be most useful for this type of patient too. Day patients by specialty have been included as a separate category of patient in the revised version.

When the model was extended to cover the whole of the Bloomsbury District it was necessary to expand greatly the database, but another important modification was made to the bed pools. These could not be altered by the user in the original version, but such a facility seemed logical and useful, and was included in the second version. Using this day cases would be a useful development. Such an analysis might cover capacity constraints on day case treatment, the variable costs of such treatment, and whether patients treated in this way significantly reduced demand for inpatient beds. Day cases and their costs have been introduced into the structure of the revised version (Beech:1984).

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The changes described above should add considerably to the power of the model and enable more DMT planning options to be explored in greater detail. These modifications, along with the expansion of the database with a revised structure (Beech:1984), have turned the original prototype into a versatile planning tool which can be readily implemented in other health districts.

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CHAPTER TEN: PLANNED USE OF THE OUTPUT AND EXPERIENCE GAINED

1. INTENDED USE OF THE SYSTEM

The envisaged use of the decision-support system is shown in Figure 31: while it is primarily intended as an aid for corporate planning for the DMT, it has been found useful by planning teams and individuals considering change to particular services. The aim of the system was clearly stated early in the research: to show the feasibility and likely implications of operational planning options. The research effort was never deflected towards other management problems such as budgeting or the assessment of efficiency. This discipline meant that the structure and content of the model and the database can be shown to follow from a clear and limited purpose. This was most important when the researcher was forced to respond to hostile criticism, both before groups such as the DMT and before particular individuals such as consultants. He could more easily justify the scope of the system, the structure of the model, and the methods of data collection and analysis, because all decisions about the nature of the system were taken in the light of its intended use for planning.

The ultimate aim is for managers and doctors to access such a decision-support system directly through a terminal; perhaps DMT members could each have such a facility in their offices. However, at present this does not seem practical, mainly because of the lack of experience of the potential users with such systems, so the OR analyst acts as intermediary. The data and the results from the model need to be presented to managers with the main assumptions on which they rest clearly indicated (see Appendix 5). These assumptions are given in the system documentation, but it seems unlikely that a busy manager or

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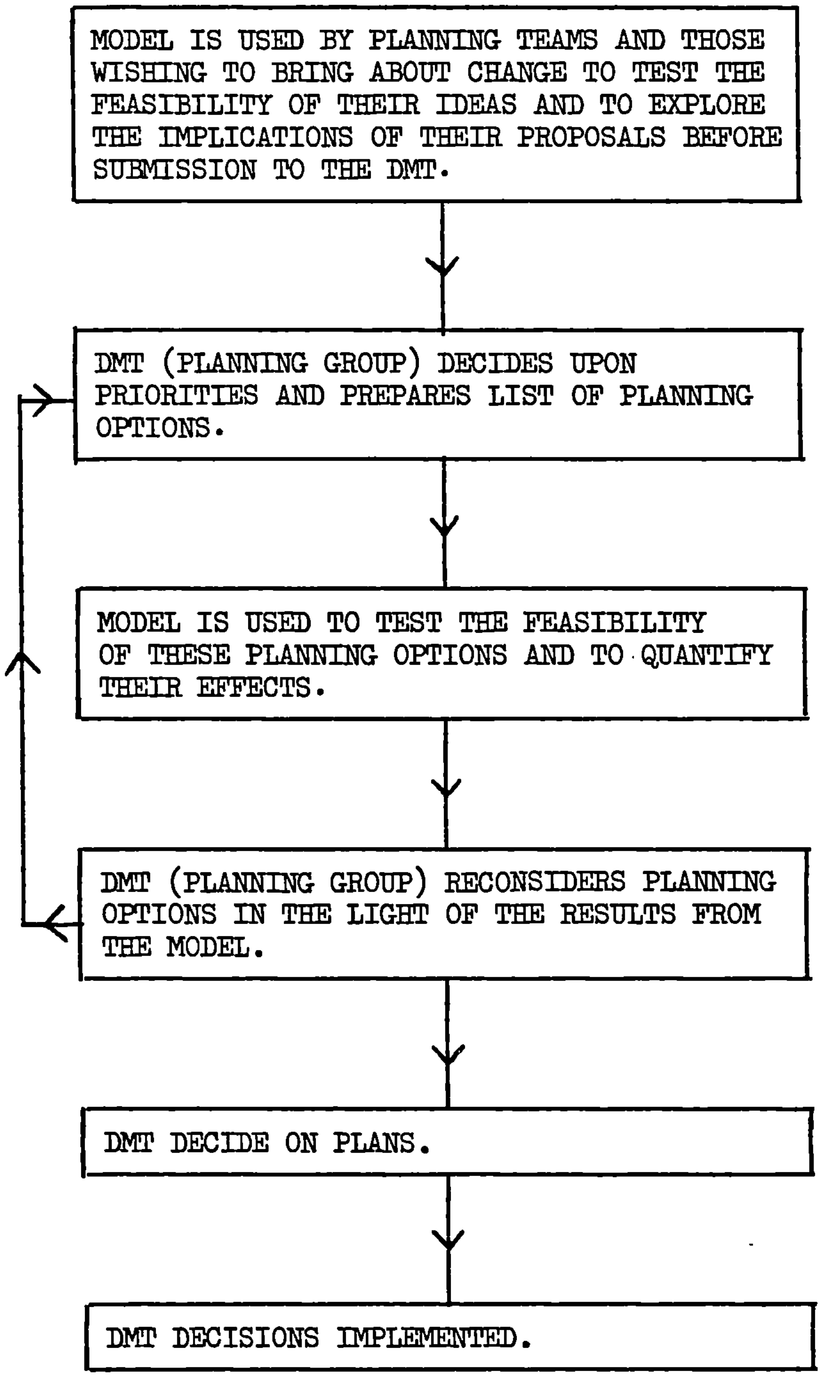

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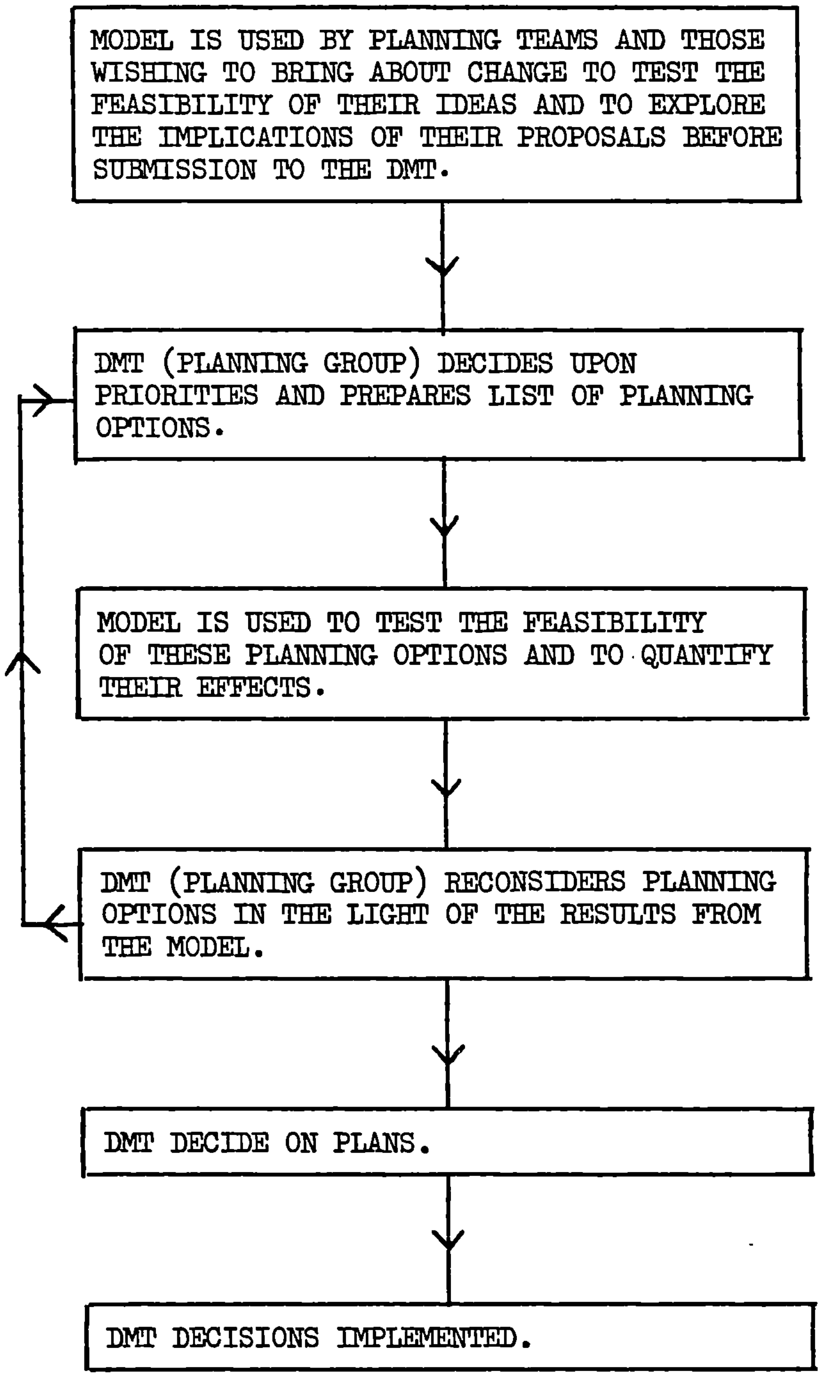

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The practice of the researcher acting as intermediary between the user and the database or model was found to be successful during the initial phase of implementation. A list of the early applications of the data and the model are shown in Figure 32 and discussed below.

2. EXPERIENCE WITH THE DATA

It was necessary to establish some confidence in the data which support the model before the results from the model were exposed to senior management. This has been done, and continues to be done, through responding to a variety of requests for information from senior staff. Early examples of such requests are described below.

In August 1981 the assistant district finance officer asked for help in estimating the non-staff costs likely to be generated by a major expansion of two expensive specialties: cardiology and cardio-thoracic surgery. The costs were derived from the database by the researchers and included in the financial report to the DMT (see Appendix 6). They mainly comprised "patient variable" specialty costs which are certainly doctor unused to the system would find these out by himself when interrogating the database or running the model. A good understanding of the assumptions and the way the model works is most important if the data and the results are to be used appropriately and successfully defended in debate. The analyst who is providing the information should try to find out the purpose for which it is to be used, and give guidance as to how suitable the data and the results are for that purpose. It seems likely that users would quickly become disillusioned with the system if they found that when they used the data or results they could not respond to criticism because they were unclear about the analysis or assumptions on which the figures were based.

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BLOOMSBURY DISTRICT MODEL (REAL211 : APPLIC)

APPLICATIONS OF THE DATABASE AND MODEL TO 14.4.82

DATE	RECIPIENT	APPLICATION
6.7.81	D.F.O.	REVENUE COSTS OF NEW REGIONAL CARDIAC CENTRE
8.12.81	A.D.F.O.	HEATING COSTS OF HEALTH CENTRE
2.2.82	GENERAL	IMPLICATIONS OF CHANGE OF USE OF PRINCESS ALICE WARD FROM AN INPATIENT WARD TO A G.I. DAY UNIT
7.4.82	GENERAL	REVISION OF IMPLICATIONS OF CHANGE OF USE OF PRINCESS ALICE WARD
17.2.82	DIV. N.O. (MIDDLESEX)	EFFECTS OF MORE CARDIAC SURGERY ON THE AVAILABILITY OF BEDS IN THE I.T.U..
11.3.82	MR. STEELE (CON. IN OBS. AND GYNAE.)	COSTS OF TREATING INFERTILITY
16.3.82	ACTING D.F.O.	REVENUE COSTS OF NEW PSYCHO-GERIATRIC WARD AT ST. LUKE'S HOSPITAL.

R.L. BROUGH (14.4.82)

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17.2.82	DIV. N.O. (MIDDLESEX)	EFFECTS OF MORE CARDIAC SURGERY ON THE AVAILABILITY OF BEDS IN THE I.T.U..
11.3.82	MR. STEELE (CON. IN OBS. AND GYNAE.)	COSTS OF TREATING INFERTILITY
16.3.82	ACTING D.F.O.	REVENUE COSTS OF NEW PSYCHO-GERIATRIC WARD AT ST. LUKE'S HOSPITAL.

R.L. BROUGH (14.4.82)

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the most contentious data. It will probably be several years before such costs are generally accepted by senior staff and consultants. At present they are usually thought reasonable or at least plausible. The costs provided from the database were accepted by the regional cardiac centre planning team. In the autumn of 1981 the same manager requested and received certain heating and electricity costs which could be drawn from the database, for use in estimating the cost of a new health centre.

In January 1982 an extra cardiac surgeon was appointed at The Middlesex. Since all patients who have an open-heart operation spend some time in the ITU, the divisional nursing officer was concerned about whether the unit could cope. She asked whether any information could be provided from the database to illuminate the problem. She was sent the graph shown in Appendix 7 which she said she found useful.

In February 1982 a consultant gynaecologist requested information about the costs of certain procedures used to treat infertility and the nursing costs of an operating session for gynaecology. These were supplied and during an ensuing discussion he expressed support for the research programme.

These examples show how the data have been supplied to managers facing problems. The data have also been exposed to many senior staff for comment. The main reason why staff generally accept the data, with all their obvious shortcomings, is because they have been derived locally. The data are the product of studies in the NE District. Also, because of their local knowledge the modellers have a good idea about the strengths and weaknesses of the data and what claims should be made for their reliability. The depth of this knowledge is of crucial importance when arguing for the validity of the data before a consultant or a senior manager. No DHSS or Regional "norms" or guidelines have been used.

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Such data are almost invariably regarded with suspicion or antipathy by the hospital staff, and especially doctors. Also those data systems which are generally considered unreliable, such as HAA, have been avoided as far as possible. However, in the long run, with the model working successfully, the hope is gradually to make more use of such systems so that they will be taken more seriously by doctors which should lead to an improvement in the data input. The authors of a research paper for the Royal Commission noted that the root cause of the inaccuracy of such data is "that they have not in the past been seen as useful locally in aiding decision-making "(Perrin et al: 1978). The decision-support system in the Bloomsbury District is an attempt to use some of the data in this way.

3. EXPERIENCE WITH THE MODEL OUTPUT

In this section two applications of the model to urgent planning problems are described. These initial implementations were largely experimental, but began to establish the image of the model in the District as a useful and accessible management tool.

A ward (Princess Alice) at The Middlesex was closed in November 1981 to be modified in order to re-open in July 1982 as a gastro-intestinal day case unit. The model was not sufficiently developed in early 1981 to be run in parallel with the conventional assessment of the cost and other implications of the change. However, from late 1981 onwards the model was run many times in connection with this scheme. Varying assumptions were made, and in February 1982 a report was submitted to the assistant district finance officer (Beech, Brough: 1981:1). The report based on the results from the model was seriously at odds with the report by the planning team for the new unit. For example, the

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In March 1982 the acting DFO asked for a report about the likely costs and implications of opening a new psychiatric ward at St Luke's Hospital. This planning option was being considered by the DMT at the time. A conventional assessment and a report based on the model were both produced (Beech, Brough: 1982:). Again there were differences, but importantly these were not concerned with the basic costing approach as before, but were discrepancies arising out of the likely staffing of an entirely new ward. They were explored with the acting DFO.

At this stage in the research programme, the parallel running of the two systems, there might have been friction if the staff of the finance office had felt that the modellers were outsiders exposing weaknesses in their practices. This did not happen because the researcher had been planning team report estimated that the costs of all the learner nurses transferred from Princess Alice ward would be saved through a reduction in agency nurse staff costs. For the reasons given in Chapter 7:3:c the researchers argued that such savings were probably most unrealistic and their view was accepted by the divisional nursing officer at The Middlesex. Other major areas of difference were the non-staff savings from an unquantified reduction in inpatients (£25,000) and savings from an unspecified reduction in nursing staff (£10,000). The report by the modellers suggested that the recurring savings from the scheme, estimated at about £80,000 per year by the planning team, would be very low and the result might even be an increase in costs. The researchers then wrote a note attempting to explain the differences. Both reports and the extra note have been circulated to senior staff for comment. Most of the reactions have been in favour of the argument presented in the report based on the model, including that of the acting DFO, and the consultant who had proposed the scheme.

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The runs described above have demonstrated that real planning options can be input to the model and from many contacts with senior staff there seems no doubt that the sort of information provided by the model is useful to those faced with planning decisions.

4. GENERAL COMMENTS ON IMPLEMENTATION

The researcher felt himself responsible for the initial implementation as well as the design, construction and testing of the system, and towards the end of the project he increasingly played the role of adviser to senior management rather than technical specialist. The model and the database have been used as aids for planning by senior managers who continue to support the research programme. Several points seem important concerning the successful undertaking of the first phase of the research programme.

Firstly, as mentioned in Chapter 1, the researcher had spent the year previous to this doctoral research constructing and running a simulation model of a health district as an aid for training senior managers in corporate planning. This gave him an opportunity to practise based in the finance office for the previous two and a half years and was well known to the regular staff. The staff realised that the researcher understood the problems they face when responding to the demands of senior management often with inadequate information systems and that he was not critical of the staff. All discussions of the conventional systems and the model were open and constructive. This was essential since many of the ideas for the modification of the model are derived from comments by the finance staff. If the finance staff, let alone anyone else, had not co-operated in a positive way then the research project would have probably foundered.

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Firstly, as mentioned in Chapter 1, the researcher had spent the year previous to this doctoral research constructing and running a simulation model of a health district as an aid for training senior managers in corporate planning. This gave him an opportunity to practise simulation techniques (which in the event he never used in the NE District), and to develop an understanding of health planning principles, and to discuss planning problems with senior managers and consultants. This experience also gave him important insights into the attitudes of health service professionals and made him aware of problems likely to arise in the building and implementation of a real-life decision-support system. Moreover, the researcher arrived in the District having had plenty of time to consider how to approach the problem and was able to make a swift start to the research which seemed essential given the scale of the problem with which he was faced. The rapid production of some initial data which could be seen to be useful for planning was important because staff in the District took the researcher and his enquiries more seriously in consequence.

Secondly, the aim of the model was from the beginning clearly stated: to show the feasibility and likely implications of operational planning options.

Thirdly, the modeller has been based full-time in the NE District and could keep in close touch with managers, and could gain a good understanding of the politics of a health district and the way decisions are made. Senior finance staff were always available for advice, especially the management accountants who currently estimate the financial consequences of planning options. Regular meetings were held with a consultant paediatrician so that the model would be more likely to be acceptable to clinicians. Since the research student has been working in a particular health district there has been the danger that the result of the research might only be of use in that district. The academic supervisor has played an important role in ensuring that the system developed is likely to be of general use to the NHS rather than just to a specific health district.

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Fourthly, the responsibility for the outcome of the first stage of the research programme was borne from the start by one person: the research student. He was fortunate to receive unwavering support and sound advice from the senior managers of the project steering group.

Fifthly, he was prepared to be flexible in his approach given the problems encountered. He found that the development of the discrete simulation model he had hoped to build was impractical, nor could he effectively use such standard methods as mathematical programming (see Chapter 6:1). Instead he developed a holistic structure of relationships, collected and analysed the data to support it, and programmed this framework as a deterministic model. This decision-support system was immediately found useful by management and should form a solid base from which to explore the use of more sophisticated OR techniques. If the researcher had not shown this flexibility and had not tackled what seemed the main problem, but instead had built a stochastic simulation which rested on a string of heroic assumptions, the research programme would have probably have run into increasingly severe problems.

These seem to be the chief reasons why the research effort progressed steadily during the difficult period (over two years) before the model was operational and during initial implementation. When the model began to produce results based on real data in the autumn of 1981 much constructive and detailed criticism was received from managers and this continues to be generated. Such criticism covered, for example, the need to incorporate day cases and day patients into the system, but also included many comments about the appropriateness of the content and arrangement of the output. However, the basic structure of the model was never called in question. Reaction to this criticism is mainly the responsibility of the researcher undertaking the second phase of the research programme.

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The effect of the research, however, is wider than the use of the results from the model and the database by management. The collection of the data has led the staff of service and supply departments to become more conscious of the costs of these departments and how they are generated. For example a senior technician in the bacteriology department, a senior radiographer, and the sister in the cardiac catheterisation unit all commented in these terms. The construction and maintenance of the database has also brought about an improvement in the quality of data which have been collected, but little used in the past. For example, in the X-ray department at The Middlesex the radiographers and clerical staff were asked by management to complete statistical returns more carefully since the data were clearly being used and inaccuracies were being investigated. The inability of management to make use of data from the routine systems is one of the chief reasons why such data are often of uncertain or of poor reliability.

Key general assumptions of the model and the assumptions made for a particular run always form the first section of a management report based on the model. This has meant that current planning assumptions have to be made explicit if the predictions of the conventional and the computer based systems are to be compared. When the model is not used important planning assumptions tend to remain implicit; for example, if extra beds are planned it is generally assumed that these will be occupied to some considerable extent. Planning tends to be done by facilities which are assumed will be used, rather than by change to patient activity and then by the facilities required to handle the extra or fewer patients. The clear statement of these assunptions must make for more soundly-based planning. Patching over the flaws in plans which are not based on a clear method and relevant information can waste the time of many senior people in seemingly endless planning meetings as inconsistencies come to light;

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a view expressed to the researcher by the divisional nursing officer at The Middlesex. In the past plans were probably scrutinised less closely because more "growth money" was available. It was easier for powerful doctors to demand changes and get their way. This attitude still existed in the District, but with developments having to be funded by cuts elsewhere in the services the analyses on which plans are based were being increasingly challenged and their deficiences exposed by other powerful persons. In previous years if a consultant representing his own service (but with general medical support) made an unsuccessful bid for resources in one year, he might reasonably expect it to be approved within a year or two, but this is no longer the case. The fight for resources within the District is intensifying as it becomes increasingly apparent that the District is not undergoing a temporary squeeze as in the past, but what is likely to be a permanent reduction in the resources available.

The completion of the model input forms has resulted in greater clarity of planning. The logic of the model inputs is generally accepted, so if it is impossible to enter a plan in its entirety on the input form, this may well be due to omissions or inconsistencies in the planning. For example, during discussion with a senior administrator prior to a run to assess the effects of a new regional cardiac centre at The Middlesex it became evident that information had been produced by the planning team about the current position and the target, but that the phasing of the development was unclear. The question was raised at the next meeting of the planning team by the administrator's deputy and the planning report was altered.

The analysis of fixed and variable costs embodied in the model has affected the way the financial consequences of one important scheme have been assessed. In September 1980 the DMT produced a report on the future a view expressed to the researcher by the divisional nursing officer at The Middlesex. In the past plans were probably scrutinised less closely because more "growth money" was available. It was easier for powerful doctors to demand changes and get their way. This attitude still existed in the District, but with developments having to be funded by cuts elsewhere in the services the analyses on which plans are based were being increasingly challenged and their deficiences exposed by other powerful persons. In previous years if a consultant representing his own service (but with general medical support) made an unsuccessful bid for resources in one year, he might reasonably expect it to be approved within a year or two, but this is no longer the case. The fight for resources within the District is intensifying as it becomes increasingly apparent that the District is not undergoing a temporary squeeze as in the past, but what is likely to be a permanent reduction in the resources available.

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The output of the model is based on a number of assumptions and necessarily the estimates are subject to errors. Two important points can be made about this. Firstly, where improvement is believed to be necessary the estimates can be improved (although extra costs are likely to be incurred). Secondly, when change occurs in the District, for example, the computerisation of recording systems, the model can point the way to improvements. The second point is less obvious, but perhaps more important.

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The form of the output has affected the way the cost implications of plans are viewed both in terms of which costs are likely to change and when such costs are likely to be incurred or savings made. Results from the model alerted the finance staff to the omission of domestic staff costs from the analysis of the costs of the change of use of Princess Alice ward (see Chapter 10:3). The finance staff were initially unaware that domestic staff costs are important "ward variable" costs which were likely to be saved when Princess Alice ward was temporarily closed. Also the costs associated with the Princess Alice ward scheme were not clearly identified with a period when they were to be incurred or saved. This led to the under-estimation of the likely savings from the plan in one financial year and the over-estimation of costs in the next. The operation of strict cash limits means that the timing as well as the scale of costs is crucial. The cost estimates were revised when the errors were indicated. The reporting of costs at quarterly intervals by the model makes any such mistakes apparent.

Also the output clearly shows the type of change which causes certain costs to vary. The conventional planning report about Princess Alice ward associated "patient variable" costs with the closure of a ward. Such an analysis matched the thinking of doctors and managers who wanted to close a ward without taking difficult decisions about how exactly caseloads should be cut. The accountants concerned are competent, but they have to produce planning estimates with inadequate information which means that they sometines cannot strongly defend their estimates against critics. They may face severe pressure from doctors, who are trying to improve the service they provide, to produce low estimates of costs of schemes. The cost estimates associated with the change of use of Princess Alice ward were reduced in the face of such pressure. When the budgets had to be set for the year in which part of this development

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CHAPTER ELEVEN: FUTURE DEVELOPMENTS

1. UPDATING THE MODEL AND THE DATABASE

The model and the data may need to be updated in response to two types of changes: firstly, those to the structure of the District which affect the type and arrangement of the elements included in the model, and secondly, those to the data which quantify these elements and the relationships between them.

The model. If changes occur in the structure of the District the logic or the assumptions of the model may need to be altered. In the case of the current model such changes might include the way beds are shared between specialties. The amalgamation of the NE District and the South Camden District necessitated revision of this sort along with other changes of such a scale that a new model, largely based on the previous version, had to be built. This model is much more flexible and generalisable than the earlier version which was a model of the NE District specifically. Lessons learned while running the NE District model have been applied to the structuring of the Bloomsbury District model (see Chapter 9:4). The maintenance of the logic and the assumptions of the model can only be rendered routine by the permanent association of an analyst with the model and the District. Management may also decide that the cost of further refinement of current elements is justified by the increased usefulness of the results; at this point the distinction between updating and developing the model becomes blurred. Future developments are discussed below.

The database. A change to the number of elements in the model rather than the nature or structure of these elements may be accommodated by extending the database of the current model. For example, extra

CHAPTER ELEVEN: FUTURE DEVELOPMENTS

1. UPDATING THE MODEL AND THE DATABASE

The model and the data may need to be updated in response to two types of changes: firstly, those to the structure of the District which affect the type and arrangement of the elements included in the model, and secondly, those to the data which quantify these elements and the relationships between them.

The model. If changes occur in the structure of the District the logic or the assumptions of the model may need to be altered. In the case of the current model such changes might include the way beds are shared between specialties. The amalgamation of the NE District and the South Camden District necessitated revision of this sort along with other changes of such a scale that a new model, largely based on the previous version, had to be built. This model is much more flexible and generalisable than the earlier version which was a model of the NE District specifically. Lessons learned while running the NE District model have been applied to the structuring of the Bloomsbury District model (see Chapter 9:4). The maintenance of the logic and the assumptions of the model can only be rendered routine by the permanent association of an analyst with the model and the District. Management may also decide that the cost of further refinement of current elements is justified by the increased usefulness of the results; at this point the distinction between updating and developing the model becomes blurred. Future developments are discussed below.

The database. A change to the number of elements in the model rather than the nature or structure of these elements may be accommodated by extending the database of the current model. For example, extra specialties could be included. The model of the NE District was designed so that the database was as small as possible; this has resulted in a rather complex program specific to the NE District. The second version of the model has a more complicated database, but a more simple program. This means that the model and the database can reflect greater changes in the District through alteration to the data rather than the program; this is preferable. Such flexibility will be most important since major changes are likely to occur in the next few years. For example, regional centres may be developed and other services in the Bloomsbury District may be radically changed as the population of inner London continues to fall, financial constraints tighten, and private medicine is developed.

The different types of data used by the model are not currently updated at the same intervals. For example, some are changed quarterly, some annually. The procedures are discussed above in Chapter 8. The frequency of the updating of the different sorts of data depends on the importance of the data and the difficulty in obtaining them. So, for example, the time likely to be spent by a patient in each surgical specialty in theatre is to be updated every two years, but the inpatient caseload by specialty is updated using a moving average each quarter. All data are checked at least once a year with a senior member of staff and if doubts are expressed then the full data collection procedure can be activated. All decisions about collecting and analysing data are taken by balancing the cost of doing so against the likely magnitude of the error, if the data are incorrect, and the likelihood of a real planning run to use such data.

The broad schedule of the update is for a renewal of most of the cost data through sampling once a year with a revision using the Health Services Prices Index after six months to allow for inflation. Data specialties could be included. The model of the NE District was designed so that the database was as small as possible; this has resulted in a rather complex program specific to the NE District. The second version of the model has a more complicated database, but a more simple program. This means that the model and the database can reflect greater changes in the District through alteration to the data rather than the program; this is preferable. Such flexibility will be most important since major changes are likely to occur in the next few years. For example, regional centres may be developed and other services in the Bloomsbury District may be radically changed as the population of inner London continues to fall, financial constraints tighten, and private medicine is developed.

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The broad schedule of the update is for a renewal of most of the cost data through sampling once a year with a revision using the Health Services Prices Index after six months to allow for inflation. Data about facilities are checked every six months and data about patient activity are changed at various intervals. Figure 33 shows the estimated staff time required for each part of the update which appears on an annual timetable, and Figure 34 the cost of the system to the NE District. The staff time required to maintain the database should decrease as more computerised systems are introduced into the service and supply departments: this was the strong opinion of the head of technical accounts at The Middlesex. The only place where relevant data can be drawn from a computerised data recording system is the department of chemical pathology. The time taken to collect and analyse data from that department is only a quarter of that taken in the comparable department of bacteriology.

2. FUTURE DEVELOPMENTS WITHIN THE BLOOMSBURY DISTRICT

During the first phase of the research programme several lines of enquiry were eventually considered unpromising at that time and direct research in such areas was then discontinued. For example, originally the researcher had hoped to clarify and if possible quantify the links between the services provided in hospital and in the community; so that if hospital doctors decided to reduce the average length of stay by maternity patients it might be possible to suggest the effect this would have on the workload of local GPs and community nurses. Figure 35 shows some of the lines of research and methods which were given up so that the researcher could concentrate his efforts in areas where he was more likely to produce information, structures or methods useful for the health district and the NHS, and where problems were especially pressing. Some of these discontinued lines of research will probably be re-explored in the future.

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DISTRICT MODEL (REAL123:STFTIME)

UPDATING THE DATABASE : STAFF TIME

DATA	ANNUAL UPDATE (HOURS)	INTERMEDIATE UPDATE QUARTERLY OR MID-TERM ACCORDING TO THE DATA (HOURS)
PATIENT ACTIVITY		
NED1	8	0
NED1A	0	24
NED2	4	0
NED5	2	0
NED6	0.5	0
NED8	0.5	0
NED14	4	0
NED15	0.5	0
NED16	2	0
NED20	1	0
NED21	1	0
NED22	1	0
NURSING DATA		
NUR1	12	12
NUR2	1	1
NUR4	1	1
THEATRE DATA		
[PATIENT ACTIVITY]	[BIANNUAL 24]	0
[RESOURCES]	[BIANNUAL 3]	0
COSTS	8	0.5
DOMESTICS		
DOM1	1	1
DOM2	1	1
PROVISIONS	0.5	0.5
IMAGING SERVICES		
RADIOGRAPHY	48	1.5
CT SCANNER	3	0.5
ULTRA-SOUND	3	0.5
NUCLEAR MEDICINE	30	0.5
DRUGS	80	1
PATH. LAB.		
CHEM. PATH.	5	0.5
BACTERIOLOGY	20	0
VIROLOGY	2	0

- NO PAGE No.255

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NED8	0.5	0
NED14	4	0
NED15	0.5	0
NED16	2	0
NED20	1	0
NED21	1	0
NED22	1	0
NURSING DATA		
NUR1	12	12
NUR2	1	1
NUR4	1	1
THEATRE DATA		
[PATIENT ACTIVITY]	[BIANNUAL 24]	0
[RESOURCES]	[BIANNUAL 3]	0
COSTS	8	0.5
DOMESTICS		
DOM1	1	1
DOM2	1	1
PROVISIONS	0.5	0.5
IMAGING SERVICES		
RADIOGRAPHY	48	1.5
CT SCANNER	3	0.5
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NUCLEAR MEDICINE	30	0.5
DRUGS	80	1
PATH. LAB.		
CHEM. PATH.	5	0.5
BACTERIOLOGY	20	0
VIROLOGY	2	0

J.P.H.	2	0
C.S.S.D.	6	0.5
) INSTRUMENTS	20	0.5
) DRESSINGS	20	0.5
) PATIENTS APPLS.	3	0.5
3) ESTATE MANAGEMENT		
ELECTRICITY COSTS	1	0.5
HEAT COSTS	1	0.5
4) LINEN	20	0.5
5) STATIONARY	4	0.5
6) MISCELLANEOUS	80	0
7) COMPUTER FILE EDITING		
NED3	2	2
NED4	2	2
NED22	2	2
NED23	2	2
NED24	2	2
NED25	2	2
TOTAL	414 MAN HOURS (10 WEEKS)	61.0 MAN HOURS (2 WEEKS)

N.B.

1) ESTIMATES OF THE STAFF TIME REQUIRED TO RUN THE SYSTEM HAVE BEEN BASED ON WORK IN A LONDON TEACHING HOSPITAL. LESS STAFF TIME MIGHT BE NEEDED IN A LESS COMPLEX DISTRICT.

2) THESE ESTIMATES ARE BASED ON THE FOLLOWING ASSUMPTIONS :

A) THAT THE SYSTEM HAS BEEN RUNNING IN THE DISTRICT FOR 2 OR 3 YEARS AND STAFF ARE REASONABLY CONVERSANT WITH PROCEDURES AND FORMS;

B) THAT NO MAJOR PROBLEMS ARISE WHILE OPERATING THE SYSTEM;

C) THAT HOSPITAL STAFF ARE FULLY COOPERATIVE.

3) THE HOURS SHOWN AGAINST "MISCELLANEOUS" COVER ADDITIONAL TIME FOR UPDATING THE DATABASE CAUSED BY : TRAVEL, MINOR DELAYS, PROBLEMS CONTACTING PEOPLE, AND MINOR CHANGES TO HOSPITAL DATA COLLECTION SYSTEMS.

R.L. BROUGH (14.12.81)

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C.S.S.D.	6	0.5
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R.L. BROUGH (14.12.81)

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N.E. DISTRICT MODEL (REAL123:MODCOST)

WHAT THE "N.E. DISTRICT MODEL" COSTS THE N.E. DISTRICT

THE PROJECT BEGAN IN OCTOBER 1979.

FINANCIAL YEAR	DESCRIPTION	COST
1979/80	-	0
1980/81	-	0
1981/82	0.5 (WTE) GA IN FINANCE OFFICE	3520
	HCO IN FINANCE OFFICE FROM OCTOBER 1981	3000
	POSTGRADUATE STUDENT GRANT AND FEES	3000
	EXPENSES	30
	TOTAL	9550

NOTES : 1) THE TIME OF PEOPLE WHO HAVE PROVIDED INFORMATION FOR THE PROJECT HAS NOT BEEN COSTED.

2) COMPUTER TIME IS AVAILABLE FREE ON THE IMPERIAL COLLEGE COMPUTER BECAUSE THIS IS AN ACADEMIC RESEARCH PROJECT.

R.L. BROUGH (4.11.81)

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FIGURE 35

Selected Discontinued lines of research

Area of research		Reason for discontinuation
Interaction between hospital and community services	:	ill-defined community
Patterns of referral by GPs to hospitals studied in future	:	too many factors which could not be quantified
Likely future need or demand for hospital services in NE District	:	ill-defined population to be served
Capacity constraints on outpatient department	:	not pressing problem
Detailed fluctuations in nursing costs on the closure of a ward	:	data inadequate at present
Services for private patients and interaction with NHS services	:	not pressing problem
Radiotherapy as a service dept for other specialties	:	too few patients involved
GI Unit as a service dept for other specialties	:	insufficient time in first phase of research programme, but merits examination
Day case treatment: costs and constraints	:	"
Day patient care: costs and constraints	:	"
Variation in medical staff costs	:	problems of quantification
Effect of change on overall theatre time required, rather than an estimate of change to patient time in theatre	:	inadequate data and the scheduling problem
Variation in staff costs in service and supply depts	:	problems of quantification
Discrete stochastic simulation	:	data and relationships inadequate at present
Graphical input and output	:	not pressing requirement at present
Relationship between number of inpatient and outpatients treated by specialty	:	problems of quantification
Analysis of costs of high-cost sub-specialties eg endocrinology	:	insufficient time in first phase of research programme, but merits examination

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The relationship between the modeller and management in the new Bloomsbury District will probably be considerably different from what it was during the construction and implementation of the original model in the NE District. Management will have far more influence on the development of the model in the Bloomsbury District than they did in the NE District because the model now exists and works. Managers can see the sort of problems it is designed to tackle and the type of guidance it can give. In this section probable developments of the model are discussed, but it is recognised that through use of the model important new ideas about its future form and content may arise. As the model becomes established as a planning tool its potential will probably become more clear and the interplay between the way planning is done and the information produced by the model should lead to more soundly-based planning and the gradual improvement of the model. The use of the model by senior managers and the way it affects, and is affected by, the planning process is a major part of the second stage of the research programme.

The likely developments can be classed as follows:

- extension of the model to incorporate all the hospitals in the new Bloomsbury District;
- expansion of the current elements of the model;
- analysis and integration of fresh elements;
- re-assessment of areas which have been investigated, but have not been included in the model at this stage.

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The major development of the model to occur with the creation of the Bloomsbury DHA in April 1982 was its extension to cover all of the new District. The Bloomsbury District, run by a new DMT, comprises the former South Camden District, which includes University College Hospital, and the former NE District without the two large psychiatric hospitals at Horton and Banstead. This District is one of the most expensive and complicated in the NHS. It contains two large undergraduate teaching hospitals, several post-graduate teaching hospitals, for example, the Royal National Orthopaedic Hospital, and many other hospitals. The undergraduate teaching hospitals lie within quarter of a mile of each other; it is already planned to merge the medical schools. Beds allocated to particular specialties will probably be concentrated on one or other of the sites and, as with the proposed regional centres, the District management will be faced with severe problems in estimating the effects of such fundamental changes. In 1982 a major exercise was begun in the formerly South Camden part of the Bloomsbury District to identify the most important constraints on patient activity, the key variable costs, and the needs of the nurse training programme. The specialties at each hospital will continue to be treated as separate specialties on the advice of consultant staff who consider that specialties with the same name in different hospitals (especially in centre London) may treat largely different types of patients and incur different costs. The database has been restructured and the program suite altered and reprogrammed in Pascal. Several new elements have been included such as day cases.

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At present in the model patients are classed as either inpatients or outpatients. Day patients and day cases are incorporated with outpatients, although the day cases treated in the gastro-intestinal unit and most of their costs are excluded from the model entirely because of the specialist nature of the treatment compared with other general medical outpatients: this is unsatisfactory. Day care and treatment is becoming increasingly important, although in the NE District there were only considerable numbers of day cases in general medicine, gynaecology and urology; and the only specialties with day patients were psychiatry and geriatrics. Day patients differ from day cases in that they usually attend a day centre for regular care rather than a single day's treatment: the services provided for the two types of patient are generally quite different. It seems useful to try to separate such day patients and day cases from outpatients and to investigate their costs and the demands they place on service departments. Also there seem to be important relationships to explore between services for day patients and day cases, and those for inpatients and outpatients. In early 1982 the DMT of the NE District decided to expand psychiatric day care facilities rather than construct a new psychiatric ward. The clarification of such alternative types of care for planning might be an important part of a future model.

A difficulty in attempting the type of analysis proposed above is that the difference between day cases and outpatient attendances is sometimes unclear. Some trained nurses, such as the sister in the urology unit at The Middlesex, consider patients who have a general anaesthetic to be day cases, whereas the DHSS defines day cases as

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Another extension of the model might be the inclusion of the likely effects of the closure of either of the casualty departments on the case-load of inpatient specialties and the coronary care unit. Also the sex of patients is currently ignored in the model, but may be important in calculating the effect of the bed constraint since some wards at The Middlesex are single sex.

There are many areas which so far have been only partially investigated and which are not included in the current version of the model. The costs of various high-cost sub-specialties such as endocinology and vascular surgery need further examination, as do the costs of the radiotherapy and oncology department. The position of the gastro-intestinal units as providers of services to other specialties should be explored. The costs of medical staff need to be identified with the inpatient and outpatient services of each specialty, so that the effect of the removal of all the patients of either type in any specialty can be shown in terms of medical staff costs as well as "patient variable" costs. For example, if all the ophthalmology beds at The Middlesex were closed, but an ophthalmology outpatient service were retained, the model would show the savings on medical staff costs. However, no such savings would be reported "persons who come for investigation, treatment or operation under clinical supervision on a planned, non-resident basis and who occupy a bed" (DHSS:1977), and some clinical departments may use this definition. Despite the confusion it seems helpful to try to distinguish between day cases and outpatient attendances and derive consistent information. This problem with the day cases is typical of the sort of difficulties of categorisation which the model-building exercise highlights. It seems clear that the number of patients treated as day cases rather than as inpatients will continue to grow.

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There are many areas which so far have been only partially investigated and which are not included in the current version of the model. The costs of various high-cost sub-specialties such as endocinology and vascular surgery need further examination, as do the costs of the radiotherapy and oncology department. The position of the gastro-intestinal units as providers of services to other specialties should be explored. The costs of medical staff need to be identified with the inpatient and outpatient services of each specialty, so that the effect of the removal of all the patients of either type in any specialty can be shown in terms of medical staff costs as well as "patient variable" costs. For example, if all the ophthalmology beds at The Middlesex were closed, but an ophthalmology outpatient service were retained, the model would show the savings on medical staff costs. However, no such savings would be reported if the number of ophthalmology inpatient cases were reduced by 50 per cent. Also the demand by specialty on the major service departments needs to be re-examined in terms of staff workload. The future model is not expected to show the change in staff required in, for example, the X-ray department for a given proposal, but it may be possible to provide information similar to that supplied for the theatres. The likely effect of a plan on the theatres is shown in terms of patient time; no costs are calculated. A change to the expected workload of the X-ray department could be reported in terms of hours of staff time. This would only be used as an indicator of the scale of the effects of the change and to highlight potential difficulties. Such results would not be intended to show the actual staff time required in a service department for a planning option to be feasible: this is because it is difficult to see how estimated changes in staff time required would be likely to be reflected in the real service departments. It might be possible, for example, with revised scheduling of the workload in a service department for extra cases to be handled with the same staff. Also it is hard to estimate what delays in the provision of the service would be likely to be acceptable to clinicians. For these reasons the model will probably not attempt to predict whether higher or lower staff costs will be incurred in service departments as the result of a planned change.

Finally, there is a need to ensure that the systems which have been developed in the two merged districts are compatible. While an operational planning model has been developed for the NE District, a specialty budgeting system has been established in South Camden District. These systems should enable the DMT to plan by specialty with reasonably sound and relevant information available, and to allocate money to fund the plans in particular years to specialty or functional budgets as appropriate. It is likely that the specialty budgeting and planning model systems will be if the number of ophthalmology inpatient cases were reduced by 50 per cent. Also the demand by specialty on the major service departments needs to be re-examined in terms of staff workload. The future model is not expected to show the change in staff required in, for example, the X-ray department for a given proposal, but it may be possible to provide information similar to that supplied for the theatres. The likely effect of a plan on the theatres is shown in terms of patient time; no costs are calculated. A change to the expected workload of the X-ray department could be reported in terms of hours of staff time. This would only be used as an indicator of the scale of the effects of the change and to highlight potential difficulties. Such results would not be intended to show the actual staff time required in a service department for a planning option to be feasible: this is because it is difficult to see how estimated changes in staff time required would be likely to be reflected in the real service departments. It might be possible, for example, with revised scheduling of the workload in a service department for extra cases to be handled with the same staff. Also it is hard to estimate what delays in the provision of the service would be likely to be acceptable to clinicians. For these reasons the model will probably not attempt to predict whether higher or lower staff costs will be incurred in service departments as the result of a planned change.

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The development of the system in the Bloomsbury District is being documented in another thesis (Beech: 1984). Since the decision-support system became operational in late 1981 there have been about 30 significant applications and, as mentioned in Chapter 1, some of these involved studies of the effects of important changes such as the closure of a major post-graduate hospital. Roger Beech, the researcher responsible for the second phase of the research programme has managed to bring OR and the decision-support system into the main process of decision-making at the highest level in the District. This is a considerable achievement in what is often a hostile environment, and it seems likely that the system will continue to make a significant contribution to corporate planning in the Bloomsbury District since it is now managed by district staff comprising a senior accountant and two assistants. The willingness of senior management to commit scarce staff resources in this way shows the value they attach to the decision-support system.

3. FUTURE DEVELOPMENTS OUTSIDE THE BLOOMSBURY DISTRICT

A set of general procedures exists for constructing the database and the model in any health district: the relevance of the system developed in the NE District and the Bloomsbury District to other health districts is discussed in Chapter 12.

Should further research be instigated in other health districts the following areas might be explored:

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Should further research be instigated in other health districts the following areas might be explored:

- The projection of the size and characteristics of the catchment population of the health district and the likely need or demand for services which would result. For example: what proportion of the future population are likely to be elderly and what proportion of the female population are likely to be of child-bearing age? Output from such a model could then be used as input to a model such as that developed in the NE District. This exercise (and that which follows immediately below) would probably only be useful in a district with a well-defined catchment population unlike the NE District.
- The relationships between hospital and community services. Perhaps special attention might be focused on alternative forms of treatment and care of the mentally ill and handicapped. How far and at what cost could small community based units replace the large institutions? Also, how might changes in clinical policies affect demand on the community services?
- The extension of the financial model to include capital schemes: their phasing and their revenue consequences over time. Such a model might be used to examine such problems as whether capital might usefully be transferred to revenue and vice-versa over the planning period.
- The development of the revenue cost analysis in terms of detail, precision of timing and reliability of the costs, so that the model could be used to assess whether the district is likely to meet the cash limit for the current year and what courses of action might rectify any projected over- or under-spending.
- The development of the deterministic model into a discrete simulation model, perhaps with the facility to allow the user to intervene as the model is running to change the configuration

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of services and see the results. So, if the user can see that queues are building up as patients wait to enter the operating theatres he can increase the operating sessions or even open another theatre, and see whether the problem is alleviated. This would be a more refined guide to the effects of planning options and one which managers might find highly stimulating especially if a graphical element could be introducted (Secker: 1979). However, the database required to support such a model would inevitably be more extensive than that for the deterministic model and the extra costs would have to be justified by the extra benefits, which would probably be considerable.

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These suggestions of the general areas which future researchers might consider give an indication of the scope for OR in the field of planning health services.

CHAPTER TWELVE: RELEVANCE OF THE RESEARCH TO OTHER DISTRICTS

1. GENERALISABLE ASPECTS OF THE RESEARCH

The deterministic computer model constructed by Richard Brough was designed to be used in the NE District, but also to address planning problems common in the NHS. The structure of this program, and much of the detailed logic too, was used when a second more generalisable version was built to cover the Bloomsbury District: incorporating two former health districts.

What is of relevant to other health districts from the first phase of the research programme is the structure of relationships between elements important to the operational planning of hospital services in a health district, and a practical and tested means of quantifying many of those relationships. Such an analysis was not available when the research began as is demonstrated by the literature survey; if it had been the researcher would have used it and concentrated his attention elsewhere. The researcher carefully studied other systems to find out if they could provide a means of answering such questions as: what is the likely cost of doubling the geriatric caseload over the next two years and at the same time transferring all ENT surgery cases to another hospital? Are there enough beds and will it be possible to close a theatre with the departure of ENT surgery? Can the number of beds in the children's ward be reduced? How will this affect nurse training? The researcher found that no system could provide answers to such a variety of questions (see Chapter 5). Since he had been directed to produce a "comprehensive" information system for corporate planning the researcher attempted to develop a structure and a data system which could give guidance on all these points (see Chapters 7 and 8). This framework and the data collection system which supports it is at the heart of the decision-support system

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2. CAN THE SYSTEM BE USED IN OTHER DISTRICTS?

The researcher compiled a set of procedures for implementing the system in other health districts. The documents do not contain exact instructions about how to collect and analyse the data, since information systems differ from district to district, although the necessity to make certain returns to the DHSS, for example, the SH3 data, ensures some uniformity. The procedures explain what data are required and suggest how they might be gathered and processed. Other procedures are available, if required, to show exactly what was done in the NE District. The system has been designed so that it can be readily understood by a senior manager (of any discipline) from a health district. This is not only to avoid the obvious difficulties of getting people to trust techniques they do not fully understand, but also to give them the capacity to develop and improve the system to meet their needs better. The purpose of the project after all is to change the attitudes of managers by helping them to understand more fully the way the health services work. This will be more easily achieved through methods that people can properly understand and criticise. It is essential that managers see the strengths and weaknesses of the system so that they can use the results judiciously. Once the managers have understood the model and accepted it as useful, then the directness of the procedures and the lack of interference with the day-to-day running of the hospitals should mean that the database can be constructed without too much difficulty.

Having produced the general set of procedures the researcher was developed in the NE District. This structure and data analysis is the product of the first phase of the research programme which is considered of relevance to other health districts.

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Having produced the general set of procedures the researcher was faced with the questions of whether the structure he had identified in the NE District was common to other health districts, and whether the data required could be collected and processed in a similar way and at similar cost in other places.

These questions were explored by a post-graduate student from the University of Warwick as a summer project in 1981 at the John Radcliffe Hospital in Oxford. He found that the relationships included in the NE District model broadly held true in this major hospital as well, and that "in general, the procedures can be followed, although some modifications of them and in one case an alternative procedure would be needed to overcome problem areas. All of the changes made to procedures are in keeping with the principles upon which the model was built", and that a "model of the type developed at the NE District ... could be developed at the John Radcliffe Hospital". (Beech: 1981). Although the John Radcliffe Hospital is a large teaching hospital, the range of services at the hospital is both smaller and they are more simply organised than at The Middlesex. The research in the NE District covered a major London teaching hospital and several small specialist hospitals (gynaecology, geriatrics, and psychiatry). Also two large long-stay psychiatric hospitals were analysed, although they were not included in the computer model since it became clear that they would not form part of the NE District for much longer (see Appendix 3). The different types of hospital investigated and the complexity of the Middlesex Hospital itself mean that should the system be implemented in another health district most problems are likely to have already been encountered in the NE District.

Finally, the extension of the decision-support system across the whole of the new Bloomsbury District has demonstrated that the structure is applicable and the data procedures can be used in another health district: namely that part of the Bloomsbury District including faced with the questions of whether the structure he had identified in the NE District was common to other health districts, and whether the data required could be collected and processed in a similar way and at similar cost in other places.

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University College Hospital which was formerly South Camden District (Beech: 1984).

3. IS THE SYSTEM USEFUL IN OTHER DISTRICTS?

There are several reasons why this decision-support system is likely to be relevant to the needs of other health districts, but the chief argument is that (with revisions) it has been shown to be useful in what was formerly the South Camden District. Each indication of the likely usefulness of the approach elsewhere in the NHS is discussed in turn.

When the researcher was operating simulation models on management training courses he was often asked whether similar models would soon be available as real-life management tools. Such comments indicated that models which could show the likely consequences of planning options, and especially the financial effects, would be of interest to senior managers in many districts. Chapter 3 discusses the financial pressures common to many health districts. The decision-support system developed in the NE District is an attempt to help management cope with these pressures and so is likely to be useful to managers facing similar pressures in other districts.

During the course of the research managers were continually asked whether they thought that the sort of information to be produced by the system would be likely to be relevant to the needs of managers in other districts. Most managers in the NE District had worked in at least one other health district so they were in a position to comment. Invariably they said that they thought such information would also be valued by managers in other districts. Also the project was monitored by a senior official in the DHSS OR Service who would probably have intervened if he thought the product of the research would have no relevance outside the

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NE District. Furthermore considerable interest was shown in the research by the staff of other health districts, for example the District Treasurer at St Mary's Hospital and the finance staff at St Thomas' Hospital, which suggests that the direction of the research had some relevance to their problems. When the acting District Administrator left the NE District to take up a post as District Administrator in a South London health district he expressed the hope that it might be possible to implement such a decision-support system in the other district in the future as he recognised its usefulness to district management grappling with operational planning problems. Also two groups of management consultants expressed interest in developing a commercial package based on the research in the NE District for use elsewhere, although no such developments have taken place as yet. The decision-support system has been used during the Financial Management option in the Corporate Management Programme at the King's Fund College which indicates that its structure and purpose is likely to be of interest to senior managers from a wide range of health districts.

The clearest sign that the system is of relevance to other districts was the decision by the DMT of the new Bloomsbury District to extend it across the whole of the new district, thereby including what was formerly South Camden District. This decision was taken against a background of the departure of the senior managers who had been most closely involved in the project. These included the DFO, the District Community Physician, the District Nursing Officer, and the acting District Administrator. The researcher had to defend the research programme before a meeting of the DMT of the new district and was subject to searching and detailed questioning before the DMT accepted the continuation and extension of the research programme. The decision-support system currently includes 17 hospitals of varying sizes and types, amongst which are two major London

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In conclusion, there seem to be several strong indications that the information system developed in the NE District and extended across Bloomsbury District is of considerable relevance to other health districts trying to assess the effects of planning options in a climate of financial stringency. The implementation of the system in what was formerly South Camden District shows that in the opinion of senior managers and doctors, the structure and data analysis developed in the first phase of the research programme could be usefully extended to another health district to provide relevant information for corporate planning.

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CHAPTER THIRTEEN: THE ROLE OF THE DECISION-SUPPORT SYSTEM IN THE CONTEXT OF PLANNING, RESOURCE ALLOCATION AND BUDGETING

In this chapter the role of the decision-support system developed in the NE District and the Bloomsbury District is placed in a wider context of strategic planning, operational planning, resource allocation, and budgeting. The researcher also comments on problems in these areas themselves in the light of 3 years experience developing a model for operational planning in a London health district. This chapter considers how far the current arrangements seem to make sense from the point of the managers of the Bloomsbury District and suggests improvements. The emphasis is on trying to ensure that the system is workable and that people at various levels are given tasks which they can be expected to carry out in a technically sound way. Little useful purpose is served for the NHS by devolving power to take certain planning decisions to district level, if those decisions could be taken more soundly at a higher level in the service. Some of the remarks relate only to London with its special problems, but most are of a more general nature.

In March 1982 HC(82)6 (DHSS:1982) described the revised NHS planning system to be introduced with the new DHAs. This document emphasises that as much strategic and operational planning as possible should be done at district level: "The DHA is the basic planning unit" (DHSS:1982). However, it is not made clear what the phrase "basic planning unit" means. For example, the problem remains of how much strategic planning should be done at regional level. While some districts may reasonably be expected to do almost all their strategic planning, such an arrangement does not make sense for the Bloomsbury District and probably does

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In this chapter the role of the decision-support system developed in the NE District and the Bloomsbury District is placed in a wider context of strategic planning, operational planning, resource allocation, and budgeting. The researcher also comments on problems in these areas themselves in the light of 3 years experience developing a model for operational planning in a London health district. This chapter considers how far the current arrangements seem to make sense from the point of the managers of the Bloomsbury District and suggests improvements. The emphasis is on trying to ensure that the system is workable and that people at various levels are given tasks which they can be expected to carry out in a technically sound way. Little useful purpose is served for the NHS by devolving power to take certain planning decisions to district level, if those decisions could be taken more soundly at a higher level in the service. Some of the remarks relate only to London with its special problems, but most are of a more general nature.

In March 1982 HC(82)6 (DHSS:1982) described the revised NHS planning system to be introduced with the new DHAs. This document emphasises that as much strategic and operational planning as possible should be done at district level: "The DHA is the basic planning unit" (DHSS:1982). However, it is not made clear what the phrase "basic planning unit" means. For example, the problem remains of how much strategic planning should be done at regional level. While some districts may reasonably be expected to do almost all their strategic planning, such an arrangment does not make sense for the Bloomsbury District and probably does not for many London districts with their large cross-boundary flows of patients. This problem is recognised in HC(82)6: "Especially in conurbations, cross-boundary flows may make it advisable for neighbouring DHAs to co-ordinate their planning" (DHSS: 1982), but no further guidance is given as to how this should be done. In Chapter 4.3 it was argued that it was not reasonable to expect a district such as the NE District to produce a strategic plan for most of its services for two main reasons. Firstly, because it is difficult to model likely future demand from a widely dispersed catchment population with shifting GP referral patterns which are beyond the control of the DHA. Secondly, there is the problem of co-ordinating service developments with changes in other districts. This is particularly acute in a district such as the Bloomsbury District because of the large number of districts from which patients are drawn, and the existence of other large hospitals in central London where the patients might receive treatment. Changes to services in the catchment areas or at the other hospitals might affect the number of patients to be treated at hospitals in the Bloomsbury District. Clearly it does not make sense for districts in London with sizeable cross-boundary flows to try to build local models of their overlapping catchment populations, and the likely future size and nature of these populations, and their likely demand on services in particular districts. Even if a series of models of demand were built at district level in London the problem would remain of district managers being unaware of developments in other districts which might affect their cross-boundary flows. It might be argued that all health districts, however self-sufficient they appear to be, are in this position because changes in adjacent districts might cause extra or fewer patients to cross the boundary. But especially in London there is a need for the co-ordination of strategic planning by districts for most services.

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For this purpose, districts might be grouped in such a way as to minimise the flows of patients between the groups. And such a grouping would cross regional boundaries. Such strategic planning should not be simply the setting of broad objectives, but, for the hospital service, the detailed specifications by specialty of the caseload each district is expected to meet. The date for the achievement of each objective should be set, although it is recognised that districts need considerable flexibility on the timing of change. Decisions on timing would be part of operational planning at district level. Strategic planning of this nature might use models to analyse the likely caseload for each district to bear in the light of facilities currently available and of likely changes to populations and services. The management of a district might need detailed guidance on, for example, how many orthopaedic cases they should provide services to treat in particular years: none was available in the NE District.

The regional boundaries between East and West London make little sense from the point of view of strategic planning because of the significant patient flows across them. For this reason, amongst others, the LHPC and the LAG were established to consider the future of the hospital service in London as a whole. This was a step towards improving the strategic planning for London. However, this attempt to consider the planning problems of London as a whole was not organised as a continuing activity: the LHPC and the LAG were disbanded once they had reported. This seems inexplicable, since the DHSS in proposing the NHS planning system (DHSS:1976:2) emphasised that planning ought to be a continuing and integral part of management and not simply the production of occasional blue-prints of the future. Plans need to be modified in the light of changing circumstances, assumptions and projections. If such analysis could be extended and accepted as the

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Once districts with large cross-boundary flows have been given detailed guidance on their objectives in terms of the caseload by specialty, with broad indications as to timing, then such districts can be expected to produce operational plans of good technical quality at least. If such an approach were adopted by the North East Thames Regional Health Authority (which includes the Bloomsbury District), perhaps, it would be unrealistic and inappropriate to expect the districts to follow the detailed strategic plans to the letter in terms of the service provided or the timing of the service. But if strategic plans were constructed broadly in this way, it would constitute a major advance in the technical planning of acute services at least. Resources should, as far as possible, be allocated to districts on the basis of these plans, not as at present largely by the use of methods similar to those proposed by the RAWP (DHSS:1976:1). These methods seem unsuitable for allocating method for strategic planning in London it should be possible to advise each district how much of which services to provide. A technical strategic plan of this nature could be produced by a central group of high-calibre planners. Each district could then produce operational plans showing how it will attempt to provide the services for which it is responsible as shown in the strategic plan. This could technically be done by each district as long as the strategic objectives are specified in sufficient detail: caseload by specialty. If no coherent and detailed planning is done by the regions in London or by a body considering the health care needs of the city and environs as a whole, then it appears that little coherent strategic planning can be expected to be done. It is to be hoped that senior management in the NHS and the DHSS do not fail to meet the planning challenge presented by the changing population and health services of London by claiming that it is best for districts to take their own strategic planning decisions.

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This is an outline of a suggested response to a most complicated problem. It is well recognised that effective planning is not the production of a blue-print for the future, but a sensitive and iterative process. If planning is to succeed in the NHS, then management at the different levels should be given tasks that technically they can reasonably be expected to achieve, which is not the case in central London at present. The alternative to planning which is set within a coherent framework is for management simply to react to pressures which may or may not lead to coherent responses.

The burden of operational planning which could reasonably be placed on the individual health districts is how to achieve best the detailed strategic objectives. If it is not possible to accomplish them all on time, given various constraints, those responsible for planning the future of the district might rank the objectives in priority order. This is largely a matter of value judgments. Once priorities have been set, the DMT, or planning teams, might generate several courses over time by which each aim can be achieved. Ideally these should be assessed in relation to their immediate objective and in relation to the plans to achieve the money to health districts with catchment populations which are difficult or impossible to define. If such detailed strategic planning were performed, then the DMT as it attempts to implement the strategic plan would be seeking to attain several objectives over various periods of time and the model being developed in the Bloomsbury District provides a means of rapidly exploring the consequences of a range of options. It seems important that each planning tier in the NHS should be given responsibilities that lie within its competence so that the important discussions about value judgments and unquantifiable factors take place with sound technical planning information available.

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The role of the system would be to enable management to consider quickly the feasibility and implications of service options open to them given the strategic objectives and any agreed ranking of these objectives. In this chapter it is argued that such objectives should be set at a level above that of health district. However, if such targets are set by district management, perhaps in the absence of useful guidance from higher tiers in the NHS, then the system can still usefully perform this role. Management will still need guidance on how the strategic objectives can be achieved through detailed operational planning.

Turning to the allied problem of resource allocation, it seems logical that districts should receive the resources required to implement agreed operational plans. These plans having been constructed to achieve strategic plans developed with the emphasis at regional or district level depending on the extent of the likely cross-boundary flows. In London a "top down" approach to strategic planning seems useful along with a "bottom up" approach to operational planning and the associated allocation of resources. Clearly there may not be enough money to fund all the operational plans proposed by districts in a particular year, so senior managers and doctors at regional and district levels will have to choose which should have priority. This would mean that some districts would have to re-schedule their operational plans; again the decision-support system could give useful guidance at this stage, as managers seek to find the best plan or combination of plans within the resource constraints.

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The problem of relating planning and resource allocation is recognised in the First Research Report of the FIP: "Existing formula-based systems for allocating resources from one tier to another are insensitive to the planning aspirations of the lower tier. We considered that there is a need for integration of the two dislocated processes and a strengthening of the influence of plans on resource allocations" (FIP:1979). This support for the views expressed by the researcher is echoed by Cunningham-Greene, quoted in Butts, Irving, Whitt: 1981 who states: "Resource allocation should begin, not at the apex of the hierarchy as the problem of dividing a homogeneous resource called money ... but at the base of the hierarchy as a management problem of estimating what needs to be done, of formulating projects, costing them and attaching some index of priority".

In the section above, the NE District operational planning model has been placed in a context of strategic planning and resource allocation. The type of strategic planning envisaged at regional level or above may be thought idealistic and unworkable, but promising moves have been made in the general direction indicated with the development of gravity models (Yates:1981). Such models could be used to assess the likely effect on patient flows of the provision of services at various locations.

After strategic and operational planning and the allocation of resources, the next stage in the process is the setting of budgets as the first year of the current operational plan is implemented. Budgets are the means by which resources are allocated in detail to parts of an organisation so that a plan can be achieved; they enable management to control expenditure, and to monitor actual expenditure against planned. Most budgets in the NHS are functional budgets: for example, there are budgets for nurses and radiographers. If one acute specialty has been

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Those responsible for generating the costs within a budget should ideally be responsible for managing that budget. A problem in the NHS is that although the district pharmacist manages the drug budget, the costs which make up this budget are generated by doctors and the prescribing practices of the doctors are beyond his control. The Royal Commission noted that in the NHS "those held responsible for expenditure were often not in a position to control it" (Royal Commission: 1979). In what was the NE District the expenditure on various types of drugs and instruments is reported monthly and there are committees of doctors who watch this expenditure. This attempt to encourage doctors to regulate themselves has been quite successful, although when these committees meet, the debate about who is responsible for an overspending can be fierce. However, these are crude controls and the expenditure information is only available after the event and not by specialty.

Given that the DMT has selected a planning option using the operational planning model, what sort of budgeting system at reasonable cost would enable them effectively to control and implement their plan? Since some important costs are generated directly by doctors some type of clinical budgeting may be appropriate. Several approaches to clinical budgeting are described in Chapter 5:2, and the recent Griffiths' report on NHS management emphasised the broad need for budgets "which involve planned to expand at the expense of another in a hospital, then any planned changes in the numbers of doctors should and could be reflected in the functional budgets. However, the implications of such a plan for some budgets is extremely difficult to estimate at present. For example, it is almost impossible to adjust the instrument budget in the light of such planned change since the instrument costs associated with each specialty are not known.

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Given that the DMT has selected a planning option using the operational planning model, what sort of budgeting system at reasonable cost would enable them effectively to control and implement their plan? Since some important costs are generated directly by doctors some type of clinical budgeting may be appropriate. Several approaches to clinical budgeting are described in Chapter 5:2, and the recent Griffiths' report on NHS management emphasised the broad need for budgets "which involve clinicians and relate workload and service objectives to financial and manpower allocations" (Griffiths: 1983). The problem of clinical autonomy is often associated with clinical budgeting. The authors of the First Research Report of the FIP comment: "If it is the consultant who is to effect budgetary control, to whom is he accountable for these responsibilities? Who is entitled to take what action if he carried them out ineffectively and how could such action be reconciled with the concept of clinical autonomy?" (FIP: 1979). The Royal Commission notes that "a doctor has clinical responsibility, but is not usually accountable for the resource and financial implications of his decisions" (Royal Commission: 1979). It may be argued that the prime responsibility of a doctor is the treatment and care of individual patients and that he cannot carry out this responsibility properly if he has to check whether his actions will result in a budget becoming overspent. It may also be argued that doctors should not waste their valuable training and energy by becoming involved in financial management. While recognising that the maintenance of clinical autonomy is a very genuine concern of many doctors, with NHS financial constraints tightening there will be increasing pressures on and interest in doctors becoming involved in the allocation and control of resources. And this may lead to clinical budgets of some sort. The Griffiths' report recognised that doctors "largely dictate the use of all resources and they must accept the management responsibility which goes with clinical freedom. This implies active involvement in securing the most effective use and management of all resources". (Griffiths: 1983). The report further states that in order to do this doctors need "administrative support, together with strictly relevant management information, amd a fully developed management budget approach" (Griffiths: 1983).

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The objective of clinical budgeting is to link more closely than is possible with functional budgeting the power to generate expenditure with responsibility for the control of that expenditure: the problem is described above in connection with the pharmacy. Clinical budgets would also provide a useful means of monitoring and controlling expenditure with planned change in a health district. If agreed changes to patient activity by specialty are to be implemented the clinical budgets involved would be adjusted after consultation between financial and clinical staff. There must be considerable flexibility in clinical budgets because it may be impossible to predict the demand for a clinical service and hence its use of resources, but the budgets should only be flexed in relation to changes in patient activity or price. Consultants have argued that "most doctors have no control over the demands made on them and therefore their expenditure" (Bartlett, Neil-Dwyer, Penney, Harwood: 1981). A more constructive point of view comes from West Midlands RHA:

> "The volume of ailments presented to them (doctors) is not something they can control and the idea to a clinician that he should have a budget and that, because the volume is higher than anticipated, he should change the treatment method to something cheaper would be directly contrary to his professional responsibility to his patient. It is much more likely that clinicians will think of their spending in terms of deciding what their own particular standard treatments should be and the proper time to present them with financial information will be when they are considering the various options" (Taylor, Worsley: 1981).

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A doctor should not have to take a decision about a particular patient he is treating with finance as an important consideration. But he could reasonably be expected to consider cost when deciding on a standard form of treatment. A doctor cannot call on unlimited resources and the Royal Commission emphasise "that there can be no such thing as absolute clinical freedom" (Royal Commission: 1979).

Clinical budgeting can take a variety of forms. Budgets may be allocated to doctors individually or to specialties. The budgets may contain only the consumable costs generated by doctors, or elements for the staff costs as well. Such staff costs may only cover medical staff, or they may include the costs of staff in service departments, such as radiographers, or they may also include ward staff costs, such as nurses. A decision about what type of system to choose would probably be based on the following considerations. Firstly, how far is variation in the expenditure budgeted by specialty within the control of doctors? If a doctor prescribed a drug he is clearly and directly generating expenditure, but should the cost of the pharmacist's time spent in processing the prescription be included in the budget of that doctor? The answer to this question is not obvious since the number of prescriptions dispensed may vary without any change in pharmacy staff costs. Secondly, how many budgets can doctors be reasonably expected to control without being overburdened and distracted from their prime occupation of treating patients? If doctors feel that care of the patient is suffering because of the demands on their time of budget management, they will undoubtedly allocate less time to the budgets. Thirdly, how far is the cost of running the clinical budgeting system justified by better planning, monitoring and control of expenditure? Any clinical budgeting system must provide accurate reports of expenditure by individual doctors or specialties if it is to win the support of clinicians. Without automated systems the staff costs of regularly gathering and analysing such information could be heavy, especially if the clinical budgets cover a wide range of expenditure.

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Clinical budgets do not mean burdening doctors with responsibility for managing all costs. It seems that only a relatively few costs may need to form part of clinical budgets. The FIP team have observed that cost data for clinicians "should relate only to those resources which are variable with patient numbers and over which the consultant has some control" (FIP:1979). Research in the NE District suggests that if the costs of medical and surgical supplies and equipment, drugs, and the consumable costs of imaging and pathology services were included by far the greater part of expenditure directly generated by clinical decisions would be covered. There are great advantages in confining clinical budgets to those few areas where the effect of the clinical decisions on the costs is direct and readily identified. Doctors' decisions may affect many other parts of the hospital system, but these effects are difficult to trace back to individuals. They are hard to quantify and may not be reflected in cash terms, but in terms of longer queues in service departments or heavier workload. A doctor might feel (if he considers the problem at all) that although an action of his has resulted in more work for a service department, there is sufficient slack in that department for the staff to cope with the change so no extra staff costs should be generated. If current staff costs in service departments in some way formed part of a clinical budgeting system there might easily be conflict between the doctors and the heads of the service departments. A doctor might claim that if a service department was run more efficiently it could cope with more work, but the departmental head might disagree and perhaps use the change in demand from the clinician to press for more staff. A doctor might accept a delay in service from a department if he increases the use he makes of that department: this could be a choice between quality and level of care. A major problem here is that increased demands by a particular doctor may lead to a lower quality of service for all doctors. The doctors may well disagree as to

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Experiments with ambitious clinical budgeting systems might be attempted with research support. However, it seems important, should clinical budgeting be generally introduced into health districts, that experience be gained in each district with a simple system before more complicated plans are implemented. If clinical budgeting is attempted, the initial system should be easy to run and easy to understand, and should carefully present simple, reliable and relevant information. If doctors develop confidence in such a system they may well be more inclined to become involved in other developments of resource management.

A central problem with clinical budgeting remains: what should be done if a specialty or a firm overspends with no obvious extenuating circumstances? It seems that the only effective control would be peer what is an acceptable quality of care. The more widely a clinical budget is extended the more problems there are likely to be in judging whether a clinical decision has actually resulted in more or less expenditure. A further advantage of narrowly defined clinical budgets is that the burden of financial control placed on the doctor is as light as possible. The usefulness of a budgeting system must be related to its cost. While sampling and apportioning methods may be acceptable for the costing of operational plans they are likely to be too imprecise for budgeting purposes. Rough costs would probably satisfy managers considering operational planning options, but not clinicians trying to meet agreed budgets. Systems for allocating expenditure to firm or specialty would have to be established at some cost; a further reason for confining the analysis to as few areas as possible. A system of limited clinical budgeting could be run at low cost and yet enable doctors to monitor and control most of the expenditure they generate directly without placing excessive demands on their time.

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A central problem with clinical budgeting remains: what should be done if a specialty or a firm overspends with no obvious extenuating circumstances? It seems that the only effective control would be peer group pressure, since a doctor could respond to pressure from the finance department by claiming that all the expenditure was absolutely necessary for the treatment of his patients. If doctors are aware of what each other spends, and if overspending by one doctor is clearly seen to mean that others may have to be especially restrained, then the doctor responsible for the excess expenditure may face questions from colleagues. There might be serious problems, however, if some doctors in a hospital agreed to clinical budgeting and others did not.

There are major differences between current practice in planning, resource allocation and budgeting in the NHS and the methods proposed in this chapter. The final paragraphs of this chapter contrast current practice with these proposals to indicate directions of future development.

At present in the NHS the linked processes of strategic planning, operational planning, resource allocation and budgeting are "not based upon a consistent set of criteria or classification of services" (Whitt:1981). Client groups seem to be used for strategic planning and specialties for operational planning. Resources are commonly allocated to authorities on the basis of existing expenditure and movement towards targets calculated using "populations weighted to reflect their need for non-psychiatric inpatient services, outpatient and day patient services, community health services etc, with the objective of securing geographic equality" (Whitt:1981). Budgeting is usually conducted by function.

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The research student has concluded that soundly-based strategic planning by managers of districts with large cross-boundary flows such as the NE District is virtually impossible for many, if not all, services.

Strategic planning for these districts should be done at a higher level where planning models may be available and from which viewpoint it is easier to assess the effect of a service development in one district on another. These strategic plans may need to be specified in considerable detail in terms of intended future caseload by specialty for each district and the phasing of changes to achieve those intentions.

The districts such as the NE District and the Bloomsbury District could then develop operational plans for the next few years perhaps with the aid of decision-support systems such as that developed during this research programme. Once objectives have been set either at regional (or similar) level, or by district managers, the role of the system is to help management to understand better the effect of planning options and combinations of options over a few future years. The major problem might well be the implementation of planned changes of consultant posts which may only be possible on consultant retirements. Resources for the coming year might then be allocated largely on the basis of these operational plans. The operational plans, revised in the light of actual resource allocations, should be expressed each year in terms of budgets, some of which should be clinical budgets related to planned caseload and covering a very few key areas in which doctors generate significant costs. Such budgets could not be rigidly enforced, but they may prove to be a useful means of encouraging doctors to become more constructively involved in decisions about how the limited resources of the NHS should be used.

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CHAPTER FOURTEEN: CONCLUSION

The main purpose of this research has been to help management in the NHS, and in the Bloomsbury District in particular, gain greater understanding of planning options. This has involved the construction of a decision-support system comprising a model, a database and a data collection system to be run at minimum cost. The aim throughout has been to develop the system as a means for influencing management attitudes. In this conclusion the image of OR and the role of the OR analyst is further discussed, the relationship of the decision-support system to other major initiatives in the NHS is briefly described, and finally the contribution of this research project to the alleviation of planning problems at health district level in the NHS is reviewed.

The research project has aimed to alter the public image of OR in the NHS. Too often OR seems to be regarded as a narrow, highly technical expertise to be applied to readily quantifiable, tactical problems. This research is an example of OR applied to a central, highly political, ill-defined area of problems which are recurrent and are becoming increasingly pressing in many health districts.

The public and private images of OR, and useful roles which analysts might play have been explored (see Chapter 2) and the role of the research student in the NE District has been described (see Chapter 6). It has been suggested that the image of established OR groups in the NHS and DHSS in the minds of managers in the NHS may correspond to the general and unsatisfactory public image of OR identified by Mitchell. This may be one reason why little of the potential for the application of OR in the health service has yet been realised. To reiterate, Mitchell picks out **four elements in the image of a successful OR group:** political

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The research was based in a politically powerful department: the finance office, and was largely instigated by and has always had the clear support of the head of that department. Also the steering group for the project included three powerful managers. The research has had access to planning meetings at all levels, including the most senior. The most powerful professional group in the district, the hospital consultants, have been involved with the project from the start. The modelling exercise was originally authorised by the DMT Planning Group the majority of whom are consultants, and a consultant paediatrician has acted as a regular adviser. The result has been that so far nothing has been done to alienate the goodwill of the consultants, who have shown increasing support for and co-operation with the research programme. The research student recognises the danger that political pressures may lead to bias in an OR study. He has tried to maintain a reasonable balance in the face of such pressures between pure scientific enquiry and the production of a practical decision-support system. The responsiveness of the research to the current needs of management is demonstrated by the use of the data and the model in the district so far and especially by the ability of the model to provide sensible information about real planning options. An impression of the durability of the research effort was initially produced because it was known that the researcher would be present for at least two years in order to complete a degree. This image (along with that of stability) was strengthened when half the time of an sensitivity, responsiveness to the values and concerns of management, stability and durability of the research programme, and other competences (for example: clarity of thought, technical competence, ability to communicate, holistic thinking, knowledge of the employing organisation) (Mitchell:1980). This research project has attempted to create such an image.

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The rolesthat the researcher has attempted to play have been those of change agent and genuine researcher rather than technical expert, and adviser and problem-solver rather than technician and puzzle-solver. Eilon strongly contrasts the puzzle-solver with the problem-solver, the technician with the adviser. The latter "tends to be a generalist, his role is less well-defined, his premises and recommendations are more liable to be questioned and his approach relies on synthesis" (Eilon:1980).

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An analyst playing the role of adviser is more vulnerable than one playing the role of technician because he may lose the claim to the uniqueness of his expertise in an organisation:

> "As an oversimplification, one might say that the difficulty lies in the fact that the analyst feels comfortable when he deals with variables that are measurable, with criteria that are definable, and with conjectures that are testable, so that when he has to face systems that lack these attributes, his contribution as a scientist can be seriously challenged. His reluctance to be drawn into such situations is understandable, but alas this is precisely where his advice - if it is accepted - is likely to have the greatest impact". (Eilon:1980).

Perhaps OR analysts are not regarded as effective problem-solvers/advisers by NHS managers who conceive of them in a more narrow role. They may be seen as technicians who can provide useful information about the quantifiable part of a problem (which may be a small part), rather than as analysts who may provide new ways of approaching a problem, or a general framework for helping to solve a recurrent problem, or clarification of the assumptions supporting a particular decision-making method.

The decision-support system developed in the NE District and the Bloomsbury District is seen as complementary to other methods in the field of planning and budgeting in the NHS. The intensive research on various aspects of these problems shows how concerned management are for the improvement of current methods. The various projects differ in emphasis and in sum should provide management with a range of tools and systems to help them cope with the important and pressing problems in planning and budgeting.

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The care group approach seems useful as a framework for the discussion of strategic plans. Once such objectives have been set: perhaps, for example that services for the mentally ill are to be expanded at the expense of the acute services, then the decision-support system could be used to explore in detail how this might be done and at what cost over a few forward years. Once the preferred options have been implemented, the care group structure might be used for monitoring costs to see how far the strategic objectives are being achieved. An important advantage of the care group approach is that activity and costs can be matched using existing NHS information systems.

Regression analysis seems to have a role as an aid to the broad costing of strategic plans, but as the operational planning takes place within the strategic framework, then the decision-support system should prove more suitable. However, a promising application of the results of regression analysis seems to be in relation to new hospital developments, in which case clearly a system like that developed in the Bloomsbury District cannot be used to predict costs. National averages of specialty costs might prove a good, quick guide in this situation, although more precise estimates may be required as the date of commissioning draws near.

The Balance of Care system in its revised form for local use seems to give helpful guidance on the resources required to provide different types of care for particular groups of patients. It seems to have been most successfully used with respect to the care of the elderly. While this approach would not seem immediately applicable to planning general acute hospital services, it would seem to complement the Bloomsbury decision-support system in giving managers relevant information about those services where there are important choices to be made between hospital and community care.

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The specialty costing system developed by Magee and Osmolski does not seem directly applicable to the costing operational planning options. This is mainly because little attempt has been made to disintangle the fixed and variable costs or to provide guidance on marginal costing. However, the method could be used in conjunction with the decision-support system to monitor broadly the financial effects of planning decisions to see whether, for example, resources really have been switched from general surgery to mental illness as planned. It could further be used to pin-point particularly high-cost specialties (and in which departments those high costs are incurred) for further investigation and perhaps control. The system might also have a role in comparing the specialty costs of one hospital with those of another in studies of efficiency.

The decision-support system could be used as a tool by CASPE CAT's to explore the wider as well as the more immediate effects of planning options they may be considering. Such teams might also find the analysis of fixed and variable costs could guide them in determining what savings they might realistically claim. The decision-support system is intended for use in corporate planning by the DMT rather than the more narrow planning of CAT's. However, use of the system by planning teams in the Bloomsbury District suggests that CAT's are likely to find the information from the system relevant to their planning.

The specialty budgeting system developed at St Thomas' could also complement the decision-support system in the Bloomsbury District. The DMT might use the latter to help them assess the feasibility and implications of planning options, and then they might use the specialty budgeting system to control the implementation of the plan and to monitor the effects of change. Reservations were expressed earlier about the

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Patient costing is another important aspect of the development of information in the NHS. The FIP has taken an important initiative in this field although by mid-1982 no large scale system was operational. Such systems would also complement the decision-support system by providing more information in areas of particular concern, but much more importantly by giving new opportunities in terms of analysis of patients with the appropriate costs. As current research comes to fruition it should become clear how such systems can contribute to strategic decision-making, the evaluation of planning options, budgeting and monitoring. However, it seems that particular care will need to be taken that the costs of such detailed, comprehensive patient costing systems are justified by the benefits derived from such systems.

The decision - support system in the Bloomsbury District constitutes a fresh and practical attempt to draw together the elements in a health district important to operational planning so they may be rapidly analysed over time in the light of planned change. The system has been implemented within tight constraints on staff time, has been found useful by management, and has been shown to be relevant and applicable in another health district. Management in the NE District have recognised the value of modelling in giving an overview of complex problems, so that each part of the problem is more easily seen in proportion. Managers have accepted that data should be collected for a clear purpose and methods of apportionment used in the St Thomas' budgeting system, but if the costs which vary as the result of change can be more clearly defined, the system may prove an effective budgeting tool. Also, in common with the "Magee" system, the results from the St Thomas' approach could be used for identifying particularly high cost specialties and for purposes of inter-hospital comparison.

Patient costing is another important aspect of the development of information in the NHS. The FIP has taken an important initiative in this field although by mid-1982 no large scale system was operational. Such systems would also complement the decision-support system by providing more information in areas of particular concern, but much more importantly by giving new opportunities in terms of analysis of patients with the appropriate costs. As current research comes to fruition it should become clear how such systems can contribute to strategic decision-making, the evaluation of planning options, budgeting and monitoring. However, it seems that particular care will need to be taken that the costs of such detailed, comprehensive patient costing systems are justified by the benefits derived from such systems.

The decision - support system in the Bloomsbury District constitutes a fresh and practical attempt to draw together the elements in a health district important to operational planning so they may be rapidly analysed over time in the light of planned change. The system has been implemented within tight constraints on staff time, has been found useful by management, and has been shown to be relevant and applicable in another health district. Management in the NE District have recognised the value of modelling in giving an overview of complex problems, so that each part of the problem is more easily seen in proportion. Managers have accepted that data should be collected for a clear purpose and that a modelling approach can indicate which data to collect and how these data should be analysed. This is shown by the analysis of fixed and variable costs which has formed an important part of the research and has considerably altered the approach to the costing of plans at all levels in the finance department. Perhaps the most significant effect of the research programme so far has been in convincing management of the value of establishing a permanent system to provide a logical, technical basis for the assessment of the implications of planning options with important assumptions clearly specified.

Most senior staff accept that it is sensible to construct and maintain a system for assessing the consequences of plans, especially in a period of considerable change, and that the return on the cost of the system will not be immediate. In a time of financial restraint the accurate estimation of the service and financial implications of planning options is most vital, but it is also when senior staff may be most resistant to the cost of a system which provides such estimates. Such feelings are exacerbated in a hospital where there is a sense that might not the money spent on modelling be better spent on direct patient care? Gradually staff in the NE District appreciated that it is more efficient to build a system which can produce information about all sorts of planning options rather than to seek answers to particular planning problems by mounting special studies each time they arise. The modelling approach also enables managers to consider quickly some of the opportunity costs of a scheme, and assess variants of a basic plan, both of which are usually quite impractical if ad hoc studies have to be initiated.

An important aim of the research has been that the assumptions and the structure of the model, the data used, and the means by which the data have been derived should be accessible to managers using the results from the model. If it is difficult for a manager to understand the analysis that a modelling approach can indicate which data to collect and how these data should be analysed. This is shown by the analysis of fixed and variable costs which has formed an important part of the research and has considerably altered the approach to the costing of plans at all levels in the finance department. Perhaps the most significant effect of the research programme so far has been in convincing management of the value of establishing a permanent system to provide a logical, technical basis for the assessment of the implications of planning options with important assumptions clearly specified.

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An important aim of the research has been that the assumptions and the structure of the model, the data used, and the means by which the data have been derived should be accessible to managers using the results from the model. If it is difficult for a manager to understand the analysis which produces the results, he can neither take the assumptions and limitations of the model into consideration when using the results nor make suggestions as to how the model can be improved. It is necessary to establish a satisfactory relationship in the form of a dialogue between the manager and the model (with the modeller acting as a filter) as options and assumptions are explored. Fresh options, as well as difficulties, may arise during such an exchange. Although initial implementation was achieved during the first phase of the research programme, the full use of the system and the development of its role in decision-making lies in the second phase.

The system has been extended throughout the new Bloomsbury District and the possibility of introducing it to other health districts facing similar problems is being discussed. It is hoped that this programme of research will encourage other OR analysts also to contribute to the development and implementation of practical methods and tools for corporate planning at health district level - a major problem area in which OR can make an important contribution.

The purpose of the observations made on planning, resource allocation, and bugeting (based on experience in the NE District) is to further the development of compatible systems in these fields, and to try to ensure that managers and doctors are presented with tasks which they can fulfill satisfactorily. The system constructed during this research project, although it addresses only one of these related problems - namely planning, might provide a useful reference point for research on other problems so that the different approaches can complement and relate to each other.

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The image of the model-building effort in the NE District seems to have developed in the direction of the private image of successful OR groups as described by Mitchell. OR analysts ought to shift their attention to include the problem of health districts because this is the level at which management will have to resolve serious problems of coping with cuts in resources. In order to change the public image of OR in the NHS, and to do more than "solve" temporary problems, it might be useful to develop more long-term research programmes in particular districts, but on general problems facing many districts. Such work might perhaps alter the image of OR in the NHS especially with the production of more accounts of useful work done on the recurrent and central, but less well-defined, problems of district managers. This thesis is an example of one such account.

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MEETING OF THE REGIONAL HEALTH AUTHORITY - 26.7.1982

REVIEW OF FINANCIAL STRATEGY 1983/84 TO 1990/91

MAIN REPORT

1.0 Introduction

1.1 The Regional Operational Plan (published February 1982) contained the following paragraph:

> "There are no firm figures for growth in 1983/84 and 1984/85, 0.33% is used as a working assumption. If this minimal growth rate fails to come about, there would need to be urgent and drastic re-planning by all Districts since it would probably be necessary to make real-term reductions in some or all Districts' revenue allocations to fund the required RCCS".

1.2 This urgent and drastic re-planning now seems to be necessary.

It is now known that for 1983/84 and 1984/85 there will be no growth and a 0.5% efficiency deduction. For the purpose of this paper, nil growth is assumed to continue on after 1983/84 for the period this report covers; efficiency savings deductions are also assumed to continue until 1986/87 at least. (The effect of any change in these assumptions is discussed under Section 15 "Sensitivity").

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1.3 There are essentially five problems; these are listed below and examined in more detail in subsequent sections.

(a) Cash planning in general (Section 2)

(b) Efficiency savings (Section 3)

(c) Commitments to 1986/87 vis a vis nil growth (Section 4)

(d) Funding service developments in Priority Groups (Section 4)

(e) Financial policy post-1986/87 (Section 5)

2.0 Cash Planning

2.1 Since 1976/77 cash limit squeezes in any one year have been made good the following year by restoring the revenue base to a correctly-valued level. From 1982/83 onwards, any shortfall in inflation provision recurs indefinitely; if the inflation provision is set too low, too often, the inflation shortfall not only continues, but compounds.

2.2 The table overleaf shows the effect of the current pay offers on a typical District assuming that they continue unrestored, and assumed shortfunding to a lesser extent in 1983/84 onwards.

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Table 1	1982/83 %	1983/84 %	1984/85 %	1985/86 %
Recurring allocation at 1981/82 levels	100	100	100	100
Shortfunding of pay awards 1982/83	- 0.7	- 0.7	- 0.7	- 0.7
Price inflation shortfall 1982/83	- 0.1	- 0.1	- 0.1	- 0.1
Pay and prices shortfunding 1983/84	-	- 0.3	- 0.3	- 0.3
Pay and prices shortfunding 1984/85	-	-	- 0.3	- 0.3
Pay and prices shortfunding 1985/86	-	-	-	- 0.3
Real value of allocation as compared with 1981/82 level	99.2	98.9	98.6	98.3

3.0 Efficiency savings

3.1 If efficiency savings at the expected 1983/84 level are continued for a further two years then the overall position appears as follows:

Table 2

1982/83	0.2	0.2	0.2	0.2
1983/84	-	0.5	0.5	0.5
1984/85	-	-	0.5	0.5
1985/86	-	-	-	0.5

giving a further decline in the overall real value of the allocation as follows:

99.0	98.2	97.4	96.6

3.2 Thus by 1985/86 a typical District with a £50m budget could be reduced by £1.7 million in real terms due to the combined effect of cash planning and efficiency reductions.

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KENSINGTON & CHELSEA & WESTMINSTER AREA HEALTH AUTHORITY (TEACHING)

NORTH-EAST DISTRICT (TEACHING)

PRINCESS ALICE G.I. UNIT PROJECT

ESTIMATED ANNUAL REVENUE CONSEQUENCES (PAY & PRICES NOV. '81)

order to assess the revenue consequences arising from this project it is essary to review the changes in patient services which are contained in the n viz.

i) Closure of Princess Alice Ward (24 beds) from 2 November 1981.

.i) Reallocation of beds following the closure of Princess Alice Ward:-

a) Ophthalmology moves into Hardy-Roberts where the bed complement is increased by one.

b) Rheumatology moves into King George V/Northumberland.

c) Neurology and Dermatology moves from Hardy Roberts to Latymer.

d) Increase in 5 beds on King George V/Northumberland.

.i) There is thus a net reduction of 18 in-patient beds (mainly in General Medicine).

iv) Opening of New G.I. Unit on Crosspiece floor 2. This includes ERCP treatments and some day case patients with improved patient recovery facilities.

(v) Closure of the present G.I. Unit on Crosspiece floor 1 and also 3 screening sessions in the X-ray department for ERCP patients.

vi) In consequence of G.I. Unit day cases (which would formerly have been admitted as in-patients) beds will be released for the admission of patients in other specialties.

e project team was advised that the net revenue savings for this project quired for the Operational Plan 1982/83 amounted to £84,500, and that the net timated savings amounted to £41,300 as shown in the appendix, leaving a deficit £43,200. It was also understood that the D.M.T. expected that any ditional savings needed to meet the sum required could come from any of the nges associated with the project (items 1 (i) to 1 (vi) above) and not just ly the opening of the new G.I. Unit on Crosspiece Floor 2.

e project team discussed the effect of the service changes on the revenue quirements, and decided that the additional savings necessary (£43,200) should found as follows:-

	Number (W.T.E.)	Amount £	Amount £
(i) Defer addicnal staff appointments for the new G.I. Unit			
Enrolled Nurses (reduction from 2 to 1)	1	6200	
Technician (reduction from 1 to 0)	1	8200	14,400

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			Amount £
(ii)	Reduction of assessment of Non-staff costs for the new G.I. Unit from £10,000 to £5,000		5,000
(iii)	Absorbtion of Non-staff costs for:-	Amount £	
	(a) Additional cost of patients in other specialties	5,000	
	(b) 5 additional beds on King George V ward	5,000	10,000
(iv)	Seek agreement of District Nursing Officer to a reduction of the Nursing establishment for the wards associated with this project		10,000
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ESTIMATED REVENUE CONSEQUENCES (PAY & PRICES NOV '81)

IMATED SAVINGS ON CLOSURE OF PRINCESS ALICE WARD (24 BEDS)

Staffing

Grade	Number (W.T.E.)	Amount £
*Sister	1	9,700
*Staff Nurses	3	20,700
*Student Nurses	8	40,800
Domestics	1.87	10,000
	13.87	81,200

*The establishment on Hardy Roberts Ward as the establishment on Princess Alice was retained in order to cover the work load.

Non-Staff

Mainly Provisions, Drugs, M.S.S.E. Imaging Services, Pathology, Energy Services, Linen Services cleaning materials, etc., say	25,000
Total Staff and Non-Staff	106,200

MATED ADDITIONAL COST OF NEW G.I. UNIT ON CROSSPIECE FLOOR 2

Staffing	Number (W.T.E.)	Amount £
Staff Nurse	1	6,900
Enrolled Nurses	2	12,400
Domestic Assistant	1.12	6,000
Porter	1	5,100
Higher Clerical Officer	1	6,300
Technician	1	8,200
Total	7.12	44,900

Non Staff

Mainly Drugs, M.S.S.E. Imaging Services, Pathology, Energy Services, Linen Services, Cleaning materials etc., say	10,000
Total Staff and Non Staff	54,900

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Total	7.12	44,900

Non Staff

Mainly Drugs, M.S.S.E. Imaging Services, Pathology, Energy Services, Linen Services, Cleaning materials etc., say	10,000
Total Staff and Non Staff	54,900

STIMATED ADDITIONAL COST OF PATIENTS IN OTHER SPECIALTIES IN BEDS FORMERLY CCUPIED BY G.I. PATIENTS FOR PRE-TREATMENT OR POST RECOVERY CARE

		Amount £
on-Staff	say	5,000

STIMATED ADDITIONAL COST OF PROVIDING 5 ADDITIONAL BEDS ON KING GEORGE V WARD

on-Staff	say	5,000

STIMATED NET SAVINGS

TEM I LESS ITEMS II, III & IV ABOVE	41,300

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THE ANALYSIS OF HORTON AND BANSTEAD HOSPITALS

Horton and Banstead are large, long-stay psychiatric hospitals situated in Surrey which formed part of the N E District. All of the patients at Banstead and most of the patients at Horton are drawn from catchment areas outside the N E District. The analysis of the services at these hospitals was conducted in much the same way as for the general hospitals in the district. However, the bounds of change which may be input to the model in relation to these two psychiatric hospitals were much wider than for the other hospitals in the district. This was because either of the psychiatric hospitals may eventually be closed completely. The DMT need to know not only the effects of varying the number of patients treated, and of the opening and closure of a fairly small number of wards, but also the cost and service implications of much larger changes. The scale of the changes modelled meant that a much wider range of costs, and especially staff costs, had to be included than in the case of The Middlesex. For example, the variability of the staff costs of service and supply departments at The Middlesex could reasonably be ignored because of the type of planning options likely to be considered by the DMT with respect to that hospital. However, all such costs must be analysed when total hospital closure is a clear possibility. A fresh approach had to be found to provide management with useful information about how these costs are likely to vary with substantial change to the service.

In the summer of 1981 it became clear that neither of these hospitals were likely to be managed by the N E District after the reorganisation of the NHS in April 1981 so the analysis was terminated. This Appendix shows how far the modelling of these hospitals had progressed before the research was abandoned.

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In the summer of 1981 it became clear that neither of these hospitals were likely to be managed by the N E District after the reorganisation of the NHS in April 1981 so the analysis was terminated. This Appendix shows how far the modelling of these hospitals had progressed before the research was abandoned.

1. Patient Activity and "Patient Variable" Costs

All patients at Horton and Banstead hospitals are classed under mental illness on the statutory return SH3 . The Hospital Activity Analysis excludes psychiatry although some further, if belated, information about psychiatric patient activity at the hospitals is available from the Mental Health Enquiry. However, the categories of patient adopted for this enquiry are not useful for the model. Discussion with the senior consultant at Banstead Hospital revealed that drugs, provisions, linen, and patients clothing were likely to be the only important "patient variable" costs. In the non-psychiatric hospitals of the District "patient variable" costs are mainly calculated as costs per case, but given the often very long lengths of stay in psychiatric hospitals this approach seemed inappropriate. The author of a profile of the N E District states: "Many of the patients at Banstead have been resident there for the major part of their lives" (KCWAHA: 1982). Since the input of planned change to patient activity by number of cases treated or cared for does not seem sensible for long-stay psychiatric hospitals, the choice then lies between inputs such as patient-days, patient-months, patient-years. The patient-day was chosen as the input because this gives the greatest flexibility. "Patient variable" costs were to be calculated as costs per patient-day. The cost of drugs varies considerably per day for different types of patient according to the chief pharmacist at Banstead hospital. To consider all patients as belonging to the same category of "mental illness" would be too insensitive for a model of resource use. The senior consultant at Banstead hospital suggested that the patients be grouped as follows:

Psychiatric medical;
admission/acute;
disturbed/locked ward;
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long stay low dependency;
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long stay high dependency and psycho-geriatric.

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Psychiatric medical; admission/acute; disturbed/locked ward; medium stay; long stay low dependency; long stay medium dependency; long stay high dependency and psycho-geriatric.

This classification of patients was adopted for both hospitals. Information currently available enabled all wards at both hospitals to be associated with one of these categories of patient. Since patients of all types are admitted by each medical firm, it is essential that the costs of particular wards can be associated with particular sub-specialties of mental illness. Negligible "bed borrowing" takes place at Banstead, in contrast to The Middlesex; the position at Horton was never investigated. The costs of drugs, linen, and patients' clothing per patient-day are not routinely available by the above categories and were never estimated. The cost of provisions per general patient-day is readily available. The medical ward was identified as a service department for all the other wards. There is also a flow of patients from the admission wards to all other wards; this was being explored when the study ended.

2. "Ward Variable" Costs

The "ward variable" costs identified at these hospitals are as follows: nurses by grade, domestics, doctors, and estate management costs.

a. Nurses

Nurse ward establishments are not routinely available at either Horton or Banstead hospitals, but this information was supplied by nursing officers at both hospitals. These ward establishments, excluding learners, vary widely from 4 to 20. The considerable costs of the overtime worked at both hospitals are assumed to be roughly balanced by the savings from the serious under-staffing on the advice of the finance staff. There is a nurse training school at each hospital, but the costs of learner nurses were not considered . "ward variable".

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b. Domestics

The domestic establishments by ward at both hospitals are available from the district domestic services manager. The wards at both hospitals are mainly arranged in blocks of two or three, one above the other, so there are no "floor variable" domestic costs as at The Middlesex.

c. Doctors

The variable nature of medical staff costs was only investigated at Banstead Hospital (the hospital recommended for eventual closure in a report by the DMT in September 1980). The senior consultant at that hospital thought that medical staff costs could reasonably be regarded as "ward variable". He suggested that the doctors at the hospital be asked to declare the proportion of their clinical time they spend on the various types of ward which correspond to the psychiatric patient categories listed above. With the support of the senior consultant this exercise was successfully completed. Although the analysis was taken no further, it would clearly have been possible to derive an estimate of the "ward variable" medical staff costs.

d. Estate Management

"Ward variable" heating, domestic hot water, and electricity costs for summer and winter were supplied for typical wards at Horton and Banstead hospitals. The District Works Officer estimated the proportion of the costs to be saved if a ward were closed, allowing for the effects of other ward closures in the same block.

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3. Costs Associated with Changes Leading to Total Closure

The initial assumption to be made when the total closure of a hospital is modelled concerns the minimum viable size of the hospital. On the advice of the DFO and in keeping with the findings of a separate research project the minimum viable size of Banstead Hospital was assumed to be nine wards, forming three blocks, which would accommodate about 300 patients. No such assumption was made with respect to Horton Hospital. The approach to fixed and variable costs above ward level being explored at Banstead just before the research ended is illustrated in Figure A. For a wide range of costs which cannot be clearly identified as "patient" or "ward variable" it was proposed to find out the likely size of such costs with only three blocks open and, with the knowledge of the current position, establish a simple linear relationship between these costs and numbers of beds. This method was accepted as reasonable by the DFO, and by the works manager and a senior administrator at Banstead.

4. Learner Nurses

A detailed analysis of the links between service provision and the needs of the nurse training programmes at Horton and Banstead hospitals was conducted. A wide range of courses is run at these schools (there are about 20 different types of learner at Horton), so a different approach to that at The Middlesex and St Luke's was adopted. The training function of each ward currently used for training was identified along with the learner "establishment" and the maximum number of learners who might be assigned to that ward. It was then assumed that if the establishment of a school changed the number of learners sent to each training ward would change in proportion. Allowance was made for the learners from The Middlesex who went to Horton for psychiatric training and the learners

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5. Conclusion

The proposed model should have been applicable **given the likely course of** events at Horton and Banstead hospitals. The populations of both hospitals are declining due to the introduction of new drugs and new forms of treatment in the community. It appeared probable that one of the hospitals would be closed and its dwindling number of patients transferred to the other. The senior consultant at Banstead thought that admissions from particular catchment areas would be sent to the other hospital from a particular date and that patients already resident at a hospital would be transferred by ward. The feasibility in terms of patient numbers and bed capacity, and the service and cost implications of either of these moves could have been estimated using the proposed model.

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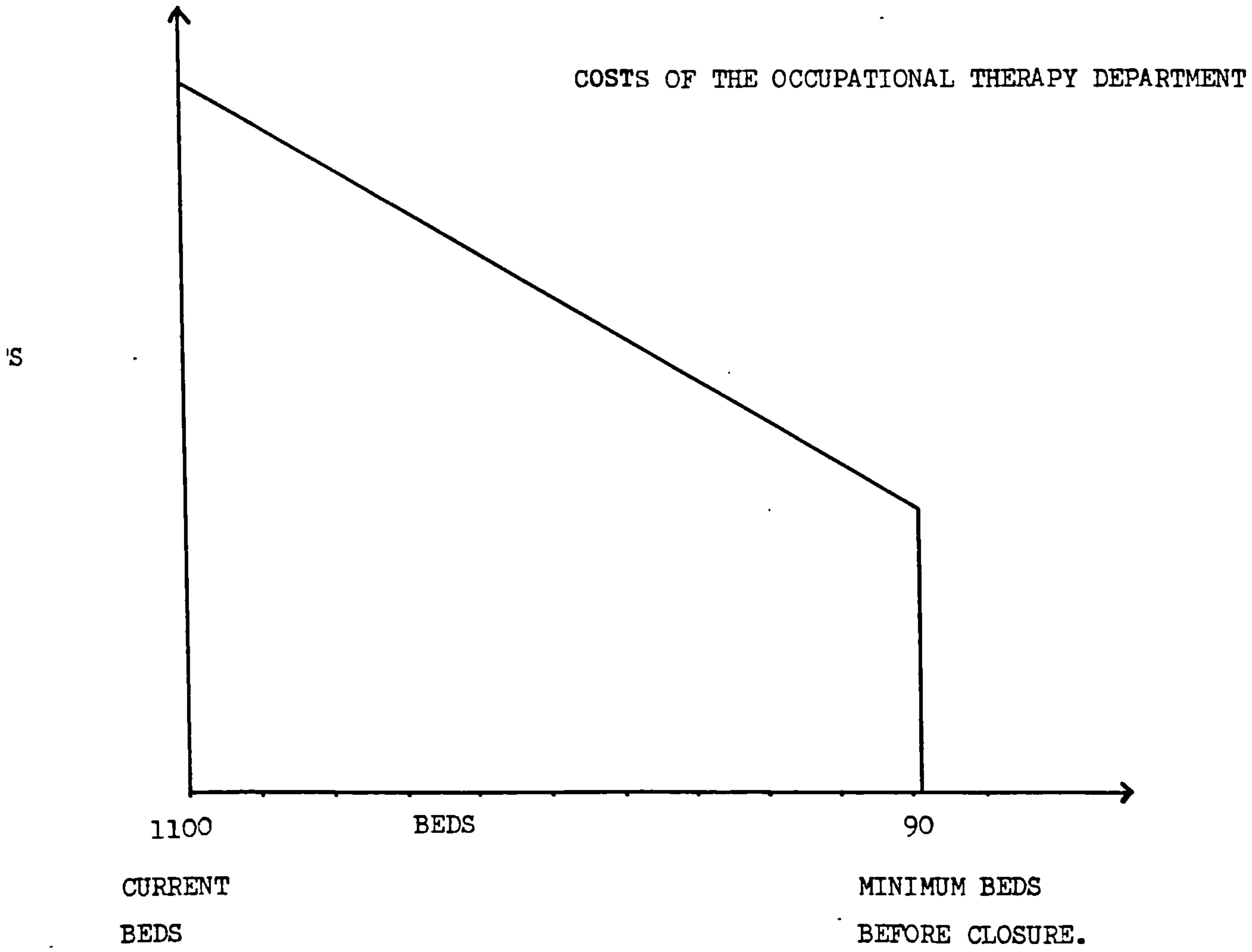
APPENDIX 3
(Figure A)

BANSTEAD HOSPITAL OVERHEAD COSTS



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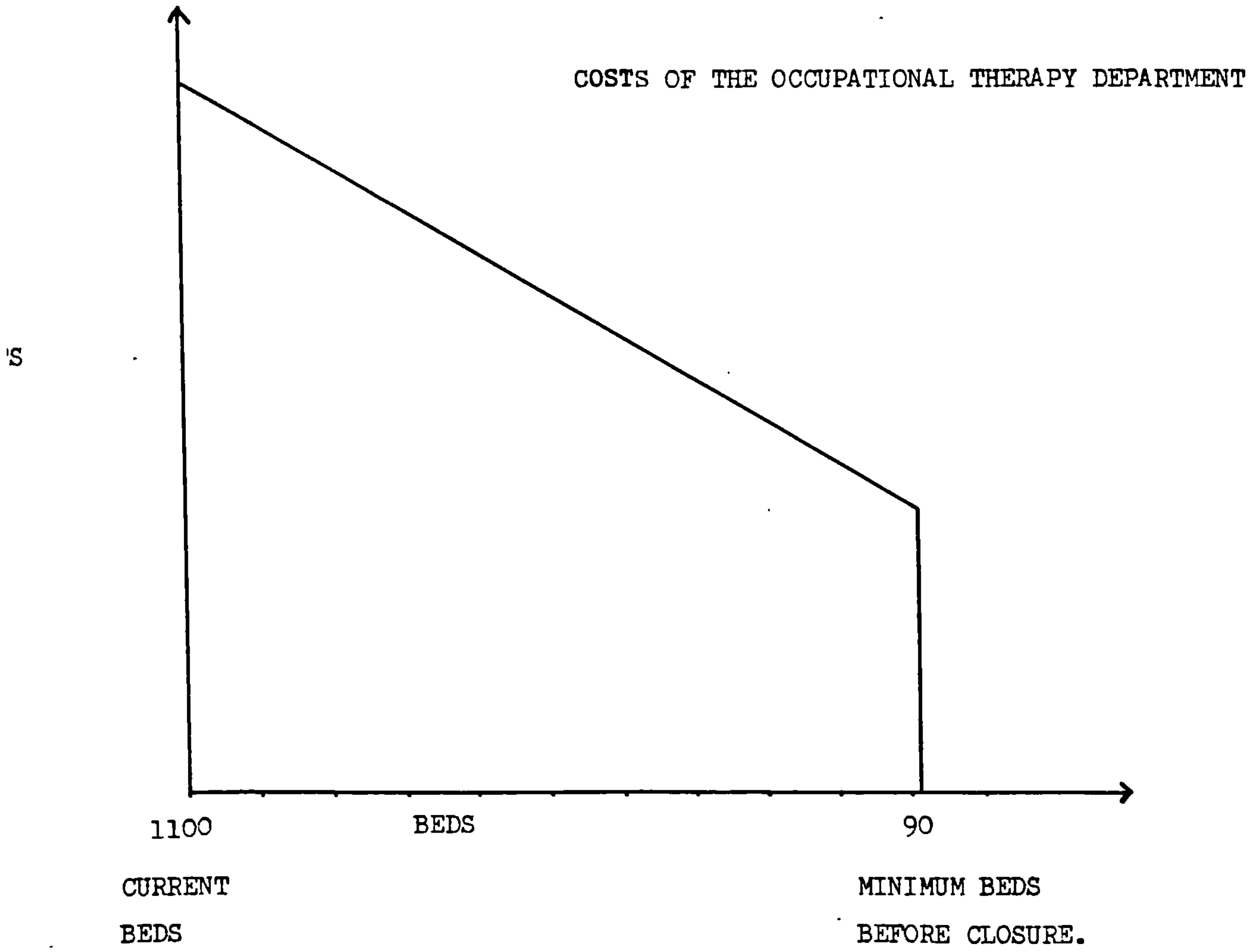

PECIALTY - GENITOURINARY - NEPHRO-LITHOTOMY

AJOR OR MINOR OPERATION: MAJOR

. ANAESTHETIC - RESOURCES

(EXCL. VAT)

	Drug/Fluid	Quantity	Inj/Ing	Strength	Cost
D	Thiopentone 400mg	1 amp		500mg/20ml Water	0.70
D	Suxamethonium 100mg	1 amp		100mg/2ml	0.34
D	Alcuronium 15mg	3 amps		5mg/ml	1.37
D	Fentanyl 100mcg	1 amp		100mcg/ml	1.70
D	Atropine 1.2mg	2 amps		6mg/ml	0.80
D	Neostigmine 25mg	1 amp		2.5mg/ml	0.52
G	Nitrous Oxide)	2 hrs			-
G	Oxygen)				-
D	Pentothal mixer	1			0.01
D	Hartmanns Solution	I.L.			0.99
1	Giving set	1			1.09
1	16G Medicut	1			0.34
D	Omnopon 15mg	1 amp		20mg/ml	0.05
1	2ml Syringe	3			0.09
1	5ml Syringe	1			0.06
1	20ml Syringe	1			0.11
1	Orange needles	5			0.12
1	Green needles	2			0.04

TOTAL £8.33

2. PACKS

	Packs Used	Quantity	Cost
C	2 trolley	1	0.27
C	4 gown	1	0.28
C	Basic	1	1.00
C	12" swabs	3 pkts	1.50
C	Towel pack	1	0.18
C	Endotracheal tube	1	0.10

TOTAL £3.33

3. LOTIONS

	Lotions	Quantity	Cost
D	Water for irrigation	1 litre	0.76
D	Intravenous sodium chloride 0.9%	1 litre	0.92
D	Staining chlorhexidine	60ml	0.09
D	Chlorhexidine in cetrimide	100ml	0.13
D	Cidex	300ml	0.24

TOTAL £2.14

PECIALTY - GENITOURINARY - NEPHRO-LITHOTOMY

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OTHER EQUIPMENT

	Extra Equipment	Quantity	Cost
1	Surgeons gloves	4 pairs	1.20
1	Giving set	1	1.09
1	Intravenous extension tubing	1	0.54
/	Kidney X-ray films (Kodak)	2	N/A*
1	15 blades	2	0.06
1	Sucker tubing	1	0.51
1	20 blade	1	0.03
1	Wide silicone tubing (drain)	1	0.30
1	¼" penrose drain	2	0.46
1	Kidney sling	1	0.05
1	Set of Cummings Catheters (3 per pkt)	1	15.00
1	Urine drainage bags (Aldon)	3	1.31
1	Rack of ⅛" nylon tape	1	0.29
1	Foley catheter size 14	1	0.42
1	10ml Syringe	1	0.08
1	776) (Silk Sutures)	1	0.34
1	775)		
1	4/0 (Dexon Suture)	2	1.38
1	2/0 (Dexon Suture)	1	0.69
1	0 Dexon ties	2	1.32

TOTAL £25.41

INSTRUMENTS

Sets Used	Quantity	Cost
General set	1	N/A
Nephrolithotomy extras set	1	N/A

TOTAL NOT APPLICABLE

RETURN TO CSSD

Equipment	Quantity	Cost
Towels from basic pack	3	N/A
Large towel from basic pack	1	N/A
Towel pack	2	N/A
Towels from 2 trolley pack	4	N/A
Gowns	4	N/A
Endotracheal tube	1	

TOTAL NOT APPLICABLE

	£
Cost excluding VAT	39.21
VAT	5.88
Total Cost	45.09

* COSTED AS PART OF ANALYSIS OF X-RAY DEPT.

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:CIALTY: GENITO URINARY

IOR OR MINOR OPERATION: MINOR - CYSTOCOPY

ANAESTHETIC - RESOURCES (EXCL VAT)

Name of Drug/Fluid	Quantity	Inj/Inf	Strength	Cost
Thiopentone	1 Ampoule	500mg	in	0.70
Nitrous oxide)		½ hr	20ml water	-
Oxygen)				-
Halothane	2 ml	2ml		0.05
20ml Syringe	1			0.11
Needle	1			0.02

TOTAL £0.88

PACKS

Packs Used	Quantity	Cost
Trolley pack	1	0.14
Cystoscopy Pack	1	0.15
2 Gown Pack	1	0.20

TOTAL £0.49

LOTIONS

Lotions Used	Quantity	Cost
Water for irrigation	1 litre	0.76
Cetrimide	100ml	0.16
Water for irrigation (for cystoscopy)	3 litres	2.28
K - Y Jelly x 5 ml sachets	2	0.58
Cidex	1 litre	0.80

TOTAL £4.58

OTHER EQUIPMENT

Extra Equipment	Quantity	Cost
Gloves (Regent Surgeons)	2 pairs	0.60
Y Type Administration Set	1	1.00

TOTAL £1.60

INSTRUMENTS

Sets Used	Quantity	Cost
Cystoscopy Set	1	N/A
Telescopes (varying degrees)	3	N/A
Fibre Light Lead	1	N/A

TOTAL: NOT APPLICABLE

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Telescopes (varying degrees)	3	N/A
Fibre Light Lead	1	N/A

TOTAL: NOT APPLICABLE

RETURNED TO CSSD

Equipment	Quantity	Cost
Trolley Pack (2 towels)	2	N/A
Gowns	2	N/A
Leggings	2	N/A
Towel with a hole	1	N/A

TOTAL NIL

	£
Cost excluding VAT	7.55
VAT	1.13
Total Cost	8.68

RETURNED TO CSSD

Equipment	Quantity	Cost
Trolley Pack (2 towels)	2	N/A
Gowns	2	N/A
Leggings	2	N/A
Towel with a hole	1	N/A
	TOTAL	NIL

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Cost excluding VAT	7.55
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Total Cost	8.68

THE PROGRAM

1. DATA INPUT

The program reads the base data from disk file and accepts the changes planned by the user in conversational mode. The form of the input closely matches the form taken by planning options in the NE District: for instance, if the specialty bed allocation is to be changed, this is input by changes to specific wards, rather than altering the total beds allocated to particular specialties in the hospital. Changes may be made at quarterly intervals up to four years ahead. User documentation consists of: a form for data to be input to the model, guides showing how to run the model and how to produce a report for management, a list of codes, the bounds to the model and the limits to the input values, and prompts at the terminal. The term "NHS" is used to describe non-private patients and facilities.

a. Inpatient cases and days

The number of NHS inpatient cases treated by any specialty in any hospital per quarter may be altered. The current NHS caseload per quarter is printed before the change is made. This current state is a moving average for the previous four quarters. Throughout the input the user is fed information about the parts of the system he intends to change. For specialties at Athlone House and St Lukes Hospital planned occupied bed-days rather than cases are input.

b. Average length of stay

The average NHS length of stay may be altered by specialty. The current length of stay is printed before input of planned change.

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The average NHS length of stay may be altered by specialty. The current length of stay is printed before input of planned change.

c. Assumption of maximum bed occupancy rate

The maximum average bed occupancy rate for NHS inpatients may be set for the bed pool at The Middlesex, the children's ward, the maternity wards, the psychiatric ward, the ITU and for each minor hospital. A default value of 0.99 is set if the user makes no input. The caseload of up to three specialties may be reduced should the maximum bed occupancy rate for a hospital bed pool be exceeded. These specialties are input by the user. If no specialties are chosen and there are excess cases, the program stops.

d. Outpatient attendances

Total outpatient attendances by specialty may be altered.

e. New wards

Only one new ward (as distinct from a closed ward reopening) may be opened at each hospital. The "standard" ward establishment at the hospital is listed as a suggested establishment, which may then be altered. If the ward will have an "establishment" of learners the maximum learners who can train on the ward must be input as well as the type of training experience provided on the ward. If the ward is to be used for either medical or surgical nurse training the user must specify whether the ward can be switched from being used for one type of training to the other. The electricity and heating costs of a new ward are assumed to be those of a "standard" ward at the hospital.

f. Ward closures

Ward closures may be either permanent or temporary (up to two years).

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Ward closures may be either permanent or temporary (up to two years).

g. Reopening wards

Wards currently closed in the NE District and those planned to be shut temporarily are listed. The bed allocation by specialty and the ward establishment on closure are given and may be changed by the user on the reopening of the ward. The user also sets the nurse training characteristics of the ward.

h. Alteration of the specialty bed allocation by ward

Such change may be accompanied by a change to the way in which the ward may be used for nurse training.

i. Change to ward establishments

The establishment of a ward comprises sisters or charge nurses, staff nurses or senior enrolled nurses, enrolled nurses, untrained nurses, learners and domestics.

j. New theatres

One new theatre (as distinct from a closed theatre reopening) may be opened at either The Middlesex or Soho Hospital. The air-conditioning costs are assumed to be the same as those of a theatre in the main theatre suite at The Middlesex.

k. Theatre closures

Theatre closures may be either permanent or temporary (up to two years).

l. Re-opening theatres

Theatres currently closed or planned to be shut temporarily are listed before the change is made.

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m. Change to nursing school establishments

The current establishment of the school which is to be altered is given. The establishment covers all types and grades of learner at a school.

n. Period of simulation

The simulated period always begins at quarter one of year one. The final quarter to be simulated is set by the user. The simulation can run for four years; but it has never been run for more than three which seemed to be the practical limit to operational planning in the NE District. If management should want output from the model over a long period, this could be achieved by running the model more than once.

o. Output options

The options which may be set are as follows:

- patient activity and/or demand on service departments and/or patient and occupied bed-day variable costs for up to ten specialties; inpatient and outpatient information is requested separately;
- costs associated with up to ten wards;
- total variable costs associated with a plan summed by hospital;
- a listing each quarter of patients by specialty who are estimated to be unable to enter hospital or specialist units within a hospital, such as the ITU, as a result of planned change;
- an analysis of how a plan is likely to affect the nurse training programme;
- quarterly or annual results.

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- quarterly or annual results.

After every two or three questions the changes which the user has input are listed, so that they may be checked and any alterations made.

If all possible output were produced this would be of little use to a busy manager. The output options enable the user to present to management only the information most relevant to the problem he faces.

The model selects, relates and arranges data and transforms them into information. The facility to choose only the most important information for output is central to this process.

2. DATA PROCESSING

The program simulates each quarter in turn, scanning for any change. There are four main parts to the simulation loop.

a. Patient facilities and activity

The bed capacity is checked against the planned caseload in the main pool, maternity wards and psychiatric ward at The Middlesex, in the pool at Soho Hospital, and in the wards allocated to specialties at Athlone House and St Luke's Hospital. If the bed capacity is exceeded the cases are reduced and can be printed out for each quarter. Allowance is made for the likely demand by specialty on the children's ward at The Middlesex to which a bed constraint is also applied. The model estimates the likely demand in terms of patient time in the theatres and the anaesthetic rooms and recovery area by each specialty, and the expected demand on beds in the ITU. If there is insufficient capacity in the ITU the cases refused admission are listed at the terminal.

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b. "Patient variable" costs

The change to "patient variable" costs for the quarter by specialty is calculated: only the variation from the baseline is estimated. For inpatients this difference may be due either to reductions of caseload, because of insufficient bed capacity, or to planned change in the number of patients to be treated by specialty. Inpatient cases are thought to generate significant costs in the following areas: imaging services, the pharmacy, pathology services, instruments, patients' appliances, CSSD supplies, and dressings. Inpatient occupied bed-days are considered to affect the following costs: linen and bedding, stationery, and provisions. There are no constraints in the model on the number of outpatients seen in a specialty, so variation in outpatient costs is always the result of planned change. The "outpatient variable" cost heads are the same as those for inpatient cases.

c. "Ward variable" costs

The costs associated with the opening or closure of wards are assessed for the quarter. The nursing and ward domestic costs are the establishment multiplied by the quarterly cost to the District. The floor domestic costs are included if both the wards on a floor are closed. The electricity cost and the fuel cost for heating and domestic hot water are calculated for the quarter. The fuel cost varies with the season and at Athlone House and St Luke's Hospital with the simultaneous closure of contiguous wards.

d. Nursing training

The likely effects of a service plan on the nurse training programmes at The Middlesex and St Luke's Hospital are calculated. If a ward used for surgical or medical nurse training is switched to the alternative category, the change is printed at the terminal.

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3. INFORMATION OUTPUT

The effects of certain constraints are printed during the main processing routines as described above. The main output is arranged by inpatient specialty, outpatient specialty, ward, hospital, and nurse training (see Chapter 9:1).

4. TECHNICAL DETAILS OF THE PROGRAM

The program comprises about 7,000 lines of Fortran and divides into three main sections: input, main simulation loop, and output. Each section comprises a library of routines accessed by a procedure file and a main program. All data are held on disk file between the activation of each group of routines. The input section accepts data from the disk files and the terminal. The details of a normal run can be entered and verified by an experienced user in about half an hour using a 30 characters-per-second terminal. The routines in the main loop check the feasibility and assess the implications of planned changes each quarter, and the output section lists the results. All the routines, apart from two minor subroutines, are processed sequentially, those in the main loop being accessed each time a quarter is simulated. The program runs on the computer complex at Imperial College, University of London and requires about four seconds of central processor time using about 28K of core.

5. VERIFICATION

The program has been verified in several ways. Firstly, by means of checks on the data written to disk file at the end of the input and main processing sections of the program. Secondly, a large number of intermediate values can be generated throughout the program if such an output option is set. This facility permits the functioning of the program to

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6. PROGRAM DOCUMENTATION

The program has been documented at various levels. There is a broad flowchart of all the routines (see Figure B) and separate flowcharts of each particular routine which show the position and purpose of the main blocks of program code. Finally the detailed and full comments in the program itself should render the code comprehensible. There is also a library of variables. All program and system documentation is held on disk file for ease of updating and editing (available on request).

7. THE MANAGEMENT REPORT BASED ON THE MODEL

The output from the model does not constitute the report to management. A procedure shows the steps by which model output is changed into a document for management. Such a report consists of the following:

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- a title page giving the subject, data, and the recipients of the report, as well as who should be contacted with any enquiries;
- a listing of a few key general assumptions of the model (the same list is used for almost all reports);
- a page showing the assumptions made for the particular run of the model and any comments on the output generated;
- page(s) of output from the model;
- page(s) of comments on the output, describing its strengths and weaknesses and setting it in context.

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****

.E. DISTRICT MODEL (REAL123 : STRUCT)

PROGRAM STRUCTURE

	SETUP	: READS DISTRICT DATA INTO CORE FROM DISK FILES.
	PINPT	: PATIENT ACTIVITY INPUT BY USER.
INPUT	IN2	: WARDS OPENING/CLOSING INPUT BY USER.
	IN3	: WARDS REOPENING, CHANGE TO SPECIALTY BED : ALLOCATION, CHANGE TO WARD ESTABLISHMENTS : INPUT BY USER.
	IN4	: THEATRES OPENING/CLOSING INPUT BY USER.
	IN5	: CHANGES TO NURSING SCHOOLS, END OF SIMULATION, : OUTPUT OPTIONS INPUT BY USER.

DATA HELD ON DISK FILE "COMFIL"

	UPDATE	: SCANS FOR CHANGE IN QUARTER.
	BEDCON	: CHECKS BED CAPACITY OF MAIN POOL, CHILDRENS : WARD,MATERNITY,PSYCHIATRY AND MINOR HOSPITALS.
MAIN	THECON	: ESTIMATES THEATRE TIME AND ANAESTHETIC ROOM/ : RECOVERY AREA TIME.
SIMULATION	ITU	: ESTIMATES DEMAND ON THE INTENSIVE THERAPY : UNIT.
LOOP	PATVAR	: ESTIMATES CHANGE TO INPATIENT AND OUTPATIENT : VARIABLE COSTS, SUCH AS DRUGS, BY SPECIALTY
	WRDVAR	: ESTIMATES CHANGE TO WARD AND FLOOR VARIABLE : COSTS, FOR EXAMPLE, NURSING,DOMESTIC,ESTATE : MANAGEMENT COSTS.
	NURTRN	: ESTIMATES IMPACT OF CHANGES ON THE NURSE : TRAINING PROGRAMME.

DATA HELD ON DISK FILE "COMFL2"

	OUTIP	: PRINTS OUT INPATIENT ACTIVITY AND COSTS.
	OUTOP	: PRINTS OUT OUTPATIENT ACTIVITY AND COSTS.
OUTPUT	OUTWRD	: PRINTS OUT WARD AND FLOOR VARIABLE COSTS.
	OUTUT	: SUMS AND PRINTS OUT COSTS BY HOSPITAL.
	OUTNR	: PRINTS OUT LEARNER NURSE VARIANCE.

APPENDIX 5
(Figure B)

****

.E. DISTRICT MODEL (REAL123 : STRUCT)

PROGRAM STRUCTURE

INPUT

SETUP : READS DISTRICT DATA INTO CORE FROM DISK FILES.

PINPT : PATIENT ACTIVITY INPUT BY USER.

IN2 : WARDS OPENING/CLOSING INPUT BY USER.

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: ALLOCATION, CHANGE TO WARD ESTABLISHMENTS
: INPUT BY USER.

IN4 : THEATRES OPENING/CLOSING INPUT BY USER.

IN5 : CHANGES TO NURSING SCHOOLS, END OF SIMULATION,
: OUTPUT OPTIONS INPUT BY USER.

DATA HELD ON DISK FILE "COMFIL"

MAIN SIMULATION LOOP

UPDATE : SCANS FOR CHANGE IN QUARTER.

BEDCON : CHECKS BED CAPACITY OF MAIN POOL, CHILDRENS
: WARD,MATERNITY,PSYCHIATRY AND MINOR HOSPITALS.

THECON : ESTIMATES THEATRE TIME AND ANAESTHETIC ROOM/
: RECOVERY AREA TIME.

ITU : ESTIMATES DEMAND ON THE INTENSIVE THERAPY
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OUTWRD : PRINTS OUT WARD AND FLOOR VARIABLE COSTS.

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KENSINGTON AND CHELSEA AND WESTMINSTER AREA HEALTH AUTHORITY (TEACHING)

NORTH EAST DISTRICT (TEACHING)

REGIONAL CARDIAC CENTRE PLANNING TEAM

FINANICAL REPORT

INTRODUCTION

An assessment has been made of the additional annual revenue costs arising from the proposed increase in Cardiology and Cardiac Surgery at The Middlesex Hospital to provide a Regional Cardiac Centre. A summary of the estimated additional recurring revenue costs totalling £706,000 is shown in Appendix I.

The assumption has been made that the overall bed complement of The Middlesex Hospital will remain approximately the same, and that therefore there will be a corresponding reduction in other specialties. Until the contracting specialties are identified it is not possible to estimate any savings arising and especially if the policy of no redundancies is to continue to apply.

It is envisaged that this development would take place over one or two years, but it is not practical at this stage to separate the additional costs over different financial years.

WORK LOAD

The main features of the increases in the work load are shown in the recommendation of the report. A more detailed comparison of the patients statistics is shown in the attached Appendix IV.

A summary of the work areas reviewed is as follows:

i) Cardiological Investigation Departments
ii) Cardiology Ward
.ii) Cardiac Surgery Ward
iv) Operating Theatres
v) I.T.U.
vi) O.P.D.

METHOD OF COSTING

The method of working is to identify for Cardiology and Cardiac Surgery respectivel the main "fixed" and "variable" costs in the direct treatment departments.

In this project the "fixed" costs relate to staffing and Appendix II and Appendix I respectively show the current establishments and costs and the proposed levels necessary to sustain the increase in work load, and covers the areas listed in paragraph 2 above.

Staff establishments are able to provide for a range of level of work and it is only when the margins are exceeded that additions become necessary with resulting rises in costs.

The variable costs however fluctuate directly in line with the level of work performed, and these have been broadly assessed from sample data as follows:

(i) Cardiac Catheterisation at £90

(The components include Catheters, Anaesthetics, X-ray films, contrast materials, disposable and other expendable equipment)

KENSINGTON AND CHELSEA AND WESTMINSTER AREA HEALTH AUTHORITY (TEACHING)

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(The components include Catheters, Anaesthetics, X-ray films, contrast materials, disposable and other expendable equipment)

(ii) Nuclear Medicine Cardiac Scans at £50

(The components include radio pharmaceuticals, films etc.)

iii) By-Pass Operation with Valve Replacement at £890

(The components include anaesthetic resources, by-pass equipment, packs, lotions, sutures, other equipment and valves)

(iv) By-Pass Operation without Valve Replacement £340

(The components as in (iii) above except for Valve)

(v) Pace Maker Insertions at £26

(The component mainly X-ray films)

(vi) Pace Maker Appliances £460

(Based on average price for current workload)

FUNDING OF REGIONAL SPECIALTIES

No information is available as to the possible changes in the funding of Regional Specialties. The reconciliation of any funding changes with the RAWP target formula could be a complicated matter which would have repercussions for this Teaching District.

The implications suggest a mixture of allocations based on standard specialty costing and that of weighted population. The monitoring of performance is also likely to require more detailed accounting information.

NON-RECURRING COSTS

A list of the additional durable equipment and theatre instruments required together with the estimated cost is provided by the Technical Officers elsewhere in the main report.

CONCLUSION

The information required by the Planning Team has reinforced the need to continue to research and develop systems of specialty costing which would allow resources to be allocated on accurate financial data commensurate with the planning process.

AF/6.7.81

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AF/6.7.81

KENSINGTON AND CHELSEA AND WESTMINSTER AREA HEALTH AUTHORITY (TEACHING)

NORTH EAST DISTRICT (TEACHING)

REGIONAL CARDIAC CENTRE PLANNING TEAM

SUMMARY OF ESTIMATED ADDITIONAL RECURRING REVENUE COSTS

I ARISING FROM PROPOSED ADDITIONAL STAFFING

Details	Cardiology	Cardiac Surger
	£'000	£'000
Cardiologists/Cardiac Surgeons	74.9	63.2
Anaesthetists	2.1	23.5
Nursing		
(a) Catheter Laboratory	18.8	
(b) Twin Theatre Suite		46.6
(c) I.T.U. (Additional 2 beds)		67.9
(d) Progressive care surgical ward		75.9
Physiological Technicians	12.2	
Medical Physics Technicians		
(a) Pump technicians		26.4
(b) Equipment Maintenance		15.6
Physiotherapists	7.2	6.2
Nuclear Medicine (Heart scans)	21.4	
Medical Secretary		5.5
Porters		5.6
TOTAL	136.6	336.4
II ARISING FROM ESTIMATED VARIABLE COSTS RELATED TO WORKLOAD		
480 Additional Cardiac Catheterisations at £90	43.2	
150 Additional Nuclear Medicine Cardiac Scans at £50	7.5	
100 Additional By Pass Operations with valves at £890		89.0
160 " " " " without " " £340		54.4
80 " Pace Maker insertions at £26	2.1	
80 " " " appliances at £460	36.8	
TOTAL	89.6	143.4
GRAND TOTAL	226.2	479.8
	706.0	

KENSINGTON AND CHELSEA AND WESTMINSTER AREA HEALTH AUTHORITY (TEACHING)

NORTH EAST DISTRICT (TEACHING)

REGIONAL CARDIAC CENTRE PLANNING TEAM

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KENSINGTON AND CHELSEA AND WESTMINSTER AREA HEALTH AUTHORITY (TEACHING)

NORTH EAST DISTRICT (TEACHING)

PROPOSED REGIONAL CARDIAC CENTRE

CARDIOLOGY STAFF ESTABLISHMENTS AND COSTS

STAFF GRADE	ESTABLISHMENT			ANNUAL COST		
	*June'81	*Proposed	Increase	*June '81 £'000	*Proposed £'000	Increase £'000
Cardiologists						
Consultants	14 sessions	30 sessions	16 sessions	26.8	60.7	33.9
Senior Registrars	2 WTE	2 WTE	-	37.6	37.6	-
Registrars	Nil	2 WTE	2 WTE	-	31.2	31.2
Senior House Officers	1 WTE	2 WTE	1 WTE	12.7	23.6	10.9
House Officers	1 WTE	1 WTE	-	10.2	9.1	1.1
TOTAL	5.3 WTE	9.7 WTE	4.4 WTE	87.3	162.2	74.9
Anaesthetists						
Registrars	5 sessions	7 sessions	2 sessions	5.2	7.3	2.1
Nursing						
Catheter Laboratory						
Charge Nurse	1 WTE	1 WTE	Nil	9.1	9.1	Nil
Staff Nurse	-	3 WTE	3 WTE	Nil	18.8	18.8
TOTAL	1 WTE	4 WTE	3 WTE	9.1	27.9	18.8
Physiological Technicians	7 WTE	9 WTE	2 WTE	42.4	54.6	12.2
Physiotherapists						
Senior II Grade			1 WTE			7.2
Nuclear Medicine						
Registrar			1 WTE			10.5
Senior Radiographer			1 WTE			8.3
Medical Secretary			17 HRS			2.6
TOTAL			2.5 WTE			21.4

*Where applicable

KENSINGTON AND CHELSEA AND WESTMINSTER AREA HEALTH AUTHORITY (TEACHING)

NORTH EAST DISTRICT (TEACHING)

PROPOSED REGIONAL CARDIAC CENTRE

CARDIOLOGY STAFF ESTABLISHMENTS AND COSTS

STAFF GRADE	ESTABLISHMENT			ANNUAL COST		
	*June'81	*Proposed	Increase	*June '81 £'000	*Proposed £'000	Increase £'000
Cardiologists						
Consultants	14 sessions	30 sessions	16 sessions	26.8	60.7	33.9
Senior Registrars	2 WTE	2 WTE	-	37.6	37.6	-
Registrars	Nil	2 WTE	2 WTE	-	31.2	31.2
Senior House Officers	1 WTE	2 WTE	1 WTE	12.7	23.6	10.9
House Officers	1 WTE	1 WTE	-	10.2	9.1	1.1
TOTAL	5.3 WTE	9.7 WTE	4.4 WTE	87.3	162.2	74.9
Anaesthetists						
Registrars	5 sessions	7 sessions	2 sessions	5.2	7.3	2.1
Nursing						
Catheter Laboratory						
Charge Nurse	1 WTE	1 WTE	Nil	9.1	9.1	Nil
Staff Nurse	-	3 WTE	3 WTE	Nil	18.8	18.8
TOTAL	1 WTE	4 WTE	3 WTE	9.1	27.9	18.8
Physiological Technicians	7 WTE	9 WTE	2 WTE	42.4	54.6	12.2
Physiotherapists						
Senior II Grade			1 WTE			7.2
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KENSINGTON AND CHELSEA AND WESTMINSTER AREA HEALTH AUTHORITY (TEACHING)

NORTH EAST DISTRICT (TEACHING)

PROPOSED REGIONAL CARDIAC CENTRE

CARDIAC SURGERY STAFF ESTABLISHMENTS AND COSTS

STAFF GRADE	ESTABLISHMENT			ANNUAL COST		
	*June '81	*Proposed	Increase	*June '81	*Proposed	Increase
				£'000	£'000	£'000
Cardiac Surgeons						
Consultants	10.5 sessions	20 sessions	9.5 sessions	19.2	44.5	25.3
Senior Registrars	1 WTE	1 WTE	-	18.9	18.9	-
Registrars	1 WTE	2 WTE	1 WTE	14.6	31.2	16.6
Senior House Officers	1 WTE	2 WTE	1 WTE	13.3	25.0	11.7
House Officers	-	1 WTE	1 WTE	-	9.6	9.6
TOTAL	4 WTE	7.8 WTE	3.8 WTE	66.0	129.2	63.2
Anaesthetists						
Consultants	10 sessions	20 sessions	10 sessions	21.0	42.0	21.0
Senior Registrars		8 addit. UMTS	8 addit. UMTS		2.5	2.5
TOTAL				21.0	44.5	23.5
Nursing						
(a) Twin Theatre Suite						
Charge Nurse	1 WTE	2 WTE	1 WTE	9.1	18.2	9.1
Staff Nurses	2 WTE	8 WTE	6 WTE	12.5	50.0	37.5
Students	2 WTE	2 WTE	-	9.5	9.5	-
TOTAL	5 WTE	12 WTE	7 WTE	31.1	77.7	46.6
(b) I.T.U.(Additional 2 beds)						
Nursing Officer	1 WTE	1 WTE	-	9.7	9.7	-
Charge Nurse	8 WTE	8 WTE	-	77.5	77.5	-
Staff Nurses	27 WTE	37 WTE	10 WTE	182.1	250.0	67.9
Staff Nurses JBCNS.	8 WTE	8 WTE	-	50.1	50.1	
TOTAL	44 WTE	54 WTE	10 WTE	319.4	387.3	67.9
(c) Progressive Care Ward						
Charge Nurses	2 WTE	3 WTE	1 WTE	18.2	28.9	10.7
Staff Nurses	8 WTE	18 WTE	10 WTE	55.3	120.5	65.2
Students	8 WTE	8 WTE	-	37.8	37.8	-
TOTAL	18 WTE	29 WTE	11 WTE	111.3	187.2	75.9
Medical Physics Technicians						
(a) Pump Technicians	1 WTE	4 WTE	3 WTE	13.8	40.2	26.4
(b) Equipment Maint.			2 WTE			15.6
Physiotherapists						
Basic Grade			1 WTE			6.2
Admin and Clerical						
Medical Secretary			1 WTE			5.5
Ancillary Staff						
Porters			1 WTE			5.6

KENSINGTON AND CHELSEA AND WESTMINSTER AREA HEALTH AUTHORITY (TEACHING)

NORTH EAST DISTRICT (TEACHING)

PROPOSED REGIONAL CARDIAC CENTRE

CARDIAC SURGERY STAFF ESTABLISHMENTS AND COSTS

STAFF GRADE	ESTABLISHMENT			ANNUAL COST		
	*June '81	*Proposed	Increase	*June '81	*Proposed	Increase
				£'000	£'000	£'000
Cardiac Surgeons						
Consultants	10.5 sessions	20 sessions	9.5 sessions	19.2	44.5	25.3
Senior Registrars	1 WTE	1 WTE	-	18.9	18.9	-
Registrars	1 WTE	2 WTE	1 WTE	14.6	31.2	16.6
Senior House Officers	1 WTE	2 WTE	1 WTE	13.3	25.0	11.7
House Officers	-	1 WTE	1 WTE	-	9.6	9.6
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KENSINGTON AND CHELSEA AND WESTMINSTER AREA HEALTH AUTHORITY (TEACHING)

NORTH EAST DISTRICT (TEACHING)

PROPOSED REGIONAL CARDIAC CENTRE

PATIENT STATISTICS

I IN-PATIENTS

	Beds Allocated	Average Available	Average Occupied	Discharges and deaths	Average Length of stay
CARDIOLOGY					
(Including CCU)					
1979	19	13.3	13.0	460	13.3
1980	19	26.7	25.7	634	14.8
Proposed	36	36	33	860	14
:DIAC SURGERY					
(Including ITU)					
1979 *	15	17.1	14.5	416	12.7
1980 *	15	14.6	11.4	337	12.4
Proposed	36	36	28	850	12

*Including Thoracic

II OUT-PATIENTS

	Sessions	New Patients	Total Attendances
CARDIOLOGY			
1979	198	381	1786
1980	198	424	2073
Proposed	248	530	2600
)IAC SURGERY			
1979	51	47	599
1980	52	60	616
Proposed	52	60	620

III OPERATING THEATRE

	By-Pass	Closed	Pacemakers
1979	178	48	37
1980	170	28	74
Proposed	450	70	150

IV INVESTIGATION DEPARTMENTS

	Catheterisations	Electro Cardiographs	Echocardiagrams	Excercise Tests
1979	376	10,288	728	285
1980	422	9,580	1,140	383
Proposed	900	12,000	2,000	500

KENSINGTON AND CHELSEA AND WESTMINSTER AREA HEALTH AUTHORITY (TEACHING)

NORTH EAST DISTRICT (TEACHING)

PROPOSED REGIONAL CARDIAC CENTRE

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KENSINGTON, CHELSEA AND WESTMINSTER AHA(T)

NORTH EAST DISTRICT (T)

PLANNING MODEL REPORT

SUBJECT: AN ESTIMATE OF THE EFFECTS OF ADDITIONAL CARDIAC SURGERY THEATRE SESSIONS ON THE AVAILABILITY OF BEDS IN THE ITU

DATE: 17 FEBRUARY 1982

TO: MISS CALDER

ENQUIRIES: R BEECH

DISTRICT FINANCE OFFICE
THE MIDDLESEX HOSPITAL
MORTIMER STREET
W1

636 8333 EXT 7142

KENSINGTON, CHELSEA AND WESTMINSTER AHA(T)

NORTH EAST DISTRICT (T)

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ASSUMPTIONS

1) The number of beds in the ITU occupied by patients from acute specialties other than Cardiac Surgery does not fluctuate during the week.

2) All Cardiac Surgery cases have the same average length of stay in the ITU.

3) No Thoracic Surgery cases go to the ITU.

THE DATA

The data used in this analysis is from a study of all admissions to the ITU during the financial year 1980/81.

If Cardiac Surgery admissions are ignored, the bed occupancy of the ITU is 0.29. This means that patients from other actue specialties occupy an average of 2.6 beds per day.

The average length of stay of Cardiac Surgery patients in the ITU was estimated to be 2.8 days.

CONCLUSIONS

Figure 1. is a histogram showing how the number of beds occupied in the ITU fluctuates during the week. Following each cardiac theatre session a new patient arrives in the ITU and stays for about 2.8 days.

It seems likely that in the middle of the week the ITU will be close to being full. Any adverse fluctuations in the number of beds occupied by patients from other specialties or any increase in the length of stay of cardiac cases might mean that patients could not be accommodated in the ITU.

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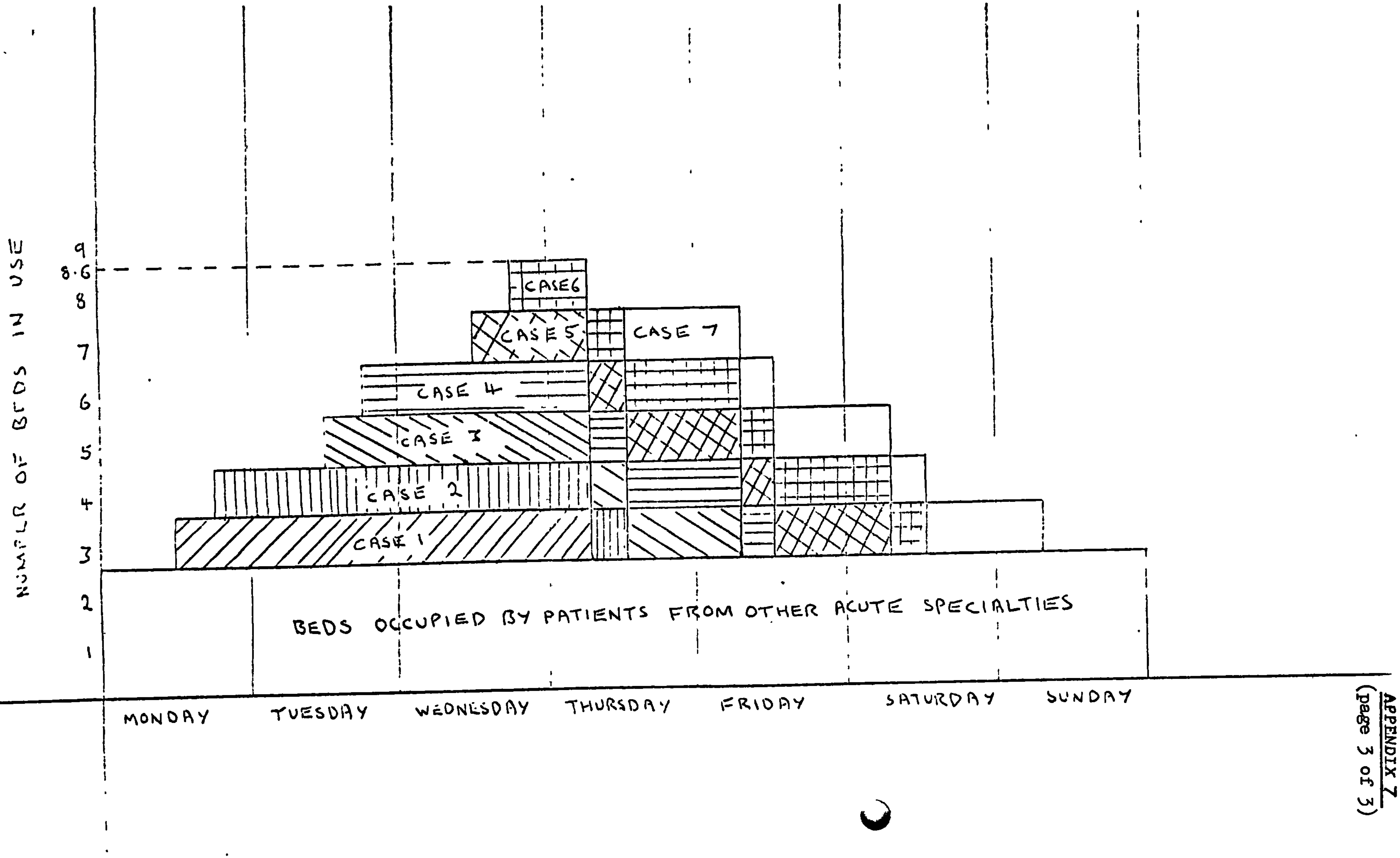
FIGURE I

AN ESTIMATE OF THE NUMBER OF BEDS OCCUPIED IN THE ITU DURING A WEEK



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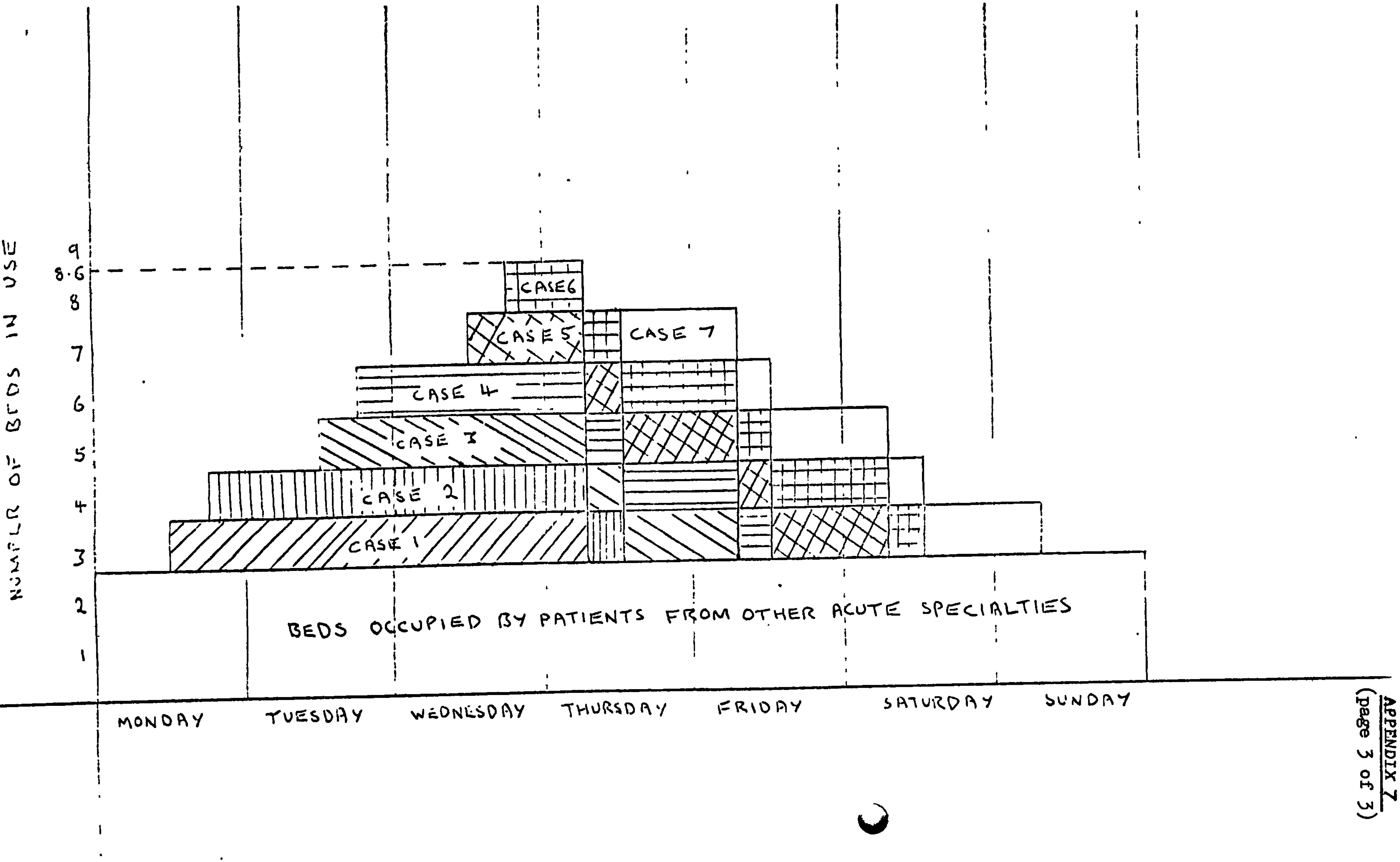

FUNCTIONAL ANALYSIS OF ESTABLISHMENTS, STAFF AND NON-STAFF VARIABLE AND FIXED COSTS (APRIL 1980)

	BANSTEAD						HORTON					
	ESTABLISHMENT		RECURRING EXPENDITURE				ESTABLISHMENT		RECURRING EXPENDITURE			
			STAFF		NON-STAFF				STAFF		NON-STAFF	
FUNCTION (1)	Funded (2)	In Post (3)	Variable (4)	Fixed (5)	Variable (6)	Fixed (7)	Funded (8)	In Post (9)	Variable (10)	Fixed (11)	Variable (12)	Fixed (13)
	No	No	£'000	£'000	£'000	£'000	No	No	£'000	£'000	£'000	£'000
MEDICAL Consultants	2.91	2.91		70			5.45	5.45		135		
Junior Medical	10.45	10.45		144		3	10.45	10.45		137		4
							0.36	0.18		7		
Nos and above	18.00	16.00	174				21.00	20.10	194			
Other Trained	218.00	196.80	1526			2	318.00	272.00	2242			22
Nursing Assts.	49.00	38.40	232				69.00	71.40	340			
Staff in Training	105.00	100.00	525				120.00	96.10	532			
M S S E					19	1					14	9
PHARMACY	4.36	3.88		24	103		3.00	2.62		26	62	
RADIOGRAPHY Medical	0.18	0.18		3			0.18	0.18		4		
PSMs	2.00	2.00		11	4		0.66	0.66		5	2	
PATHOLOGY Scientists	1.60	0.88		7		1						
PHYSIOTHERAPY	6.00	3.12	38			1	3.25	1.75	19			
SPEECH THERAPY	0.90	0.91		7								
OPTICAL						2						
PSYCHOLOGY	3.00	3.00	29			1	4.00	2.40	41			2
OCCUPATIONAL THERAPY Materials					4						16	
Sales					1CR						18CR	
Other	16.35	16.00					15.00	13.07	64			
INDUSTRIAL THERAPY Materials					102							
Sales					180							
Other	10.63	10.00	48									
CHIROPODY	1.00	1.00		8			0.47	-		3		
MISC PARA MEDICAL Music Therapist							0.33	0.33		2		
P M Technician							1.00	1.00		6		
Dental Techs.						1	5.00	5.00		37		
Dietician	0.40	0.39		2								
Med Lab Technician							0.25	0.25		1		
SUB TOTAL CARRIED FORWARD	449.18	406.02	2653	280	51	12	577.40	502.94	3432	363	76	

FUNCTIONAL ANALYSIS OF ESTABLISHMENTS, STAFF AND NON-STAFF VARIABLE AND FIXED COSTS (APRIL 1980)

FUNCTION (1)		BANSTEAD						HORTON					
		ESTABLISHMENT		RECURRING EXPENDITURE				ESTABLISHMENT		RECURRING EXPENDITURE			
				STAFF		NON-STAFF				STAFF		NON-STAFF	
		Funded (2)	In Post (3)	Variable (4)	Fixed (5)	Variable (6)	Fixed (7)	Funded (8)	In Post (9)	Variable (10)	Fixed (11)	Variable (12)	Fixed (13)
		No	No	£'000	£'000	£'000	£'000	No	No	£'000	£'000	£'000	£'000
MEDICAL	Consultants	2.91	2.91		70			5.45	5.45		135		
	Junior Medical	10.45	10.45		144		3	10.45	10.45		137		4
								0.36	0.18		7		
	Nos and above	18.00	16.00	174				21.00	20.10	194			
	Other Trained	218.00	196.80	1526			2	318.00	272.00	2242			22
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PATHOLOGY	Scientists	1.60	0.88		7		1						
PHYSIOTHERAPY		6.00	3.12	38			1	3.25	1.75	19			
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OCCUPATIONAL THERAPY	Materials					4						16	
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INDUSTRIAL THERAPY	Materials					102							
	Sales					180							
	Other	10.63	10.00	48									
CHIROPODY		1.00	1.00		8			0.47	-		3		
MISC PARA MEDICAL	Music Therapist							0.33	0.33		2		
	P M Technician							1.00	1.00		6		
	Dental Techs.						1	5.00	5.00		37		
	Dietician	0.40	0.39		2								
	Med Lab Technician							0.25	0.25		1		
SUB TOTAL CARRIED FORWARD		449.18	406.02	2653	280	51	12	577.40	502.94	3432	363	76	

Function (1)	BANSTEAD ESTABLISHMENT Funded (2)	In Post (3)	RECURRING EXPENDITURE STAFF Variable (4)	Fixed (5)	NON-STAFF Variable (6)	Fixed (7)	HORTON ESTABLISHMENT Funded (8)	In Post (9)	RECURRING EXPENDITURE STAFF Variable (10)	Fixed (11)	NON-STAFF Variable (12)	Fixed (13)
	No	No	£'000	£'000	£'000	£'000	No	No	£'000	£'000	£'000	£'000
Brought Forward	449.78	406.02	2653	280	51	12	577.94	502.94	3432	363	76	10
ADMINISTRATION	33.38	32.15		176		71	41.77	42.35		235		61
MEDICAL RECORDS	2.63	2.63		12			4.87	4.87		23		
TRAINING & EDUCATION						6						7
CATERING Patients Provisions					286						325	
Other	39.00	36.61		207		10CR	43.14	42.40		276		5CR
DOMESTIC Materials						42						36
Other	89.00	73.80	425			5	114.54	111.67	613			6
PORTERING	24.00	17.00		104			20.16	20.23		119		
LAUNDRY Materials					6						12	
Other	11.30	10.44		45		4	36.00	25.18		172		127CR
LINEN Patients Clothing					39						11	
Bedding & Linen					61						30	
Other	5.00	4.51		21	12		7.38	7.50		37	20	
TRANSPORT	4.00	4.00		24		12	2.00	2.00		15		5
ESTATE MAN. Build & Engineer	40.25	33.25		254		82	42.00	41.00		321		85
Energy & Utility	3.00	3.00		16		394						446
Grounds & Gardens	6.00	5.00		38		8	7.50	8.00		41		10
Rates						67						82
MISC Patients Travel											7	
" Allowances					106						63	
Furniture	14.18	12.26		58		85	11.40	15.88		66		25
SUB TOTAL	717.52	640.67	3078	1235	561	737	908.16	824.02	4045	1668	544	657
General Direct Credits												
Lodging Charges						47CR						
Staff Rents						17CR						
Other						1CR						
Health Service Income						1CR						
TOTAL (NET)	721.52	640.67	3078	1235	561	671	908.16	824.02	4045	1668	544	

Function (1)	BANSTEAD ESTABLISHMENT Funded (2)	BANSTEAD ESTABLISHMENT In Post (3)	BANSTEAD RECURRING EXPENDITURE STAFF Variable (4)	BANSTEAD RECURRING EXPENDITURE STAFF Fixed (5)	BANSTEAD RECURRING EXPENDITURE NON-STAFF Variable (6)	BANSTEAD RECURRING EXPENDITURE NON-STAFF Fixed (7)	HORTON ESTABLISHMENT Funded (8)	HORTON ESTABLISHMENT In Post (9)	HORTON RECURRING EXPENDITURE STAFF Variable (10)	HORTON RECURRING EXPENDITURE STAFF Fixed (11)	HORTON RECURRING EXPENDITURE NON-STAFF Variable (12)	HORTON RECURRING EXPENDITURE NON-STAFF Fixed (13)
	No	No	£'000	£'000	£'000	£'000	No	No	£'000	£'000	£'000	£'000
Brought Forward	449.78	406.02	2653	280	51	12	577.94	502.94	3432	363	76	10
ADMINISTRATION	33.38	32.15		176		71	41.77	42.35		235		61
MEDICAL RECORDS	2.63	2.63		12			4.87	4.87		23		
TRAINING & EDUCATION						6						7
CATERING Patients Provisions					286						325	
Other	39.00	36.61		207		10CR	43.14	42.40		276		5CR
DOMESTIC Materials						42						36
Other	89.00	73.80	425			5	114.54	111.67	613			6
PORTERING	24.00	17.00		104			20.16	20.23		119		
LAUNDRY Materials					6						12	
Other	11.30	10.44		45		4	36.00	25.18		172		127CR
LINEN Patients Clothing					39						11	
Bedding & Linen					61						30	
Other	5.00	4.51		21	12		7.38	7.50		37	20	
TRANSPORT	4.00	4.00		24		12	2.00	2.00		15		5
ESTATE MAN. Build & Engineer	40.25	33.25		254		82	42.00	41.00		321		85
Energy & Utility	3.00	3.00		16		394						446
Grounds & Gardens	6.00	5.00		38		8	7.50	8.00		41		10
Rates						67						82
MISC Patients Travel											7	
" Allowances					106						63	
Furniture	14.18	12.26		58		85	11.40	15.88		66		25
SUB TOTAL	717.52	640.67	3078	1235	561	737	908.16	824.02	4045	1668	544	657
General Direct Credits												
Lodging Charges						47CR						
Staff Rents						17CR						
Other						1CR						
Health Service Income						1CR						
TOTAL (NET)	721.52	640.67	3078	1235	561	671	908.16	824.02	4045	1668	544	

RESOURCE PROJECTIONS OF THE FINANCIAL CONSEQUENCES OF KEEPING 937 PATIENTS IN HORTON HOSPITAL BY REGULAR TRANSFERS FROM BANSTEAD HOSPITAL

(STATISTICAL PROJECTION H)

BANSTEAD HOSPITAL

Year	Occupied Beds	(£'000) Variable Costs Nursing	Domestic	Other	(£'000) Fixed Costs	(£'000) Total	(£'000) Savings Annual	Cumulative
1980/81	803	2457	425	757	1906	5545	-	-
1981/82	644	2457	425	670*	1906	5458	87	87
1982/83	561	2384*	425	583	1906	5298	247	334
1983/84	489	2078	381*	509	1906	4874	671	1005
1984/85	423	1798	330	440	1906	4474	1071	2076
**1985/86	246	1046	192	256	1906	3400	2145	4221
***1986/87	196	151	153	204	1906	3096	2449	6670
****1987/88	151	642	118	157	1906	2823	2722	9392
*****1988/89	111	472	87	115	1906	2580	2965	12357
1989/90	75	319	59	78	1906	2362	3183	15540
1990/91	42	179	33	44	1906	2162	3383	18923
1991/92	13	55	10	14	1906	1985	3560	22483
1992/93	-	-	-	-	-	-	5545	28028

*Represents Achievement of Resource/Occupied Bed Target
**Projected Date of Closure under Option 2 (a) Appendix IV (i)
***Projected Date of Closure under Option 2 (b) " IV (j)
****Projected Date of Closure under Option 2 (c) " IV (k)
*****Projected Date of Closure under Option 2 (d) " IV (l)

HORTON HOSPITAL

Year	Occupied Beds	(£'000) Variable Costs Nursing	Domestic	Other	(£'000) Fixed Costs	(£'000) Total	(£'000) Banstead's Transferred Resour Devp's	Free	Cu
1980/81	879	3308	613	668	2228	6817			
1981/82	937	3308	613	755	2228	6904	87	-	
1982/83	937	3381	613	842	2228	7064	247	-	
1983/84	937	3687	657	881*	2228	7453	636	35	
1984/85	937	3967	708	881	2228	7784	967	104	
1985/86	937	3973*	778*	881	2228	7860	1043	1102	1
1986/87	937	3973	778	881	2228	7860	1043	1406	2
1987/88	937	3973	778	881	2228	7860	1043	1679	4
1988/89	937	3973	778	881	2228	7860	1043	1922	6
1989/90	937	3973	778	881	2228	7860	1043	2140	8
1990/91	937	3973	778	881	2228	7860	1043	2340	10
1991/92	937	3973	778	881	2228	7860	1043	2517	13
1992/93	924	3918	767	868	2228	7781	964	4581	17

*Represents Achievement of Resource/Occupied Bed Target.

RESOURCE PROJECTIONS OF THE FINANCIAL CONSEQUENCES OF KEEPING 937 PATIENTS IN HORTON HOSPITAL BY REGULAR TRANSFERS FROM BANSTEAD HOSPITAL

(STATISTICAL PROJECTION H)

BANSTEAD HOSPITAL

Year	Occupied Beds	(£'000) Variable Costs Nursing	Domestic	Other	(£'000) Fixed Costs	(£'000) Total	(£'000) Savings Annual	Cumulative
1980/81	803	2457	425	757	1906	5545	-	-
1981/82	644	2457	425	670*	1906	5458	87	87
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***1986/87	196	151	153	204	1906	3096	2449	6670
****1987/88	151	642	118	157	1906	2823	2722	9392
*****1988/89	111	472	87	115	1906	2580	2965	12357
1989/90	75	319	59	78	1906	2362	3183	15540
1990/91	42	179	33	44	1906	2162	3383	18923
1991/92	13	55	10	14	1906	1985	3560	22483
1992/93	-	-	-	-	-	-	5545	28028

*Represents Achievement of Resource/Occupied Bed Target
**Projected Date of Closure under Option 2 (a) Appendix IV (i)
***Projected Date of Closure under Option 2 (b) " IV (j)
****Projected Date of Closure under Option 2 (c) " IV (k)
*****Projected Date of Closure under Option 2 (d) " IV (l)

HORTON HOSPITAL

Year	Occupied Beds	(£'000) Variable Costs Nursing	Domestic	Other	(£'000) Fixed Costs	(£'000) Total	(£'000) Banstead's Transferred Resour Devp's	Free	Cu
1980/81	879	3308	613	668	2228	6817			
1981/82	937	3308	613	755	2228	6904	87	-	
1982/83	937	3381	613	842	2228	7064	247	-	
1983/84	937	3687	657	881*	2228	7453	636	35	
1984/85	937	3967	708	881	2228	7784	967	104	
1985/86	937	3973*	778*	881	2228	7860	1043	1102	1
1986/87	937	3973	778	881	2228	7860	1043	1406	2
1987/88	937	3973	778	881	2228	7860	1043	1679	4
1988/89	937	3973	778	881	2228	7860	1043	1922	6
1989/90	937	3973	778	881	2228	7860	1043	2140	8
1990/91	937	3973	778	881	2228	7860	1043	2340	10
1991/92	937	3973	778	881	2228	7860	1043	2517	13
1992/93	924	3918	767	868	2228	7781	964	4581	17

*Represents Achievement of Resource/Occupied Bed Target.