ECONOMIC ANALYSIS FOR POLICY FORMULATION

IN THE NATIONAL HEALTH SERVICE

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JOHN HELLYAR RICKARD M.A.(OXON.), M.Sc.

ST. JOHN'S COLLEGE

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This thesis explores the role economic analysis can play in policy formulation in the British National Health Service. The historical allocation process in the NHS is based on the idea of meeting fully the 'need' for health care of each individual. However, 'need' has never been comprehensively defined nor universally applied but has been interpreted by numerous, isolated judgements, often by doctors and others at the point of delivery of the service. These decisions have been strongly influenced by local availability of resources and since these have been distributed unevenly, the result has been a wide variation in standards of service, eg hospital cases per head of population and costs per case.

While the perceived objective was to give everyone all the health care 'needed', it was not necessary to consider problems of distribution, between individuals and geographical areas, or problems of effectiveness, that is the relative efficiency of different forms of intervention. However, in reality the NHS budget is constrained and a rational decision-making mechanism must incorporate a rationing device which contains a consideration of distribution and effectiveness and these aspects comprise the two parts of the thesis.

PART A THE ALLOCATION OF RESOURCES BETWEEN AREAS

It has been the declared objective of the NHS since its creation that health resources should be equitably distributed. However, there has always been considerable variation in the per capita expenditure of the 14 regions because the system of incremental budgeting meant that the existing level of services was always financed. Even in 1971 when a formula was introduced for hospital expenditure, 50% of revenue funds was still distributed according to factors influenced by historical provision. Moreover no consideration was given to the allocation process below regional level though it was suspected that variations sub-regionally were greater than between regions.

The objective of this study is to explore the concept of an 'equitable distribution' at the disaggregated level of Area Health Authorities, to see if it can be defined and quantified in operational terms suitable for policy recommendations. 'Equal treatment opportunity for patients of similar risk' is taken as the initial definition.

The re-organisation of the NHS in 1974 made it feasible to relate services to geographical Areas. Data for the Oxford region in 1971-2 were analysed and applied to the post 1974 structure.

Dividing general hospital expenditure by the population of each Area gave a co-efficient of variation of 20%. Tests were then applied to see if there were factors, consistent with a 'equitable distribution', which explained part of the variation. The most important factor was found to be the flow of patients across boundaries. These flows were used to derive notional catchment populations and when these were divided into expenditure, the co-efficient of variation fell to 10%.

An attempt was made to see if the variation was explained by differences in the morbidity characteristics of the populations. Various indicators were considered but the age-sex structure was found to be the only discriminator for which it was possible to obtain data on differential health service use. While nationally old people make greater use of services, there was no evidence that in the Oxford region more resources had been made available to the Areas with a greater proportion of elderly.

Others factors considered include the cost of regional clinical specialties, the cost of teaching hospitals, psychiatric hospital provision and community health care. (These costing exercises themselves have been a useful spin-off).

At each stage of the analysis an attempt was made to relate the expenditure differences between Areas to indicators of quantity and quality of services.

It was found for example that the Area with least expenditure had the lowest acute-hospital provision but not the lowest provision for the chronic sick. It was concluded that while the variation was not as great as originally suggested, nevertheless taking into account all the factors, a re-allocation of 3% of the regions expenditure would be necessary to bring about 'equality of opportunity'. However, even at this level some differences would remain. For example, if cross-boundary flows were perpetuated, some people would travel further than others to receive care, and while the special funding of teaching hospitals and regional specialties may be justified on efficiency grounds, this conveys special benefits for local residents.

Despite these reservations, in operational terms much can be done to reduce 'basic' inequalities. No work had previously been undertaken on sub-regional variations and, already, at the request of the Minister of State for Health, this analysis has been extended to all 90 Areas in England and the results have added impetus to the formation of the Resource Allocation Working Party, on which the author has served as technical adviser.

PART B COST-EFFECTIVENESS ANALYSIS OF THE COMMUNITY HOSPITAL PROGRAMME

The objective of this part is to examine how far analysis can help the choice of efficient methods of delivering health care. It comprises an appraisal of the Oxford region's Community Hospital (CH) Programme, a system of peripheral acute hospitals surrounding a District General Hospital (DGH).

Originally a full cost-benefit study was planned but the practical problems of quantifying, valuing and aggregating benefits could not be overcome. Preliminary results suggested that differences in benefits were not measurably significant and so a cost-effectiveness approach was used.

Firstly a regression analysis of the costs of 525 existing small hospitals showed that average costs vary with size, the curve being a tilted 'L' shape. The minimum cost size was 25 beds though when the sample was later disaggregated

to remove hospitals which treat more complex cases this rose to 35 beds. This result was important for subsequent analysis since the two experimental CHs are in the higher cost range.

Secondly the capital costs of CHs were compared with hypothetical DGH ward equivalents, arguing that with a rising population, building a CH is an alternative to building an additional DGH ward of the same size. CH construction costs were lower because less space per bed was used and certain features simplified. Land costs per bed, on the other hand, were higher because a low plot ratio was used which more than offset the relatively cheaper land on peripheral sites. The cheapest way, however, of providing CH services is to convert existing hospitals which have no alternative use and hence low opportunity cost.

The main part of the cost-effectiveness exercise entailed a comparison of each component service, considered in terms of the type of patient, with the service which would have been provided without the CH. For example, surgical patients transferred after their operations would otherwise have been retained in the DGH. Some medical patients would have been treated in the DGH, others at home. No evidence was found to suggest that length of stay in the CH differed from the DGH, though this could not be proved and the conclusions were contingent on this.

The CH had higher resource costs than the DGH alternative because of high nursing levels, and this was partly the result of the small scale. Also for the surgical patients the transfer by ambulance increased the cost. No account was taken of possible differences in benefits. It was concluded that the CH in-patient services could be cost-effective only if nursing staff were reduced or if converted hospital buildings with a low opportunity cost were used.

A comparison of the CH service with domiciliary care entailed a detailed study of the cost of domiciliary services. At the current level of provision, for patients in the top quartile (in terms of nursing inputs) domiciliary care was found to be cheaper than long stay hospital care, even when a notional cost of family support and domestic housing was included.

The short-stay CH in-patient service had much higher costs than corresponding domiciliary care though here the benefits are likely to be greater. Because the difference in cost of domiciliary care and long stay hospital care is so great, the expenditure on the CH day ward service could be justified in cost terms alone if it resulted in forstalling deterioration which would otherwise have occurred and so postponing the point in time when patients are so dependent that permanent admission is the only answer.

Finally in the appendix to Part B a study was made of the real cost of General Practitioner involvement in the CH. Although time spent in the CH was offset partially by less time on other practice duties, notably reduced home visiting, the remuneration expressed as a hourly rate was very much less than the average rate calculated for normal practice duties.

An inevitable criticism of this study is that the benefits were not quantified. However, the significant differences can only be expressed in terms of personal preferences - by patients, relatives, local residents and so on. The merit of the cost-effectiveness approach is that local decision-makers are now able to form judgements in the light of the resource implications of the decisions they take.

CONCLUSION

The two parts of this thesis were distinct in their origin and execution. However, it is argued that the two concepts of distribution and effectiveness are essential components of a rational decision-making system. A major

weakness of the NHS in the past has been that administrators have concentrated their energies on increasing the quantity of resources made available to them. Part A demonstrated that it is feasible to distribute resources by objective criteria in terms of equality. Once local administrators can no longer influence their own allocation, the main incentive is to maximise the benefits from given resources. To do this, it is necessary to know the consequential effects of policy options. In many cases a full analysis of benefits is not possible but, as demonstrated in Part B, the cost-effectiveness approach offers a framework within which rational policy choices can be made.

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ABBREVIATIONS

AHA	Area Health Authority (post re-organisation)
AHAT	Area Health Authority - Teaching (post re-organisation)
CH	Community Hospital
CSSD	Central Sterilised Stores Department
DGH	District General Hospital
DHSS	Department of Health and Social Security
DMT	District Management Team (post re-organisation)
FPS	Family Practitioner Services
GP	General Practitioner
HIPE	Hospital In-patient Enquiry
HO	House Officer
HMC	Hospital Management Committee (pre re-organisation)
MHE	Mental Health Enquiry
NHS	National Health Service
PT	Part-time
RCCS	Revenue Consequences of Capital Schemes
RHA	Regional Health Authority (post re-organisation)
RHB	Regional Hospital Board (pre re-organisation)
SEN	State Enrolled Nurse
SHO	Senior House Officer
SMR	Standardised Mortality Ratio
SRN	State Registered Nurse
UGC	University Grants Committee
WTE	Whole time equivalent

HEALTH ECONOMICS

The principles of rational resource allocation, as developed in the branch of Economics known as Welfare Economics, have been applied during the past 30 years to a wide range of social and environmental problems such as education, water provision, transport and town planning. Their practical application, in the form of cost-benefit analysis has been brought to the public attention in situations where personal and social issues are as important as or even overshadow purely commercial considerations, notably the choice of the site of the third London airport. However, the application of these techniques to the delivery of health care in the United Kingdom has been largely exploratory and fragmentary, identifying the difficulties rather than reaching meaningful conclusions (for example see Hauser 1972).

One reason for the slow growth of Health Economics in the UK is that the philosophical ancestry of Economics is in theories concerned with the market mechanism and only in comparatively recent times have Economists considered areas of human activity where market and price relationships appear to be less central. Many of the early incursions into the study of the health service by economists were undertaken solely to discuss the merits of a tax-financed State controlled system like the National Health Service (NHS) and to pose the question whether resources could be optimally allocated according to the axioms of Welfare Economics if a fee-paying system were to be introduced (Jewkes and Jewkes 1963 and Lees 1964). Arguments that health care is an exception to the rules applying to private goods have focused on the unique characteristics of health care, particular types of uninsurable

risks involved (Arrow 1963), the 'moral hazard' in insurance (Feldstein 1971), consumer ignorance (Klarman 1965) 'external' costs and benefits including the altruistic desire of society to ensure that everyone has access to some level of care (Culyer 1971). However, as Culyer points out, the debate is inconclusive because writers tend to compare the imperfections of one system with the ideal of the other system: qualitative a priori arguments give no guide to policy and empirical studies "would involve in many cases impossible cost-benefit efforts". In practice the debate is largely academic since the NHS was created because it was felt politically that the allocation of health care by the market mechanism was inadequate and that a more efficient and equitable system could be achieved by State provision. Given this as a fact, at least for the present time, the question then becomes whether the Economist, denied the use of axioms based upon market demand and supply relationships, has analytical tools which can be applied constructively to the problems of resource allocation in the NHS.

In principle, the methodological framework of the analysis of resource allocation in the NHS should be the same as for other public activities and comprise:

a an examination of objectives and their relative importance, leading to the specification of the objective function;

b the determination of production functions, that is the technical relationships between input and outcomes;

c a demonstration of how the resources available can be allocated so as to optimise the objectives in the objective function.

In practice, there is no clearly defined objective function because there are many objectives of the health service which are often vague and

difficult to express in quantitative terms. Secondly, there are relatively little verified data on the cause and effect relationships between medical inputs and outcomes: the reasons for this seem to be the complexity of the human body and the inter-relationship with social and psychological factors but also there has been a general lack of scientific study of many accepted medical practices (Cochrane 1972). Thirdly, the variability in health care delivery practices between individual patients, doctors, hospitals and areas, which are largely unexplained as yet, have made it particularly difficult to discover meaningful production functions from aggregate data.

Many of these problems will no doubt be solved in time, though not by the Economist alone since they require the attention of other disciplines too, notably medical. Such multi-disciplinary co-operation has not been easy to achieve. For the present, it seems that progress must be sought by examining the nature of policy decisions and by placing them in a more rational, systematic framework.

ALLOCATION BY NEED

Following the creation of the NHS in 1948, the allocation mechanism which evolved was constructed upon 2 essential dogmas, namely:

a that health services should be available to all regardless of ability to pay (National Health Service Bill 1946): the implication of this was that medical care was a right from which no one should be deterred;

b that doctors should have clinical freedom to provide the standard of treatment which they feel is appropriate for the well-being of each patient, the only constraints being the professional judgement and conscience of each doctor (see DHSS 1970).

These golden rules are tenable as sufficient conditions for rational resource allocation only as long as the demand for health services is finite and the resources available match the demand. At the time of nationalisation the belief was widely held that demand was self-limiting, that once a back-log of ill-health had been cleared, the number of sick people would decline and the level of expenditure would be contained. The major medical problems were the acute infectious diseases for which a clear-cut diagnosis and treatment were possible. However, the success of the pharmaceutical revolution, in particular the development of sulphanomides and anti-biotics, in eliminating most of the killing diseases, changed the direction of medical practice to the problems of sustaining and caring for crippling and chronic sickness. At the same time, conditions such as obesity and alcoholism were considered to be medically treatable and a wide range of social problems are now regarded as suitable for psychiatric care. Also there has been rising public expectation of what need not be tolerated, lower thresholds of disability and discomfort. It has been realised that drugs and gadgetry can make more comfortable,people with conditions previously untreated. And at the more dramatic level, progress in medical technology has greatly increased the possible range of treatable conditions, in some areas such as renal dialysis, at considerable cost. With a zero money price to the consumer, there may be no limit to demand until everyone's use of health care resources has reached saturation at which point marginal productivity is nil, or until the dis-benefits in terms of the time expended by the patient plus his inconvenience or discomfort outweigh the benefits gained.

It was soon recognised in the early history of the NHS that the only way to control growth in the total demand for health care was to have a fixed budget. The rising cost proved to be a continuous problem for successive Chancellors of the Exchequer in the 1950s. The Guillebaud Committee (1956) was set up in 1953 to enquire into the rising cost but did not find evidence of extravagance. The increase could be explained in terms of increasing units of service provided (see discussion in Abel-Smith and Titmus 1956). The Guillebaud Committee argued that a fixed budget was inevitable and that the objective of the service was: "to provide the best service possible within the limits of the available resources".

Thus the early vision of an attainable self-limiting ideal was finally shattered but no systematic allocation mechanism was found to put in its place. The committee accepted the need for a fixed budget but was unable to define an 'adequate' service which might determine what that budget should be. Moreover, having accepted a fixed budget it was necessary to devise a method of allocating resources between different competing outputs. 'Allocation by need' became the standard concept of conventional wisdom. 'Need' is inevitably a subjective concept and has defied any attempt to define and measure precisely. 'Need' is not the same as the economist's notion of 'demand' since it is possible for people to be in 'need' but because of ignorance or unwillingness to seek care, they do not demand care. Conversely some people may demand care who are considered not to be in 'need'. 'Need' is what the 'service' collectively considers is necessary to treat, and in most circumstances it is the views of the medical profession which predominate. The doctors are influenced by what they think is capable of being achieved, that is the technical

possibilities, and also they take into account the general climate of public opinion - namely what potential consumers and other interested members of society think should be provided. However, because of ignorance, potential consumers are not always thought to be the best judges of their own need so that, inevitably, the allocation system is dominated by medical opinion.

An attempt to determine 'need' in terms of utilisation is made by Bailey (1954). He uses utilisation rates and a study of waiting lists to calculate the 'correct' supply of hospital beds. Firstly he estimates the number of patients recommended by GPs for admission to a hospital by taking throughput and changes in waiting lists. This is multiplied by the average length of stay of the patients discharged in the previous period. Dividing by 365 gives the number of beds required at 100 per cent occupancy and an estimate can then be made for other occupation rates. A 'critical' number of beds is that necessary to treat this flow at the length of stay and occupation rate selected by local clinicians. The 'correct' supply is the 'critical' number plus two standard deviations to allow for fluctuations in demand, assuming that demand is a Poisson process. But insofar as the number of hospital referrals by GPs and the choice of length of stay by clinicians are influenced by their knowledge of bed availability, then Bailey's 'need' is a function of supply. Demand will always equal supply except where GPs increase the pressure on the hospital services and allow the waiting lists to increase in the hope of thereby persuading the hospital authorities to increase the bed provision. 'Need' then becomes a factor influenced by different people's subjective views and public pressure.

Because of the unreliability of utilisation rates to assess 'need', an alternative approach is to use factor input ratios such as the number of

hospital beds or GPs per head of population. It is implied that the higher the ratio the better and then 'unmet but identified need' is thought to exist in those areas with below the national average level of input provision. For example if one area has below the national average level of hospital bed provision for the conventional clinical specialties, then central permission is given to provide additional beds, whereas it would not be given to an area with provision already above the national average. Also financial inducements are now used to encourage GPs to move to under-doctored areas. In most cases, the national average assumes a crucial importance, regardless of its real merit in terms of outcome effectiveness. Moreover, beds made available are invariably utilised and evidence of excess capacity is revealed only in extreme cases such as TB and psychiatry where changes in medical practice have substantially reduced the utilisation of beds.

In other respects, 'need' has depended upon particular arbitrary views of relative priorities. For example, Sir Keith Joseph, Secretary of State for Social Services 1970 to 1974, was reported in the Times 10 October 1972 as saying:

"We are in each generation aware of areas that were not considered relevant, which never entered into the thinking of my predecessors. Now alcoholism, deafness, incontinence and arthritis were not areas identified and then neglected - they were never identified".

And having been identified, these problems then become part of 'need' as an explicit policy decision.

It is also recognised that there may be 'need' which is unmet because it has not been identified but which comprises sickness capable of being treated with current technology. For example, in a survey of a random

sample of the population of 6 electoral wards of Lambeth (Bennett et al 1970) 7 per cent of men and 10 per cent of women aged 35 to 74 years were sufficiently disabled to be dependent on other people and could have possibly benefited from rehabilitative treatment. Similarly Last (1963) discusses the 'failure' of present medical practice to persuade all those who, in his view, 'need' care, to present themselves for it, with the result that there is a 'clinical iceberg' of untreated disease which may be just as important as the identified 'need'. Certainly one of the disadvantages of 'clinical responsibility' is that doctors have felt obliged to provide the 'best' for those patients before them at each moment in time, without giving thought to others not present and perhaps unidentified who might benefit from care and treatment and, given a fixed quantity of resources, may be left unattended.

The question which must be asked is whether this system of "allocation by need" has been capable of maximising benefits. To test this it would be necessary for the benefits to be identified and quantified: a major weakness of the 'need' approach is that 'need' has never been measured in a reproducible way. Prima facie it would seem that an allocation method based upon the unquantified view of the medical profession, tempered by varying degrees of public opinion, is unlikely to ensure rationality. Inevitably there is considerable difference of opinion of what constitutes 'need' and the wide variations in medical practices and utilisation rates between regions, hospitals and individual doctors (see Cooper and Culyer 1971) while they might in part be explained by differences in morbidity, are of such an order to suggest that a consistent system has not been achieved.

The other essential component of a rational system is a consideration of alternative benefits and at present there is no built-in mechanism for considering "trade-offs". Each doctor has the moral responsibility to provide the 'best' possible service for the patients presented to him: he does not have the direct responsibility to consider alternative uses of the resources at his command or the welfare of those patients not presented to him. Moreover the mechanism by which the resources are made available to each doctor are far from clear and is probably best explained in terms of historical factors such as the dominance of particular personalities, the part played by pressure groups and the policies adopted by the various authorities in the pyramidal structure. So often each decision is ad hoc in the sense that it is not possible, because of lack of information, to assess the effect of one decision on the system as a whole.

An ideal rational allocation system would require the quantification of all the treatable morbidity in the country, an assessment of the benefits which could be obtained by treating each case and a judgement of the relative merits of those benefits. Such a proposition is impracticable because of the current lack of measures of morbidity and of the benefits from treatment. But also there is the problem of who should take the responsibility of determining the relative priorities between client groups, different parts of the country and different individuals (for example on a waiting list). There may also be thorny problems about the <u>degree</u> of improvement for each patient since, with finite resources, there may be situations where it is preferred to improve the health of a large number marginally (that is less than the medical ideal) rather than provide the 'best' for a few and leave the remainder totally untreated. While doctors,

because of their knowledge of technical aspects, will inevitably have a primary influence over the decision-making process they do not necessarily have a prior superiority in settling the other evaluative decisions. So far the NHS has not resolved how these decisions should be taken, though it is one of the objectives of the planning system which is being introduced following re-organisation in 1974 to make the process more explicit and rational. The old process of 'allocation by need' was tolerated because it appeared to permit clinical freedom: however it obscured the problems of decision making and relieved the decision-makers of mind-bending and soul-searching value-judgements which would otherwise be necessary.

DISTRIBUTION AND EFFECTIVENESS

One of the attractions of 'need' as a criterion for resource allocation was that it appeared to solve simultaneously the problem of efficient allocation and that of securing a fair distribution of resources between individuals. If each person was to get all the health care resources he needs to keep him as healthy as is possible, the economies of scarcity disappeared and the problems of both allocation and distribution were solved. But as we have seen, 'need' does not provide the answer and the NHS has evolved complex administrative machinery for allocating resources between geographical groups - the problem of distribution, and between different types of health care and methods of delivery - the problem of effectiveness.

Distributional decisions within the pyramidal structure of the NHS emanate from the top tier, the DHSS, which has the responsibility of allocating resources to the 14 Regional Health Authorities (RHAs): these, in turn, allocate resources to their constituent Area Health Authorities (AHAs).

AHAs distribute the resourses among the various services with delegation to the District Management Teams (DMTs) where appropriate who undertake day-to-day routine management at local level.

Decisions about 'effectiveness' are taken at the bottom of the pyramid, notably by doctors at the point of contact with the patients where the choice of the most effective form of treatment is made. DMTs administer the particular services and with their AHAs decide upon the most effective organisation of services, for example the balance between hospital and community services. The RHAs and the DHSS formulate policies involving "effectiveness", though the more remote they are from the delivery of care the more the policies become general, strategic and long term.

The two parts of this thesis are separately concerned with resource allocation in "distributional" and " effectiveness" terms. Part A is concerned with the criteria for allocating resources in geographical terms, from DHSS to Regions and Areas and the practical problems in fulfilling distributional objectives. In Part B the allocation of resources in order to maximise " effectiveness" is discussed by taking an example of a possible change in the organisation of health care resources - the Community Hospital Programme. The objective of both parts is to explore how far decisions might be improved if objectives are clearly specified, if there is a systematic examination of the factors which affect the attainment of the objectives, such an examination being in terms of researched and verifiable relationships between variables, and if conclusions are based on explicit assumptions. Inevitably a number of unknowns remain, and some decisions must be based ultimately on intuitive judgement. The success of the research must be judged in terms of how far the unknowns can be reduced, or exposed for future research.

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PART A

THE ALLOCATION OF RESOURCES

BETWEEN AREAS

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SECTION 1 INTRODUCTION

1.1 The re-organisation of 1974

The 1974 re-organisation of health services in England and Wales entailed changes in regional boundaries, administrative bodies and the delineation of responsibilities of such an order as to pose new problems about the nature of the policy decisions taken at the various levels of the pyramidal structure. This study is concerned with one of those problems, the formulation of rational criteria for the allocation of revenue (ie current expenditure) funds at the regional level.

The National Health Service Re-organisation Act 1973 created 14 Regional Health Authorities, replacing the previous Regional Hospital Boards. Included in the responsibilities of the Regional Health Authorities are:-

a the control of capital schemes

b the monitoring of lesser authorities

c the allocation of the revenue funds to the Area Health Authorities

There are 90 Area Health Authorities, that is about six in each region. The Area Health Authorities, in turn, are responsible for the administration of all health services and delegation, where appropriate, to the District Management Teams who undertake day-to-day routine administration at local level. Hospital Management Committees, which formerly administered the hospitals supported by Regional Hospital Boards, are abolished, as are the Boards of Governors of Undergraduate Teaching Hospitals. Similarly, the Health Departments of the local authorities cease to exist.

This re-organisation of the health service, the first reform of significance since nationalisation in 1948, involves many fundamental changes. For the purposes of this study, three important changes are relevant:-

1 The changes in boundaries and the replacement of HMCs by Area Health Authorities require regional authorities to re-appraise the methods by which they allocate funds. In particular, the areas will be of such a size that most of the AHAs should be able to offer a fully comprehensive range of health services. It will be argued that this should make it easier to develop rational criteria for decision making at regional level.

2 The inclusion of the teaching hospitals in the regional structure for the first time, requires regional authorities to consider what is the appropriate differential for funding these as compared with similar district general hospitals which do not provide undergraduate teaching facilities.

3 The community health services, which were formerly organised by the local government authorities and funded both by central exchequer grants and by the rates, are to be administered and funded in the same way as the hospital service. This means that health administrators can effectively plan the combined deployment of both hospital and non-hospital resources and seek to establish trade-off situations on cost-effectiveness grounds where substitution is possible.

1.2 Territorial equality as a policy objective

A policy objective capable of application at the regional level of the NHS concerns the geographical distribution of health care resources. It was a declared aim of the NHS to create a system of health services "available to everyone regardless of financial means, age, sex, employment or vocation, area of residence, or insurance qualification". (My emphasis) (National Health Service Bill 1946). The mention of area of residence implies that resources should be evenly distributed throughout the country, a notion which can be developed as an operational policy objective. It may of course conflict with other policy objectives such as that of maximising "effectiveness", judged in terms of the "improvement in health status of the population at risk". For example, because of economies of scale the provision of a large, well equipped hospital in one central location may be more "effective" than if the same resources were dispersed thinly though more evenly over a wider area. Also, greater progress in medical care may be achieved by a spear-head advance on a narrow front, rather than gradual improvement over a broad front: this is the argument used to justify "centres of excellence". Moreover, a policy to reward the most efficient management unit may conflict with an equitable distribution. Nevertheless, territorial equalisation is a declared objective of the NHS and warrants detailed consideration and decision-makers must decide how to balance this objective with their other objectives.

While an equitable distribution of health care resources may be advanced as a policy objective, its precise meaning is not self evident and must be examined in operational terms. For example, it would seem to be wrong to argue that everyone must consume the same quantum of health care resources, regardless of medical condition, namely 'equal treatment for unequal need'. Indeed, equality of consumption is meaningful only if everyone has equal 'need' which implies not only the same medical condition but also the same desire to be treated (see Logan et al. 1973). A practical definition of the objective of territorial equality might be "equal treatment opportunity for patients of similar risk regardless of their places of residence".

This implies that if a person has a particular medical condition which requires treatment or care, he should have the same opportunity of access to the health services as any other comparable person living elsewhere.

However, even with this definition, qualifications are necessary, since complete equality of opportunity in relation to all circumstances of health care provision may not be attainable. For example, people may have to travel different distances to receive their care. The times when care and treatment are provided may be convenient to some people but not to others. The "cost" of time lost may vary between people. The qualitative aspects of treatment may vary, especially in terms of the "hotel factors" such as the hospital ward environment or the nature of the food; because of differences in tastes, what some people prefer, others do not. On the other hand, all these factors may be considered secondary to the standard of medical care.

Even as far as equality of medical care is concerned, it may not be thought desirable to standardise treatment patterns. For example, clinical freedom is a cherished concept in the National Health Service which implies that clinicians should be free to select the treatment pattern which they think is appropriate, and this may entail different levels of costs.

It seems, therefore, that we must accept that complete equality is not possible. However "equal treatment opportunity" will be interpreted to mean that each area has the same quantum of resources per capita of population served, adjusted for differences in 'need', as any other area. Initially we shall consider this in relation to an "equal spend per head" and the analysis will be extended to see if equal expenditure can be converted to "equal resources". It is recognised in particular that even if an "equal spend per head" of revenue expenditure is achieved, inequalities will remain because of differences in the distribution of capital assets and also in the distribution of skilled personnel.

1.3 Geographical distribution nationally

When the National Health Service was established in 1948, the allocation of revenue funds reflected the geographical distribution of hospital resources which had evolved historically, with a substantially more generous level of provision per head of the population in the south-east than elsewhere. Because it was argued that existing services had to be maintained, a system of "incremental budgeting" was used which served to perpetuate any original inequality. The procedure is described in the Guillebaud Report (Ministry of Health 1956).

"The total amount available is first divided between the Regional Hospital Boards as a whole and the Boards of Governors as a whole, broadly in proportion to the expenditure of these two groups in the last year for which actual figures are available. The Regional Boards' share is then divided among the individual Boards, leaving aside a limited amount for the running costs of new developments. The sum is available for the maintenance of existing services, the allocation being on the basis of permitted increases to support the increased costs of existing services, with a report and consultation procedure to ensure that the final total equals the sum available".

Thus in the early days of the NHS the primary criterion for the allocation of funds was the maintenance of existing services. The Guillebaud Report did consider the possible use of a formula to bring about greater equality of distribution but added:

"We have concluded, however, that any national formula would have to be weighted to take account of such a wide range of variables in Hospital Regions that it cannot be considered as a practical proposition at least for the present".

The main argument was that the populations of the RHBs did not necessarily co-incide with the catchment areas of their hospitals and, more particularly, HMCs were not always responsible for specific geographical areas. Because of incremental budgeting and the small hospital building programme in relation to the total number of hospitals (the number has increased by only 3% since 1948) very little has been achieved in redressing the original inequalities. Griffiths (1971) pointed out that the differences between regions

persisted and that the top region spent 69% more per capita than the bottom region in the early 1950s and in 1969/70 still spent 64% more per capita than the bottom region. He observed that the high spending regions provide more expensive acute beds and fewer, cheaper geriatric and chronic beds. He argued that, given the slow rate of hospital building, to bring about greater equality of provision, it would have been necessary to close hospitals in the more generously provided areas.

Nor is inequality of distribution confined to hospital beds. Cooper and Culyer (1970) analyse the anomalies in the distribution of manpower: the Sheffield Region had half as many consultants per capita as the Birmingham Region, and Liverpool $2\frac{1}{2}$ times as many persons per general practitioner as Birmingham. They go on to consider 27 indices of extensiveness, intensiveness, and quality and find a close correlation between all of them, that is (page 214) "areas which are relatively poorly served by one criterion are also poorly served by others too".

This situation almost certainly resulted from the incremental budgeting approach since, until a region benefited from an increase in capital resources in the form of new hospitals, it had no means by which it could increase its revenue funds and so improve its services.

For the financial year 1971/2, the Department of Health and Social Security introduced a formula designed to produce a more equitable distribution of funds between Regional Hospital Boards. The Boards of Governors of the teaching hospitals, however, were excluded from the formula and continued to be funded on an ad hoc basis, following

an assessment of "needs". The formula incorporated three elements:-

1 Population: the population of each region was forecast, adjusted for inter-regional patient flows and the estimated catchment populations of the teaching hospitals. 50% of the total sum was then allocated on the basis of an equal spend per head.

2 Bed-stock: the average daily number of occupied beds and the average number of out-patient attendances for each specialty in each region were calculated. 25% of the total sum was then allocated in proportion to the ratio of occupied beds and out-patient attendances in each region to the national totals, weighted by national average costs for the respective specialties.

3 Case-flow: the numbers of in-patient and out-patient cases in each region in each specialty were calculated. 25% of the total sum was then allocated in proportion to the ratio of regional figures to national totals, again weighted by national average costs for the respective specialties.

The target allocation indicated by the above factors was not introduced immediately but was to be phased in gradually over ten years, one tenth of the difference between the previous year's allocation and the target to apply in the first year and so on. Also the Revenue Consequences of Capital Schemes system, the method by which new hospital buildings attracted additional and above average revenue allocations, was to be retained until 1978. In this way, the overall growth in the total NHS budget enabled the adjustment to take place without causing the well-provided regions to face cuts in expenditure. Moreover as long as the regions had different ratios of bed-stock and case-flow to population, achieving the target would still have left considerable inequalities in the geographical distribution of resources.

The bed-stock element retained the principle of incremental budgeting by financing capital facilities already available. It was argued that it is inefficient to provide additional revenue to regions which lacked additional capital and at the same time deny revenue to other regions which could not then fully utilise their existing capital. However, it is not necessarily efficient to sustain capital utilisation in a region which has a surplus of beds in relation to its population, where the marginal productivity of the capital is zero, as has been cited in Liverpool (Logan et al. 1973). Also the argument ignored the possibility of alternative revenue-capital input ratios. In the interests of equality it might be argued that regions with less generous bed provision should be given more revenue allocations and not less to substitute for the productive contribution of the capital deficiency and to enable other means to be devised to provide a level of service comparable to that in the more generously bedded regions. Or if the distinction between capital and revenue allocations could be waived, then an under-bedded region might choose to use part of its revenue allocation on capital schemes, and perhaps 'borrow' capital funds against future allocations.

The bed-stock element could have been regarded as a temporary expendient for achieving efficiency while capital stock was itself being equalised. However, capital sums were not distributed according to a formula. The gestation period of large hospital building is such that at any point in time, the greater part (70% in 1973) of the total capital allocation is absorbed by projects commissioned in earlier years. Population was taken into account in deciding how to apportion the remainder but the effect on the total stock inevitably was negligible.

Nor was the distribution of the existing stock taken into account because there had not been a comprehensive survey of the stock. While the distribution of beds was known, no data were available on the quality of buildings or the range of support facilities. The age of hospital buildings varies considerably: 75 per cent were built before 1948 and the age-distribution is not the same throughout the country. A further complication is that political factors have always played a major part in the choice of new projects, the selection of main schemes being made at Ministerial level, often favouring areas which could exert the greatest influence. For all these reasons, little progress could be made to reduce inequalities in capital provision and the bed-stock element in the revenue formula served to perpetuate the inequalities.

The case-flow element in the formula also favoured the regions which were historically well-endowed in so far as a high capital stock per head of population enabled a high level of service to be provided. It has been suggested (West 1973a) that the case-flow element had the effect of rewarding the regions more efficient in terms of high throughput at low cost, and penalising the less efficient. If one region was able to increase its case-flow at below national average costs by greater efficiency, it was to receive additional funds in the subsequent year, at the expense of another region which did not increase its case-flow or which had a higher cost per case. Then, in so far as the

more efficient region was able to use its increased allocation to increase its case-flow further, without increasing cost per case, it could continue to improve its allocation. However, this raises questions about the reliability of case-flow as an indicator of efficiency. Firstly, a lower cost per case in one hospital may indicate a lower quality service than elsewhere. This is particularly true for non-acute hospitals where a short length of stay, and hence low cost per case, might impose a burden on the family and on the domiciliary services, and also where hotel standards and the level of nursing provision are the essential components of the service so that a low cost would suggest a low standard of provision. In the case of acute care, a reduction in the length of stay may reflect the more efficient use of resources or it may indicate the premature discharge of patients in terms of slow recovery or medical complications. Secondly, case-flow is measured in terms of the numbers of discharges and deaths, not in terms of the number of patients. Thus a patient who is discharged and subsequently re-admitted is counted as two cases and this might reflect poor medical management. Lastly, while in most cases an increase in the case-flow would seem to be an efficiency gain, increasing the number of patients treated need not necessarily be beneficial if the medical outcome achieved is deemed less valuable than that from improving the treatment for the existing number of patients. It was not officially stated what arrangements would be made after

the ten year period of adjustment and when the NHS was re-organised in 1974 the formula was abandoned and replaced by incremental budgeting. The bed-stock and case-flow elements were essentially short-term measures designed to encourage the efficient use of resources but they served to perpetuate the historical imbalances. Equality of distribution might have been possible if the capital stock had been equitably distributed but, as has been suggested, no effort was made to bring this about.

Footnote: This part of the thesis was finished in 1974. Partly as the result of the interest aroused by this research throughout the NHS and its extension to the ninety English Area Health Authorities (Rickard 1976), in May 1975 a working party of DHSS and NHS officials was set up to reconsider the national formula. The author was invited to become a member and submit a series of papers. The first interim report in August 1975 established a major break-through in recommending firstly that the bed-stock element should be removed from the formula, secondly that well provided regions should face cuts to speed up the transition to a more equitable system and thirdly that the principles should be applied to sub-regional allocations. The case-flow element was retained for one year, pending the development of indicators of differences in morbidity.

1.4 Geographical distribution sub-regionally

The logical consequence of trying to achieve a more equitable distribution of revenue between regions is to extend the principle to sub-regional allocations. It has always been suspected that intra-regional differences are greater than inter-regional differences though before re-organisation no data were available. Davies (1968) and Pinker (1968) found evidence that within some areas, relatively prosperous on average, the provision of social and welfare services varied such that a sub-area was relatively poorer than sub-areas in other areas which were on average less well endowed. In pursuing this with regard to health services, the problem has been to define viable, homogeneous units for comparisons to be made. Cooper and Culyer (op.cit. p.217) took the area of a Hospital Management Committee and concluded that:

"there are significant variations again within the regions which are at least as great as those between the regions"

The areas of the HMCs were not suitable units of measurement, since these were not designed to be uniform, either in areas served or the nature of the service. For example, in the former Oxford region, some HMCs consisted entirely of psychiatric hospitals, others general hospitals only and others a mixture of the two. Some HMCs had a fairly clearly defined catchment area, while others had hospitals scattered over a wide area with

a complex flow of patients between hospitals of different HMCs., the more so when the teaching hospitals were included. However, as described at the beginning of this paper, the 1974 re-organisation rationalized the system by creating the Area Health Authorities as units with populations, of about 500,000, sufficiently large to support almost the entire range of hospital and community health services. Thus the re-organisation made the following analysis of sub-regional allocations feasible.

The object of this analysis is to take one region and examine the distribution of revenue funds and resources between its four constituent Area Health Authorities. For this purpose, a simulated model of the new post re-organisation region is used, taking the new boundaries and populations, and applying the allocation which took place in 1971/2. This has involved breaking down all items of expenditure and apportioning them to the services which are now the responsibility of the new AHAs.

In looking for evidence of the degree of equality of provision between areas, we take, as a starting point, the variation in the level of expenditure per capita of the resident populations of the four areas and compare these with the variation between regions nationally, as in table 1. The national figures relate to the old pre-1974 regions: the sub-regional figures to the new Oxford region and its areas. The Oxford region was below

the national average for hospital expenditure, and above for community health expenditure. However, within the Oxford region, the area of Oxfordshire was substantially above the national average, higher in fact than two of the metropolitan regions. The area of Buckinghamshire, on the other hand, was lower than all of the regional averages.

The measure of variation which will be used frequently in this paper is the co-efficient of variation. This expresses the standard deviation as a percentage of the arithmetic mean and has the advantage that it can be used to test variability of distributions with different variables or where the arithmetic means are very different. Because the variables are ratios, a weighting procedure is required and the formula used is given in appendix A.

As is shown in table 1 the co-efficient of variation for hospital expenditure is greater with the Oxford sub-regional distribution than the national distribution, 20.75% compared with 18.81%. For community health services the Oxford sub-regional variation is less than the national variation, 7.82% compared with 8.13%. Prima facie, these figures suggest that sub-regional variation is as important as the national regional variation.

However, a knowledge of the Oxford region would lead one to suppose that analysis based upon expenditure per capita of the actual populations is too simplistic. The Oxfordshire

area contains a teaching hospital group, which the others do not, and this serves as a "centre of excellence", that is it undertakes more complex cases which other district general hospitals do not undertake and one would expect these to be more expensive. Also, this group tends to attract patients from all over the region so that its potential catchment population is greater than the area's geographical population. On the other hand, Buckinghamshire, because of its elongated geographical shape and its position close to the North West Metropolitan region exports a number of patients. Also, simple expenditure per capita ignores any differences in the morbidity characteristics of the population, in particular the age distribution, which would influence the pattern of health service use. Thus to examine the degree of equity in distributions, it is necessary to consider the following factors:-

a cross-boundary patient flows

b morbidity characteristics of the populations

c the provision of regional clinical specialties

d the special funding of teaching hospitals.

Also it is necessary to examine the relationship between equality of expenditure per capita and equality of service and the importance of differences in the capital stock. Thus this research exercise is partly analytical in so far as the

meaning of an "equitable distribution" will be examined and an attempt made to consider the data required to identify such a distribution, in the light of the complicating factors mentioned above.

This exercise is also prescriptive in part, in so far as the problems will be examined of devising a formula in operational terms which could be used, if the decision makers so chose, to bring about a more equitable distribution in the allocation of revenue funds.

1.5 The three branches of the service considered

Once it is accepted that it is necessary to examine the cross-boundary flows of patients, the provision of regional specialties and differences in morbidity characteristics, the analysis is facilitated if the three main branches of the health service for which the Regional Health Authorities are responsible are considered separately. These are:-

a general, non-psychiatric hospitals

b psychiatric hospitals, ie hospitals for mental illness and mental handicap

c community health services

(NB. The expenditure of the Family Practitioner Services are not included since these will be financed directly by DHSS and will not fall within the discretion of the RHA. It is possible, however, that the RHA would wish to compensate AHAs for differences

in the provision of these services and this expenditure will be considered for information only).

In 1971/2 it is estimated that the total expenditure on RHA services in the case of the new post-1974 region was £51,471,329. This was divided in the following way:

RHBs' own services	£ 1,532,040	3.0%
General hospitals	£35,213,480	68.4%
Psychiatric hospitals	£ 7,584,743	14.7%
Community health	£ 7,141,066	13.9%

The RHB's own services include central administration, training and the blood transfusion service. This level of expenditure must be determined in the light of the estimated benefits compared to those from alternative expenditure on clinical services. It is not intended to consider the problem here. The percentage of total expenditure to the three branches of the service can be compared to the national average.

Table 2 gives the national level of total hospital and community expenditure: the percentages in 1970/71 of 89.2% to 10.8% with 86.1% and 13.9% in the Oxford region which indicates that in the Oxford region a greater percentage was devoted to community health care. Table 3 gives the level of expenditure on general hospitals and psychiatric hospitals. (The total does not equal that in table 2 because in table 3 the expenditure of the regional hospital boards does not include the cost of the

salaries of senior medical and dental staff). The ratio of 81:19 nationally compares with 82:18 in the Oxford region which suggests that Oxford devoted a slightly greater percentage to general hospitals than psychiatric hospitals. An interesting question which arises is whether expenditure on community health services is ever adjusted to compensate for relative deficiencies in expenditure on hospital services. The expenditure per head in each region for hospitals and for community health in table 1 were tested for linear correlation and were found to be positively correlated ($r^2 = 0.7664$). Thus regions which spend relatively more on hospital services also spend relatively more on community services.

In table 4 per capita expenditure for each area in the new Oxford region is given by type of service. The RHA services are for 1971/2 and the Family Practitioner Services are estimates for 1974/5. There is some evidence here that below average expenditure in Buckinghamshire for general hospitals is offset by above average community health expenditure, and above average general hospital expenditure in Berkshire is offset by below average community health expenditure. However, as was argued above, using simple population figures may give

a false picture, though it is interesting to note that Northamptonshire is below the regional average in all services.

SECTION 2 GENERAL HOSPITALS

2.1 Introduction

During 1971/2, a total of £35,213,480 was spent within the new Oxford region on the general, non-psychiatric hospital services. The expenditure by each area is given in table 5 and the derivation of these figures is given in Appendix B. Some hospitals, though located in one area are administered by the AHA of another area and in these cases the costs have been attributed to the administering AHA. This applies, for example, to Peppard, Henley and Townlands Hospitals which are located in Oxfordshire but are administered by Berkshire, and Iver, Denham and Langley Hospital and the Canadian Red Cross Hospital which are located in Buckinghamshire but are administered by Berkshire. A similar problem arises with the populations of Henley Municipal Borough and Henley Rural District which, though in Oxfordshire, are to be provided with services administered by Berkshire: to allow for this in the analysis the population of Oxfordshire has been appropriately reduced, and that of Berkshire increased. The population figures so derived will be referred to as the "actual populations" in the text though they are not the strict geographical populations.

2.2 Expenditure per head of the actual populations

The expenditure of each AHA is divided by its actual population in table 6. This shows a considerable variation around the region mean, with a co-efficient of variation of 20.39%. In fact Oxfordshire spent 63% more per head than Buckinghamshire. To remedy this apparent discrepancy and establish an equal spend per head would have required a considerable shift in money between areas, a

total of £2,789,904 as indicated in table 6. The target allocation gives an equal spend per head and is derived by multiplying the regional spend per head by the actual populations of each AHA. It was argued in section 1.4, that using the actual populations as the divisor could give a misleading picture of the degree of inequality of distribution. The figures are, however, presented as a starting point for comparision with other calculations. In particular, we shall see whether the introduction of other variables has the effect of reducing the co-efficient of variation.

2.3 Weighting by age and sex

It was argued in section 1.2 that territorial equality means that a similar treatment opportunity should be available for all people with similar medical conditions. If the pattern of morbidity were the same in each of the four areas, there would be no need to consider this problem further. However, if it were the case that one area had a greater proportion of sick people than another, it would seem to be necessary in order to fulfil the objective as stated in 1.2 to allocate that area a greater amount of finance. To achieve this we require an analytical device which will

a indicate the differences in morbidity between areas accurately

b indicate the relative importance of the nature of the morbidity, that is enable a weighting system to be introduced which reflects the decision makers' view of the relative importance of different illnesses or states of ill health.

At the present time, there are no generalised measures of morbidity and while some measures exist for assessing the rate of change in the health of specific diagnostic groups (Fanshel, S. and Bush I W 1970 and Breslow, L. 1972) little progress is being made in deriving measures which will distinguish, for all people, between differences in medical condition with respect to factors such as the intensity of pain or duration of disability in a form that could be used for general weighting as that proposed by Culyer, Lavers and Williams (1972).

Two indicators of the general level of health which are conventionally used in epidemiological studies are the perinatal mortality rate and the death rate: these are given for the old local authority areas of the Oxford region in table 7. In fact the perinatal mortality rate proves to be a very poor discriminator between the various areas, being 19 per 1,000 for all except for Reading at 18 and Oxford County Borough at 24. The reason is that the number of still-births and deaths during the first week is small. The standard of medical care throughout the region is of such a level that variations in other aspects of general health have no noticeable effect on the rate, which is more appropriate for time series data at a higher order of aggregation or comparisons between grosser differences of basic health status, as for example between countries. The high rate for Oxford County Borough is unlikely to be of significance and is probably a chance occurrence: it was 19 in 1970, and 21 in 1969.

The death rates present more interesting comparisons. Northamptonshire County and the County Borough both have crude death rates which are higher than the rest of the region. This is partly explained by the fact that Northamptonshire as a whole has a greater proportion of old people than the other areas as can be seen in table 8. To compensate for the age differences, the comparability factor can be applied (Registrar General, 1965,) and the crude death rate is multiplied by this to give the adjusted death rate. Even so, the differences remain and Northamptonshire still has the highest death rate.

Another factor which can explain differences in death rates is the socio-economic mix of the populations. Table 9 gives the percentage break-down for the old local authority areas from the 1961 Census. The main difference between the four counties (which include the county boroughs) is that Northamptonshire has a lower proportion of people in the first three groups, that is the non-manual working population: the figures are

Oxfordshire	29.5%
Berkshire	35.6%
Buckinghamshire	33.6%
Northamptonshire	25.2%

Logan (1959) examined the Standardised Mortality Ratio of the five social classes in 1931 and 1951. (The SMR is the death rate of men in a particular occupational group compared with that of all men of corresponding age distribution, the latter being set at 100.) He found that after adjustments for changes in the definitions of the classes between 1931 and 1951, the SMR increased from the lowest for

social class 1 (88 in 1931 and 86 in 1951) to the highest for social class 5 (111 in 1931 and 118 in 1951). A possible explanation is the uneven distribution of fatal diseases among the social classes. This relationship between social class and mortality could explain some of the difference in adjusted death rates between Northamptonshire and the other three areas.

The fact that Northamptonshire had a higher death rate than the other areas would lead one to argue that for "equality of opportunity" as defined in 1.2 to be obtained, a mechanism is required to compensate for this apparent greater potential demand of resources. As already observed, the differences in the age distribution offer an explanation for some of the differences in death rate and these could also be used to indicate differences in potential demand for hospitals since older people, particularly those over the age of 75 have a greater potential 'need' than other age groups. However, 'need' is an exceedingly vague concept since it entails a value judgement about the relative importance of different age and diagnostic groups. The decision-makers would have to be asked to devise weighting factors which reflect these relative values. In the absence of these, it is possible to use data of the existing distribution of hospital services as between age groups to calculate proxy weighting factors which are implicit in the present system. Presented with these weights, the decision-makers can then more easily consider whether these are appropriate or not.

A weighting system based upon existing 'norms' can be constructed by considering the age-sex propensity to be hospitalised, that is the relative probability of each age-sex group of being admitted to

a general hospital, given current admission practices nationally. The weighting factors which are given in table 10 were derived by the following calculations:-

1 The average number of beds occupied by each age-sex group in general hospitals in England and Wales in 1970 is given by HIPE (DHSS 1972). Thus, for example, males aged 65 - 74 occupied 15,197 beds.

2 These figures were divided by the population in England and Wales in the relevant age-sex group to give the occupancy rate per 1,000 of the population which indicates the overall probability of each group being hospitalised. There were 1,703,600 males in England and Wales aged 65 - 74, that is a rate of 8.921.

3 The occupancy rate was also calculated for the population as a whole and then divided into the bed occupancy rate for each age-sex group to give the weighting factor. The total population rate was 3.917 and this gave a weighting factor for males aged 65 - 74 of 2.278.

4 The weighting factor for each age-sex group was multiplied by the number of people in that group in each Area and the products summed. This gave the weighted populations of the Areas which are compared with unweighted populations in table 11.

If an Area had the same age-sex distribution as England and Wales, the weighted population would be the same as the unweighted population and the correction co-efficient would be unity. In fact the region as a whole has a younger population than England and Wales and so the

region's weighted population is less than its actual population, with a correction co-efficient of 0.9495. In examining the age-sex distribution of the four Areas in table 8, it has already been observed that the major difference between the Areas is that Northamptonshire has a greater proportion of people in the 65 - 74, and 75+ ranges. Because of this the weighted population is greater than the unweighted population, with a correction co-efficient of 1.0022. Thus the use of weights in an allocation formula would favour Northamptonshire compared to the other areas.

A weakness of this weighting technique is that it may overstate the importance, in relative cost terms, of old people since all general hospitals are included, that is both acute hospitals with an national average cost per in-patient week in 1971/2 of £78.58 (for non-teaching hospitals over 100 beds) and hospitals for the chronic sick with an average cost per in-patient week of only £30.50. Since old people are more likely to be in the cheaper beds than younger people, a bias in favour of older areas is introduced. On the other hand, it was suggested above that the high death rate in Northamptonshire is explained not just by age differences but by other factors, possibly socio-economic class. Since there is no allowance for this factor in the weighting system, the 'over compensation' effect in the weighting system is, perhaps, acceptable.

In table 12, the expenditure of each AHA is divided by the weighted populations. Compared with the corresponding calculation with the unweighted populations, the variation of expenditure per head has increased and the co-efficient of variation is 22.24% compared with 20.39% before. This suggests either that the fact that Northamptonshire has an older population has not been taken into account by decision-makers in making allocations, or that the weighting factors used do not reflect the value judgements of the decision-makers in the Oxford region.

2.4 Cross-boundary patient flows

If patients from one area are normally treated in a hospital in another area, it would seem to be equitable to increase the allocation to the latter area since the resources of that area are supporting a population greater than its geographical population.

There are a number of reasons why patients may cross over boundaries:

1 People who are travelling, perhaps on holiday, visiting friends or on business may be taken ill and be hospitalised away from home. Those involved in motoring accidents are an obvious example.

2 General practitioners may send their patients to a hospital in another area because of established relationships between GPs and consultants, or because the area boundary arbitrarily cuts across a natural traffic flow and transport for patients and visitors is more convenient. This may be particularly true for centres of population located near to area boundaries.

3 Patients may have a medical problem which requires specialist care which is available only in a hospital in another area. This is the case of "regional specialties" and, indeed, in some cases "supra-regional specialties" where patients come from all over the country or even from abroad for treatment. (NB. When a private patient is admitted to an NHS hospital, the costs incurred by that hospital are borne out of its revenue allocation and the fees paid for the hospital service are remitted directly to the DHSS and the consultant's fees are retained by the consultant. Thus hospitals' cash flow does not benefit from private patients, even when a supra-regional specialty is provided).

4 Patients may be sent to hospitals outside their area because of a shortage of facilities in general within their own area.

To derive a model of patient cross-boundary flows, data from HIPE for 1970 (op.cit.) were analysed by computer. The data for each hospital in the region are collected in the form of a sample of about 10%: there was a slight variation between hospitals and the precise sample size was used in each case to calculate the estimated total. The hospitals were counted as being located in the area which actually administers them even though some are geographically located elsewhere. Details of the hospitals in each of the four areas are as given in Appendix B. From the data, estimates of the following were made:-

1 the number of discharges of patients hospitalised in the same areas as their places of residence,

2 the number of discharges of patients in each of the four areas in the Oxford region whose place of residence was outside the region,

3 the number of discharges of patients hospitalised in other regions whose place of residence was in one of the four areas of the Oxford region,

4 the number of discharges of patients who crossed over from one area to another within the Oxford region for hospital services.

The samples were grossed up to give estimated numbers and the flows are summarised in table 13 and illustrated in figure 1. These show,

for example, that 48,919 patients from Oxfordshire were treated in hospitals within the Oxfordshire area and 3,629 patients crossed out of Oxfordshire to be treated elsewhere. 12,100 patients came into Oxfordshire for hospital care, 4,588 from outside the region. There was a net inflow in Oxfordshire of 8,471. Taking the region as a whole out of 221,046 patients discharged from all the hospitals in the region, 31,546 or 14.3% had crossed an area boundary to be hospitalised.

For each area a net inflow, or outflow, was calculated and the results are presented in table 14. To relate flows to the size of the populations served by the hospitals, and to derive the catchment populations of the four areas, the net inflow, or outflow, was multiplied by the co-efficient of the total population of the region divided by the number of discharges of patients, resident in the region, from general hospitals both in and outside the region in 1970, ie.

$$\frac{2,075,395}{216,018} = 9.6075$$

It is argued that the flow represents a constant re-alignment of population to hospitals and that since, on average in the region, each person discharged can be thought of as representing 9.6075 members of the population, so each person crossing a boundary is adding 9.6075 people to the catchment population of the hospital in which he is treated. The population adjustment is then added to or subtracted from the actual geographical population of each area. The results which are given in table 14 show that because of the net inflow into the region, the notional catchment population of the region is 2.3% greater than the actual population. The effects on

the other areas are such that the catchment population of Oxfordshire is 17.6% greater, Berkshire 8.0% greater, and that of Buckinghamshire 18.7% less, while Northamptonshire experiences little change, with 0.7% more.

One might expect changes of this magnitude to be reflected in the actual revenue allocations. The expenditure of each area was divided by the notional catchment populations in table 15 and the variation between expenditure per head was found to be much less than hitherto with the co-efficient of variation only 9.96% compared to 20.39% with the geographical populations. This might lead us to conclude that the flows of patients had been taken into account when the allocations were made, at least as far as the major flows into Oxfordshire and out of Buckinghamshire were concerned.

To derive weighted notional catchment populations, since nothing is known of the age distribution of the patients who cross over boundaries, nor of the age distribution of the specific geographical locations from which they came, the population adjustments given in table 14 were multiplied by the weighting correction factor for the whole region, namely 0.9495. This gave a notional weighted population adjustment which was added to, or subtracted from, the actual weighted populations. Weighted notional catchment populations are given in table 16. The allocation procedure was then re-worked, as in table 17, and the variation around the region mean of expenditure was found to be greater than before, with a co-efficient of variation of 12.52%, suggesting as before that the allocations do not compensate for Northamptonshire's older population.

There is no doubt that cross-boundary patient flows explain a large part of the apparent discrepancies between the expenditures per capita which were obtained by taking the actual geographical populations. However, we do not know whether the allocations were historically adjusted to compensate for the flows or whether the flows resulted from the uneven allocations. For example, patients may move to Oxfordshire for treatment because more or better facilities are available and to use notional catchment populations, as calculated above, for future allocations will serve to perpetuate the basic differences which result in the patient flows observed. In so far that patients, and their visitors, are obliged to travel greater distances, increasing their costs and inconvenience, such movements may not be deemed to be desirable. On the other hand, since many of these patients are moving for treatment at the Oxford teaching hospitals and the Nuffield Orthopaedic Centre, it could be argued that because of economies of scale it is more efficient to provide these 'special' facilities in one area and oblige patients to move. However, whether the cross-boundary flows are desirable or not in the longer term, it is unlikely that changes in revenue allocations alone would result in a redistribution of services which would overcome all the flows, since adjustments in capital resources would be required as well. And as capital resources are adjusted in time, so the cross-boundary flow pattern would change, the notional catchment populations would change and the formula in prescriptive terms would automatically adjust revenue allocations.

Nevertheless, there are a number of reservations about the uses of the data on boundary flows. Firstly, the pattern of flows may be changing through time and, if the analytical and data resources were available it might be desirable to repeat the exercise for a number of years. Secondly, the HIPE data are based on a 10% sample so that each patient is multiplied by 10 to give an estimated number. Then, to reach a population adjustment, this is multiplied by 9.6. Thus any original error is multiplied by nearly 100. Thirdly, we have not considered the expenditure on out-patients and the pattern of flows for these may be quite different from in-patients. This problem is discussed below under the "hybrid version" in section 2.5. Fourthly, those patients which cross boundaries for treatment for clinical specialties not available in their own areas may cost the hospital more, per case, than the typical case of a patient not crossing a boundary. Thus we need to examine the costs of regional specialties as in section 2.6. Finally, a patient may go to the teaching hospitals, not because the clinical specialty is not available locally, but because the case is particularly difficult and complex. Again, the case is likely to be more expensive. This problem is considered in section 2.7 as part of the special problem of teaching hospitals.

2.5 The "hybrid" version

As mentioned above, the allowance for boundary cross-overs and for age-sex differences relates only to in-patients. Since comparable data for out-patients are not available, we do not know if out-patients and day-patients cross over boundaries for treatment nor do we know of the age-sex composition of these patients. If they have the same characteristics in these respects as in-patients then the previous

versions of the formula suffice. If not, a further version, the "hybrid" version can be offered: this is based on the assumptions that out-patients and day-patients come only from the Area in which the hospital is located and that their age-sex distribution is the same as that of the actual population so that no weighting is required. In practice it is recognised that the truth lies somewhere between the "hybrid" version and the previous version.

The "hybrid" version allocates the regional expenditure on in-patients, namely £27,786,873 which is 79% of total general hospital expenditure, on the basis of the weighted catchment populations. The regional spend on out-patients and day-patients was £7,426,607: this includes non-costed items such as peripheral clinics. In the "hybrid" version this is allocated on the basis of the unweighted actual populations. The results are given in table 18.

Separating out-patients from in-patients demonstrates that the variation in expenditure on out-patients is far greater than it is on in-patients, the co-efficient of variation being 27.19% and 10.79% respectively.

One important change brought about by the hybrid version is that Buckinghamshire, which in the previous version was over-generously funded, is now under-generously funded. This arises from the assumption that out-patients do not leave the area for treatment.

The greater variability of out-patient expenditure raises the interesting question of how far these figures reflect differences in medical policy and how far medical policy has been influenced by the allocations historically. This question will be pursued further in section 2.8.

SECTION 2.6 REGIONAL SPECIALTIES

2.6.1 Introduction

While the above methods of treating cross-boundary patient flows compensate for the fact that a hospital may serve a catchment population greater than the actual population of its AHA., it has been assumed that the cost of treatment received by the patients who cross boundaries is not significantly different on average from the cost of treatment provided for those who are hospitalised within their own areas. In the case of a clinical specialty which is only available in one hospital in the region, or indeed, over a much larger area of the country, this may not be the case.

To test the implications of this, two specialties at Stoke Mandeville Hospital were examined.

Stoke Mandeville Hospital was chosen because half of the facilities are devoted to two regional specialties and because, as can be seen in table 19, the hospital has the highest cost per case in the region, 60% greater than the average for the acute hospitals with over 100 beds. On the other hand, its cost per in-patient week is less than the average. Since the analysis is based on notional catchment populations which are related to the number of discharges, it is the cost per case which is relevant.

Stoke Mandeville Hospital supplements the Royal Buckinghamshire Hospital in the provision of District General Hospital facilities for the Aylesbury area of Buckinghamshire. However, of the 571 beds at Stoke Mandeville, 269 beds are used by two clinical specialties, the Spinal Injuries Unit and the Plastic Surgery and Burns Unit. Both of these attract patients from elsewhere in the

country: indeed the Spinal Injuries Unit has an international reputation and serves as a centre for the development of treatment and facilities for paraplegic patients. Clearly the Spinal Injuries Unit, and to a lesser extent the Plastic Surgery and Burns Unit, provide a good example of services not generally available within an AHA which, because of their expected high cost, should receive special consideration in the allocation of revenue funds. Indeed, since the Spinal Injuries Unit is a national specialty, it could be argued that the Oxford Region should itself receive a special allocation from DHSS.

2.6.2 Costing method used

Babson (1973) describes a method he used to cost herniorraphy and appendicectomy in three separate hospitals which ".....entailed personal observation of key phases of each patient's treatment.... to determine as precisely as possible the nature of the treatment with regard to cost ie time spent by various categories of personnel, drugs, ancillary services, etc....". This proved to be extremely time consuming and, despite the close attention to minutiae, inevitably involved a number of very arbitrary assumptions. Although a similar, empirical accounting approach was followed in this study, the task was made easier since the wards used by the two specialties are clearly identifiable and it was possible to assess the resources such as nurses, domestic staff, and cleaners deployed exclusively in these wards. The spinal wards were used only by the spinal patients. However eight beds in the wards used by the plastic surgery and burns patients were used by dental patients and, having calculated the costs of the wards, it was necessary to

allow for these. Because of their short length of stay, their costs per day are likely to be high, but since, in fact, only 4.66% of the in-patient days in these wards were attributable to the dental patients, it is reasonable to argue that a satisfactory estimate of the costs of the plastic surgery and burns patients can be obtained by taking 95.34% of the total cost of the wards. Medical staff were identifiable by specialty. Some treatment departments had data on the number of units of service provided to the two specialties: others kindly undertook sample studies and the percentages so derived were applied to the expenditure for the year. For the general services such as catering and laundry, the apportionment was based on in-patient days or the number of beds. A principal requirement for the exercise was that the method should produce results quickly, utilise data already available as far as possible, and not impose too much additional work on the staff of the hospital. Some of the data were kindly provided by the Treasurer's Department of the Royal Buckinghamshire HMC: the rest were collected by the staff of the hospital. Inevitably some arbitary assumptions were necessary but these have been clearly itemised in appendix C and it is felt that a change in these assumptions is unlikely to affect the final result in a significant way.

2.6.3 Results: Spinal Injuries Unit

The results of the study appear in tables 20, 21 and 22 based on the calculations and assumptions given in appendix C. The cost per case was calculated to be £927 compared with £127 for the 'other' clinical specialties in the hospital, that is excluding

Plastic Surgery and Burns. The cost per in-patient week, on the other hand, was less, £83.25 compared with £92.51 for the hospital as a whole and £95.32 for the 'others'. It is the much longer average length of stay, namely 77.97 days, compared with 9.33 for the 'others' which makes the Spinal Unit appear so much more expensive.

The items which were found to be more expensive for patients in the Spinal Injuries Unit compared with the 'other' patients were relatively few. Far more ward orderlies were required to care for the paralysed patients, many of whom had to be turned over at regular intervals. This item cost £14.33 per in-patient week, compared with £0.59 for the 'others'. Also 63% of the physiotherapists timeand 87% of their equipment were devoted to the spinal patients. Similarly for 85% of the time, the remedial gymasium was used by spinal patients and the swimming bath resulted in a high cost under the item 'power, light and heat'. However, these more expensive items together accounted for only 28% of the total cost of the specialty. For most of the other items the cost per in-patient week was less than for the other specialties, notably medical salaries and nursing. This arose because the length of stay is greater and the intensity of treatment per day is less.

2.6.4 Results: Plastic Surgery and Burns Unit

The average cost per in-patient week was substantially greater than for the hospital as a whole, £109 compared with £92, and also greater than the 'other' specialties, ie excluding spinal injuries, at £95. Also, the average stay per case was greater than the 'others' and the average cost per case was greater, namely £192 compared with £127.

The main example of higher costs was the operating theatre which cost £54 per case, compared with £12 which was the average for the 'others' some of which were medical cases. If the total operating theatre costs of the 'others' is divided by surgical patients only, the average cost is £22. Nevertheless, the high costs of the operating theatre for plastic surgery patients alone accounted for the extra in the total figures. Some other items were slightly more expensive, for example domestic staff, ward cleaning, dressings and clinical photography; but these did not account for a large percentage of the total cost and were offset by lower costs on other items, such as medical pay, pathology and equipment.

2.6.5 Implications for the analysis

This study identifies a total cost of £732,575 for the 790 paraplegic patients and £320,484 for the 1,669 patients in the Plastic Surgery and Burns Unit giving a total of £1,053,055. These together account for 49% of the expenditure of Stoke Mandeville Hospital. These figures apply to 1972-3 and to relate them to the base 1971-2 figures used in the simulated model, we must deflate them, The cost per case increased by 30.79% between 1971-2 and 1972-3 at Stoke Mandeville. Assuming that this increase applied pro rata to the two specialties, the corresponding cost in 1971-2 was £805,153.

Two reservations arise in relating the cost of these specialties to the allocation model. Firstly, this is only one example of regional specialties and it is difficult to specify what other potential candidates should be considered. Advice was obtained from the medical officers of the Oxford Regional Hospital Board to

the effect that the only major regional specialties of significant size were to be found in the Oxford teaching hospitals: this is part of a larger problem which will be dealt with in section 2.7 of this study. However, other clinical departments may provide special services not generally available and it would have to be a matter of judgement by the decision-makers to determine which to include and which to exclude.

The second reservation is that while this study has shown what the probable cost of the Stoke Mandeville specialties is, it has not shown what it <u>should be</u>. To do this it would be necessary to compare the effectiveness of the expenditure in this field with the effectiveness of a corresponding quantum of resources elsewhere. Because of the problems of quantification this is impractical at the present time and would have to be a matter of judgement by the decision-makers.

For the purposes of the model, it is argued that the actual sum spent on the Stoke Mandeville specialties is the <u>desired</u> sum. The £805,153 is then deducted from the global in-patient sum and the reduced global sum is allocated on the basis of an equal spend per head of the weighted notional catchment populations. However, just as patients crossing boundaries were deemed to represent a catchment population, so the 2,459 patients in the two Stoke Mandeville specialties can be thought of as representing a catchment population. These are multiplied by 9.6075 to give the population adjustment, and by 0.9467 to give the weighted population adjustment and this is deducted from the notional weighted catchment

population of both Buckinghamshire and the region. The variation of expenditure per head under these new assumptions has increased with a co-efficient of variation of 11.49%. This suggests that the actual allocations did not take into account the cost of these regional specialties. The resulting target allocation is given in table 23 which shows how the cost of the Stoke Mandeville specialties has been shared. Buckinghamshire receives an extra £411,806 which is met by the other three areas as shown in the last column, that is in proportion to the relative sizes of their populations. Buckinghamshire, in fact, appears to contribute £393,347 to the cost of the specialties, greater than each of the other three but the reason for this is that in previous versions, the target allocation to Buckinghamshire had been increased because of the patients which flowed into Buckinghamshire to receive treatment from these special units.

SECTION 2.7 THE DIFFERENTIAL FOR THE TEACHING HOSPITALS

2.7.1 Introduction

Since the NHS was formed, it has been recognised that the teaching hospitals have a special role to play: the 1946 National Health Service Act specified that certain hospitals were to be designated as teaching hospitals to be administered by Boards of Governors, responsible to the Minister of Health and with funds supplied directly by the Ministry of Health. They were thus placed outside the pyramidal structure of the Regional Hospital Boards and Hospital Management Committees. (Exceptions to this have in fact arisen more recently where some hospitals have become university hospitals under the Health Services and Public Health Act, 1968, but have remained under the authority of the Regional Hospital Boards). Many of the teaching hospitals when nationalised already enjoyed above average standards, with the prestige to attract staff of high calibre, and staffing ratios appropriate for teaching and research. They often provided the comprehensive range of services normally found in a district general hospital but also served as regional or even national centres for particular specialties. Funds were allocated to them primarily on the basis of incremental budgeting, with annual reviews between the Boards of Governors and the central department: the previous year's services would invariably continue to be funded and the Board's future plans would be considered. Since the proportion going to the teaching hospitals of the national sum available for all hospitals had usually been determined in advance of these annual reviews, the bargaining for extra funds

was on the basis of the relative merits of one Board's case compared to those of another. Thus there could be no attempt to 'trade-off' the funds for a particular teaching hospital with those for its neighbouring RHB or vice versa. Moreover, the teaching hospitals were excluded from the formula introduced in 1971/2 by DHSS to bring about greater uniformity nationally in the allocation of revenue funds. Thus incremental budgeting and the pressure of the prestigious medical groups in teaching hospitals served to ensure their continuance as privileged centres.

The special position of the teaching hospitals has been questioned on several occasions and the possibility of merging the Boards of Governors with the Regional Hospital Boards debated. For example, The Guillebaud Report (Ministry of Health 1956) considered the financial aspect and found (para. 181 ii):

"The average costs of maintaining patients in teaching hospitals are very much higher than those of the non-teaching hospitals, and this could be held to indicate that the teaching hospitals are receiving more than a fair share of the available resources".

Further evidence for this was:

...."the maintenance costs of the teaching hospitals in Scotland (where the teaching hospitals are already administered by the Regional Boards) are considerably lower than their English counterparts."

The Report argues that the difference is justified since the provision of "centres of excellence" serves to bring about advances in techniques and knowledge. They had found no evidence of a

wasteful use of resources and it was argued that the RHBs would be in no better position to ensure efficiency than the Boards of Governors. A minority report, on the other hand, signed by one member of the Committee of Enquiry, Miss Godwin, states (para.4): "Whilst allowing for the maintenance of a high standard, I have the impression that the teaching hospitals, in their comparative isolation, have not been so acutely aware of the need for economies and the means of securing them as the non-teaching hospitals." Certainly the dual system of control and funding must have made it more difficult to balance the standards of health care of those populations in the catchment areas of the teaching hospitals, where some hospital facilities might also be provided by the RHBs, with those elsewhere.

The reorganisation of the Health Service in 1974 entails the creation of a single administrative structure, and teaching hospitals will be incorporated under the area and regional authorities. However the Consultative Document, May 1971, (para. 23(b)) states: "expenditure for the services in a teaching district will be separately identified in the regional health authority's approval of expenditure for the area."

At the time of writing this paper it is not clear what this statement means nor whether the RHAs will have power to determine the level of expenditure of those areas which incorporate the teaching hospitals, the AHATs. If a sum is specified for the full range of services of the AHAT, then the RHA will have no power to influence this in relation to the other areas in the region and this analysis will then be relevant only to the other AHAs. On the other

hand, if the DHSS merely specifies the sum to go to the teaching hospitals, the RHA still has the problem of determining what is an equitable allocation to the other services in the AHAT. If, finally, the statement from the Consultative Document becomes void, the RHA has the problem of determining the appropriate sum for the teaching hospital element in the AHATs' allocation. In the two latter cases, we must ask:

1 What sum should the teaching hospitals be entitled to for the ordinary, conventional DGH functions which they perform, if an equitable distribution is to be made between all areas in a region?

2 What differential is judged to be desirable in the light of other claims on resources, to meet the special circumstances of a teaching hospital?

For the purposes of an allocation formula, if the RHA is unconstrained, then the special differential for the teaching hospitals needs to be determined, subtracted from the global sum before the allocation on the basis of an equal spend per head of notional catchment populations and then added back into the allocation to the AHAT. If the DHSS specifies a given sum for the teaching hospitals, to cover both conventional DGH services and the teaching element, then the matter is a little more complicated. Let us suppose that the DHSS specifies the sum S to be spent on the teaching hospitals, that T is the sum for the rest of the region and D is the differential, ie the 'extra' the RHA deems to be justified. The global sum now becomes

$$T + S - D$$

The allocation per head in the formula is

$$\frac{T + S - D}{\text{total catchment population of region.}}$$

The allocation to each AHA

will be this sum multiplied by its notional catchment population with D added on for the AHAT. S will still be provided to the teaching hospitals, and the equitable distribution between areas ensured by adjusting the allocation to the other hospitals in the AHAT. This will suffice so long as S does not exceed the sum, even with D, allocated to the AHAT: in that case it can be pointed out that the DHSS is creating a most inequitable sub-regional distribution of funds.

2.7.2 The Selection of the Differential

The Differential is defined as that sum which is deemed to be appropriate for a teaching hospital to receive, over and above that which it would receive for its role as a DGH., (ie if it were not a teaching hospital) on the basis of an equitable distribution as defined in the rest of the formula. Ultimately, it must be a policy decision, based upon value judgements to decide what, in the light of the demands made on all the other branches of the health services, should be devoted to meet the special needs of teaching hospitals. It may be helpful, however, in formulating a policy to examine the historic costs of teaching hospitals compared to non-teaching hospitals though, on the other hand, if historic cost differentials are unquestioningly followed, we are in fact returning to incremental budgeting. A useful aspect of this formula is its facility to show the implications for the rest of the system of any one decision about teaching hospitals.

The costs of a teaching hospital may exceed those of a large, comparable DGH for three types of reasons:-

1 A teaching hospital provides clinical teaching and research facilities, part of which, such as lecturing theatres and specifically appointed teaching staff, are paid for by the University from the UGC but part are indirectly borne by the hospital Examples of the latter may be a higher ratio of medical staff to patients, greater use of diagnostic services, notably X-ray and pathology, partly for teaching purposes.

2 A teaching hospital may provide regional and supra-regional specialties which could be more expensive in terms of cost per case and cost per in-patient week than conventional specialties. Also it may treat the more difficult types of cases within conventional specialties, especially if it deliberately attracts a wide range of case types which have special interest for teaching purposes.

3 There may be a policy to create a "centre of excellence", deliberately providing a more intensive and higher standard of treatment in an attempt to raise the standards of medical care generally by example to the on-coming generation of doctors. There is some evidence that medical outcome in teaching hospitals is better than in non-teaching hospitals. Lee et al. (1957) reported that case-fatality rates for common surgical conditions were higher in regional board hospitals than in teaching hospitals. Similar observations, for example, Lipworth et al. (1963) were made for a number of other medical conditions. However these studies were based on HIPE data and the differences could in part

be explained by differences in the information system, the state of patients on admission and variations in the social class of the patients. Ashley et al. (1971) undertook a more detailed study of the case-fatality rate of hypertension of the prostate and found an age-adjusted case fatality rate for planned admissions of 2.1% in teaching hospitals and 3.6% in non-teaching hospitals and for unplanned immediate admissions 4.6% in teaching hospitals and 8.6% in non-teaching hospitals. However the evidence is not entirely unambiguous as it was found upon closer examination of two teaching hospitals and three non-teaching hospitals that the non-teaching hospitals tended to admit a greater proportion of higher risk patients. Also more operations were carried out in the teaching hospitals than in the non-teaching hospitals and operations have a lower mortality risk than non-operative treatment. It is not stated whether shortage of resources was the reason for fewer operations in the non-teaching hospitals.

Thus, while prima facie evidence points to higher standards of care in teaching hospitals, reliable comparison is confused by other factors. Moreover, there is as yet no evidence of a relationship between the cost of resources deployed and medical outcome ie a production function, and until a functional relationship has been established, it means that any decision to fund one hospital more generously than another <u>in order</u> to achieve better outcome must be a matter of professional judgement.

It has been argued that the choice of the differential for teaching hospitals must be a policy decision which reflects policy objectives, with regards to teaching facilities, regional specialties and the desirability of a "centre of excellence". And, to form such a policy decision, it is helpful to attempt to analyse the historical cost differential in these terms.

The Royal Commission on Medical Education (1968) initiated a study in four teaching hospitals with comparisons with similar non-teaching hospitals to identify the direct and indirect costs of the "teaching element" and found that (para.409):

"The results, which are supported by a comparison of unit costs in teaching and in "acute" non-teaching hospitals throughout Britain, suggest that the normal service function of a teaching hospital accounts for roughly three-quarters of its total costs".

This suggests that the "teaching element" imposes a differential of about 33% on the costs compared to a non-teaching DGH.

If we consider more recent figures a similar, though slightly lower differential is found. The average costs of non-teaching hospitals over 100 beds in England 1971/2, excluding the Metropolitan regions, can be compared with the average costs of the English provincial teaching hospitals with the following results:-

	Non-teaching acute	Teaching	Differential
Cost per case	£104.57	£135.58	29.65%
Cost per in-patient wk	£ 77.84	£ 99.53	27.97%
Av. length of stay, days	9.7	9.5	

Thus it would seem that we have a differential of between 25% and 30% to attempt to explain. With total in-patient expenditure in 1971/2 at the Radcliffe and Churchill of £4,486,252 this represents between £897,000 and £1,035,000. Out-patient costs which are also important will be considered later.

One factor which has an influence on cost per in-patient week is the average length of stay: the shorter this is the greater the intensity of medical treatment provided per day is likely to be, and so the greater the cost. However, the difference in average length of stay nationally between teaching and non-teaching hospitals is so small that it is unlikely to have a significant effect on costs. Similarly the difference within the Oxford region is unlikely to influence costs to an appreciable extent. On the other hand the Radcliffe and Churchill had a lower average length of stay than the other provincial teaching hospitals in England and Wales, 6.86 days compared with 10.16, and this may explain the difference in costs between the Radcliffe and Churchill and the average of the other provincial teaching hospitals, which were as follows in 1971/2:

	Radcliffe & Churchill	Other provincial teaching hospitals *
Cost per case	£108.33	£142.40
Cost per in-patient week	£110.60	£ 98.12
Av. length of stay, days	6.86	10.16

*excluding the Radcliffe and Churchill.

The higher cost per in-patient week at the Radcliffe and Churchill is offset by the lower cost per case. While the relationship does not seem to be important in the comparison of the Radcliffe and Churchill with the non-teaching DGHs when considering the total average figures, it will be argued that it does become important when differences of case-mix have been removed.

2.7.3 Differences for case-mix nationally

Feldstein (1967) demonstrated that some, though not all, of the differences between the costs of non-teaching acute hospitals could be explained by differences in case-mix and advocated that cost comparisons are meaningful only if they have been standardised for case-mix. R Gibbs (1972) used 1969/70 data to calculate the expected average cost per case for acute non-teaching hospitals, standardised for case-mix, by regressing the average costs per case for 231 hospitals against the proportion of total deaths and discharges in each specialty, the size of the hospital in terms of numbers of available beds and also whether or not the hospital was situated in London. The best fit gave the following equation:

Expected average cost per case = 133 (General Medicine) + 41 (Paediatrics) + 60 (General Surgery*) + 57 (ENT) + 94 (Tr. & Orth.) + 116 (Other Surg.) + 73 (Gynae.) + 63 (Obst.) + 141 (Other Specialties) - 0.048 (Size) + 0.000065 (Size^2) + 15 (London factor).

(* Specialties 17 to 23 in the SH3 returns which include Ophthalmology and Neurosurgery).

This equation explained 40% of the variation in costs which suggests that a number of other factors influence hospital costs and, also perhaps that variations within the specialties have some influence. Nevertheless, it provides some guide to the nature of the differential. By applying the case-mix data of the Radcliffe and Churchill to the co-efficients, the results were as follows:-

	Predicted cost per case 1969/70	Actual cost per case 1969/70	Differential %	£
Radcliffe	£79.86	£82.58	3.4	75,861
Churchill	£83.03	£84.00	1.2	17.626

The suggestion is that the differential of 3.4% and 1.2% are explained by under-graduate teaching costs. P West has gone on to regress the differential for all teaching hospitals against the number of under-graduate students and for the provincial teaching hospitals only, he finds that 37% of the variation can be explained by student numbers, with an average predicted cost per student in 1969/70 of £1,455.

These regression techniques involve such high standard errors that it is debatable whether they should be applied to individual hospitals with any confidence. The technique merely standardises for differences in case-mix <u>within</u> non-teaching hospitals and it may be that the difference in case-mix between non-teaching hospitals and teaching hospitals as a whole is not the same as the difference within non-teaching hospitals. Also, the classification is so broad that it does not allow for specific specialties which are unusual and to be found only in a few hospitals. On the other hand, the calculations suggest that under-graduate teaching in the Radcliffe and Churchill has a very small effect on costs.

To examine the effect of differences in case-mix on the costs of the Radcliffe and the Churchill in greater detail, a study of those clinical specialties which are not available in the other DGHs in the region was undertaken, and an attempt was made to ascertain the effect of the expected high costs on the average costs of the hospitals.

2.7.4 The estimated cost of the Neurosurgery Department at the Radcliffe Infirmary

The costing method used was to take the expenditure under each cost heading in the cost return and apportion it between the neurosurgery department and other specialties. Inevitably a number of arbitary assumptions are made and the method used for each item is given in appendix D. For ward costs, the costs of the Nuffield 1 ward were calculated. However, 5 of the 619 patients who used this ward in 1972/3 were for general surgery so the costs related to neurosurgery are assumed to be 99.19% of the costs of this ward. On the other hand, 115 neurosurgery patients used other wards; it is assumed that the costs of these patients are the same as those in Nuffield 1 Ward and so the ward costs of the 614 are divided by 614 and multiplied by 733. This gives a "grossing-up co-efficient" of 1.1841, and its use is given in the appendix.

The results of the analysis are given in tables 24, 25 and 26. The cost per in-patient week for neurosurgery patients was found to be higher than for average for the hospital, £153.26 compared to £135.25. This is accounted for by three main elements. Higher medical pay caused ward costs to be greater. Operating theatre costs were much higher but the average for the hospital is an average for all patients, many of whom were medical patients. X-ray costs were higher but pathology and ancillary medical services were lower.

The average cost per neurosurgery case was higher than for the hospital as a whole, to a greater extent than with the cost per in-patient week, £241.67 compared to £134.69. The explanation of

this is that the average length of stay for neurosurgery patients was greater, 11.04 days, compared with 6.97 days. This had the effect of increasing the general services cost per case which was £71.56 for neurosurgery cases compared to £46.03 for the whole hospital.

The study establishes that the neurosurgery department is indeed more expensive than the other clinical specialties. However, as the proportion of neurosurgery patients is small, this higher cost has little effect on the average of the hospital and the comparison with the other DGHs in the region shows that the cost per in-patient week, excluding neurosurgery, is 34% greater, and the cost per case 26% greater. In the absence of other evidence, it must be concluded that the difference is related to the teaching activities and, more importantly, its role as a "centre of excellence".

In table 25, a comparison of the costs of the "other"specialties of the Radcliffe and the average of the non-teaching hospitals in the region shows that about one third of the total difference is attributable to ward costs, one third to treatment costs and one third to general services. Higher costs for medical pay, nursing pay and operating theatres might be considered consistent with the notion of a greater proportion of medical staff for teaching purposes and to maintain a higher standard of care. Higher general services costs can be explained by the fact that a higher complement of medical staff tends to result in a higher complement of supporting staff which influences the cost of administration and medical records and then, because these extra staff require office accommodation so the cost of power, light and heat, and building maintenance tend to be higher.

In deciding whether these differences are desirable, a decision maker would need to consider two factors, firstly whether the additional expenditure does indeed result in improved medical outcome for the patients, and secondly, if it does, whether improved outcome is desirable when considered in the light of a policy objective of "equality of opportunity". It has already been suggested in section 2.7.2 that there is some evidence of improved medical outcome from teaching hospitals. However, if improved outcome is to be achieved it does not mean that all the additional expenditure is effective in bringing that about. For example, one of the features of the higher costs observable in table 25 is much greater costs of diagnostic services, over twice as much on X-ray and just under twice as much on pathology. It is questionable whether excessive use of diagnostic services is effective in terms of medical outcome. Todd (1970) and Naish (1970) point to the dangers of "losing sight of the patient under a welter of pathological investigations" in such a way as to make some of the investigations counter-productive. However anecdotal evidence of this kind serves only to suggest that a full justification of the differential in terms of medical outcome would require a major research programme to examine not only the effects of increased expenditure on the patient but also the effects of these practices on trainee doctors who subsequently do not practice in teaching hospitals.

2.7.5 The costing of regional specialties at the Churchill Hospital

The Radcliffe Infirmary and the Churchill Hospital comprise the main part of the former United Oxford Hospitals group and while the Radcliffe provides the main part of the range of conventional DGH specialties, the Churchill provides the bulk of the regional specialties.

Estimates were made of the costs of the following clinical specialties which in general are not to be found in the other DGHs. in the region:

neurology

plastic surgery

radio therapy

thoracic surgery

renal dialysis

haemophilia

The figures which relate to the year 1972/3 are presented in tables 27, 28, 29. The costs were derived by the same methods as used in the Radcliffe study and the precise details are given in appendix E. In some cases, for example, for medical salaries, it was possible to identify these actual costs from the tabulations available in the Treasurer's Department. In other cases data were available, or could be collected without troubling the staff of the hospital unduly, related to the units of service provided to particular wards. Having derived the costs of the ward, it was necessary to relate them to patients in the specialties concerned. For neurology this was simple since wards 13 and 14 were used exclusively by neurology patients and no neurology patients were nursed in any other ward. For plastic surgery, 93.43% of the in-patient days of ward 5 and 90.19% of the

in-patient days of ward 8 were used by patients for this specialty and so these percentages were applied to the costs of those two wards respectively: it is thus assumed that as these patients utilize the resources of the wards to such a great extent that any 'above average' requirements will be reflected in the above average costs of the wards. For radio-therapy, ward 7 was used exclusively by these patients, plus 17.50% of the in-patient days of the "minimum care" ward, ward 18. Ward 6 was used for 89.47% of the time by thoracic surgery patients and this percentage was used to derive the costs of this specialty. Renal dialysis and haemophilia proved to be more complex; both these specialties used Ward 1, for an estimated 85% of the time. Renal dialysis patients used Ward 1 for 67.35% of the time. Haemophiliac patients used Ward 1 for the remaining 17.65% of the time but 73 of the total 279 patients in the hospital used other wards. It is assumed that these 73 patients utilised the same quantum of resources as the 206 in Ward 1. Thus the 17.65% of the costs of Ward 1 were divided by 206, and multiplied by 279, ie 23.90% of the costs of Ward 1 was taken to represent the cost of the haemophilia patients.

The costs which have been derived by these methods must be considered as estimates. In many cases, the complexities of the organisation of the hospital proved to be so great that more accurate costs could be gained only after a level of effort on the part of hospital staff quite unacceptable in relation to the use to which the figures will be put. For example, a small number of haemophiliac patients are admitted for surgical operations and receive the resources of the surgical firm as well as those of the haemophilia unit. In this

exercise the resources of the haemophilia unit only have been counted since it would have been necessary to trace the progress of such patients through the hospital to include the other costs. However, it is estimated that the costs so missed are not substantial and if excluded from the "other" column would have a negligible effect on the average cost per in-patient week or cost per case.

Four of the specialties studied had an estimated cost per in-patient week greater than the average for the hospital as a whole: these were the haemophilia patients at £160, thoracic surgery at £151, radiotherapy at £141 and plastic surgery at £136. On the other hand the other two specialties had an estimated cost per in-patient week less than the average for the hospital, neurology and renal dialysis both at £111.

All the specialties studied had a longer average length of stay than the hospital as a whole, renal dialysis with the longest at just under 20 days. Other things being equal, one would expect this to cause the cost per in-patient week to be less than the average for the other DGHs in the region, namely £100, and the extent to which they are not reflects the special nature of the services being provided. Similarly, the costs per case of the specialities, the lowest being £162 for plastic surgery and highest £305 for renal dialysis compared to £104 for other district general hospitals, reflects both the special services and the longer length of stay. Patients for neurology had an average length of stay of 12.08 days, compared to 6.84 for the whole hospital. The less intensive nature of the treatment may account for the fact that, per in-patient week, this was the least expensive of the specialties studied. Some items

were in fact more expensive than for the "others." For example, wards 13 and 14 are heavy users of domestic staff who undertake extra "house-keeping" activities such as serving meals: on the other hand, this seems to have made it possible to economise on nursing which more than offset the extra domestic costs. This specialty made above average use of X-ray and also EEG., and occupational therapy, the latter two explaining the high costs of ancillary medical services. On the other hand, negligible operating theatre costs and low use of pathology cause the treatment costs to be below the average for the hospital.

Plastic surgery patients had an average length of stay of 8.31 days. On the wards, nursing and dressings proved to be more expensive than average and together with the high operating theatre costs explain the high costs overall, despite the lower than average use of X-ray and pathology. It is interesting to compare these costs with those of plastic surgery costs at Stoke Mandeville Hospital. There the cost per in-patient week was £109 compared to £136 at the Churchill, and the cost per case was £192 compared to £162 at the Churchill. Both these pairs of figures are consistent with the fact that the average length of stay at Stoke Mandeville is greater, namely just over 12 days compared to just over 8 days at the Churchill. Allowing for this, the costs in the two hospitals appear to be similar.

The radio therapy costs are high because of the treatment costs themselves. These patients have a call on the rest of the services of the hospital, notably pathology of which they are heavy users, but in addition to this the radio therapy treatment is expensive.

Thoracic surgery patients had an average length of stay of 8.06 and the high treatment costs reflect the intensity of the treatment provided notably the operating theatre, X-ray and physiotherapy. The cost per in-patient week for renal dialysis patients was below the average for the hospital, which is consistent with a long average length of stay of 19.19 days. For the same reason, the cost per case was the highest in the hospital, £305. Major costs were drugs and the diagnostic services. Since capital costs are not included, and since the bulk of the costs of the Renal Dialysis Unit are attributed to day-patients which are not incorporated in the in-patient accounts of the hospital, these costs do not reflect the full costs of this specialty. Our purpose, however, is not to accurately estimate these costs but rather to offer a possible explanation of the average costs of the hospital as a whole.

Similarly, the estimated costs of the haemophilia patients do not reflect the full cost of the resources provided for these patients but only the proportion of them which appear in the cost returns. With an average stay of 7.62 days, the cost per in-patient week of £160 indicates an intensive treatment regime. The most expensive item was drugs and, because of the method of cost apportionment used, the pharmacy itself. Pathology was also used more than average. The study showed that, on the basis of cost per in-patient week, four specialties proved to be above the average for the hospital as a whole and two below the average. The cost per in-patient week for the 'others' was slightly above the average for the hospital as a whole and, in turn, greater than the other DGHs which, at first sight

appears paradoxical since, having eliminated the expensive specialties, one would expect the average cost to be less. The explanation is that the average length of stay of the 'others' at the Churchill was only 5.42 days, compared with 7.07 days in the DGHs. The average cost per case of the 'others' was, on the other hand, much less than the costs per case of the six specialties studied and, at £104 was the same as the cost per case of the non teaching DGHs. The costs per case of the six specialties were considerably greater than those of the DGHs and account for the high cost per case of the Churchill as a whole.

2.7.6 Out-patient costs

In 1971/2 the average cost per 100 out-patient attendances in non-teaching acute hospitals over 100 beds in England and Wales, excluding the metropolitan regions was £319.85 and for the provincial teaching hospitals it was £385.85. This is a differential of 20.6%. In the Oxford region, out-patient costs were higher than the national averages, £357.51 for the non-teaching DGHs and £520.65 for the Radcliffe and Churchill together. This is a differential of 45.6%. Taking the Radcliffe and Churchill separately the comparison was as follows for 1971/2:

	Cost per 100 attendances	No. of attendances	Differential %	Differential £
Radcliffe	£463.59	192,747	29.67%	£204,453
Churchill	£766.18	44,791	114.31%	£183.031
Other DGHS in region	£357.51			

Thus the out-patients of the Radcliffe and Churchill cost £387,484 more than if the unit cost had been the same as the other DGHs in the region.

In 1972/3 the differential between the Radcliffe and Churchill and the other DGHs widened, as the following figures show.

	Cost per 100 out-patient attendances	No. of attendances	Differential %	Differential £
Radcliffe	£533.99	184,668	34.27%	£229,600
Churchill	£1137.27	34,681	185.95%	£256,480
Other DGHs in region	£397.71			

The differential for the Radcliffe of 34.27% is considerably greater than the differential nationally. It is difficult to offer an explanation of this. The ratio of out-patient attendances to new patients was 3.9: 1 for the Radcliffe and 3.8: 1 for the non-teaching DGHs and, if this does have an effect on costs, one would expect it to cause a lower differential. It was 3.1: 1 for the provincial teaching hospitals together which might indicate that the Radcliffe undertakes more elaborate procedures in clinics. Also it is generally held that the average cost of accident and emergency attendances is less than other out-patient attendances and, if this is the case, the percentage of accident and emergency attendances of 25.89% at the Radcliffe compared with 32.73% at the other DGHs would cause the average cost at the Radcliffe to be higher.

A breakdown of the costs given in table 30 shows that at the Radcliffe more is spent per 100 out-patient attendances on medical pay, domestic pay and drugs to give a ward cost 43% greater than for

the other DGHs. Twice as much is spent on X-ray and pathology and the overheads are greater because of nurses in training and medical records. It has not been possible to find an explanation for differences of such magnitude and it is more difficult to justify the differences on the grounds on a "centre of excellence" when the differential is so much greater than the national differential.

The differential for the Churchill was even greater, 186% in 1972/3. The Churchill has no accident and emergency attendances which would make the unit cost high and also the ratio of attendances to new attendances is low which would have a similar effect: yet the differential remains excessive. In table 30 the cost of two of the special units, namely radio-therapy and haemophilia, have been extracted from the total for the hospital but this reduces the unit cost for the rest of the hospital by very little. (The cost of the renal dialysis unit which is funded directly by DHSS is not included in the cost statement for the hospital). Two explanations for the differential have been given:

1 The out-patient clinics provide an intensive level of treatment for special cases not generally found in other DGHs and the clinics which on average have low unit costs are not to be found at the Churchill. In particular there are clinics, for example, for neurology and thoracic surgery, with a very low rate of throughput: in 1971 only 297 and 381 attendances for those specialties respectively. However, if all the cheaper clinics took place at the Radcliffe one might expect its average unit cost to be correspondingly lower.

2 The clinics at the Churchill are spatially separate and there is no centralised out-patient department sharing common admissions offices, records and nursing facilities. This would result in higher costs of power, light and heat and medical records.

2.7.7 Application of the differential to the 1971/2 model

In 1971/2 the Radcliffe and Churchill together had an average cost per case which was 25% greater than the average of the non-teaching DGHs in the region, and an average cost per in-patient week which was 30% greater. It has been argued that the differential is attributable to the Radcliffe's role as a "centre of excellence" and to the regional specialties at the Churchill. Less success was achieved in finding explanations for the out-patient cost differential though it is likely that it also results from the same causes as the in-patient differential but it is disturbing that the estimated average differential of 46% is so much higher than the identified differential between non-teaching DGHs in England and provincial teaching hospitals.

Although these differentials relate to unit costs, they can be applied to the total expenditure provided that it is accepted that the number of units of service, ie the number of in-patient cases and out-patient attendances, is at the desired level.

Whether the identified differential should be retained, increased or decreased, must be a policy decision. For the purposes of the 1971/2 model, however, to illustrate the implications of possible choices by the decision maker, two examples are taken. The first uses a high estimate, a 30% in-patient differential, which for

1971/2 is £1,035,000, and the actual 46% out-patient differential, namely £387,484. The "comprehensive hybrid version" of the formula extends the previous version and is presented in table 31. The extra allocations for the teaching hospitals are deducted from the regional sum which is then allocated on the basis of an equal spend per head of the population. This provides Oxfordshire with an equitable sum to provide conventional DGH services. The differentials are then added back to Oxfordshire's target allocation. The variation in the actual in-patient spend per head which is derived excluding the differential is, of course, reduced with a co-efficient of variation of 7.18%, the lowest encountered so far. Similarly the variation of out-patient expenditure is less, though it remains high at 20.94%.

The second example in table 32 uses a low estimate for the teaching hospital differential. This entails 25% for in-patients, namely £897,000 and the national differential for out-patients, 20.6% namely £174,940. The resulting variation in spend per head is greater than before. The second example shows how the low estimate results in Oxfordshire having a lower target allocation, and how each of the other areas gains. One feature of the formula is that if it is decided to increase the differential for the teaching hospitals by a given sum, Oxfordshire itself does not receive all of that sum since the global sum allocated on the population basis is less. In other words, devoting more to the teaching hospitals results in less being available not only for the other AHAs but also the other hospitals in Oxfordshire.

SECTION 2.8 THE BASIC INEQUALITY FOR GENERAL HOSPITALS

In table 6, total expenditure on general hospitals in each AHA was divided by the actual populations of each area and this revealed substantial variations between the expenditure per head. Various factors have been considered to explain this. Cross-boundary flows were found to be the important factor to explain the variation. Weighting for age-sex differences in the population had a perverse effect and increased the variation. Taking in-patient and out-patient expenditure separately revealed less apparent inequalities in in-patient expenditure but greater inequalities in out-patient expenditure. Allowance for the regional specialties at Stoke Mandeville did not explain the inequalities and required greater compensation for equality to be achieved. Finally, when allowance was made for the teaching hospitals, the apparent inequality was substantially reduced, the more so with the higher estimate. This suggested that the more generous allocations for teaching hospitals has been a prime cause of apparent inequalities. Even so, having excluded this differential Oxfordshire still remained more generously funded than the target allocation.

If it is assumed that the allowances for Stoke Mandeville and the teaching hospitals are acceptable in the light of the objective of "equality of opportunity" then table 31 illustrates the prescriptive conclusions of the formula, namely that a basic inequality existed in the 1971/2 allocation, though it is small in relation to the total expenditure. To achieve an equal spend per head, allowing for all the factors in the formula and subject to the assumptions and reservations made, the version of the model presented in table 31 suggests that an additional £895,946 would have had to be given to Northamptonshire, and an additional £452,828 to Buckinghamshire, and £791,431 subtracted from Berkshire and £557,342 from Oxfordshire. Other versions of the formula produce different results though a common feature of them all is that Northamptonshire was under-funded in relation to the other areas.

However, while we have been able to identify a basic inequality in the distribution of finance, this need not necessarily mean that these differences reflect proportionate differences in the treatment opportunities between the areas. Because of variations in treatment opportunities between diagnostic groups, it would be another major research exercise to establish the true differences between areas. We can, however, derive some crude indicators about which cursory comment can be made.

In table 33 the number of general hospital beds and the number of cases in the hospitals in each area are related to the populations. The variation in the number of beds per weighted notional catchment population is fairly low, with a co-efficient of variation of only 5.09%, less than the variation in expenditure per head. This would suggest that if the number of beds is an indicator of physical resources, resources are distributed more equitably than revenue expenditure. However, Northamptonshire, which is the least well provided financially has in fact the highest number of beds per head, and Oxfordshire has the least number of beds per head of the weighted notional catchment population. Moreover, Oxfordshire has the highest number of cases per head of the weighted notional catchment population whereas Northamptonshire has the least. Thus it appears that Northamptonshire uses its capital resources less intensively than Oxfordshire. The explanation of this lies in the mix of hospital types. 49.88% of the beds in Northamptonshire are non-acute compared with 24.13% in Oxfordshire and 36.23% of the total expenditure in Northamptonshire goes on non-acute care whereas it is only 16.26% in Oxfordshire. A separate analysis of acute and non-acute care will be made below.

The variation in the number of out-patient attendances per head of the actual population, also given in table 33, is high with a co-efficient of variation of 26.4%. This compares with the variation in expenditure per head of out-patients of 27.1%. Buckinghamshire which, as shown in table 18, spends the least per head on out-patients, has a lower level of out-patient attendances per head of population than Oxfordshire and Berkshire. Northamptonshire which spends slightly more than Buckinghamshire on out-patients has the least number of attendances per head but spends considerably more per attendance than Buckinghamshire. Indeed, the high cost per attendance at Northamptonshire, the highest in the region, might suggest that Northamptonshire undertakes more treatment procedures in its out-patient departments as a substitute for in-patient care, though the number of patients treated overall remains comparatively low.

In table 34, the indicators relate just to acute hospitals. Having excluded non-acute care, it can be demonstrated that Northamptonshire as expected has the lowest number of beds per head of population, and the lowest number of cases per head of the weighted notional catchment population. Unless Northamptonshire has a lower than average level of morbidity, which is unlikely in view of the death rates given in table 7, it would seem that its population is less well provided for acute care on both counts, in terms of capital resources, and the numbers of cases treated. This is consistent with the observed distribution of revenue funds.

Northamptonshire also has the lowest average cost per case. This could be indicative of either greater efficiency or a lower standard of service and, without further research, it would be wrong to conclude that it is one rather than the other. However, in view of the low level of funding and low throughput, it would seem to be reasonable to suggest that the low cost per case is a result in part of the low level of funding and may be reflected in a lower standard of provision of service than elsewhere.

Buckinghamshire has below the regional average number of acute beds and cases per actual population, though when divided by the weighted notional catchment population, these indicators are all above the regional average. The cost per case is high, inflated to some extent by the regional specialties at Stoke Mandeville. These indicators suggest that because of the ability of patients to move out of the area for acute care, the population of Buckinghamshire is not inequitably served in this respect and one is led to suppose that the identified deficiency in revenue allocations related to non-acute care. This is discussed below.

A further indicator of the adequacy of acute care which is frequently used is waiting lists. Data on waiting lists in 1971 were available only for the former HMCs so that strict comparisons are not possible. However, as these relate mainly to the DGHs and also primarily to the surgical specialties, the data would probably be the same for the AHAs. It is tempting to consider waiting lists as indicators of excess demand. However, waiting lists are influenced by a wide variety of other factors. For example, they often include a number of people who subsequently refuse operations, or for whom the operation is later considered unnecessary on medical grounds. Also patients may have been admitted as emergency cases elsewhere and not removed from the list. Thus lists can vary between hospitals merely because of differences in clerical practices in keeping the lists up-to-date. Moreover waiting lists depend critically upon the operational policies of the consultants concerned. The lists serve as a rationing system by which more urgent cases can be given preference to less urgent cases and so they depend upon the consultants' attitude to admitting people of different perceived priorities and "emergency and immediate" admissions. One consultant may favour a first-come-first

served principle more than another. Cullis (1973) has attempted to relate waiting lists to the volume of medical services provided but has not as yet discovered any significant statistical relationships. The main reason for this, he suggests, is that GPs act as filters of demand and do not recommend a patient of lower priority if the waiting list is of a particular length and the differing reaction of different GPs and the consultants "distorts waiting lists in such a way as to make them largely a meaningless statistic".

Certainly the data on waiting lists given in table 34 bear no relation to the data on revenue allocations. For example, Berkshire has the highest waiting list per head of population and yet it also has a high spend per head. Oxfordshire, on the other hand, has the lowest waiting list per head of the weighted notional catchment population. Moreover, the low rate per actual population might be considered to be one reason for the in-flow of patients from other areas. On the other hand, when the waiting list is related to the actual population of Buckinghamshire, it is the lowest in the region so that pressure on its own hospitals does not seem to have been the reason for its high out-flow of patients. Following Cullis' observations above, it is doubtful if these data are meaningful for the purposes of this study.

Finally, indicators for non-acute care are given in table 35. The co-efficients of variation are very high, far higher than for the variation of expenditure. As noted above Northamptonshire has the highest number of non-acute beds per head and also cases per head. Thus the historical explanation of Northamptonshire's relatively low revenue expenditure lies in the fact that it maintains a greater number of cheaper non-acute beds and fewer acute beds, compared with the other areas.

The other significant feature of table 35 is that Buckinghamshire has low indicators of non-acute care, particularly if the actual populations are used as the divisors, which are the more appropriate particularly in the case of the elderly chronic sick. In the final versions of the financial model, a deficient allocation to Buckinghamshire was observed. The explanation of this now appears to be its less well developed non-acute facilities compared with the rest of the region.

It must be concluded that simply to adjust revenue allocations would not, per se, result in the creation of "equal treatment opportunity", though it would nevertheless be an essential component of any policy to bring that about. Other factors must be considered, notably the mix of hospital types and the medical policies pursued. For while the financial model indicated a deficient allocation to Northamptonshire, the indicators suggest that while Northamptonshire has less well developed acute services it has more non-acute services. And while the least number of out-patients per head of the population are treated, more is spent on each one. It would require a major study of medical policy to determine how far this package of health care facilities and medical policies is beneficial in terms of medical outcome.

Thus it must be acknowledged that financial adjustment is only one part of any rational policy towards equalising treatment opportunity and, despite the complexities of the model developed, even more complex issues remain to be analysed further.

SECTION 3 PSYCHIATRIC HOSPITALS

3.1 Introduction

The methods of analysis in this section are essentially the same as those developed for general hospitals, though differences of catchment areas and age-specificity arise. As described in section 1.5, the expenditure during 1971/2 within the new Oxford region on psychiatric hospital services was £7,584,743: this represents 14.7% of the total expenditure on RHA services and is the expenditure on hospital services for mental illness and mental handicap. The expenditure in each AHA is given in table 36 with full details in appendix F.

As before, a financial allocation model will be developed for the allocation of revenue funds to the four constituent Area Health Authorities of the Oxford region. For descriptive purposes, the model relates to the actual expenditure in 1971/2, using the boundaries which exist following the 1974 re-organisation. Under the arrangements for "extra-territorial management" those hospitals in the former St. Birinus Group, though not necessarily located geographically in Berkshire, will be administered by Berkshire and it is assumed that Berkshire will be allocated the revenue monies. Similarly the populations of Henley Municipal Borough and Henley Rural District have been assumed to be the responsibility of Berkshire and its population has been increased accordingly.

The expenditure on the psychiatric hospitals in 1971/2 is related to the actual populations of the new AHAs in table 37. This shows a considerable variation around the regional mean average of £3.65.

Oxfordshire has the highest level of expenditure. The co-efficient of variation is 23.7% which is higher than the co-efficient for the corresponding calculation for general hospitals. Administrative boundaries may tend to be arbitary, cutting across natural communication flows and established relationships between primary care and the hospital service. Nevertheless, one would expect catchment areas for psychiatric hospitals to be more clearly definable in geographical terms than for general hospitals because there are fewer regional specialties and it is perhaps surprising that the variation of expenditure per head is greater for psychiatric care than for general hospital care. If a policy decision were taken to limit the catchment areas of the psychiatric hospitals to the geographical areas of the AHAs, and no boundary cross-over movements were to be allowed in future, then table 37 could be used to assess the change which would be required to bring about an equitable distribution of funds. As before the 'target allocation' is derived by multiplying the regional spend per head by the actual population of each AHA. It can be seen that the main shift of monies would be from Oxfordshire to Buckinghamshire since Buckinghamshire is the least well endowed with services and Oxfordshire the most generously served. However, it may be that such adjustment is impractical without corresponding capital expenditure.

3.2 Expenditure by Local Authorities

Because of the importance of Government policy to extend the services in the community, it could be argued that any plan for psychiatric care should take into account the expenditure by the Social Services Departments of the local authorities on services for mentally handicapped patients. Such expenditure was identified for this exercise by the Treasurer's Departments of the local authorities and adjusted for the new boundaries as in table 38. The variation of expenditure per head is greater than for the hospital services, with a co-efficient of variation of 43.7%, though it is interesting to note that the co-efficient of variation for the spend per head of hospital and local authority expenditure combined is 23.3% slightly lower than the 23.7% for hospital services alone. This arises because Northamptonshire which has a below average level of hospital expenditure has above average local authority expenditure and Berkshire has above average hospital expenditure and below average local authority expenditure. However this compensating effect is very weak since Oxfordshire is above average in both and Buckinghamshire is below average in both. Moreover, the level of local authority expenditure is small compared to hospital expenditure, £460,643 for the region as a whole, that is only 6% of hospital expenditure. The level of expenditure is likely to rise, £836,355 being the aggregate estimate for 1973/4, but its impact on the provision of hospital services is unlikely to be felt for some time and as this expenditure will remain outside the reorganised health service, it is felt that there is nothing to be gained by including it as a variable in the formula.

3.3 Weighting by age and sex

Weighting factors were derived by the same method as that used for general hospitals, and described in section 2.3. Data on the average number of beds occupied by each age-sex group in psychiatric hospitals in England and Wales were provided by DHSS. They were divided by the population in the age-sex groups and the occupancy rate for each group was divided by the occupancy rate for the whole population. The resulting weighting factors are given in table 39 and the weighted populations of the areas are given in table 40. As with general hospitals, this weighting system favours Northamptonshire which has the oldest population of the region, though because of differences in the age-sex occupancy rates, the effect is not as great as it was for general hospitals.

In table 41 the expenditure of each area is divided by its weighted population. The variation around the mean is increased slightly with a co-efficient of variation of 24.71% compared with 23.7% with the unweighted populations. As with general hospitals, this suggests that age-sex differences had not been taken into account when the allocation was made. Whether the weighted population is to be used for the prescriptive target allocation is a matter for policy decisions: as suggested in table 41 it results in giving an additional £65,363 to Northamptonshire compared with the previous calculation.

3.4 Notional Catchment Populations

The previous two versions of the formula were based on the assumption that, as a matter of policy, the catchment populations of the hospitals of the four areas were to be the actual populations of the Areas. While this may be future policy for psychiatric hospitals, at present there are a number of patients in hospital who have been admitted from other areas and, since the majority of them are long-stay patients, they are likely to remain the responsibility of the Areas in which they are hospitalised for some time. Moreover, until the bed provision is more evenly matched with population in each of the areas, some boundary cross-overs are likely to continue. An analysis of patient flows is therefore necessary.

The patient flows for general hospitals were analysed by taking the data of discharges and deaths from HIPE. For psychiatric hospitals the situation is complicated by two factors. On the one hand there are a number of patients discharged and readmitted on a continuing basis, which makes admissions an unreliable guide to patient flows. On the other hand, many patients have a long length of stay, possibly for some the major part of their lives. Some of these were originally admitted as long as thirty years ago and over that time the circumstances which caused them to be admitted from their original place of residence have so altered that such flows are unlikely to be repeated. For example, a number of patients were admitted during the war years from bomb damaged industrial areas.

To overcome the first problem, it was decided to base patient flows on the places of origin of all patients in hospital on a certain day, using the census of patients in mental illness hospitals undertaken by DHSS on December 31, 1971, and the census of mentally handicapped patients on December 31, 1970. This overcomes the problem of the unreliability of using admissions. The census data were kindly prepared for us by DHSS giving the place of origin of the patients.

To allow for the second problem of unrepresentative long stay cases, it was decided to select 10 years as an arbitary cut-off point. Those admitted more than 10 years before the census dates were identified separately and were counted as residents of the area in which they were hospitalised. Patients who had been in hospital for 10 years or more accounted for 40% of the patients in the censuses, but we do not know what proportion of these came from other areas.

The results of the analysis of flows are summarised in table 42 and illustrated in figure 2. The details for each hospital are given in tables 1 and 2 of appendix G. From these tables, it can be seen that 4,738 patients were resident in the region's hospitals and 5,123 people from the region were in hospital: thus the region as a whole is a net exporter of patients. While 271 patients came from outside, 656 went out, giving a net outward flow of 385. This is perhaps, a little surprising since catchment areas for psychiatric hospitals are more clearly defined than for general hospitals and the problem of supra-regional specialties scarcely exists. Closer

analysis of the figures reveals that 394 patients from Berkshire were hospitalised outside the region, despite the fact that Berkshire includes Fairmile Hospital, the largest mental illness hospital in the region and Borocourt, the largest hospital for mentally handicapped patients in the region. It seems reasonable to conclude that the anomaly arises from the boundary changes and that most of these 394 patients come from the area of the Windsor HMC which at the time of the Census was outside the region, and looked to the North West Metropolitan Region for the care of the mentally ill.

Other flows were as expected. Berkshire which has more beds than the other Areas had the largest inflow of patients, namely 472, and of these 209 came from Oxfordshire which is understandable since some of the hospitals are in fact geographically located in Oxfordshire. Buckinghamshire with the lowest number of beds, had the greatest net outflow, namely 206 patients.

It is hoped that these census figures give a representative picture of patient flows. The major weakness is that flows are affected when new units are provided: for example, Wexham Park, an acute hospital in the Windsor area of Berkshire, had recently opened 100 psychiatric beds which may influence the regional outflow noted above. This will affect future allocations though in this study the data on flows is matched in time with the expenditure figures so the problem does not arise.

As noted above, 5,123 people from the region were resident in hospitals, which gives a population per patient rate of

$$\frac{2,075,385}{5,123} = 405.11$$

To relate patient flows to catchment populations, it is argued that each patient in a hospital represents a notional catchment population for that hospital of 405.11. Thus to derive notional catchment populations for each Area, the net patient inflow, or outflow , is multiplied by the co-efficient 405.11 and the product added to, or subtracted from the actual populations, as in table 43. This results in an increase in the population of Berkshire by 3.3% and a reduction in the others, as much as 17.5% for Buckinghamshire. The distribution of funds can now be related to notional catchment populations, as in table 44. The variation in spend per head is reduced (the co-efficient of variation has fallen from 23.7% for the actual population to 17.7% for the notional catchment population) and the total sum which must change hands to achieve an equal spend per head is reduced. As with general hospitals, a consideration of cross-boundary flows is important in explaining part of the apparent inequality in the distribution of funds, though the remaining variation in expenditure per head still remains high.

As before we do not know the age-sex distribution of the areas from which patients who cross over boundaries come, and to derive weighted notional catchment populations we have to assume that it is the same as for the region as a whole. The "population adjustment" in table 43 is multiplied by the regional weighting correction factor of 0.9468 and then added to or subtracted from the weighted actual populations in table 40. The weighted notional catchment populations are given in table 45 and these are used in table 46 to re-work the allocations. As noted earlier, weighting does not significantly affect the results.

3.5 The "hybrid" version

No distinction has been made between in-patients on the one hand and out-patients and day-patients on the other and the allowance for boundary cross-over and for age-sex differences relates only to in-patients. We do not know if out-patients and day-patients cross over boundaries for treatment nor do we know of the age-sex composition of these patients. If they have the same characteristics in these respects as in-patients then the previous versions of the formula will suffice. If not, a further version, the "hybrid version" is based on the assumptions that out-patients and day-patients come only from the Area in which the hospital is located and that their age-sex distribution is the same as that of the actual population, ie no weighting is used.

The "hybrid version" allocates the regional spend on in-patients, namely £6,928,188 which is 91.3% of total psychiatric hospital expenditure, on the basis of weighted notional catchment populations: the regional spend on out-patients and day-patients (including non-costed items which are not in-patient items and cover for example, clinics) which is £656,555, 8.7% of the total, on the basis of simple actual populations. The results are given in table 47.

It is interesting to note that the pattern is similar to that with general hospitals and the variation in the spend per head on in-patients is the least encountered so far, namely a co-efficient of variation of 13.6%, whereas the variation for the out-patients and day-patients is very considerable, 106%. Although the total sum spent on out-patients and day-patients is so small, this does suggest that the overall difference between Areas is greatest in the provision of out-patient and day-patient services.

3.6 The "teaching element"

The Warneford Hospital in 1971/2 had a cost per in-patient week of £57.12., compared to the regional average for mental illness hospitals of £32.11. (For mentally handicapped hospitals it was £28.18). For its 123 patients recorded in the census, the expenditure was £2,657 per annum per patient, compared to the average of £1,430 per patient for the other psychiatric hospitals in the region.

Part of this extra cost may be attributable to the Warneford's function as a teaching hospital but without an extensive study it is not possible to determine the factors which explain this greater cost and in any case it would be a matter for the decision makers to decide what, in the light of other demands on financial resources should be the allocation for the "teaching element". So far in this paper it appears that the "target allocation" for Oxfordshire in all the versions of the formula is below the actual expenditure and so it is helpful to examine the extent to which the high costs of the Warneford account for this. To do this, the expenditure on the Warneford, £402,112 was excluded from the allocation on the population basis. Thus the global sum is reduced. But also, the 123 patients at the Warneford represent a notional catchment population of 49,829 (ie 123 x 405.11) in the same way that boundary cross-over patients were argued to represent a notional catchment population. Weighted, this figure becomes 47,178. Thus we can reduce the weighted notional catchment population of the region and of Oxfordshire by 47,178. The usual procedure of re-allocating by population is then followed in table 48 adding back the £402,112 at the end to Oxfordshire. As can be seen, part of Oxfordshire's excess has been reduced, though it has not been eliminated.

3.7 Conclusions

It is a matter of judgement by the decision makers which version of the formula is considered to be the most relevant for prescriptive purposes. Six models have been constructed and all indicate a relative deficiency in Buckinghamshire. Berkshire and Northamptonshire are close to the target. Oxfordshire remains above the target, even when an allowance is made for the Warneford Hospital.

The next fundamental question is to ask whether in fact these differences in expenditure have made an identifiable difference in the "treatment opportunity" of the populations of the four Areas. It is possible to use the data in this paper to derive hospital activity rates per 1,000 of the population as in table 49. However, we do not know whether the differences in hospital activity rates represent genuine differences in medical and social "need" between the populations, which are not explained by differences in their age-sex composition, or whether they merely reflect differences in availability and until we have a measure of medical need which is independent of hospital availability, we can only surmise that the populations are similar in "need" and that a higher hospital activity rate is to be preferred to a lower activity rate.

The first quantity indicator is the number of patients admitted to any hospital from the Area concerned, expressed per 1,000 population: both actual simple and actual weighted populations are considered. The spread about the mean is greater than the expenditure per head of the weighted notional populations (co-efficient of variation of 24.11% compared to 13.58%) which suggests that the variation in the level of service provided is greater than the variation in expenditure.

The other quantity indicators are for out-patients and the two combined. The spread about the mean is greater than for in-patients, with the co-efficient of variation of 55.15% for day-patients and 69.34% for both day and out-patients. As noted earlier, the variations in expenditure are much greater for day and out-patients than for in-patients.

Buckinghamshire has the lowest hospitalisation rate of the four Areas and the ability to send patients to other areas does not seem to compensate for the lower availability of beds. Thus the population of Buckinghamshire suffers a double disadvantage: fewer potential patients are hospitalised and a greater number are likely to be hospitalised outside their area (and, probably though not necessarily, further away from home). Also Buckinghamshire has the lowest attendance rates for out-patients and day-patients.

Northamptonshire has a higher level of hospital utilisation per 1,000 population both in in-patients, out-patients than Buckinghamshire, but these rates are nevertheless lower than Oxfordshire. Northamptonshire has a lower in-patient rate than Berkshire though a higher rate for out-patients and day-patients. However the data for Berkshire may be deficient in so far that we have not been able to include those out-patient and day-patient attendances by residents of the Windsor area in hospitals outside the new region.

For quality indicators we ideally require indicators of the efficacy of the treatment and care being provided. Again such measures are not readily available and their application would anyway require a mammoth research effort. Without this, we can only surmise that in psychiatric care, as the in-patient service is primarily a "caring service", the higher the average cost per in-patient day, the more

comfortable the patient is. This may not be true if there are differences in the capital facilities or in management efficiency. All we can note from table 50 is that Berkshire has the lowest costs and that the variation in in-patient costs (13.06%) is slightly less than for expenditure per head of notional catchment population (13.58%) wheras the variation of the in-patient utilisation rates is much higher. This would suggest that in general, lower than average funding affects the quantity of the service provided rather than its quality.

However, while a re-allocation of revenue funds may go some way to even out activity rates and "quality factors", it may be that a change in the distribution of capital resources as well will be necessary to correct the apparent inequalities.

SECTION 4 COMMUNITY HEALTH SERVICES

4.1 Introduction

The 1974 re-organisation of the National Health Service brings within a single regional and area administrative structure the management of both the hospital services and the community health services. In 1971/2, the year to which this study relates, the community health services were administered by the Health Departments of the county borough and county authorities: in the new Oxford region these comprised seven authorities altogether. The services were funded by central government grants plus support from local rates. Because of the greater degree of local autonomy in determining the level of expenditure, one might expect a greater variation of expenditure per head than in the case of the hospital services. However, as was noted in section 1, the co-efficient of variation for community health services was only 7.82% in the Oxford region compared with 20.75% for hospital services, and 8.13% for community health services nationally compared with 18.81% nationally for hospital services. On the other hand, as was argued in sections 2 and 3, a major distortion for hospital services is caused by cross-boundary flows so that this comparison is unreliable. If we take the co-efficient of variation from table 31, which gives the basic variation of expenditure on general hospitals after all the other compensating factors have been taken into account, it is only 7.18% which suggests that the variation is about the same as with community services, though the variation for out-patient hospital services remains much higher. And as noted in section 1.5, it does appear that

Buckinghamshire has a higher level of expenditure per head on community health services compared with the regional average and a lower level on hospital services while Berkshire has the opposite combination. On the other hand, Oxfordshire has higher than the regional average expenditure on both and Northamptonshire has lower than the regional average on both.

4.2 Analysis of the levels of service provided

The level of expenditure within the new region on community health services in 1971/2 is estimated to have been £7,141,066, which is 13.8% of the total spent on RHA services. As shown in table 1, the average level of expenditure per head within the region was £3.44 and this was greater than the estimated national average of £3.35. A correspondingly greater percentage of the total RHA expenditure was devoted to community health services in the Oxford region than in the country as a whole. In this respect the Oxford region is in advance of the country in following a declared policy objective of increasing the proportion of resources devoted to community health services.

To derive the costs of the community health services in each of the four areas entailed a detailed examination of the accounts of the seven health departments concerned and valuable help was provided by the treasurer's departments. There were two main problems encountered.

The first problem was that the accounts are not presented in a uniform format and considerable variations arise in the precise definition of services and in the methods of cross-accounting between the various services. The costs were assessed under the following headings:-

1 Health centres and multi-purpose clinics;

2 Care of mothers and young children;

3 Midwifery and home nursing;

4 Health visiting;

5 School medical service;

6 Administration;

7 Prevention and after care;

8 Vaccination and immunisation;

9 Ambulance service.

Debt charges were not included in any of the calculations because, in future, these will not be supported by revenue allocations. Multi-purpose clinics occur only in Berkshire but it was thought that their similarity to Health Centres was sufficiently great for them to be included under the same heading. This item proved to have the greatest variation of expenditure per head between the areas which arises from the piece-meal nature of the building programme. Care of mothers and young children includes expenditure on such items as ante- and post-natal clinics and welfare foods: the distinction between this item and health visiting was not always clear-cut since in many areas health visitors organise this service. In Northamptonshire the cost of family planning was also included because it was not possible to extract the cost: for other areas it appears under item 7. A precise breakdown between midwifery, home nursing and health visiting was not possible for all local authorities because some staff served in all three services. The breakdown was estimated for Buckinghamshire by taking the percentage breakdown for the other authorities which did give separate figures

and then applying these percentages to the total figure for Buckinghamshire. Some costs of the school health service, such as educational psychologists, were extracted because these will remain outside the National Health Service. Some authorities charged administrative costs to the individual services while others did not: to achieve uniformity all of the administrative costs were collected together under item 6 though part of the variation between areas is accounted by the different techniques for apportioning overhead administrative costs, for example clerical costs of paying salaries, to the health departments. Prevention and after-care includes services such as chiropody, cervical cytology, health education and family planning. The costs of fluoridation of water supplies and control of air pollution were excluded on the assumption that these are not NHS commitments. Finally, for items 8 and 9 net costs were calculated: for example nursing costs were excluded.

The second problem was the change in the area boundaries. It was necessary to estimate the cost of the services which applied to that part of a county which now forms part of another area, for example north Berkshire has become part of the Oxfordshire area. This was undertaken with the collaboration of the treasurers concerned by a number of methods. Where physical assets such as health centres were involved, it was a matter of costing these health centres. For other services, the cost was split in proportion to the number of staff, for example the number of nurses, who transferred. For other services such as prevention and after-care, it was estimated in proportion to the population. One effect of this is, of course, to tend to even out some of the otherwise greater differences between areas.

For the analytical part of this paper, the areas of Henley Rural District and Henley Municipal Borough are considered to be part of Oxfordshire. An adjustment is made in the prescriptive section to allow for the fact that the services for this area are being provided by Berkshire.

In table 51 the estimated level of expenditure on each service is given with the percentages of the total devoted to each service. Midwifery and home nursing are the largest items of expenditure followed by the ambulance service and these together account for over half of the total. The area percentages do not vary greatly from the regional percentages which suggests that there is common agreement on the relative importance of the various services.

4.3 Expenditure per head of population

A comparison of expenditure per head is simpler with community health services than in the case of hospital services since there is no complication of boundary cross-overs. In the past, where one health department provided services for people living in another county, a charge was made on that authority. This occurred when, for example, district nurses were attached to a general practitioner group whose area crossed a county boundary. It is assumed that this system of cross-accounting will continue.

In table 52 the costs of each service are divided by the actual population in 1971. The greatest variation in expenditure per head is for health centres which, as explained above, arises from the piece-meal nature of the health centre building programme. Similarly the variation in the cost of administration probably arises in part from the costing techniques used and the extent of joint use of overhead facilities: one would expect the variation to be less when a more stable administrative system is established with the Area

Health Authorities. The ambulance service and the school medical service have low variations. The other services more importantly reflect differences in the actual level of service being provided. Care of mothers and young children, midwifery, home nursing and health visiting each have a co-efficient of variation greater than that for the total and the services may vary more than the 7.82% co-efficient variation for the total. On the other hand, these figures may slightly exaggerate the differences because the methods used to break down costs between the different services may not be entirely accurate, particularly where nursing time is involved and also to some extent the services act as substitutes for each other. A further reason why the above comparisions based on expenditure per head of the total populations are unreliable guides to the level of service is that certain services are provided specifically for particular age-sex groups, for example the care of mothers and young children, and the age-sex composition between the four areas varies as shown in table 8. A more accurate comparison can be achieved by taking the number of people directly concerned with each service. We considered that services 1, 6, 7, 8 and 9 were sufficiently general to be divided by the population as a whole. For the other services the following assumptions were made, based on intuitive judgement and certain ad hoc studies which have been undertaken in the research on the Community Hospital Programme.

2	Care of mothere and young children:		0 - 4 age group
3	Midwifery:		0 - 1 age group
3	Home nursing:	30% to	0 - 64 age group
		70% to	65 & over age group

4 Health visiting	65% to	0 - 4 age group
	15% to	5 - 64 age group
	20% to	65 & over age group
5 School Medical Service		5 - 19 age group

In table 53 the expenditure on each service is divided by the relevant population in each area and compared to the regional average. The variation of expenditure is reduced slightly for the care of mothers and young children and the school medical service but is increased for midwifery, home nursing and health visiting. Since these latter three services represent such a large proportion of the total expenditure, the variation over-all is increased. This means that the variation of expenditure per head of the total population understates the variation in the level of service. Northamptonshire has the lowest rate of expenditure per head overall and it is possible in table 53 to identify where a lower level of service is being provided. Less per head is spent on midwifery, home nursing and health visiting, though this is slightly offset by a higher rate of expenditure on the care of mothers and young children. Berkshire, which also overall spends slightly less per head than the regional average, spends less on its ambulance service and administration though this may arise because of its joint user arrangements. For example, the ambulance service shares garaging and repair facilities with the local bus service.

4.4 Development of a prescriptive formula

In table 54 the regional expenditure on community health services is re-allocated to the four areas on the basis of an equal spend per head. To achieve an equitable re-distribution would have entailed decreasing the allocation to Oxfordshire and Buckinghamshire and increasing the allocation to Northamptonshire and Berkshire. Also it is possible to use this formulation to identify the expenditure for the 43,235 people in Henley Rural District and Henley Municipal Borough which should be transferred from Oxfordshire to Berkshire.

It was argued above that to use simple population figures is too unsophisticated since some community services are provided only for certain age groups in the population and one AHA might have a greater proportion of its population in that age group than another AHA which could justify a greater allocation. For example, Northamptonshire has a greater proportion of people both in the 0 - 4 range and over 55. A weighting formula must inevitably be a normative planning process but the following technique is offered for discussion. We need to take into account the age distribution differences between the four areas but also the relative importance of those services for which the age differences apply. The weighting factors therefore have two components: firstly the percentage of the total expenditure of the region on each service, and secondly the ratio of

$$\frac{\%\ \text{AHA population in the relevant age group}}{\%\ \text{RHA population in the relevant age group}}$$

These two factors are multiplied for each service, and the resulting product summed for each AHA. The weighting factors are given in table 55. For elucidation an example is given of the calculation. For item of service 2, the Care of Mothers and young children, the factor for Oxfordshire is derived as follows:-

A % regional expenditure on the service 4.06%

B % Oxfordshire population in 0 - 4 age group: $\frac{42448}{505212} \times \frac{100}{1} = 8.402\%$

C % Region's population in 0 - 4 age groups: $\frac{181,085}{2,074,695} \times \frac{100}{1} = 8.728\%$

$$\text{Weighting factor} = \frac{A}{100} \times \frac{B}{C}$$

$$= \frac{4.06}{100} \times \frac{8.402}{8.728} = 0.0391$$

For items of service 1,6,7,8,9 the weighting factors for all the AHAs are the same since total populations are used and the weighting factors are merely the percentage expenditure on those services. The weighting factors are multiplied by the populations to give the weighted populations of each area and the re-allocation formula is re-worked in table 56. The variation about the regional mean expenditure per head is increased to 8.46% and the effect of weighting is to re-distribute an additional £29,848 to Northamptonshire with corresponding reductions to the other areas.

SECTION 5 SUMMARY OF CONCLUSIONS

The extent of the basic inequality in terms of differences in expenditure per head has been identified for the general hospital service, psychiatric hospital service and community health service and evidence from utilisation rates has been found which suggests that the financial differences are reflected in the levels of service provided for the populations concerned. However, the inequalities are much less than those indicated by taking the simple relationship between expenditure and the actual population. Cross-boundary flows in particular explained a large proportion of the apparent differences for both the general hospital and psychiatric hospital services. The special funding of the teaching hospitals also explained part of the apparently higher rate of expenditure per head in the teaching area of Oxfordshire. On the other hand, weighting for age and sex differences between the populations and treating the specialties at Stoke Mandeville Hospital seqarately did not explain the differences. The main examples of services below the regional average were the level of acute in-patient provision in Northamptonshire and non-acute in-patient provision in Buckinghamshire. Moreover, neither Northamptonshire nor Buckinghamshire compensated for these by having a higher rate of out-patient attendances per head of population than in the other areas. Thus part but not all of the basic inequality arises from the inequitable distribution of capital resources.

For psychiatric hospital care, a pattern similar to that for general hospital care emerged and surprisingly, the variation of expenditure per head was greater than for general hospitals. Cross-boundary flows again proved to be important in explaining part of the apparent differences but, despite these, Buckinghamshire, which had the greatest outflow of patients also had the lowest hospitalisation rate per head. As with general hospitals, a reallocation of capital resources would be necessary to establish equality of opportunity.

The variation of expenditure per head on community health services proved to be less than for the hospital services. One item of variation was expenditure on health centres which, once more, is related to the distribution of capital assets. Apart from this, the most significant difference was the lower than average expenditure per head on midwifery, home nursing and health visiting in Northamptonshire, the more so when the population in the relevant age brackets was used as the divisor.

Allowing for all the factors, a formula was developed from the analysis for re-allocating revenue funds to achieve an equal spend per head and the total sums which would have to be redistributed are presented in table 57. The total of £1,703,203 is only 3.31% of the total expenditure of the region. If such a re-distribution were to take place then a more equitable distribution of health care services would be achieved though, while the financial adjustment identified is a necessary condition to achieve 'equality of opportunity' it cannot be claimed that it is a sufficient condition. A number of reasons for this have been found.

Firstly, the analysis of the hospital services suggested that the differences in revenue allocations may have resulted from historical differences in the distribution of capital assets, ie hospital beds. To remedy the deficiencies of, for example, acute in-patient provision in Northamptonshire and non-acute in-patient provision in Buckinghamshire would require new hospital building and, at the present slow rate of building overall, this might take a number of years. The question which then arises is whether additional revenue allocations should be made in some areas if capital resources are not available to fully exploit them, particularly if, as a consequence, the capital assets in the other areas are left under-utilised. If on the other hand revenue funds are provided only where matched by capital assets, then we are back to a system of incremental budgeting which is inequitable until the capital adjustment is made. The formula does, however, indicate where the priorities for additional hospital building should lie.

Alternatively, it could be argued that, because of the time required to adjust capital resources, the under provided areas will be doubly penalised - in both capital and revenue terms, and that even greater increases in revenue allocations should be made to compensate for the lack of hospital provision. The additional funds could be used to increase both out-patient provision, which at present is lower in Northamptonshire and Buckinghamshire than the other two areas, and the community health services.

The second feature of the analysis of the inequality of revenue allocations is the extent of the cross-boundary patient flows. In so far as such flows entail longer than average journeys by patients and their visitors and require greater expenditure of time and money, then it could be argued that compensation should be made to people in those areas where a net out-flow of patients arises. Indeed to examine 'equality of opportunity' fully would require a more detailed study of the cross-boundary patient flows than was possible in this study. It would be interesting to analyse the causes of the flows and to establish whether, considering both NHS and all private costs, it would be cost-effective to leave hospital services as they are, perpetuate the flows and devote funds to improve travelling conditions or build more hospitals and so reduce the flows.

Thirdly, in so far as the special funding of the teaching hospitals results in an improved level of hospital service for all patients, those living in Oxford benefit more than those living elsewhere. This is an example where it may be thought better to sacrifice equality for efficiency since providing teaching hospital centres in all areas may be inefficient, even though the present concentration on a single regional centre may be inequitable.

Fourthly, it is recognised that the difficulty of actually reducing the level of expenditure in the more generously funded areas imposes a major constraint in implementing a policy of re-allocation. An alternative solution is to ask how much it would cost to bring all areas up to the level of expenditure of the highest per head of population for each of the three services, having excluded the effect of the teaching hospitals and the regional specialties of Stoke Mandeville. A calculation, the details of which are given in table 58, indicates that £5,225,070 would have been required in 1971/2, that is an additional 10.15% of the total expenditure.

The annual increases in the allocation to the old Oxford Regional Hospital Board, identified as the "permissible expenditure", are given in table 59. For all but two years since 1963/4, the annual increase has been greater than 10.15% which, prima facie, suggests that the inequality could be overcome by devoting all of one year's increase to that end. However, these increases are in money terms and not real terms and to a large extent reflect rising costs. For example, in 1972/3 it is estimated that roughly 2/3rd of the increase of £5,581,121 went towards meeting higher costs. The remaining £1,738,000 was provided for Revenue Consequences of Capital Schemes and for additional services. Even if such an increase were available each year and it were all devoted to reducing inequalities, it would take three years to achieve the target. This might be considered as the most optimistic estimate. In practice the practical difficulties might require a programme of gradual adjustment over a period of, say, ten years and, even then, the major problem would be to restrain the 'best' areas from becoming better.

This exercise has been undertaken to explore the analytical concepts involved in identifying the objective of equality of provision. Its practical application is limited but it is hoped that it will establish the broad direction in which developments can be made so that future allocations may converge towards the target rather than diverge from it. Or if divergence takes place, it is by conscious choice rather than historical accident.

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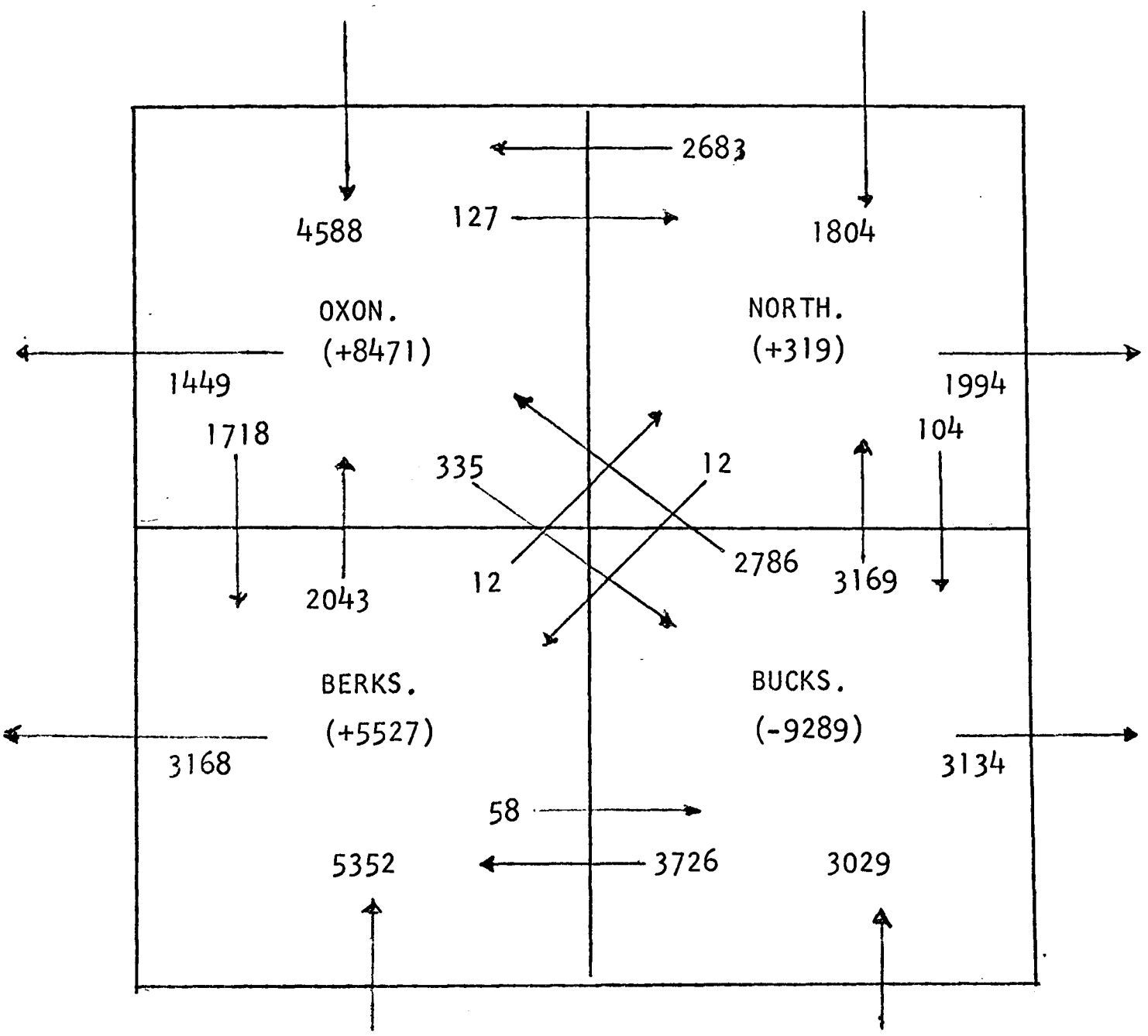
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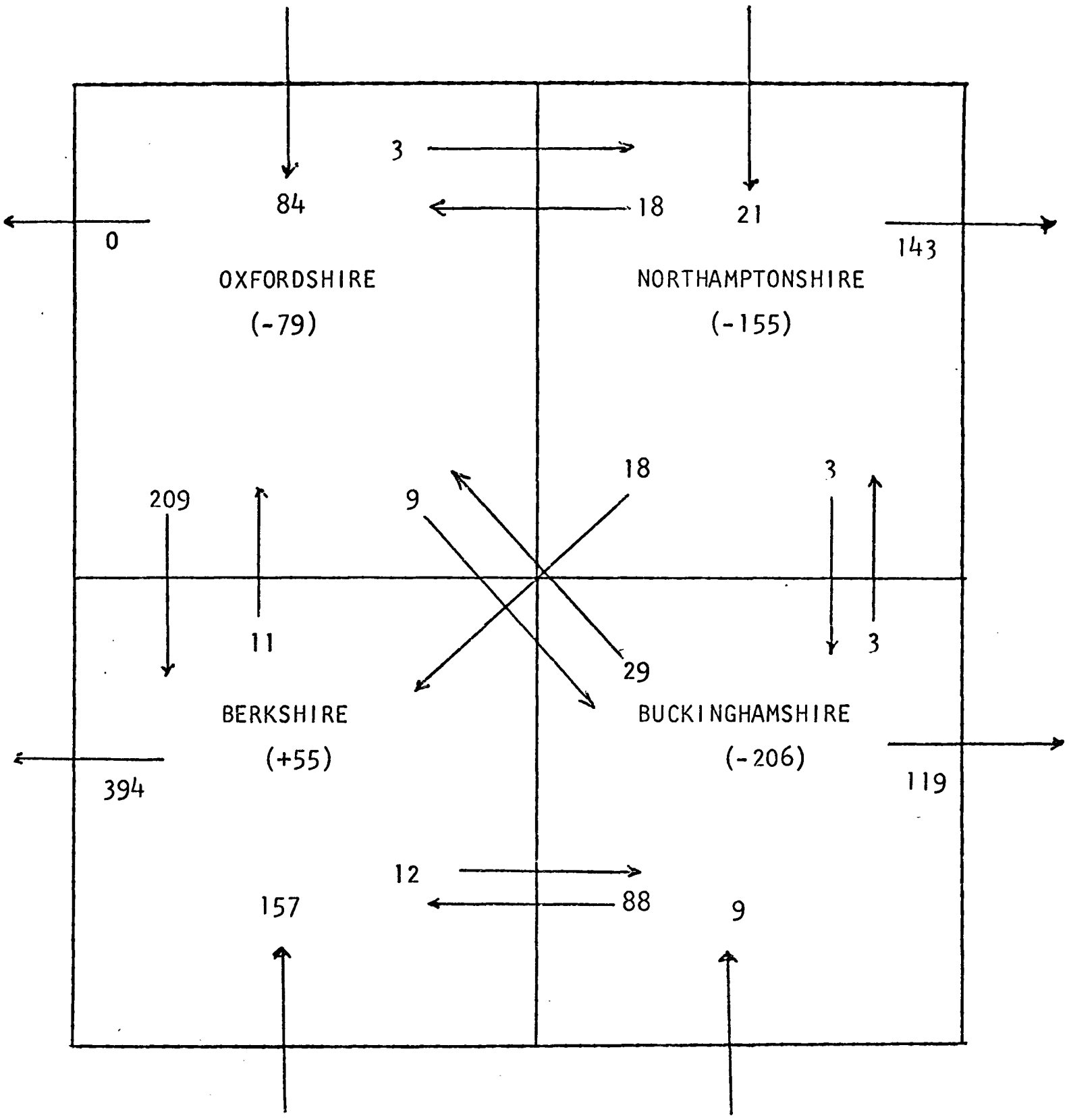
Figure 1.



Non-psychiatric Hospitals: boundary cross-overs. 1970.

Psychiatric Hospitals: boundary cross-overs.

Figure 2.



REVENUE EXPENDITURE PER CAPITA BY REGIONS 1971/2

	Hospital Services £	Community Health £	Total £
Pre-1974 Regions*			
SW Metropolitan	33.58	3.92	37.50
NW Metropolitan	31.89	3.76	35.65
SE Metropolitan	26.44	3.55	29.99
NE Metropolitan	26.27	3.56	29.83
Liverpool	25.47	3.22	28.69
South Western	22.96	3.28	26.24
Leeds	22.91	3.08	25.99
Newcastle	21.80	3.36	25.16
Manchester	21.64	3.36	25.00
Oxford	21.41	3.45	24.86
Wessex	20.58	3.06	23.64
Birmingham	20.28	3.15	23.43
East Anglian	19.66	2.91	22.57
Sheffield	18.44	3.08	21.52
National mean	23.87	3.35	27.22
Co-efficient of variation	18.81%	8.13%	
Post-1974 Areas of Oxford Region *			
Oxfordshire	26.61	3.49	30.10
Berkshire	21.71	3.33	25.04
Northamptonshire	17.97	3.15	21.12
Buckinghamshire	15.91	3.83	19.74
Regional mean	20.62	3.44	24.06
Co-efficient of variation	20.75%	7.82%	

* Including expenditure of Boards of Governors of Teaching Hospitals

HOSPITAL REVENUE AND COMMUNITY HEALTH EXPENDITURE
IN ENGLAND AND WALES OVER TEN YEARS

	Hospital Revenue Expenditure		Community Health Expenditure	
	£m	% *	£m	% *
1961/2	457.5	88.7	58.3	11.3
1962/3	486.0	88.8	61.5	11.2
1963/4	520.4	88.7	66.3	11.3
1964/5	557.4	88.7	71.0	11.3
1965/6	614.7	88.5	79.9	11.5
1966/7	662.0	88.5	85.9	11.5
1967/8	707.1	88.9	87.9	11.1
1968/9	769.3	89.0	95.4	11.0
1969/70	839.7	89.1	102.4	10.9
1970/71	997.2	89.2	121.2	10.8

* % of the sum of hospital revenue expenditure and community health expenditure.

REVENUE EXPENDITURE IN ENGLAND AND WALES BY HOSPITAL TYPE

	Non-psychiatric Hospitals		Psychiatric Hospitals	
	£m	% *	£m	% *
1961/2	321.0	79.5	82.7	20.5
1962/3	342.2	79.7	87.4	20.3
1963/4	366.3	79.9	92.3	20.1
1964/5	393.8	79.8	99.4	20.2
1965/6	438.1	80.2	108.2	19.8
1966/7	473.1	80.5	114.5	19.5
1967/8	507.9	81.0	119.0	19.0
1968/9	555.0	81.0	130.2	19.0
1969/70	604.2	81.1	141.0	18.9
1970/71	715.4	81.3	165.0	18.7

* % of both types

EXPENDITURE PER CAPITA IN NEW OXFORD REGION

	Oxfordshire	Berkshire	Buckinghamshire	Northamptonshire	Region
RHA Services 1971/2	£	£	£	£	£
General Hospitals	21.99	17.67	13.45	14.60	16.97
Psychiatric Hospitals	4.62	4.04	2.46	3.37	3.65
Community Health	3.49	3.33	3.83	3.15	3.44
Total RHA Services	30.10	25.04	19.74	21.12	24.06
Family Practitioner Services (estimates) 1974/5					
General Medical Services	4.70	4.01	4.29	4.16	4.31
General Dental Services	2.64	2.64	2.42	1.47	2.33
General Ophthalmic Services	0.33	0.29	0.26	0.23	0.28
Pharmaceutical Services	4.66	4.68	4.64	4.05	4.54
Total FPS	12.32	11.61	11.52	9.90	11.46

Table 4

GENERAL HOSPITAL EXPENDITURE 1971/2

	In-patients	Out-patients		Day-patients	Non-costed	Total
	£	£		£	£	£
Oxfordshire	7,874,187	1,752,986	£ 2,284,918	132,165	399,767	10,159,105
Berkshire	9,224,641	2,197,325	£ 2,571,201	35,122	338,754	11,795,842
Buckinghamshire	5,130,611	1,076,583	£ 1,285,552	78,061	130,908	6,416,163
Northamptonshire	5,557,434	1,100,440	£ 1,284,936	77,344	107,152	6,842,370
REGIONAL TOTAL	27,786,873	6,127,334	£ 7,426,607	322,692	976,581	35,213,480

Table 5

ALLOCATION BY ACTUAL POPULATIONS

General Hospitals	Expenditure £	Simple Actual Population	Spend per Head * £	Target Allocation £	Change £	Change as % of Actual.
Oxfordshire	10,159,105	461,934	21.99	7,837,690	-2,321,415	-22.85
Berkshire	11,795,842	667,606	17.67	11,327,353	- 468,489	- 3.97
Buckinghamshire	6,416,163	477,210	13.45	8,096,880	+1,680,717	+26.20
Northamptonshire	6,842,370	468,645	14.60	7,951,557	+1,109,187	+16.21
REGION	35,213,480	2,075,395	16.97			

* co-efficient of variation of 20.39%

Table 6

DEATH RATES 1971

	Crude Death Rate	Comparability Factor	Adjusted Death Rate	Perinatal Mortality * Rate
Oxfordshire County	9.0	1.10	9.90	19
Oxford County Borough	10.4	0.94	9.78	24
Berkshire County	9.0	1.08	9.72	19
Reading	10.6	0.96	10.18	18
Buckinghamshire	8.7	1.14	9.92	19
Northamptonshire County	10.7	0.97	10.38	19
Northampton County Borough	12.4	0.86	10.66	19

* Still births and deaths under one week per 1,000 live and still births

AGE DISTRIBUTIONS

(1971 CENSUS)

	Oxfordshire %	Berkshire %	Buckinghamshire %	Northamptonshire %
Age Group				
0 - 4	8.4	8.9	8.8	8.9
5 - 19	24.2	24.0	24.1	23.1
20 - 64	56.3	56.5	56.2	54.9
65 - 74	7.0	6.6	6.8	8.3
75+	4.1	4.0	4.1	4.8

SOCIO-ECONOMIC GROUPS
OF OLD COUNTY AREAS

1961 CENSUS

	Oxfordshire * %	Berkshire * %	Buckinghamshire %	Northamptonshire * %
Professional (3 & 4)	5.0	6.0	5.2	2.6
Management (1, 2 & 13)	10.0	11.3	12.8	10.1
Non-manual (5 & 6)	14.5	18.3	15.6	12.5
Foremen & Supervisors (8, 9, 12 & 14)	34.4	33.8	38.2	48.0
Semi-skilled & Agricultural (7, 10 & 15)	20.5	16.4	15.7	16.7
Unskilled manual (11)	7.3	6.7	6.4	6.9
Armed Forces & others (16 & 17)	8.5	7.3	5.9	3.3

* including the appropriate County Boroughs

WEIGHTING FACTORS FOR GENERAL HOSPITALS

Age Group	Males	Females
0 - 4	0.719	0.549
5 - 14	0.322	0.235
15 - 19	0.339	0.617
20 - 24	0.289	1.167
25 - 34	0.319	1.013
35 - 44	0.388	0.759
45 - 54	0.985	0.879
55 - 64	0.981	0.877
65 - 74	2.278	1.991
75+	5.268	5.876

COMPARISON OF ACTUAL AND WEIGHTED POPULATIONS

General Hospitals	Actual	Weighted	Correction Co-efficient
REGION	2,075,395	1,970,656	0.9495
Oxfordshire	461,934	430,937	0.9329
Berkshire	667,606	621,307	0.9306
Buckinghamshire	477,210	448,750	0.9404
Northamptonshire	468,645	469,662	1.0022

ALLOCATION BY WEIGHTED POPULATIONS

General Hospitals.	Expenditure £	Weighted Population	Spend per head * £	Target Allocation £	Change £	Change as % of actual
Oxfordshire	10,159,105	430,937	23.57	7,700,376	-2,458,729	-24.20
Berkshire	11,795,842	621,307	18.99	11,102,080	- 693,762	- 5.88
Buckinghamshire	6,416,163	448,750	14.30	8,018,675	+1,602,512	+24.98
Northamptonshire	6,842,370	469,662	14.57	8,392,349	+1,549,979	+22.65
REGION	35,213,480	1,970,656	17.87			

* co-efficient of variation of 22.24%

FLOWS OF NON-PSYCHIATRIC PATIENTS

Area of Hospitalisation ↓ / Area of Residence →	Oxon	Berks	Bucks	Northts	Outside	Total Inflow	Total Patients of Region
Oxon	[48,919]	2,043	2,786	2,683	4,588	12,100	56,431
Berks	1,718	[63,458]	3,726	12	5,352	10,808	68,914
Bucks	335	58	[31,261]	104	3,029	3,526	31,758
Northts	127	12	3,169	[45,862]	1,804	5,112	49,170
Outside	1,449	3,168	3,134	1,994	-	-	9,745
Total Outflow	3,629	5,281	12,815	4,793	14,773	-	-
Total Patients in Areas	52,548	68,739	44,076	50,655		-	216,018

(Total number discharged from the region's hospitals is:

a	the total patients resident in the region	216,018
b	minus those hospitalised outside the region	- 9,745
c	plus patients resident outside the region	+ 14,773)

Table 13

NOTIONAL CATCHMENT POPULATIONS OF GENERAL HOSPITALS

	Inflow of Patients	Outflow of Patients	Net flow	Actual Population	Population* adjustment (% of actual)	Notional Catchment Population
Oxfordshire	12,100	3,629	8,471	461,934	+81,385 (+17.6%)	543,319
Berkshire	10,808	5,281	5,527	667,606	+53,101 (+8.0%)	720,707
Buckinghamshire	3,526	12,815	9,289	477,210	-89,244 (-18.7%)	387,966
Northamptonshire	5,112	4,793	319	468,645	+ 3,065 (+0.7%)	471,710
REGION	14,733	9,745	+ 5,028	2,075,395	+48,307 (+2.3%)	2,123,702

* Net flow multiplied by 9.6075

ALLOCATION BASED ON NOTIONAL CATCHMENT POPULATIONS

General Hospitals	Actual Expenditure £	Notional Catchment Population	Spend Per Head * £	Target Allocation £	Change £	Change as % of Actual £
Oxfordshire	10,159,105	543,319	18.70	9,008,869	-1,150,236	-11.32
Berkshire	11,795,842	720,707	16.37	11,950,171	+ 154,329	+ 1.31
Buckinghamshire	6,416,163	387,966	16.54	6,432,933	+ 16,770	+ 0.26
Northamptonshire	6,842,370	471,710	14.51	7,821,507	+ 979,137	+14.31
REGION	35,213,480	2,123,702	16.58			

* co-efficient of variation 9.96%

WEIGHTING OF NOTIONAL CATCHMENT POPULATIONS

General Hospitals	Actual Weighted Population	Weighted Population Adjustment	Weighted Notional Catchment Population
Oxfordshire	430,937	+77,275	508,212
Berkshire	621,307	+50,420	671,727
Buckinghamshire	448,750	-84,737	364,013
Northamptonshire	469,662	+ 2,910	472,572
REGION	1,970,656	+45,868	2,016,524

Table 16

ALLOCATION BASED ON WEIGHTED NOTIONAL CATCHMENT POPULATIONS

General Hospitals	Actual Expenditure £	Weighted Notional Catchment Population	Spend per Head * £	Target Allocation £	Change £	Change as % of Actual
Oxfordshire	10,159,105	508,212	20.00	8,874,635	-1,284,470	-12.64
Berkshire	11,795,842	671,727	17.56	11,730,009	- 65,833	- 0.56
Buckinghamshire	6,416,163	364,013	17.63	6,356,564	- 59,599	- 0.93
Northamptonshire	6,842,370	472,572	14.48	8,252,272	+1,409,902	+20.61
REGION	35,213,480	2,016,524	17.46			

* co-efficient of variation of 12.52%

Table 17

GENERAL HOSPITALS — HYBRID VERSION

	In-patient Expenditure £	Weighted Notional Catchment Population	Spend per head* £	Target Allocation £	Out-patient Expenditure £	Simple Actual Population	Spend per head** £	Target Allocation £	Combined Target Allocation £	Change £	Change as % o Actual
Oxon	7,874,187	508,212	15.49	7,002,953	2,284,918	461,934	4.95	1,652,988	8,655,941	-1,503,164	-14.8
Berks	9,224,641	671,727	13.73	9,256,122	2,571,201	667,606	3.85	2,388,966	11,645,088	- 150,754	- 1.28
Bucks	5,130,611	364,013	14.09	5,015,950	1,285,552	477,210	2.69	1,707,651	6,723,601	+ 307,438	+ 4.79
North	5,557,434	472,572	11.76	6,511,848	1,284,936	468,645	2.74	1,677,002	8,188,850	+1,346,480	+19.68
REGION	27,786,873	2,016,524	13.78		7,426,607	2,075,395	3.58				

* co-efficient of variation of 10.79%

** co-efficient of variation of 27.19%

Table 18

COSTS OF ACUTE HOSPITALS IN THE OXFORD REGION 1972/3

	Costs per case £	Costs per In-patient week £
Stoke Mandeville	193.85	92.51
Wycombe General	145.58	101.95
Harborough Road	143.58	64.77
Radcliffe Infirmary	134.69	135.25
Churchill	129.01	131.95
Horton General	125.15	85.57
Kettering General	102.40	102.45
Royal Buckinghamshire	100.39	87.39
Northampton General	97.80	99.48
Royal Berkshire	95.42	107.96
Average	120.83	107.10

STOKE MANDEVILLE HOSPITAL :
IN-PATIENT REVENUE EXPENDITURE (1972/3)

Wards	Total Hospital. £	Spinal £	P & B £	Others £
Pay - Medical	150,849	37,540	10,525	102,784
- Nursing	490,889	127,478	67,727	295,684
- Domestic	136,206	126,116	3,363	6,727
- Other	5,279	2,000	667	2,612
Drugs	52,203	17,163	7,733	27,307
Dressings - Pre-packed sterilised	11,892	4,505	1,502	5,885
- Others	10,922	2,208	2,680	6,034
Patients' appliances	9,123	7,507	30	1,586
Equipment	77,823	29,435	8,210	40,178
Contract Services	74,676	22,042	13,526	39,108
Treatment Departments				
Operating theatres	201,986	10,099	90,894	100,993
X-ray	39,962	15,138	5,047	19,777
Pathology	76,687	19,273	6,627	50,787
Physiotherapy	30,776	19,915	2,296	8,565
Pharmacy	14,783	4,860	2,190	7,733
Ancillary Med. Services	46,897	18,614	7,161	21,122
General Services				
Nurses in training	21,066	5,471	2,906	12,689
Catering	156,669	59,346	19,787	77,536
Staff residences	66,613	25,233	8,413	32,967
Laundry	23,094	8,748	2,917	11,429
Power, light & heat	64,501	32,070	6,520	25,911
Building & engineering maintenance	63,823	21,381	8,916	33,526
Medical Records	21,586	4,101	2,675	14,810
General Administration	106,728	40,428	13,480	52,820
General portering	43,704	16,555	5,520	21,629
General cleaning	17,788	6,012	2,368	9,408
Maintenance of grounds	17,374	5,873	2,312	9,189
Transport	16,095	6,097	2,033	7,965
Other services	165,788	62,800	20,939	82,049
Direct Credits	Cr 67,142	Cr 25,433	Cr 8,480	Cr 33,229
NET TOTAL	2,148,640	732,575	320,484	1,095,581

STOKE MANDEVILLE HOSPITAL:
COSTS PER IN-PATIENT WEEK (£ 1972/3)

Wards	Total Hospital £	Spinal £	P & B £	Others £
Pay - Medical	6.49	4.27	3.59	8.94
- Nursing	21.14	14.49	23.11	25.73
- Domestic	5.87	14.33	1.15	0.59
- Other	0.23	0.23	0.23	0.23
Drugs	2.25	1.95	2.64	2.38
Dressings - Pre-packed sterilised	0.51	0.51	0.51	0.51
- Others	0.47	0.25	0.91	0.52
Patients appliances	0.39	0.85	0.01	0.14
Equipment	3.36	3.35	2.80	3.49
Contract services	3.21	2.50	4.61	3.40
Treatment Departments				
Operating theatres	8.70	1.15	31.00	8.79
X-ray	1.72	1.72	1.72	1.72
Pathology	3.30	2.19	2.26	4.42
Physiotherapy	1.32	2.26	0.78	0.74
Pharmacy	0.64	0.55	0.74	0.67
Ancillary Med.Services	2.02	2.12	2.44	1.84
General Services				
Nurses in training	0.91	0.62	0.99	1.10
Catering	6.74	6.74	6.75	6.75
Staff residences	2.87	2.87	2.87	2.87
Laundry	1.00	1.00	1.00	0.99
Power, light & heat	2.77	3.64	2.22	2.25
Building & engineering maintenance	2.75	2.43	3.04	2.92
Medical records	0.93	0.47	0.91	1.29
General administration	4.59	4.59	4.60	4.60
General portering	1.89	1.88	1.88	1.88
General cleaning	0.76	0.68	0.81	0.82
Maintenance of grounds	0.75	0.67	0.79	0.80
Transport	0.69	0.69	0.69	0.69
Other services	7.14	7.14	7.14	7.14
Direct Credits	Cr 2.89	Cr 2.89	Cr 2.89	Cr 2.89
NET TOTAL	92.51	83.25	109.30	95.32

STOKE MANDEVILLE HOSPITAL :
COSTS PER CASE (£ 1972/3)

	Total Hospital	Spinal	P & B	Others
Wards	£	£	£	£
Pay - Medical	13.61	47.52	6.30	11.92
- Nursing	44.29	161.37	40.57	34.28
- Domestic	12.29	159.64	2.01	0.78
- Other	0.48	2.53	0.40	0.30
Drugs	4.71	21.73	4.63	3.17
Dressings - pre-packed sterilised	1.07	5.70	0.90	0.68
- others	0.99	2.80	1.61	0.70
Patients appliances	0.82	9.50	0.02	0.18
Equipment	7.02	37.26	4.92	4.66
Contract services	6.74	27.90	8.10	4.53
Treatment Departments				
Operating theatres	18.22	12.78	54.46	11.71
X-ray	3.61	19.16	3.02	2.29
Pathology	6.92	24.40	3.97	5.89
Physiotherapy	2.78	25.21	1.38	0.99
Pharmacy	1.33	6.15	1.31	0.90
Ancillary Med. Services	4.23	23.56	4.29	2.45
General Services				
Nurses in training	1.90	6.93	1.74	1.47
Catering	14.13	75.12	11.86	8.99
Staff residences	6.01	31.94	5.04	3.82
Laundry	2.08	11.07	1.75	1.33
Power, light & heat	5.82	40.60	3.91	3.00
Building & engineering maintenance	5.76	27.06	5.34	3.89
Medical records	1.95	5.19	1.60	1.72
General administration	9.63	51.17	8.08	6.12
General portering	3.94	20.96	3.31	2.51
General cleaning	1.60	7.61	1.42	1.09
Maintenance of grounds	1.57	7.43	1.39	1.07
Transport	1.45	7.72	1.22	0.92
Other services	14.96	79.49	12.55	9.51
Direct Credits	Cr 6.06	Cr32.19	Cr 5.08	Cr 3.85
NET TOTAL	193.85	927.31	192.02	127.02

HYBRID VERSION WITH ALLOWANCE FOR STOKE MANDEVILLE

General Hospitals	In-patient Expenditure *1 £	Weighted Notional Catchment Population *2	Spend per Head *3 £	Target Allocation *4 £	Change compared to table 18 £
Oxfordshire	7,874,187	508,212	15.49	6,876,306	-126,647
Berkshire	9,224,641	671,727	13.73	9,088,728	-167,394
Buckinghamshire	4,325,458	341,646	12.66	5,427,756	+411,806
Northamptonshire	5,557,434	472,572	11.76	6,394,083	-117,765
REGION	26,981,720	1,994,157	13.53		

*1 excluding £805,153 for Stoke Mandeville

*2 excluding 22,367 for Stoke Mandeville

*3 co-efficient of variation of 11.49%

*4 including £805,153 for Stoke Mandeville

RADCLIFFE INFIRMARY :
IN-PATIENT REVENUE EXPENDITURE (£ 1972/3)

	Total Hospital £	Neuro-surgery £	Others £
Wards			
Pay - Medical	221,149	14.143	207,006
- Nursing	620,125	33,852	586,273
- Domestic	74,627	4,136	70,491
- Other	44,693	2,369	42,324
Drugs	103,343	5,477	97,866
Dressings	32,357	1,449	30,908
Equipment	103,292	3,329	99,963
TOTAL WARDS	1,199,586	64,755	1,134,831
Treatment			
Operating theatres	410,591	39,262	371,329
X-ray	96,295	11,037	85,258
Pathology	148,413	5,699	142,714
Physiotherapy	23,810	1,630	22,180
Pharmacy	23,403	1,240	22,163
Ancillary Med Services	41,238	1,063	40,175
TOTAL TREATMENT DEPTS	743,750	59,931	683,819
General Services			
Nurses in training	41,223	2,250	38,973
Catering	231,277	12,258	219,019
Staff residences	84,062	4,784	79,278
Laundry	42,115	2,232	39,883
Power, light & heat	74,610	3,693	70,917
Building & engineering maintenance	121,652	6,021	115,631
Medical records	37,096	1,239	35,857
General administration	118,474	6,279	112,195
General portering	82,698	4,383	78,315
General cleaning	11,984	635	11,349
Maintenance of grounds	1,988	105	1,883
Transport	12,124	643	11,481
Other services	229,917	12,186	217,731
Direct credits	Cr 80,230	Cr 4,252	Cr 75,978
Net TOTAL	2,952,326	177,142	2,775,184

RADCLIFFE INFIRMARY :
COSTS PER IN-PATIENT WEEK (£ 1972/3)

Wards	Total Hospital £	Neuro-surgery £	Others £	Average of non-teaching hospitals* £
Pay - Medical	10.13	12.24	10.01	6.38
- Nursing	28.41	29.29	28.36	26.84
- Domestic	3.42	3.58	3.41	4.06
- Other	2.05	2.05	2.05	0.59
Drugs	4.74	4.74	4.73	2.62
Dressings	1.48	1.25	1.50	1.24
Equipment	4.73	2.88	4.84	2.99
TOTAL WARDS	54.96	56.02	54.90	44.74
Treatment				
Operating theatres	18.81	33.97	17.96	11.03
X-ray	4.41	9.55	4.12	1.58
Pathology	6.80	4.93	6.90	3.87
Physiotherapy	1.09	1.42	1.07	0.71
Pharmacy	1.07	1.07	1.08	0.85
Ancillary Medical Services	1.89	0.92	1.94	1.06
TOTAL TREATMENT DEPTS	34.07	51.86	33.07	19.75 (in 0.65 (for radiotherapy)
General Services				
Nurses in training	1.89	1.95	1.89	1.11
Catering	10.60	10.61	10.60	8.53
Staff residences	3.85	4.14	3.83	3.65
Laundry	1.93	1.93	1.93	1.84
Power, light & heat	3.42	3.20	3.43	2.73
Building & engineering maintenance	5.57	5.21	5.59	3.98
Medical records	1.70	1.07	1.73	1.20
General administration	5.42	5.43	5.43	4.54
General portering	3.79	3.79	3.79	2.17
General cleaning	0.55	0.55	0.55	0.90
Maintenance of grounds	0.09	0.09	0.09	0.50
Transport	0.56	0.56	0.56	0.31
Other services	10.53	10.53	10.53	7.88
Direct credits	Cr 3.68	Cr 3.68	Cr 3.68	Cr 3.18
NET TOTAL	135.25	153.26	134.24	100.63

* Northampton General, Royal Berks, Kettering General, Wycombe General, Horton General, Royal Bucks.

RADCLIFFE INFIRMARY :
COSTS PER CASE (£ 1972/3)

Wards	Total Hospital £	Neuro-surgery £	Others £	Average of non-teaching hospitals* £
Pay - Medical	10.09	19.30	9.77	6.59
- Nursing	28.29	46.18	27.67	27.71
- Domestic	3.40	5.64	3.33	4.19
- Other	2.04	3.23	2.00	0.60
Drugs	4.72	7.47	4.62	2.71
Dressings	1.48	1.98	1.46	1.28
Equipment	4.71	4.54	4.72	3.09
TOTAL WARDS	54.73	88.34	53.57	46.17
Treatment				
Operating theatres	18.73	53.56	17.53	11.38
X-ray	4.39	15.06	4.02	1.63
Pathology	6.77	7.77	6.74	4.00
Physiotherapy	1.09	2.22	1.04	0.73
Pharmacy	1.07	1.69	1.05	0.88
Ancillary Medical Services	1.88	1.46	1.90	1.09
TOTAL TREATMENT DEPTS	33.93	81.76	32.28	20.38 (inc 0.67 for radiotherapy)
General Services				
Nurses in training	1.88	3.07	1.84	1.14
Catering	10.55	16.72	10.34	8.80
Staff residences	3.84	6.53	3.74	3.76
Laundry	1.92	3.05	1.88	1.90
Power, light & heat	3.40	5.04	3.35	2.81
Building & engineering maintenance	5.55	8.21	5.46	4.10
Medical records	1.69	1.69	1.69	1.24
General administration	5.41	8.57	5.30	4.69
General portering	3.77	5.98	3.70	2.24
General cleaning	0.55	0.86	0.54	0.92
Maintenance of grounds	0.09	0.14	0.09	0.51
Transport	0.55	0.88	0.54	0.32
Other services	10.49	16.62	10.27	8.13
Direct credits	Cr 3.66	Cr 5.80	Cr 3.59	Cr 3.28
NET TOTAL	134.69	241.67	131.00	103.86

* Northampton General, Royal Berks, Kettering General, Wycombe General, Horton General, Royal Bucks.

CHURCHILL HOSPITAL : IN-PATIENT REVENUE EXPENDITURE (£ 1972/3)

	Total £	Neuro-logy £	Plastic Surgery £	Radio-Therapy £	Thoracic Surgery £	Ronal Dialysis £	Haemo-philia £	Others £
Wards								
Pay - Medical	105,246	20,161	5,676	(13,962)*	10,969	8,061	2,099	58,280
- Nursing	377,405	42,033	35,642	22,509	20,109	17,142	6,083	233,887
- Domestic	49,295	9,795	2,934	2,986	1,638	1,850	656	29,436
- Other	31,810	3,123	1,830	10,966	1,192	1,534	531	12,634
Drugs	32,418	807	336	5,638	219	9,836	13,260	2,322
Dressings & equipment	55,581	6,238	5,280	7,816	3,008	3,223	1,123	28,893
TOTAL WARDS	651,755	82,157	51,698	49,915	37,135	41,646	23,752	365,452
Treatment								
Operating theatres	222,065	674	30,210	7,930	21,137	3,064	1,087	157,963
Radiotherapy	27,610	-	-	27,710	-	-	-	-
X-ray	37,485	8,436	1,087	2,217	5,123	3,574	1,268	15,780
Pathology	72,187	5,341	3,002	6,552	3,201	4,951	2,007	47,133
Physiotherapy	15,919	2,171	435	588	2,533	478	170	9,544
Pharmacy	14,059	350	146	2,445	95	4,266	5,751	1,006
Ancillary Medical Services	31,259	14,243	1,223	1,142	768	521	752	12,610
TOTAL TREATMENT	420,584	31,215	36,103	48,484	32,857	16,854	11,035	244,036
General Services								
Nurses in training	23,450	2,612	2,215	1,399	1,249	1,065	378	14,532
Catering	134,470	18,503	10,838	10,986	7,060	9,090	3,147	74,846
Staff residences	57,170	6,901	5,043	3,849	3,236	2,721	925	34,495
Laundry	24,766	3,408	1,996	2,023	1,300	1,674	580	13,785
Power, light and heat	55,348	7,621	5,634	4,804	2,651	3,316	1,163	30,159
Building & engineering maintenance	76,649	10,555	7,803	6,653	3,671	4,591	1,610	41,766
Medical Records	30,503	2,379	2,023	1,925	1,360	735	641	21,440
General administration	71,397	9,824	5,755	5,833	3,748	4,826	1,671	39,740
General portering	51,543	7,093	4,154	4,211	2,706	3,484	1,206	28,689
General cleaning	6,358	875	647	552	305	381	134	3,464
Maintenance of grounds	10,004	1,378	806	817	525	676	234	5,568
Transport	6,302	867	508	515	331	426	147	3,508
Other services	140,621	19,349	11,334	11,489	7,383	9,506	3,291	78,269
Direct credits	Cr 49,760	Cr 6,847	Cr 4,011	Cr 4,065	Cr 2,612	Cr 3,364	Cr 1,164	Cr 27,697
NET TOTAL	1,711,160	197,890	142,546	149,390	102,905	97,627	48,750	972,052

* Appears under radio-therapy treatment department

Table 28

CHURCHILL HOSPITAL : COSTS PER IN-PATIENT WEEK (£ 1972/3)

	Total £	Neur-ology £	Plastic Surgery £	Radio-Therapy £	Thoracic Surgery £	Renal Dialysis £	Haemo-philia £	Others £
Wards								
Pay - Medical	8.12	11.30	5.43	(13.17)*	16.11	9.19	6.91	8.07
- Nursing	29.10	23.57	34.10	21.24	29.54	19.54	20.03	32.40
- Domestic	3.80	5.49	2.81	2.82	2.41	2.12	2.16	4.09
- Other	2.45	1.75	1.75	10.35	1.75	1.75	1.75	1.75
Drugs	2.50	0.45	0.32	5.32	0.32	11.21	43.66	0.32
Dressings & equipment	4.29	3.50	5.05	7.37	4.42	3.67	3.70	4.00
TOTAL WARDS	50.26	46.06	49.46	47.10	54.55	47.48	8.21	50.63
Treatment								
Operating theatres	17.12	0.38	28.90	7.48	31.05	3.49	3.58	21.88
Radiotherapy	2.13	-	-	26.05	-	-	-	-
X-ray	2.89	4.73	1.04	2.09	7.53	4.08	4.17	2.19
Pathology	5.57	2.99	2.87	6.18	4.70	5.65	6.61	6.53
Physiotherapy	1.23	1.22	0.42	0.55	3.72	0.55	0.56	1.32
Pharmacy	1.08	0.20	0.14	2.31	0.14	4.86	8.94	0.14
Ancillary Medical Services	2.41	7.98	1.17	1.08	1.13	0.59	2.48	1.75
TOTAL TREATMENT	32.43	17.50	34.54	45.74	48.27	19.21	36.33	33.81
General Services								
Nurses in training	1.81	1.46	2.12	1.32	1.83	1.21	1.24	2.01
Catering	10.37	10.37	10.37	10.37	10.37	10.37	0.37	10.37
Staff residences	4.41	3.89	4.82	3.63	4.76	3.10	3.05	4.78
Laundry	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
Power, light and heat	4.27	4.27	5.39	4.53	3.89	3.78	3.83	4.18
Building & engineering maintenance	5.91	5.92	7.46	6.28	5.39	5.23	5.30	5.79
Medical records	2.35	1.33	1.94	1.82	2.00	0.84	2.11	2.97
General administration	5.51	5.51	5.51	5.50	5.51	5.51	5.50	5.51
General portering	3.97	3.97	3.97	3.97	3.97	3.97	3.97	3.97
General cleaning	0.49	0.49	0.62	0.52	0.45	0.43	0.44	0.48
Maintenance of grounds	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Transport	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49
Other services	10.84	10.84	10.84	10.84	10.84	10.84	10.84	10.84
Direct credits	Cr 3.84	Cr 3.84	Cr 3.84	Cr 3.84	Cr 3.84	Cr 3.84	Cr 3.84	Cr 3.84
NET TOTAL	131.95	110.94	136.37	140 95	151.17	111.30	60.51	134.68

Table 29

CHURCHILL HOSPITAL : COSTS PER CASE (£ 1972/3)

Wards	Total Hospital £	Neur-ology £	Plastic Surgery £	Radio-therapy £	Thoracic surgery £	Renal Dialysis £	Haemo-philia £	Others £
Pay - Medical	7.93	19.50	6.45	(16.68)*	18.56	25.19	7.52	6.25
- Nursing	28.45	40.65	40.50	26.89	34.03	53.57	21.80	25.09
- Domestic	3.72	9.47	3.33	3.57	2.77	5.78	2.35	3.16
- Other	2.40	3.02	2.08	13.10	2.02	4.79	1.90	1.36
Drugs	2.44	0.78	0.38	6.74	0.37	30.74	47.53	0.25
Dressings & equipment	4.19	6.03	6.00	9.34	5.09	10.07	4.03	3.10
TOTAL WARDS	49.14	79.46	58.75	59.64	62.83	130.14	85.13	39.20
Treatment								
Operating theatres	16.74	0.65	34.33	9.47	35.76	9.58	3.90	16.94
Radiotherapy	2.08	-	-	32.99	-	-	-	-
X-ray	2.83	8.16	1.24	2.65	8.67	11.17	4.54	1.69
Pathology	5.44	5.17	3.41	7.83	5.42	15.47	7.19	5.06
Physiotherapy	1.20	2.10	0.49	0.70	4.32	1.49	0.61	1.02
Pharmacy	1.06	0.34	0.17	2.92	0.16	13.33	20.61	0.11
Ancillary Medical Services	2.36	13.77	1.39	1.36	1.30	1.63	2.70	1.35
TOTAL TREATMENT	31.71	30.19	41.03	57.93	55.60	52.67	39.55	26.18
General Services								
Nurses in training	1.77	2.53	2.52	1.67	2.11	3.33	1.35	1.56
Catering	10.14	17.89	12.32	13.13	11.95	28.41	11.28	8.03
Staff residences	4.31	6.67	5.73	4.60	5.48	9.50	3.32	3.70
Laundry	1.87	3.30	2.27	2.42	2.20	5.23	2.08	1.48
Power, light and heat	4.17	7.37	6.40	5.74	4.49	10.36	4.17	3.23
Building & engineering maintenance	5.78	10.21	8.87	7.95	6.21	14.35	5.77	4.48
Medical records	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
General administration	5.38	9.50	6.54	6.97	6.34	15.08	5.99	4.26
General portering	3.89	6.86	4.72	5.03	4.58	10.89	4.32	3.08
General cleaning	0.48	0.85	0.74	0.66	0.52	1.19	0.48	0.37
Maintenance of grounds	0.75	1.33	0.92	0.98	0.89	2.11	0.84	0.60
Transport	0.48	0.84	0.58	0.62	0.56	1.33	0.53	0.38
Other services	10.60	18.71	12.88	13.73	12.49	29.71	11.80	8.40
Direct credits	Cr 3.75	Cr 6.62	Cr 4.56	Cr 4.86	Cr 4.42	Cr10.51	Cr 4.17	Cr 2.97
NET TOTAL	129.01	191.38	161.98	178.48	174.12	305.08	174.73	104.26

* Appears under radio-therapy treatment department

Table 30

OUT-PATIENT COSTS (£ 1972/3 UNIT COST = COST PER 100 ATTENDANCES)

CHURCHILL HOSPITAL

	Total		Radiotherapy		Haemophilia		Others		Radcliffe Infirmary	Average of other DGHs in Region.
Wards	Expend-iture £	Unit Cost £	Expend-iture £	Unit Cost £	Expend-iture £	Unit Cost £	Expend-iture £	Unit Cost £	Unit Cost £	Unit Cost £
Pay - Medical	68,066	196.26			21,398	1184.17	46,668	215.07	113.61	72.80
- Nursing	7,207	20.78					7,207	33.21	33.41	34.41
- Domestic & other	6,127	17.67					6,127	28.24	34.66	12.15
Drugs	4,084	11.78					4,084	18.82	22.88	13.50
Dressings, appliances	9,916	28.59					9,916	45.70	26.85	28.83
TOTAL WARDS	95,400	275.08			21,398	1184.17	74,002	341.04	231.41	161.69
Treatment										
Operating theatres	3,663	10.56					3,663	16.88	0.51	20.70
Radiotherapy	89,003	256.63	89,003	796.45						14.54
X-ray	49,420	142.50	15,924	142.50	2,575	142.50	30,921	142.50	66.60	31.54
Pathology	28,527	82.26	9,193	82.26	1,486	82.26	17,848	82.26	58.95	21.12
Physiotherapy	1,782	5.14					1,782	8.21	5.74	8.42
Pharmacy										4.98
Ancillary Medical Services	59,819	172.48			18,446	1020.81	41,373	190.67	31.89	23.04
TOTAL TREATMENT	232,214	669.57	114,120	1021.21	22,507	1245.56	95,587	440.31	165.69	124.35
General Services										
Nurses in training	449	1.30							2.22	1.31
Catering	2,084	6.01							0.64	
Laundry	591	1.70			at unit cost for 18.07 units		at unit cost for 216.99 units		2.22	1.38
Power, light and heat	4,520	13.03	at unit cost for 111.75 units						6.58	
Building & engineering maintenance	6,665	19.22							11.77	11.43
Medical records	23,716	68.38							59.51	41.84
General administration	8,029	23.15							22.66	18.51
Other overheads	21,529	62.08							33.54	30.09
Direct credits	Cr 780	Cr 2.25	Cr 251	Cr 2.25	Cr 41	Cr 2.25	Cr 488	Cr 2.25	Cr 0.25	Cr 0.04
NET TOTAL	394,417	1137.27	135,647	1213.84	47,385	2622.30	211,386	974.18	533.99	397.71

GENERAL HOSPITALS : COMPREHENSIVE HYBRID WITH HIGH ESTIMATE FOR TEACHING ELEMENT

	Actual In-patient Expenditure *1 £	Weighted Notional Catchment Population *2	Spend per head *3 £	Target Allocation *4 £	Actual Out-patient Expenditure *5 £	Actual unweighted population	Spend per head *6 £	Target Allocation £	Combined Target Allocation *7 £	Change £	Chan as % Actual
Oxon	6,839,187	508,212	13.46	7,647,536	1,897,434	461,934	4.11	1,954,227	9,601,763	-557,342	-5.49
Berks	9,224,641	671,727	13.73	8,740,090	2,571,201	667,606	3.85	2,264,321	11,004,411	-791,431	-6.71
Bucks	4,325,458	341,646	12.66	5,250,437	1,285,552	477,210	2.69	1,618,554	6,868,991	+452,828	+7.06
North	5,557,434	472,572	11.76	6,148,810	1,284,936	468,645	2.74	1,589,505	7,738,315	+895,945	+13.09
REGION	25,946,720	1,994,157	13.01		7,039,123	2,075,395	3.39				

*1 excluding £805,153 for Stoke Mandeville & £1,035,000 for the Radcliffe and Churchill

*2 excluding 22,367 for Stoke Mandeville

*3 co-efficient of variation of 7.18%

*4 including the extra sums for Stoke Mandeville, Radcliffe and Churchill

*5 excluding £387,484 for Radcliffe and Churchill

*6 co-efficient of variation of 20.94%

*7 including extra sums for Radcliffe and Churchill

Table 31

GENERAL HOSPITALS : COMPREHENSIVE HYBRID WITH LOW ESTIMATE FOR TEACHING ELEMENT

	Actual In-patient Expenditure *1 £	Weighted Notional Catchment Population *2	Spend per Head *3 £	Target Allocation *4 £	Actual Out-patient Expenditure *5 £	Actual unweighted population	Spend per Head *6 £	Target Allocation *7 £	Combined Target Allocation £	Change £	Change % of Actual
Oxon	6,977,187	508,212	13.73	7,544,705	2,109,978	461,934	4.57	1,788,990	9,333,695	-825,410	-8.12
Berks	9,224,641	671,727	13.73	8,786,576	2,571,201	667,606	3.85	2,332,692	11,119,268	-676,574	-5.73
Bucks	4,325,458	341,646	12.66	5,274,079	1,285,552	477,210	2.69	1,667,426	6,941,505	+525,342	+8.19
North	5,557,434	472,572	11.76	6,181,513	1,284,936	468,645	2.74	1,637,499	7,819,012	+976,642	+14.27
REGION	26,084,720	1,994,157	13.08		7,251,667	2,075,395	3.49				

*1 excluding £805,153 for Stoke Mandeville & £897,000 for the Radcliffe and Churchill

*2 Excluding 22,367 for Stoke Mandeville

*3 co-efficient of variation of 7.46%

*4 including extra sums for Stoke Mandeville and the Radcliffe and Churchill

*5 excluding £174,940 for the Radcliffe and Churchill

*6 co-efficient of variation of 24.11%

*7 including extra sum for Radcliffe and Churchill

QUANTITY INDICATORS : ALL GENERAL HOSPITALS (1971/2)

	IN-PATIENTS				OUT-PATIENTS	
	Total no. of beds per 1,000 weighted notional catchment population	Total no. of beds per 1,000 actual population	Total no. of cases per 1,000 weighted notional catchment population	Total no. of cases per 1,000 actual population	Out-patient attendances per 1,000 actual population	Cost per 100 attendances £
Oxfordshire	4.53	4.99	128.30	141.17	980.68	416.14
Berkshire	4.75	4.78	120.83	121.58	985.37	339.36
Buckinghamshire	4.66	3.56	113.58	86.63	650.66	371.86
Northamptonshire	5.13	5.17	111.72	112.66	576.17	436.18
REGION	4.77	4.63	119.29	115.89	814.96	381.35
Co-efficient of variation	5.09%	14.50%	6.01%	17.91%	26.43%	12.60%

Table 33

QUANTITY INDICATORS : ACUTE HOSPITALS (£ 1971/2)

	No. of acute beds per 1000 weighted notional catchment population	No. of acute beds per 1000 actual population	No. of acute cases per 1000 weighted notional catchment population	No. of acute cases per 1000 actual population	Ratio of acute cases to acute beds	Cost per case £	Waiting list per 1000 weighted notional catchment population	Waiting list per 1000 actual population
Oxon	3.44	3.78	120.55	132.63	35.05	107.63	11.80	12.99
Berks	3.56	3.58	103.96	104.60	29.29	106.97	15.74	15.83
Bucks	3.59	2.74	105.56	80.52	29.40	113.38	13.38	10.21
North:	2.57	2.59	86.92	87.64	33.81	86.28	13.98	14.10
REGION	3.30	3.21	104.44	101.47		104.30	13.91	13.51
Co-efficient of variation	14.10%	17.90%	12.78%	20.61%		9.08%	13.50%	18.45%

Table 34

QUANTITY INDICATORS : NON-ACUTE HOSPITAL (1971/2)

	Non. of non-acute beds per 1000 weighted notional catchment population	No. of non-acute beds per 1000 actual population	No. of non-acute cases per 1000 weighted notional catchment population	No. of non-acute cases per 1000 actual population	Ratio of non-acute cases to beds	Cost per case £
Oxfordshire	1.09	1.20	7.75	8.53	7.09	324.80
Berkshire	1.19	1.20	16.87	16.97	14.18	154.84
Buckinghamshire	1.07	0.82	8.01	6.11	7.48	265.37
Northamptonshire	2.56	2.58	24.81	25.01	9.70	171.75
REGION	1.46	1.42	14.83	14.41		194.63
Co-efficient of variation	46.73%	50.09%	50.74%	54.97%		30.24%

Table 35

PSYCHIATRIC HOSPITAL REVENUE EXPENDITURE 1971/2

	In-patients £	Out-patients £		Day-patients £	Non-costed £	Total £
Oxfordshire	1,740,035	91,514	£ 394,851	143,765	159,572	2,134,886
Berkshire	2,624,301	4,087	£ 71,408	51,401	15,920	2,695,709
Buckinghamshire	1,119,333	-	£ 54,771	39,562	15,209	1,174,104
Northamptonshire	1,444,519	20,659	£ 135,525	100,856	14,010	1,580,044
REGIONAL TOTALS	6,928,188	116,260	£ 656,555	335,584	204,711	7,584,743

Table 36

PSYCHIATRIC HOSPITALS : ALLOCATION BY ACTUAL POPULATION

	Expenditure £	Actual Population	Spend per head* £	Target Allocation £	Change £	Change as % of actual
Oxfordshire	2,134,886	461,934	4.62	1,688,185	-446,701	-20.9
Berkshire	2,695,709	667,606	4.04	2,439,834	-255,875	- 9.5
Buckinghamshire	1,174,104	477,210	2.46	1,744,013	+569,909	+48.5
Northamptonshire	1,580,044	468,645	3.37	1,712,711	+132,667	+ 8.4
REGION	7,584,743	2,075,395	3.65			

* Co-efficient of variation of 23.7%

Table 37

LOCAL AUTHORITY PSYCHIATRIC EXPENDITURE 1971/2

	LA Expenditure £	Actual Population	Spend per head * £	Hospital Spend per head £	Combined Spend per head ** £
Oxfordshire	146,880	461,934	0.32	4.62	4.94
Berkshire	96,334	667,606	0.14	4.04	4.18
Buckinghamshire	71,398	477,210	0.15	2.46	2.61
Northamptonshire	146,031	468,645	0.31	3.37	3.68
REGION	460,643	2,075,395	0.22	3.65	3.88

* Co-efficient of variation of 43.7%
** Co-efficient of variation of 23.3%

Table 38

PSYCHIATRIC WEIGHTING FACTORS

Age Group	Males	Females
0 - 4	0.034	0.029
5 - 14	0.285	0.188
15 - 19	0.592	0.429
20 - 24	0.727	0.486
25 - 34	0.856	0.643
35 - 44	1.076	0.837
45 - 54	1.375	1.159
55 - 64	1.561	1.477
65 - 74	1.849	2.131
75+	2.752	3.894

PSYCHIATRIC HOSPITALS :

COMPARISON OF ACTUAL AND WEIGHTED POPULATIONS

	Actual	Weighted	Correction Co-efficient
REGION	2,075,395	1,964,981	.94680
Oxfordshire	461,934	431,973	.93514
Berkshire	667,606	622,699	.93273
Buckinghamshire	477,210	449,663	.94228
Northamptonshire	468,645	460,646	.98293

PSYCHIATRIC HOSPITALS : ALLOCATION BY WEIGHTED POPULATIONS

	Expenditure £	Weighted Population	Spend per head* £	Target Allocation £	Change £	Change as % of actual
Oxfordshire	2,134,886	431,973	4.94	1,667,397	-467,489	-21.9
Berkshire	2,695,709	622,699	4.33	2,403,592	-292,117	-10.8
Buckinghamshire	1,174,104	449,663	2.61	1,735,680	+561,576	+47.8
Northamptonshire	1,580,044	460,646	3.43	1,778,074	+198,030	+12.5
REGION	7,584,743	1,964,981	3.86			

* Co-efficient of variation of 24.71%

Table 41

FLOWS OF PSYCHIATRIC PATIENTS

Area of Hospitalisation ↓	Area of Residence						
	Oxon	Berks	Bucks	North	Outside	Total inflow	Total patients of region.
Oxon	[903]	11	29	18	84	142	961
Berks	209	[1,670]	88	18	157	472	1,985
Bucks	9	12	[685]	3	9	33	709
North:	3	0	3	[806]	21	27	812
Outside	0	394	119	143	-	-	656
Total outflow	221	417	239	182	271	-	-
Total patients in area	1,124	2,087	924	988	-	-	5,123

Table 42

NOTIONAL CATCHMENT POPULATIONS OF PSYCHIATRIC HOSPITALS

	Inflow of Patients	Outflow of Patients	Net flow	Actual Population	Population Adjustment (% of actual)	Notional Catchment Population
Oxfordshire	+142	-221	- 79	461,934	- 32,004 (- 6.9%)	429,930
Berkshire	+472	-417	+ 55	667,606	+ 22,281 (+ 3.3%)	689,887
Buckinghamshire	+ 33	-239	-206	477,210	- 83,453 (-17.5%)	393,757
Northamptonshire	+ 27	-182	-155	468,645	- 62,793 (-13.4%)	405,852
REGION	+271	-656	-385	2,075,395	-155,969 (-7.5%)	1,919,426

Table 43

PSYCHIATRIC HOSPITALS :

ALLOCATION BASED ON NOTIONAL CATCHMENT POPULATION

	Actual Expenditure £	Notional Catchment Population	Spend per head * £	Target Allocation £	Change £	Change as % of Actual
Oxfordshire	2,134,886	429,930	4.97	1,698,898	-435,988	-20.4
Berkshire	2,695,709	689,887	3.91	2,726,135	+ 30,426	+ 1.13
Buckinghamshire	1,174,104	393,757	2.98	1,555,958	+381,854	+32.52
Northamptonshire	1,580,044	405,852	3.89	1,603,752	+ 23,708	+ 1.50
REGION	7,584,743	1,919,426	3.95			

* co-efficient of variation of 17.7%

PSYCHIATRIC HOSPITALS :

WEIGHTING OF NOTIONAL CATCHMENT POPULATIONS

	Actual Weighted Population	Weighted Population Adjustment	Weighted Notional Catchment Population
Oxfordshire	431,973	- 30,301	401,672
Berkshire	622,699	+ 21,095	643,794
Buckinghamshire	449,663	- 79,013	370,650
Northamptonshire	460,646	- 59,452	401,194
REGION	1,964,981	-147,671	1,817,310

Table 45

PSYCHIATRIC HOSPITALS :
ALLOCATION BASED ON WEIGHTED NOTIONAL CATCHMENT POPULATIONS

	Actual Expenditure £	Weighted Notional Catchment Population	Spend per head * £	Target Allocation £	Change £	Change as % of actual
Oxfordshire	2,132,886	401,672	5.31	1,676,422	-458,464	-21.5%
Berkshire	2,695,709	643,794	4.19	2,686,945	- 8,764	- 0.3%
Buckinghamshire	1,174,104	370,650	3.17	1,546,948	+372,844	+31.7%
Northamptonshire	1,580,044	401,194	3.94	1,674,428	+ 94,384	+ 6.0%
REGION	7,584,743	1,817,310	4.17			

* Co-efficient of variation 18.2%

PSYCHIATRIC HOSPITALS : HYBRID VERSION

	In-patient expenditure £	Weighted Notional Population	Spend per head* £	Target allocation £	Out-patient Expenditure £	Simple actual population	Spend per head** £	Target Allocation £	Combined in & out patients target £	Change £	Change as % of actual
Oxon	1,740,035	401,672	4.33	1,531,307	394,851	461,934	0.85	146,134	1,677,441	-457,445	-21.4
Berks	2,624,301	643,794	4.08	2,454,356	71,408	667,606	0.11	211,198	2,665,554	- 30,155	- 1.1
Bucks	1,119,333	370,650	3.02	1,413,041	54,771	477,210	0.12	150,966	1,564,007	+389,903	+33.2
North	1,444,519	401,194	3.60	1,529,484	135,525	468,645	0.29	148,257	1,677,741	+ 97,697	+ 6.2
REGION	6,928,188	1,817,310	3.81		656,555	2,075,395	0.32				

* co-efficient of variation of 13.6%

** co-efficient of variation of 106.0%

Table 47

PSYCHIATRIC HOSPITALS :
ALLOCATION WITH SPECIAL PROVISION FOR WARNEFORD HOSPITAL

	Actual Expenditure *1 £	Weighted Notional Catchment Population *2	Spend per head* *4 £	Target Allocation *3 £	Change £	Change as % of actual
Oxfordshire	1,732,774	354,495	4.89	1,840,539	-294,347	-13.8
Berkshire	2,695,709	634,794	4.19	2,612,309	- 83,400	- 3.1
Buckinghamshire	1,174,104	370,650	3.17	1,503,979	+329,875	+28.1
Northamptonshire	1,580,044	401,194	3.94	1,627,916	+ 47,872	+ 3.0
REGION	7,182,631	1,770,133	4.06	7,584,743		

*1 excluding £402.112 for Warneford
*2 excluding 47,178 for Warneford
*3 including £402,112 for Warneford
*4 co-efficient of variation of 14.5%

Table 48

PSYCHIATRIC HOSPITALS : QUANTITY INDICATORS

	In-patients per 1,000 Actual Population	In-patients per 1,000 Weight Population	Out-patient rate per 1,000 actual Population	Day patients per 1,000 actual Population *	Out & Day Patient per 1,000 actual Population *
Oxfordshire	2.43	2.60	41.22	102.85	144.07
Berkshire	3.13	3.35	1.97	37.38	39.35
Buckinghamshire	1.94	2.05	-	31.36	31.36
Northamptonshire	2.11	2.14	14.16	78.18	92.34
REGION	2.47	2.61	13.00	59.78	72.79
Co-efficient of variation	24.11%	25.58%	-	55.15%	69.34%

* attendances

PSYCHIATRIC HOSPITALS : QUALITY INDICATORS

	Cost per In-patient Day £	Cost per Out-patient Attendance £	Cost per Day-patient Attendance £	Cost per * Out-patient & Day-patient Attendance £
Oxfordshire	4.71	4.81	3.03	5.93
Berkshire	3.79	3.11	2.06	2.72
Buckinghamshire	4.35	-	2.64	3.66
Northamptonshire	4.69	3.11	2.75	3.13
REGION	4.26	4.31	2.70	4.35
Co-efficient of variation	13.06%	-	15.33%	44.28%

* includes non-costed expenditure

Table 50

COMMUNITY HEALTH SERVICES : NET EXPENDITURE (1971/2)

		Oxon		Berks		Bucks		North:		REGION	
		£	%	£	%	£	%	£	%	£	%
	Health centres & multi-purpose clinics	32,416	1.84	24,259	1.17	3,477	0.19	9,432	0.64	69,584	0.97
2	Care of mothers and young children	65,989	3.75	91,680	4.42	51,890	2.84	80,352	5.44	289,911	4.06
3	Midwifery & home nursing	425,882	24.19	567,397	29.85	516,588	28.26	355,257	24.05	1,865,124	26.99
4	Health visiting	236,299	13.42	263,700	10.19	225,636	12.34	178,351	12.07	903,986	11.79
5	School medical service	215,430	12.24	287,839	13.87	185,579	10.15	189,508	12.83	878,356	12.30
6	Administration	237,522	13.49	222,171	10.70	321,831	17.60	196,682	13.31	978,206	13.70
7	Prevention & after care	75,635	4.30	99,055	4.77	86,367	4.72	67,824	4.59	328,881	4.60
8	Vaccination & Immunisation	13,175	0.75	30,784	1.48	16,311	0.89	12,375	0.84	72,645	1.02
9	Ambulance	458,049	26.02	488,548	23.55	420,448	23.01	387,328	26.23	1,754,373	24.57
	TOTAL	1,760,397		2,075,433		1,828,127		1,477,109		7,141,066	

Table 51

COMMUNITY HEALTH SERVICES : NET EXPENDITURE PER HEAD (1971/2)

		Oxon £	Berks £	Bucks £	North: £	REGION £	Co-efficient of variation %
1	Health centres and multi-purpose clinics	0.064	0.039	0.007	0.020	0.034	70.16
2	Care of mothers and young children	0.131	0.147	0.109	0.172	0.140	17.44
3a	Midwifery	0.393	0.423	0.504	0.353	0.419	14.05
3b	Home Nursing	0.450	0.485	0.578	0.405	0.480	14.05
4	Health visiting	0.468	0.422	0.473	0.381	0.436	9.26
5	School medical service	0.427	0.461	0.389	0.404	0.423	7.91
6	Administration	0.470	0.356	0.674	0.420	0.471	29.09
7	Prevention & after-care	0.150	0.159	0.181	0.145	0.159	9.33
8	Vaccination & immunisation	0.026	0.049	0.034	0.026	0.035	34.30
9	Ambulance	0.907	0.783	0.881	0.827	0.845	7.05
	TOTAL	3.486	3.324	3.831	3.152	3.443	7.82

Table 52

COMMUNITY HEALTH SERVICES :

NET EXPENDITURE PER HEAD OF RELEVANT POPULATION (1971/2)

		Oxon £	Berks £	Bucks £	North: £	REGION £	Co-efficient of variation %
1	Health centres and multi-purpose clinics	0.064	0.039	0.007	0.020	0.034	70.16
2	Care of mothers and young children	1.555	1.648	1.242	1.928	1.597	16.35
3a	Midwifery	18.702	19.081	23.185	15.889	19.201	14.39
3b	Home Nursing	1.307	1.419	1.681	1.148	1.393	14.89
4	Health visiting	2.367	2.114	2.373	1.893	2.184	9.85
5	School medical service	1.767	1.917	1.609	1.754	1.773	7.57
6	Administration	0.470	0.356	0.674	0.420	0.471	29.09
7	Prevention & after-care	0.150	0.159	0.181	0.145	0.158	9.33
8	Vaccination & immunisation	0.026	0.049	0.034	0.026	0.035	34.30
9	Ambulance	0.907	0.783	0.881	0.827	0.845	7.05

COMMUNITY HEALTH SERVICES : ALLOCATION BASED ON ACTUAL POPULATIONS

	Actual Expenditure £	Actual Population **	Spend per * Head £	Target Allocation £	Change £	Change as % of actual	Adjustment for Henleys £
Oxfordshire	1,760,397	505,169	3.48	1,738,197	-22,200	- 1.26	-148,764
Berkshire	2,075,433	624,371	3.32	2,148,350	+ 72,917	+ 3.51	+148,764
Buckinghamshire	1,828,127	477,210	3.83	1,641,995	-186,132	-10.18	
Northamptonshire	1,477,109	468,645	3.15	1,612,524	+135,415	+ 9.17	
REGION	7,141,066	2,075,395	3.44				

* Co-efficient of variation 7.82%

** Henley RD & MB included in Oxfordshire, with population of 43,235.

Table 54

WEIGHTING FACTORS FOR COMMUNITY HEALTH SERVICES

		Oxfordshire	Berkshire	Buckinghamshire	Northamptonshire
1	Health centres & multi-purpose clinics	0.0097	0.0097	0.0097	0.0097
2	Care of mothers and young children	0.0391	0.0411	0.0408	0.0414
3a	Midwifery	0.1211	0.1274	0.1263	0.1282
3b	Home Nursing	0.1421	0.1371	0.1408	0.1589
4	Health Visiting	0.1147	0.1173	0.1175	0.1226
5	School medical service	0.1243	0.1239	0.1245	0.1188
6	Administration	0.1370	0.1370	0.1370	0.1370
7	Prevention & after-care	0.0460	0.0460	0.0460	0.0460
8	Vaccination and immunisation	0.0102	0.0102	0.0102	0.0102
9	Ambulance service	0.2457	0.2457	0.2457	0.2457
	TOTAL	0.9899	0.9954	0.9985	1.0185

Table 55

COMMUNITY HEALTH SERVICES : ALLOCATION BASED ON WEIGHTED POPULATIONS

	Actual Expenditure £	Weighted Population **	Spend per Head * £	Target Allocation £	Change £	Change as % of actual	Adjustment for Henleys
Oxfordshire	1,760,397	500,067	3.52	1,720,658	- 39,739	- 2.26	-147,263
Berkshire	2,075,433	621,499	3.34	2,138,489	+ 63,056	+ 3.04	+147,263
Buckinghamshire	1,828,127	476,494	3.84	1,639,547	-188,580	-10.32	
Northamptonshire	1,477,109	477,315	3.09	1,642,372	+165,263	+11.19	
REGION	7,141,066	2,075,375	3.44				

* co-efficient of variation 8.46%

** Henley RD & MB included in Oxfordshire, with weighted population of 42,798

CHANGES IN REVENUE ALLOCATIONS TO ACHIEVE EQUAL SPEND PER HEAD, ALLOWING FOR ALL FACTORS.

	Oxfordshire	Berkshire	Buckinghamshire	Northamptonshire
	£	£	£	£
General Hospitals	-577,342	-791,431	+452,828	+895,945
Psychiatric Hospitals	-294,347	- 83,400	+329,875	+ 47,872
Community Health Services	- 39,739	+ 63,056	-188,580	+165,263
£ 1971	-891,428	-811,775	+594,123	+1,109,080
% of Total Spend	-6.34%	-4.90%	+6.31%	+11.20%

Table 57

EXPENDITURE NECESSARY TO BRING ALL AREAS UP TO THE 'BEST' AREA

	General Hospitals £	Psychiatric Hospitals £	Community Health Services £	Total £
Oxfordshire	779,261	-	160,021	939,282
Berkshire	173,578*	450,656	310,750	934,984
Buckinghamshire	1,043,199	637,518	-	1,680,717
Northamptonshire	930.967**	381,134	357,986	1,670,087
TOTAL	2,927,005	1,469,308	828,757	5,225,070

* Out-patients only

** In-patients only

Table 58

INCREASES IN "PERMISSIBLE EXPENDITURE" TO
OXFORD REGIONAL HOSPITAL BOARD
FOR HOSPITAL SERVICES.

	Increase from previous year	% of previous year
	£	
1972/3	5,581,121	15.24
1971/2	4,928,150	15.56
1970/1	5,020,651	18.84
1969/70	2,668,485	11.12
1968/9	2,377,669	11.00
1967/8	1,552,772	7.70
1966/7	2,157,458	12.05
1965/6	2,062,900	13.03
1964/5	1,224,517	8.38

CO-EFFICIENT OF VARIATION

$$Var\left(\frac{X}{Y}\right) \simeq \frac{1}{Y^2}\left[Var(X) + \left(\frac{X}{Y}\right)^2 Var(Y) - 2\left(\frac{X}{Y}\right)Cov(X,Y)\right]$$

If $X = \sum_1^n x$, $Y = \sum_1^n y$

As $Var(X) = Var(n\bar{x}) = n^2 Var(\bar{x})$

Then $Var\left(\frac{X}{Y}\right) = \frac{n^2}{Y^2}\left[Var(x) + \left(\frac{X}{Y}\right)^2 Var(y) - 2\left(\frac{X}{Y}\right)Cov(x,y)\right]$

$$Var(x) = \sum (x - \bar{x})^2$$

$$Var(y) = \sum (y - \bar{y})^2$$

$$Cov(x,y) = \sum (x - \bar{x})(y - \bar{y})$$

Note.

The co-efficient of variation is a measure of dispersion which expresses the standard deviation as a percentage of the arithmetic mean and, as such, can be used to compare variability between different types of variables. However, in this paper we are comparing ratios (eg expenditure per head) and so it is necessary to weight each observation. This is achieved by using the above formula.

NON-PSYCHIATRIC HOSPITAL EXPENDITURE — OXFORDSHIRE — £ — 1971/2

Former Group	Hospital	In-patient	Out-patient	Day-patient	Non-costed expenditure	Total £
U O H	Radcliffe Infirmary	2,764,514	893,553	-	304,966	
	Churchill	1,721,738	343,181	-		
	Slade	186,740	7,750	-		
	Cowley Road	628,877	39,939	42,348		
	Oxford Eye	106,450	84,017	-		
	John Radcliffe	-	-	-		7,124,073
Banbury	Horton General	592,480	159,180	-	36,275	
	Horton Maternity Home	133,101	11,749	-		
	Neithrop & Pines Wing	132,280	4,215	34,364		
	Chipping Norton & District	60,684	7,397			
	Bicester Cottage	26,657	6,020			
	Brackley Cottage	24,212	3,725			1,232,339
Nuffield	Nuffield Orthopaedic	782,888	111,001	-	58,526	
	Mary Marlborough Lodge	49,570	10,347	-		
	Abingdon	137,034	22,306	-		
	Burford Cottage	24,600	4,832	-		
	Didcot	27,671	9,146	-		
	Victoria Cottage Thame	36,324	5,716	-		
	Wantage	32,568	8,244	-		
	Warren	40,321	-	-		
	Watlington	33,241	2,665	-		1,397,000
Isis	Rivermead	67,979	2,843	47,237		
	Longworth	80,562	-	8,216		
Reading	St Mary's Wallingford	143,294	14,308			
	St George's Wallingford	40,402	852			405,693
Total	Oxfordshire	7,874,187	1,752,986	132,165	399,767	£10,159,105

NON-PSYCHIATRIC HOSPITAL EXPENDITURE BERKSHIRE £ 1971/2

Former Group	Hospital	In-patient	Out-patient	Day-patient	Non-costed expenditure	Total £
Reading	Royal Berkshire	2,143,320	621,943	- -		
	Blagrave	93,748	-	-		
	Battle	939,218	336,536	-		
	Newbury District	218,279	73,089	-	141,358	
	Prospect Park	215,527	-	-		
	Wokingham	219,986	9,034	-		
	Sandleford	196,188	7,007	-		
	Dellwood Maternity	63,283	2,478	-		5,280,994
	Peppard	432,426	10,290			
	Henley War Memorial	55,343	15,726			
	Townlands	193,428	15,082			722,295
Windsor	Iver, Denham & Langley	42,003	808	-		
	Canadian Red Cross	918,337	42,844	-		
	Farnham Park	44,595	2,960	35,122		
	Maidenhead	272,997	103,162	-		
	St Marks	229,615	12,854	-		
	Maidenhead Isolation	89,011	-	-	197,396	
	King Edward VII	786,350	281,649			
	Princess Christian Maternity	30,029	1,150			
	Upton	449,051	71,754			
	Heatherwood	581,312	185,777			
	Wexham Park	1,010,595	403,182			5,792,553
Total	Berkshire	9,224,641	2,197,325	35,122	338,754	£11,795,842

APPENDIX B
TABLE 2

NON-PSYCHIATRIC HOSPITAL EXPENDITURE BUCKINGHAMSHIRE £ 1971/2

Former Group	Hospital	In-patient	Out-patient	Day-patient	Non-costed Expenditure	Total £
High Wycombe	Marlow	23,281	1,492	-		
	Hayward House	-	-	15,645		
	Chesham	42,772	8,249	-		
	Booker	223,918	-	-		
	Stone	37,073	1,754	-	96,436	
	Shrubbery	95,644	-	-		
	Wycombe General	864,270	450,745	-		
	Chalfonts & Gerrards Cross	87,476	41,553	-		
	Amersham General	818,186	186,777	-		2,995,273
Royal Bucks & St John's	Royal Bucks	318,781	213,088	-		
	Stoke Mandeville	1,948,813	73,376	-		
	Buckingham	26,453	4,172	-		
	Tindal General	414,681	24,645	62,416		
	Winslow	135,207	-	-	34,472	
	Bletchley	59,483	51,036	-		
	Stoke Mandeville GP Unit	34,571	994			3,402,188
	Meacham Clinic	-	14,178	-		
	Physiotherapy Clinic Stoney Stratford	-	4,524	-		18,702
Total	Buckinghamshire	5,130,611	1,076,583	78,061	130,908	£6,416,163

APPENDIX B TABLE 3

NON-PSYCHIATRIC HOSPITAL EXPENDITURE NORTHAMPTONSHIRE £ 1971/2

Former Group	Hospital	In-patients	Out-patients	Day-patients	Non-costed expenditure	Total £
Northampton*	Northampton General	1,870,012	530,367	-		
	Margaret Spencer	48,469	-	-		
	Manfield Orthopaedic	298,314	-	-		
	J G Shipman	15,657	-	4,611		
	Creaton	177,982	1,085	-		
	St Edmund's	328,553	4,975	18,560		
	Harborough Road	146,145	-	-	39,374	
	Renny Lodge	129,654	-	14,442		
	Westbury Maternity	29,947	3,691	-		
	Danetre	159,311	4,111	7,080		
	Pitsford House	141,621	-			
	Chest-Clinic		18,263			
	Manfield Orthopaedic Clinics		61,189			
	Mass Radiography Unit		19,173			4,072,586
Kettering	Kettering General	882,640	304,084	-		
	Rockingham Road	109,905	-	-		
	Isebrook	375,157	16,820	9,553		
	Wellingborough	89,480	1,923	-		
	Rushden	151,970	4,581	-	67,778	
	St Mary's	485,049	-	23,098		
	Highfield	65,203	-	-		
	Rushden Memorial Clinic		44,481	-		
	Nuffield Diagnostic Clinic		85,697	-		
	Corby Maternity Unit	52,365	-	-		2,769,784
Total	Northamptonshire	5,557,434	1,100,440	77,344	107,152	£6,842,370

* costs of Meacham Clinic and Physiotherapy Clinic at Stoney Stratford apportioned to Buckinghamshire

NOTES ON THE DERIVATION OF THE COSTS OF THE SPINAL INJURIES UNIT AND PLASTIC & BURNS UNIT, STOKE MANDEVILLE HOSPITAL 1972/3

Basic Statistics : In patients

	Total Hospital	Spinal Injuries	Plastics & Burns	Others
No of Discharges	11,084	790 7.13%	1,669 15.06%	8,625 77.81%
No. of In-patient days	162,579	61,597 37.88%	20,525 12.63%	80,457 49.49%
No. of In-patient weeks	23,225.6	8,799.6	2,932.1	11,493.9
Average stay per case, days	14.68	77.97	12.30	9.33
No. of beds	571	193 33.80%	76 13.31%	302 52.89%

Patients in Ashurst House excluded because no firm knowledge on their diagnosis.

4.66% of the in-patient days in the plastic wards can be attributed to dental patients. Hence resources in plastic wards have been reduced to 95.34% to reflect those used by plastic patients only.

WARDS

Pay - medical. Senior medical staff paid by Oxford Regional Hospital Boards identified on computer print-out. Junior medical staff allocated according to the number of staff in post, H.O = .77 S.H.O.

Pay - nursing. Over 3 month period, total nurse hours calculated for each specialty and for whole hospital and costs apportioned in same proportion.

Pay - domestic. Allocation based on 3 month sample of staff in post, at average wage rates.

Pay - others. This includes pay of a miscellany of staff, such as hairdressers and technicians. There appears to be no special allocation to particular wards and so the cost was apportioned on the basis of the proportion of in-patient days in each specialty.

Drugs. The Chief Pharmacist undertook a study of the drugs going to the two main spinal wards and the main plastic ward over a three-week period, costed them and then derived an estimated annual cost. The remaining drug bill was divided equally between the other 24 wards and apportioned to the specialties.

Dressings - pre-packed. No information was available on CSSD issues so the allocation was made on the basis of the number of in-patient weeks. This may slightly understate the costs of the spinal patients.

Dressings - other. A five-month sample was costed and the percentages so derived were applied to the total cost.

Patients' appliances. A three-month sample was costed and the percentages so derived were applied to the total cost.

Equipment. Non-CSSD equipment was apportioned on the basis of a three-month sample. As no information could be obtained on the CSSD component, this was apportioned on the basis of in-patient weeks.

Contract services. These apply to the cleaning of the wards which is undertaken by an outside firm of contractors, at a cost of 64.24p per hour. The allocation was based on the number of hours in each ward.

TREATMENT

Operating Theatres. There are two operating theatres in the hospital and the south theatre is used for spinal injuries (2 sessions per week) and plastic surgery (16 sessions per week). 2 sessions per week are also reserved for emergencies but as these are usually plastic surgery cases, this gives 18 sessions per week for plastic surgery. Costs were apportioned on the assumption of an equal cost per session.

X-Ray. The Chief Radiographer advised that there is little difference between the level of service provided per unit of time to the special units, though the number of units per patient varies, notably between long and short stay. Accordingly, costs are apportioned on the basis of in-patient weeks.

Pathology. A two-month sample was taken of requests, some identified as "weighted" (to cover the extra cost of materials) and others "un-weighted" (to cover salaries only). The numbers of requests, estimated for the year, were then costed at the estimated costs per unit.

Physiotherapy. The total cost was split between pay and equipment. Pay was apportioned on the basis of the percentage of time estimated to have been spent on the special units. The cost of equipment was apportioned on the basis of a six-month sample.

Pharmacy. Apportioned on the basis of the percentage of the drug bill for each specialty.

Ancillary Medical Services. One full-time social worker was employed exclusively for spinal patients. The cost of the other three social workers was divided equally among the other cases. Occupational therapy was apportioned on the basis of the percentage of staff hours. The remedial gymnasium was used for an estimated 85% of the time by spinal patients and its cost apportioned accordingly. Clinical photography costs were apportioned on the basis of the number of photographs taken. Speech therapy, dental services and others were apportioned on the basis of the percentage time involved.

GENERAL SERVICES

Nurses in training. Apportioned in the same percentage as Nurse pay, wards.

Catering. Apportioned on basis of in-patient days.

Staff Residence. Apportioned on basis of in-patient days.

Laundry. Apportioned on basis of in-patient days.

Power, light and heat. It was decided not to apportion this on the basis of cubic capacity of wards because of the problem of apportioning common areas. The swimming bath, which is used primarily by spinal patients is estimated, by the Chief Engineer, to cost £42.50 per day, ie £15,512.50 pa. The remaining sum was apportioned on the basis of numbers of beds.

Building & Engineering Maintenance. Apportioned on basis of number of beds.

Medical Records. Apportioned on basis of actual staff employed on special wards; general wards being apportioned in the same ratio.

General Administration. Apportioned on basis of in-patient days.

General Portering. Apportioned on basis of in-patient days.

General Cleaning. Apportioned on basis of number of beds.

Maintenance of Grounds. Apportionment on basis of number of beds.

Transport. Apportioned on basis of in-patient days.

Other Services. Apportioned on basis of in-patient days.

Direct Credits. Apportioned on basis of in-patient days.

NOTES ON THE DERIVATION OF THE COSTS OF THE NEUROSURGERY DEPARTMENT AT THE RADCLIFFE INFIRMARY.

Basic Statistics 1972/3

	Neurosurgery	Others	Total hospital
No. of cases	733 3.34%	21,186 96.66%	21,919
No. of in-patient days	8,091 5.30%	144,708 94.70%	152,799
Average stay per case	11.04 days	6.83 days	6.97days
No. of beds	21* 4.18%	481 95.82%	502

* in Nuffield 1 Ward

Wards

Pay - medical. Identified by specialty from the Treasurer's tabulation.

Pay - nursing. Calculated for Nuffield 1 on the basis of nursing days during year and then multiplied by grossing-up co-efficient.

Pay - domestic. Estimated that 150 hours per week of domestic staff time provided for Nuffield 1, compared to 3,208 for all the wards in the hospital, ie 4.68%. This percentage applied to total cost to give £3,493, and this multiplied by grossing-up co-efficient.

Pay - other. This includes various miscellaneous staff. No information is available on their deployment. Allocation based on the percentage of in-patient days of neurosurgery patients.

Drugs. The Director of Pharmaceutical Services estimated that the Neurosurgery Department is not a user of unusual and expensive drugs. In the absence of any further information, the drug cost for the hospital was apportioned on the basis of the percentage of in-patient days.

Dressings. Non-CSSD component for Nuffield 1 Ward was derived from Treasurer's tabulation. CSSD component for Nuffield 1 was calculated by taking a sample of a week's supply (weighting packs by 19, single items by 12, and disposables by 15) and expressing these as a percentage of the total supply during that week to the wards. Grossing-up co-efficient later applied.

Equipment. Derived by same method as for Dressings.

Treatment

Operating theatres. The Nuffield Theatre was used by patients from the Nuffield 1 Ward for 75.63% of the time. The cost of the theatre was calculated by taking the percentage time of total operating theatre time in the hospital and applying it to total costs.

X-ray. The computer tabulation gave the number of units of service provided to patients from Nuffield 1 Ward. These were costed at the average rate and the total was multiplied by the grossing-up co-efficient.

Pathology. A sample in one month of requests from different wards was made by the Pathology Department. This showed that patients in Nuffield 1 Ward generated 3.1% of the hospital's unweighted requests and 3.3% of the weighted requests. These percentages were applied to the costs for the hospital and the cost for Nuffield 1 Ward then multiplied by the grossing-up co-efficient.

Physiotherapy. From the records kept by the Senior Physiotherapist it was estimated that 4,076 units of service had been provided to patients from Nuffield 1, compared to 70,524 units for the hospital as a whole, ie 5.78%. This percentage was applied to the total cost and then multiplied by the grossing-up factor.

Pharmacy. Apportioned in the same way as drugs for wards.

Ancillary Medical Services. Occupational therapy: 125 units of service provided for Nuffield 1 patients out of a total of 2,318. Percentage applied to cost and multiplied by grossing-up co-efficient.
Medical Social Workers: apportioned on the basis of the percentage of cases.
E E G: based on estimate of 15% of units of service provided to neuro-surgery patients. Service was temporarily limited because of fire which has caused total figures to be low.
Cardiology; medical illustration and speech therapy: all costs apportioned to 'other' as no evidence that use made by neurosurgery patients.

General Services.

Nurses in training. Apportioned in the same proportion as nurse pay on wards.

Catering. Apportioned on the basis of in-patient weeks.

Staff residences. Estimated that approximately 75% used by nurses and 25% by medical staff. 75% of cost apportioned in proportion to nurse pay on wards, and 25% in proportion to staff pay on wards.

Laundry. Apportioned on the basis of in-patient weeks.

Power, light and heat.

Because of the problem of apportioning the heating of common areas, as an approximation the apportionment was made on the basis of the number of beds in Nuffield 1, multiplied by the grossing-up co-efficient.

Building & engineering maintenance. Apportioned as for 'power, light and heat'.

Medical records. Apportioned on the basis of the number of cases.

General administration. Apportioned on the basis of in-patient days.

General portering. Apportioned on the basis of in-patient days.

General cleaning. Apportioned on the basis of in-patient days.

Maintenance of grounds. Apportioned on the basis of in-patient days.

Transport. Apportioned on the basis of in-patient days.

Other services. Apportioned on the basis of in-patient days.

Direct credits. Apportioned on the basis of in-patient days.

NOTES ON THE DERIVATION OF THE COSTS OF
REGIONAL SPECIALTIES AT THE CHURCHILL HOSPITAL

BASIC STATISTICS 1972/3

	Neur-ology	Plastic Surgery	Radio Therapy	Thoracic Surgery	Renal Dialysis	Haemo-philia	Others	Total Hospital
Number of cases	1,304 7.80%	880 6.63%	837 6.31%	591 4.46%	320 2.41%	279 2.10%	9,323 70.29%	13,264
Number of in-patient days	12,487 13.76%	7,317 8.06%	7,419 8.17%	4,765 5.25%	6,140 6.76%	2,126 2.34%	50,524 55.66%	90,778
Average stay per case, days	12.08	8.31	8.86	8.06	19.19	7.62	5.42	6.84
Number of beds	46 13.77%	34 10.18%	29 8.68%	16 4.79%	20 5.99%	7 2.10%	182 54.49%	334

WARDS

Pay - medical. Identified by specialty from the Treasurer's tabulation. £13,962 for radio-therapy appears under the heading "Treatment: radio-therapy".

Pay - nurses. Calculated for Wards on basis of nursing days during year.

Pay - domestic. The number of WTE staff in each ward was expressed as a percentage of the total on the wards and this was applied to the total cost.

Pay - other. This includes various miscellaneous staff. £9,111 is attributable to the staff of the medical physics department and is thus apportioned to radio-therapy in this exercise. No information is available on the deployment of the other staff and the allocation of the remainder is on the basis of the percentage of in-patient days for each specialty.

Drugs. The Director of Pharmaceutical Services gave an estimate of the costs of those drugs which are specific to the specialties being studied over a six month period and the proportions applied to the costs for 1972/3. The residual which relates to general drugs was apportioned to the other specialties in proportion to in-patient days. The results are approximations and may underestimate the costs of the 'other' specialties. The reason for this is that the Pharmacy at the Churchill supplies several hospitals, and part of the costs of the expensive drugs of the specialties being studied may in fact be attributed to other hospitals because of the arbitrary method used for apportioning between hospitals.

Dressings and equipment. Of the total sum of £55,581, it is estimated that £17,356 relates to CSSD items. This was apportioned between the specialties by taking a sample of supplies going to the different wards, and after appropriate weighting for the different types of items, these were expressed as a percentage of the total and that percentage was applied to the costs. Of the remaining £38,225 spend on non-CSSD items, £3,779 related specifically to the medical physics department and is attributable to radio-therapy. The Supplies Officer suggested that the remaining items were distributed evenly between wards and so the £34,446 was apportioned on the basis of in-patient days.

Operating theatre. The number of minutes of operating time spent on patients from each ward was calculated and each specialty was then costed using an estimated cost of 25p. per minute.

X-ray. From a two-month sample, the number of units of service provided to each ward was obtained and expressed as a percentage of the number of units for the whole hospital. This percentage was then applied to the total cost.

Pathology. During a sample month, it was estimated that 6,202 unweighted requests were received from the whole hospital. The total medical pay of £19,924 was divided by 6,202 and multiplied by the number of unweighted requests for each ward. The requests were then weighted to take into account the materials used and the cost of the pathology laboratory excluding medical pay was divided by the total and multiplied by the number for each ward.

Physiotherapy. The number of half-hour units of service provided to each ward was expressed as a percentage of the total and applied to the total cost.

Pharmacy. Cost apportioned in same percentage as the drugs to the wards.

Ancillary Medical Services. Cost of medical social workers was apportioned on the basis of the number of cases. Occupational therapy apportioned according to percentage of time spent on different wards. E E G costed at an average of £28 per patient. Total E C G applied to thoracic surgery. Haemophilia centre was separately identified. The others were apportioned on the basis of in-patient weeks.

Nurses in training. Apportioned in the same proportion as nurse pay on wards.

Catering. Apportioned on the basis of in-patient weeks.

Staff residences. Estimated that approximately 75% used by nurses and 25% by medical staff. 75% of cost apportioned in proportion to nurse pay on wards, and 25% in proportion to staff pay on wards.

Laundry. Apportioned on the basis of in-patient weeks.

Power, light and heat. Because of the problem of apportioning the heating of common areas, as an approximation the apportionment was made on the basis of the number of beds in each of the wards concerned.

Building & engineering maintenance. Apportioned as for 'power, light and heat'.

of the number of cases.

General administration. Apportioned on the basis of in-patient days.

General portering. Apportioned on the basis of in-patient days.

General cleaning. Apportioned on the basis of in-patient days.

Maintenance of grounds. Apportioned on the basis of in-patient days.

Transport. Apportioned on the basis of in-patient days.

Other services. Apportioned on the basis of in-patient days.

Direct credits. Apportioned on the basis of in-patient days.

PSYCHIATRIC HOSPITAL EXPENDITURE OXFORDSHIRE 1971/2

Hospital	In-patients	Out-patients	Day-patients	Non-costed	Total £
Warneford	326,849	27,231	48,032		402,112
Park	72,226	14,708	6,656		93,590
Littlemore	815,793	31,405	89,077		936,275
Cotshill	149,965	-	-		149,965
Elms	17,300	18,170	-		35,470
Bradwell Grove	337,321	-	-		337,321
Thorncliffe House	10,019	-	-		10,019
Stapleton House	10,562	-	-		10,562
Isis Group				159,572	159,572
Total Oxfordshire	1,740,035	91,514	143,765	159,572	£2,134,886

APPENDIX F
TABLE 1

PSYCHIATRIC HOSPITAL EXPENDITURE BERKSHIRE 1971/2

Hospital	In-patients	Out-patients	Day-patients	Non-costed	Total
					£
Fairmile	1,011,636	4,087	10,624		1,026,347
Hungerford	141,900	-	-		141,900
Smith	72,874	-	9,077		81,951
Borocourt	753,062	-	13,053		766,115
Eldon Day	-	-	16,158		16,158
Clarefield Court	63,601	-	-		63,601
Wayland	140,138	-	110		140,248
Binfield Park	77,920	-	-		77,920
Church Hill House	313,918	-	2,379		316,297
Cumnor Rise	30,698	-	-		30,698
Style Acre	18,554	-	-		18,554
St Birinus Group				15,920	15,920
Total Berkshire	2,624,301	4,807	51,401	15,920	£2,695,709

APPENDIX F
TABLE 2

PSYCHIATRIC HOSPITAL EXPENDITURE BUCKINGHAMSHIRE 1971/2

Hospital	In-patients	Out-patients	Day-patients	Non-costed	Total £
St John's	934,808	-	39,562		974,370
Manor House	184,525	-	-		184,525
Royal Bucks Group (portion of)				15,209	15,209
Total Buckinghamshire	1,119,333	-	39,562	15,209	£1,174,104

PSYCHIATRIC HOSPITAL EXPENDITURE NORTHAMPTONSHIRE 1971/2

Hospital	In-patients	Out-patients	Day-patients	Non-costed	Total
					£
St Crispin	1,126,795	20,659	44,411		1,191,865
Day Clinics			56,445		56,445
Princess Marina	317,724				317,724
St Crispin Group				14,010	14,010
Total Northamptonshire	1,444,519	20,659	100,856	14,010	£1,580,044

APPENDIX F
TABLE 4

RESULTS OF CENSUS OF PATIENTS IN MENTAL ILLNESS HOSPITALS 31 12 1971

Hospital	Area of Residence					Total Patients in Region's Hospitals	Total Patients from Region
	Oxon	Berks	Bucks	Northants	Outside Region		
Oxfordshire							
Warneford	94	4	13	-	12	123	111
Park	10	-	4	1	4	19	15
Littlemore	475	2	9	6	29	521	492
Elms	8	-	-	3	-	11	11
	587	6	26	10	45	674	629
Berkshire							
Fairmile	73	605	-	-	15	693	678
Hungerford	28	98	-	-	3	129	126
Smith	7	18	6	-	2	33	31
	108	721	6	-	20	855	835
Buckinghamshire							
St John's	9	9	532	3	9	562	553
	9	9	532	3	9	562	553
Northamptonshire							
St Crispin	3	-	3	737	3	746	743
	3	-	3	737	3	746	743
Outside Region	0	394	69	19	-	-	482
REGIONAL TOTAL	707	1130	636	769	77	2837	3242

RESULTS OF CENSUS OF MENTALLY HANDICAPPED PATIENTS 31 12 1970

Hospital	Area of Residence					Total Patients in Region's Hospitals	Total Patients from Region
	Oxon	Berks	Bucks	Northants	Outside Region		
Oxfordshire							
Cotshill*	98	-	2	4	6	110	104
Bradwell Grove*	188	5	1	4	33	231	198
Thorncliffe House*	15	-	-	-	-	15	15
Stapleton House*	15	-	-	-	-	15	15
	316	5	3	8	39	371	332
Berkshire							
Borocourt	90	531	78	18	51	768	717
Binfield Park	-	51	-	-	12	63	51
Clarefields Court	-	42	-	-	21	63	42
Churchill House	-	147	-	-	51	198	147
Wayland*	11	118	4	-	2	135	133
Cumnor Rise*	-	32	-	-	-	32	32
Style Acre*	-	28	-	-	-	28	28
	101	949	82	18	137	1287	1150
Buckinghamshire							
Manor House	-	3	153	-	-	156	156
	-	3	153	-	-	156	156
Northamptonshire							
Princess Marina	-	-	-	69	18	87	69
	-	-	-	69	18	87	69
Outside Region	-	-	50	124	-	-	174
REGIONAL TOTAL	417	957	288	219	194	1901	1181

* Data kindly provided by hospitals themselves.

APPENDIX G
TABLE 2

PART B

COST-EFFECTIVENESS ANALYSIS OF THE COMMUNITY HOSPITAL PROGRAMME

PART B Cost effectiveness Analysis of the Community Hospital Programme

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SECTION 1 CHOICE OF COST-EFFECTIVENESS AS THE BASIS FOR ANALYSIS

1.1 Nature of the benefits of health care

The ideal approach in this appraisal of the Community Hospital Programme would have been to compare the benefits with its costs. On the assumption that the costs represent benefits foregone elsewhere, the choice of programmes and the determination of their level of funding could then be made in terms of maximising effectiveness, that is achieving the highest benefit-cost ratio overall. For such a benefit-cost study it would be necessary to quantify all the relevant multi-dimensional benefits and place a value on them in a form which renders them additive and comparative.* However, a brief consideration of the nature of the benefits of health care shows this to be impossible, at least within the scope of existing knowledge and techniques of measurement with the result that recourse must be made to a cost-effectiveness approach.

Medical benefits Medical benefits are the improvements in the health of patients which result from the application of health care resources, or as Cochrane (1972) defines them

> "the effect of a particular medical action in altering the natural history of a particular disease for the better".

FOOTNOTE* The benefits need not necessarily be valued in the market measure of "willingness-to-pay": indeed any attempt to ask people what they would place on health services is subject to such practical problems as to be of little value (Moser and Kalton 1971). It is sufficient for benefits to be measured in a common numeraire which reflects the value judgements appropriate to the situation - of the patient, his family, society in general and ultimately the 'decision-maker'

Medical benefits are often multi-dimensional, involving relief from pain, restoration of bodily function, change in mental attitude and so on. Attempts have been made to construct indices of medical effectiveness concentrating on a single dimension, the functional aspects of health. For example, Garrad and Bennett (1971) use a schedule of functional ability to construct a description of health status, though this in itself does not provide a scoring mechanism of outcome. Culyer et al. (1972) suggest a single qualitative index derived from a two-dimensional trade-off between painfulness and degree of restriction of activity, combined by a value judgement to give a ten point scale. Elsewhere the outcome benefit has been considered as the avoidance of a loss in functional ability which would otherwise have occurred or as Fanshel and Bush (1970) define it "the transitional probability of a change in functional state with time". The numbers on their scale are weights and not just rankings so that an improvement of two points on the scale for one person is 'worth' an improvement of one point for two people but this assumes there is no prior preference between the people by some other criterion.

The problems of an index can be considered in two parts, the practical problems of measurement and the philosophical as well as practical problems of weighting.

Some limited success has been achieved in deriving measures for particular types of patients. The measures which have varied, include physical standards such as blood pressure, functional performance such as chest expansion and static cycling, and the ability to undertake daily tasks such as getting out of bed, climbing stairs and so on.

However, the difficulties encountered are not inconsiderable, particularly as results must be reproducible when in many situations observer bias can occur or patient-observer interaction influence the results.

Even if the practical problems of measurement are overcome, there remains the problem of determining the appropriate weights to reflect the relative importance of the various characteristics measured, and to make an additive score. Because of the difficulty of inter-personal comparison of relative values, who should make the value judgement? While doctors are suited to advising on technical matters they are not necessarily better fitted to make value-judgements than anyone else. An alternative might be to ask the elected representatives of the public to do this but as Pole (1973) observes

> ".....while Ministers may be willing to take such decisions ad hoc, politicians are notoriously reluctant to answer hypothetical questions of the kind they would need to answer if a system of health indices were to be available in advance of the policy choice."

The problem of weighting different types of patients (by age, sex, diagnostic group etc) is even more controversial. Many people would find such a procedure morally wrong yet situations arise where a choice has to be made, the most dramatic being the selection of patients for life-saving procedures such as kidney machines. Loudon describes another example (1973).

> "Few would dispute that the vigour with which a patient with a stroke is treated and subjected to special investigations is likely to be much greater if the patient is 40 than if he is 80. Occasionally there is a definite policy as far as age is concerned".

If age is the only criterion for distinguishing between people then there is no need for an additional weight since the time period of the medical improvement can be incorporated in the index. If there is another criterion, such as family responsibility or occupation, then the question becomes highly controversial. Indeed some people would regard it morally wrong to make such judgements.

Contingent consequences Since health care is essentially a personal service, qualitative aspects of the care itself and the conditions in which it is provided may be deemed as important as the eventual outcome, particularly in the caring services. For, while patients may be willing to accept professional judgement on medical matters, they may not be indifferent to the various ramifications. As R Williams (1974) observes

> "Consequences contingent to the formal aims of the change evaluated are sometimes more serious than the formal results and cannot justifiably be ignored in evaluation".

A number of examples can be given. Firstly there are the qualitative factors which affect the comfort of the patients during their course of treatment. Johnston (1974) for example, collects patients' opinions on their state of anxiety, stress and depression during their period in hospital and their views on the physical amenities, food, privacy, and communications with the staff. In some respects

these factors may influence medical outcome: alternatively they may be considered as important aspects of health care outcome in their own right, particularly if ways can be found to improve them.

A second category concerns the consequential effects on the family and friends of a patient in terms of strain, inconvenience, disruption of normal life-style and so on, of importance where care at home is involved. For example, Kushlick (1972) in evaluating home and residential care for the mentally subnormal describes the burden on the family when home care is used.

Thirdly, there are the interests of the NHS staff. For example, the lack of success of mothers 'living-in'in children's wards has been attributed to opposition by the nurses (Robinson and Pill 1968). Lack of job satisfaction might be reflected in inefficient production and so need not be considered as a separate variable or it might be that, because of the personal and intimate nature of health care it should be considered as an end in itself.

Investment benefits Some health care expenditure can be regarded as an investment in human capital which generates a stream of returns in the form of a higher Gross Domestic Product than would have existed without it (review article Mushkin 1962). The returns are derived from reduced mortality, which increases the labour force, and from reduced morbidity, which cuts the work time lost through sickness and debility. The effect is likely to be most marked in under-developed countries where reduced mortality may increase economic growth, especially if dramatic improvements can be made by controlling killing diseases such as malaria, tuberculosis and yaws by pharmaceutical means. However, even then, the increase in the dependant section of the

population can result in a lower GDP per head than before (see Coale and Hoover 1968) so that the investment return is not an unqualified benefit.

In developed countries there are unlikely to be examples of substantial benefits from reduced mortality in the working population. The unhealthy features of our modern life-style - smoking, over-eating, and inadequate exercise - in general counteract the improvements in medical technology. The most recent example of a scientific discovery which influenced total mortality figures is the elimination of tuberculosis. The Office of Health Economics (1962) estimated that the expenditure on anti-tubercular compounds could be justified by £40m. production saved from reduced mortality and £15m. for fewer sanatoria beds and this calculation did not include the intrinsic value of lives saved or suffering relieved.

A further investment benefit is the saving of time, by patients, friends and relatives. Techniques devised in cost-benefit studies of transport systems can be used for attributing a monetary value to time saved. Where a patient is returned to work sooner as the result of a quick recovery, wage rates can be used if the wage is thought to reflect the value of the marginal product. However, it has been suggested (Doll 1973) that a reduction in the level of morbidity has little effect on total working time lost through sickness which is probably more closely related to job satisfaction. Investment benefits have the advantage over consumption benefits that they can be more easily quantified and expressed in money terms which facilitates a comparison with costs. However, in advanced

countries, these are unlikely to comprise the main benefits now being sought from an extension or change in health service programmes and to consider benefits in investment terms may even be misleading. For example, the saving of human life and the relief of suffering have values of a different order to the strictly 'economic' consequences. If health care programmes were directed primarily to achieving investment returns, the distrioutional effect would be to concentrate resources at the margin on the economically active, with preference to high earners, while ignoring the possibly greater medical and social benefits among others. In terms of the theory of Welfare Economics we should take the value an individual places on his own life in terms of how much he is prepared to pay to reduce the probability of premature death, and, or how much other people and society in general are prepared to pay, but it has not yet been possible to solve the problem of measurement. 'Investment returns are more easily measured but, although they might provide guidance on a minimum figure, their use does not resolve the fundamental issues.

Further practical constraints

The above list of benefits is not intended to be comprehensive or exclusive but is presented to illustrate their diversity and complexity. The problems of identification, quantification and aggregation are such that it is unlikely that we shall ever be able to derive a weighted outcome scoring system which embraces all benefits and is capable of generalised application. We are inevitably forced to a limited cost-benefit exercise where some of the benefits are identified and quantified, others merely described and their role in the final

summation left to judgement. Yet even in this limited ambition there is a further serious constraint, namely the cost of collecting data on a diverse range of benefits. The study which is reported here illustrates the problem. In many ways the conditions for a cost-benefit analysis seemed ideal. An experimental situation existed in the Oxford Hospital Region and full co-operation was provided by the authorities and local staff. The nature of the experiment was such that it was possible to identify a clear "before" and "after" situation. Also the appraisal of benefits was conceived as a team effort - the team including an epidemiologist, psychologist, sociologist, and management expert as well as economist. A full enumeration and quantification of all benefits were planned. Yet, despite the favourable circumstances, a full analysis has not been achieved. The main reason for this has been the enormity of the task in collecting data on so many outcome variables, the differences in which might eventually constitute the benefits. Because of the problem of anticipating the factors which might be relevant, initially every conceivable variable was included, though some were subsequently abandoned. Also a randomised controlled trial is being undertaken by which half a set of patients are selected for care in the Community Hospital while the other half have the alternative treatment: this trial has proved to be extremely expensive to administer and because of shortage of resources the volume of data collected has so far been insufficient to draw meaningful conclusions. It would seem likely that where benefits are diffuse, research success might only be achieved with a research effort whose cost cannot be justified in terms of the benefits derived.

1.3 The cost-effectiveness approach

The cost-effectiveness approach is used here to appraise the Community Hospital Programme. It is assumed initially that the outcome variables - in terms of medical effectiveness, contingent consequences and investment returns - are the same for the various sets of postulated alternatives. This is a standard technique for an analyst faced with the impossibility of a full cost-benefit analysis. Indeed most published studies of appraisal of health services by economists in the United Kingdom have taken this form. For example, Babson (1973) compared the resource costs of the treatment of hernias and varicose veins by conventional in-patient care and by day surgery. Also Piachaud and Weddell (1972) examined the costs of treating varicose veins by routine in-patient surgery and by injection - compression sclerotherapy in out-patient sessions. Both these studies apply to a field where the differences in benefits are likely to be small and this prompts the question, can the approach be used in a situation where benefits are more complex, as in this study of a major change in the delivery of health care?

It is recognised that there are disadvantages with the cost-effectiveness approach, though these also apply to a cost-benefit approach. Firstly, it is essentially a partial rather than a general equilibrium approach since only one or two alternative uses of resources are considered. Little information is derived about other possible uses of resources and it might be that none of the alternatives postulated is the 'best' use of resources. The objection is overcome if it is assumed that the question is clearly defined by the originator of the research and that, in his judgement, other alternatives are not feasible. Alternatively,

a dynamic modelling approach can be tried though this is often constrained by lack of reliable input data or the sheer research cost involved.

Secondly, having argued that market prices cannot be used readily for the valuation of all benefits, it is debatable whether market prices should be accepted without question for costs, for to do so implies that the rest of the health care system is in equilibrium, both between the health system and other economic activities and also between the various inputs within the health system. Market imperfections due to monopoly elements, such as the method of training and registering doctors, cause a divergence between actual costs paid and the true opportunity costs. Although this problem is often recognised by analysts, it is generally ignored in practice and assumed that the distortions do not influence the conclusions. In this study, market prices are used for inputs except in the Appendix which comprises a special analysis of the costs of general practitioners' services.

Lastly, perhaps the most serious objection to the cost-effectiveness approach is that it is not always possible to be certain that the benefits are exactly the same in the two alternatives. Doubts often remain on qualitative aspects which are not capable of measurement. A number of examples emerge in the following study, in particular patient comfort when a comparison is made of different nursing levels in hospital wards and, later, the preferences of patients and their families (which may sometimes conflict) when considering the alternatives of domiciliary or institutional care. Yet these qualitative aspects may ultimately be the critical factors in any decision. Mishan (1971)

called this the 'horse and rabbit stew'problem, namely that in a cost-effectiveness approach only one element, and perhaps the least important one, the rabbit, is being quantified with spurious precision while there remains a large complexity of variables which are ignored because they cannot be easily quantified but which are the more important, that is the horse. Undue importance is then placed on the rabbit even though its flavour is swamped by the horse.

It might be thought that the cost-effectiveness approach with its constraining assumption of equal outcome from alternatives can have little practical value. Basically it postulates that as the outcome is the same, the alternative which uses the fewer resources is to be preferred (since the resources 'saved' can generate benefits elsewhere). However, the situation is rarely as simple as this and a well constructed cost-effectiveness analysis should anyway be capable of answering far more questions than this. For example it is usually possible to identify critical factors which influence the efficiency of the service or activity, and to recommend changes in organisation, administration or method of care used. Where benefits are not identical, it should nevertheless be possible to describe the range of differences and relate them to cost differences so that a rational choice between alternative benefits can be made in the light of the resource implications.

The study which follows is based on the acceptance that there are severe data limitations in analysing the benefits from health care. It is argued that the data which are available must be manipulated as scientifically as possible to make the decision-making process more

rational. Such an approach is acceptable so long as the assumptions are specified and the point where analysis ends and judgement begins is clearly identified.

SECTION 2 A DESCRIPTION OF THE COMMUNITY HOSPITAL PROGRAMME

2.1 The background to the policy

The development of the hospital service in the 1960s was focused on the expansion of acute treatment facilities and the formation of large, comprehensive District General Hospitals. In the 1970s the emphasis is shifting towards the development of community orientated health care. The Community Hospital Programme represents a precursor of this trend and, if successful, may lead to a health policy for the next decade of a well endowed primary care system, linked via Community Hospitals to acute care facilities.

During the 1960s the hospital building programme concentrated on large specialist hospitals. Economies of scale were thought to be important, promoting lower average costs as well as services of improved quality. The Hospital Plan for England and Wales (Ministry of Health 1962) laid great stress on the need for inter-dependence of the various branches of medicine and advocated the concentration of all facilities necessary for diagnosis and treatment on a single district site. The main unit for hospital provision, the District General Hospital (DGH) should ideally have between 600 and 800 beds, and should serve a population of between 100,000 and 150,000 people. Only in rare circumstances would a new hospital be built with less than 300 beds. Moreover, many of the existing small hospitals were to be made redundant, though some might be retained for maternity and geriatric units, for medical emergencies not requiring specialist services, or for the provision of out-patient services. The Hospital Building Programme

(Ministry of Health 1966) reiterated the policy of concentration though it did discuss the possibility of the use of beds in District General Hospitals by general practitioners thus providing a link between primary and secondary care.

The Report of the Committee on the Functions of the District General Hospital (Central Health Services Council 1969) took the policy trend one stage further by arguing that small hospitals for towns within reach of a DGH should be closed and expressed the view that even in remote areas, it was more realistic to improve communications than to retain small inefficient hospitals.

Over the past fifteen years, the number of small hospitals has been falling steadily, as shown in table 1. There were 1,177 hospitals with fewer than 50 beds in 1959 and only 877 in 1973. Nevertheless, hospitals of this size still represented 38% of all non-psychiatric hospitals in 1973. Also, while the actual number of hospitals in the range 50 to 249 beds has been declining, the proportionate share of these medium sized hospitals has not been falling and in 1973 they incorporated 37% of non-psychiatric beds and represented 45% of the hospitals. The building programme has been concentrated on large hospitals, the number of which in the range 500 to 999 beds has increased. Even so the impact on the total stock has been small and the proportionate decline of small hospitals has been slow. The major constraint to a shift in the balance between small and large hospitals has been the political difficulty of actually closing hospitals, particularly as many of the smaller hospitals were originally built by public subscription and have retained local support so that a proposed closure is strongly resisted by campaigns and petitions.

By 1970 an alternative policy began to emerge in the Oxford region which may counter-balance the policy of concentration and create a new direction of health service development. This is now called the Community Hospital Programme which entails the establishment, by new buildings or by the adaption of existing buildings, of hospitals of up to about 150 beds each serving a population of up to 100,000 in areas peripheral to DGHs and under the control and supervision of the local general practitioners. These do not replace the services of the DGH but complement them and also provide a bridge between specialist facilities and primary health provision at community level.

The Community Hospital Programme is at present an experimental scheme in the Oxford Region, supported by the Department of Health and Social Security. The Oxford Region was considered appropriate because, although there are eight district centres, seven of which have full DGHs, there are also a large number of small, rural market towns, and of the 103 hospitals in the pre-1974 region, 46 have fewer than 50 beds. Discussions held from 1967 onwards between all the parties interested in health care delivery about continuing concentration, revealed a widely held view that the creation of a ring of supporting peripheral hospitals around a DGH would provide a more efficient method of expanding the hospital service, as well as being more accessible for patients. It was also felt that very large DGHs were impersonal for both patients and staff: in contrast admission to a small hospital, near to a patient's home and with supervision by a GP already known to the patient, would provide a more acceptable form of hospital care, especially for an elderly patient.

It had already been shown that a significant proportion of patients in DGHs do not require the full range of specialist treatment and diagnostic services, or at least not for the entire period of their hospitalisation. For example, Loudon (1971) examined over 600 consecutive admissions during March 1970 to the Radcliffe Infirmary, Oxford, and, according to his professional judgement based on the evidence available, concluded that 16% of medical patients were suitable for care in local hospitals under the responsibility of general practitioners, that 23% of surgical patients and 11% of medical patients could have been transferred during their period of hospitalisation: altogether the use of such peripheral units, applying his criteria would have resulted in a reduction of 29.9% of the bed days for medical patients at the Radcliffe, and 20.3% for surgical patients.

The features planned for a Community Hospital (CH) in the Oxford Region are as follows:-

a in-patient wards under the control of general practitioners, with consultant collaboration. (This provides the link between specialist DGH care and primary care).

b a health centre on the same site as the hospital, used for GP surgeries and community health service clinics (e.g. child health clinics)

c specialist clinics held by visiting consultants from the DGH

d day ward facilities for rehabilitative treatment for the disabled who are otherwise cared for at home

The policy stipulates that the CH should not provide intensive treatment facilities but should concentrate on nursing care and rehabilitation.

The categories of patients considered suitable for in-patient admission are:-

1 Pre-convalescent post-operative surgical cases, transferred after the operation at the DGH, requiring nursing care and medical supervision before discharge home.

2 Acute medical cases who would otherwise be admitted to a DGH, not for intensive treatment but for continuous nursing care which cannot be provided at home.

3 Medical cases transferred from other hospitals.

4 Medical cases who would otherwise be treated at home, including holiday admissions and selected terminal care patients.

The Department of Health and Social Security has issued guidance (DHSS 1974) on the creation of CHs nationally. Their proposals are broadly in line with the policy of the Oxford Region except that greater emphasis is laid on the provision of facilities for geriatric patients and patients with senile dementia and for these, there is flexibility on the question of medical management and the roles of consultants and general practitioners. The Department has also issued a policy recommendation (DHSS 1975) which has implications for subsequent appraisal:

"It is hoped that about four-fifths of community hospitals can be created through change of use of existing small hospitals. These may well need adaption or extension, but the capital cost should be considerably less than new building."

Thus, in the near future, the majority of CHs are likely to be converted existing hospitals for which there is no alternative use in the health service, at least in the long term, and which, had the

recommendations of the late nineteen sixties continued, (notably Central Health Services Council 1969) would be closed. The significance is that the low opportunity cost of existing small hospitals plus modest conversion costs substantially influences the cost comparisons.

2.2 The Experiment

A number of CHs are at present being planned in the Oxford Region but to date, experimentation and appraisal have been confined to two wards. The first is the Norman White Ward at Peppard Hospital which was reopened in December 1969 with 15 beds as a CH ward, separate from the rest of the hospital. Peppard Hospital is about seven miles outside Reading and was originally a chest hospital. There was no other use planned for the ward at the time and the conversion was achieved at the modest cost of £4,500, with donations from the local villages for furnishings.

At first the ward was available for use by three GPs working from a health centre one mile away, and serving a population of 7,300. In April 1971 three more GPs with a surgery four miles away joined the scheme, adding a further 5,500 to the catchment population. The 15 beds are grouped in units of 5,5,4 and one single room. There is a treatment room, dining room and offices. A day ward was opened in July 1973. Diagnostic services are provided either by Peppard Hospital or by the Royal Berkshire Hospital in Reading. Supporting domestic services are provided by Peppard Hospital. The nursing service, on the other hand, is indepèndent with the special feature that the ward nurses and district nurses rotate between ward duties and domiciliary duties with the advantage that the nurses on the ward

are aware of the patients' social conditions and also that patients get to know the nurses in both situations so that admission to hospital, especially for old people, is a less worrying experience. The Norman White Ward was originally intended as an experiment for the development of larger CHs elsewhere in the Oxford region. Because of its success, it has continued in operation.

Then in September 1973, the first purpose-designed CH was opened in Wallingford. The single site, close to the town centre, comprises a health centre, community health clinics, peripheral consultant clinics, a 17 bed general ward, a 17 bed maternity ward, a 20 place day ward and various treatment facilities. (A further ward of 38 beds is planned with additional treatment facilities). The catchment population is about 30,000 which includes the former municipal borough of Wallingford and surrounding villages. The health centre accommodates the surgeries of a partnership of 5 GPs, with a practice list of about 14,000. The general ward is also used by the patients of a further 6 GPs whose surgeries are in the surrounding villages. The other members of the primary health team, the district nurses, midwives, and health visitors also have offices on the site so that it serves as a focal point of all the health care activities. The district nurses staff a treatment room where minor surgical procedures, dressings and injections are undertaken. This also serves as a minor accident room.

2.3 The components of the cost-effectiveness analysis

The Community Hospital Programme, if it were to become national policy, would have far reaching effects on many aspects of the NHS such as the hospital building programme and the training and recruitment of

General Practitioners. However, for practical reasons, it is necessary to confine the appraisal to the experimental situation in Oxford, drawing some conclusions which will have general application.

The appraisal is limited to the in-patient general wards and the day care facilities, the essential new features of the policy, at Wallingford and Peppard Hospitals. At Wallingford the maternity ward (which is administered separately from the general ward), the consultant clinics and GP surgery were facilities already available before CH was opened. While benefits may be gained from concentrating them all on a single site, it is not proposed to examine them as they are not essential features of the CH concept.

It is unlikely that CHs would become national policy unless it can be demonstrated that a patient's medical progress is not jeopardised: indeed it might be expected that in the more relaxed atmosphere of a small local hospital, compared with the pressures of an acute ward, some patients would recover more quickly. Moreover the patient is cared for by his own general practitioner to whom he will already be known. Apart from medical consequences, health service planners also hope that CHs will be acceptable socially since in most cases, they are more convenient to reach than a DGH, are staffed by local people and attract voluntary help.

For the reasons given in Section 1, the study reported here is confined to a cost-effectiveness approach and it is <u>assumed</u> that there are no significant differences in medical outcome, personal preferences or other consequences. An analysis of these factors is being undertaken by other members of the Health Services Evaluation

Group (Bennett 1974). The results will not be reported for some time because, so far insufficient numbers of patients have been fully assessed to draw meaningful conclusions. Tentative observations suggest that no significant differences are apparent. Certainly it would be surprising if obvious differences of medical outcome did arise because the selection of patients is controlled by prescribed admission policies and periodically reviewed by the Medical Committee to ensure that no patients are inappropriately admitted. Also to date both the Norman White Ward and the Wallingford CH have been welcomed locally, though there is some superficial evidence to suggest that the preferences of patients vary with age, admission to the in-patient wards being preferred more by the older patients than the younger patients since the latter are always in the minority.

Five aspects of the CH programme are considered here.

Firstly, an examination is made of the costs of existing small hospitals. Although a comparison of the average costs of small and large hospitals is inappropriate because they are fulfilling different functions, a study of the average costs of small hospitals which have similar functions may indicate whether or not there is a relationship between average cost and size and, if there is, what the minimum cost size for CHs is likely to be.

Secondly, a study is undertaken of the capital costs of CHs to see if cost advantages can be gained by building small peripheral hospitals rather than expanding existing DGHs.

Thirdly, data on in-patient admission to the two experimental CH wards are examined and the alternative form of care postulated.

The two main categories are the surgical patients who are transferred to the CH after their operations, and the medical patients who would otherwise be admitted to the DGH. A cost comparison is then made of the resources involved with each of the alternatives.

Fourthly, the day care facilities are considered with the in-patient costs of those patients who would otherwise be treated at home. It is argued that the objective of the treatment is to delay the patients' admission to permanent long stay hospital care. The cost-effectiveness of the CH services must therefore be judged by comparing the cost difference between domiciliary care and long stay hospital care.

Lastly, in the Appendix one problem of extending the CH policy nationally is considered, namely the effect in terms of work-load and financial return on the general practitioner service.

The formulation of conclusions about the CH concept in the Oxford region requires a number of assumptions about the relationship between the CHs and DGHs. The empirical studies are limited to two small experimental situations and the impact of these wards on the existing DGH system is negligible. However, if a large number of CHs were eventually to be built in the region, the impact would be considerable. It was argued (Oddie et al. 1971) that the number of CH beds should constitute part of the overall bed provision, namely that a quarter of the beds per head of population should be in a CH, and this is, in fact, the accepted policy of the Oxford Regional Health Authority. However, the way this is achieved affects the analysis. For example, if patients are admitted to CH beds instead of DGH beds, beds are released at the DGH. A number of consequences follow. Firstly the beds may be used by other patients who would otherwise not be treated.

No resources at the DGH are saved but greater throughput overall is achieved. In this case the simplicity of the cost-effectiveness approach is lost. Secondly the occupancy at the DGH may be reduced, that is fewer patients treated and beds left idle for part of the time. The cost saving in this case is the hotel costs such as catering and laundry, some marginal treatment costs such as drugs, and if the nursing complement is reduced, then some nurse staff pay. The third possibility is that a whole ward at the DGH is closed with a saving of ward costs, hotel costs and marginal treatment costs. The fourth possibility is that because of the rising population, additional hospital beds will be provided anyway as a matter of policy. Those which are provided in the CH would otherwise have been provided at the DGH. The conclusions about cost effectiveness depend on the assumption made. In this exercise the fourth possibility is considered because population projections for the Oxford region indicate an increase of 3.0% per annum. It is assumed that the alternative to building a CH is to provide <u>additional</u> ward facilities at the DGH, the cost of which can be deduced from existing DGH wards.

SECTION 3 ANALYSIS OF AVERAGE COSTS OF SMALL HOSPITALS

3.1 Hospital costing in the NHS

Before the establishment of the NHS in 1948, the voluntary, local authority and state hospitals used a variety of accounting procedures. In 1950 the first uniform system (see Montacute 1962) was introduced by the Ministry of Health. This was based on subjective or input headings with no breakdown of costs between departments and only a notional, arbitrary allocation between in-patients and out-patients. While it fulfilled audit requirements it had little further value. For decision making purposes, it is necessary to relate costs to defined end products and also to provide them in a form which makes inter-hospital comparisons meaningful. In 1957 a new scheme of departmental costing was introduced, though only for large hospitals initially. However, the arbitrary methods for apportioning costs between the departments - patient departments (wards, clinics, casualty,etc.,), medical service departments (X-ray, physiotherapy) and general services (laundry, catering) - varied so much between hospitals that little reliance could be placed on the figures for comparative purposes (see discussion Montacute 1962 page 90). The position was clarified by 1966 when a uniform system was introduced and quickly applied to all hospitals, though doubts must remain about some of the apportionment methods. The costs of each hospital are classified as in-patients, out-patients and, where the numbers justify it, day-patients. Within each broad category, the costs are sub-divided under the following headings:-

1 Ward costs: medical pay, nurse pay, domestic and other pay, drugs and dressings dispensed on the wards, equipment and other ward services (eg ward cleaning).

2 Treatment costs: operating theatres, X-ray, pathology, physiotherapy, and ancillary medical services (eg occupational therapy, social workers).

3 General services: including catering, laundry, power light and heat, maintenance and administration.

For the most part, the ward and treatment costs include actual salaries and supplies and no attempt is made to allocate the general service costs to the wards and treatment departments. Cost data for all hospitals in the country have been published annually by the Regional Hospital Boards, up to 1972/3. The DHSS also published a summary of regional average costs for each category of hospital. In an attempt to relate the costs to outputs, the data are presented as 'costs per in-patient week' for all the cost headings, with also a single 'cost per case'. Out-patient costs are expressed as 'costs per 100 attendances'. (Detailed data are not available for 1973/4 because of the re-organisation of the NHS in 1974 and also the phased introduction of a new accounting system).

The usefulness of the published cost data for decision-making purposes is limited for two main reasons. Firstly the returns relate only to revenue (ie current) expenditure and do not include a capital component. This means that depreciation is not included and also that variations between the revenue costs of different hospitals may be explained by differences in capital assets. The absence of routinely available data on capital values means that for decision-making purposes, capital costs must be assessed as a separate exercise. For the purposes of this study of CHs, it was necessary to undertake a hypothetical comparison, as in the next section.

The second limitation of the published revenue costs is the lack of a reliable measure of output. Some progress has been achieved for the service departments; for example the cost per weighted pathology test, and the boiler cost per 1,000 lb. of steam raised give an indication of the efficiency of that particular service, though it is still not possible to determine whether the number of pathology tests or lb.s of steam are cost-effective in terms of patient recovery or comfort.

Since the objective of the short stay hospital is to provide treatment and bring about the recovery of a patient, cost per case would seem to be the more appropriate unit of measurement. This is derived by taking the total cost and dividing by the number of deaths and discharges during the year. One immediate difficulty is that when a patient is transferred from one hospital to another he is counted as an additional case. But more fundamental is the problem identified by Feldstein (1967) that the cost per case depends very much on the clinical specialty concerned, and inter-hospital comparisons of costs per case are meaningful only if adjusted for differences in case-mix. Feldstein examined the costs per case of 177 acute non-teaching hospitals in 1961 and calculated a multiple r^2 of a linear regression equation which related cost per case to the proportions of cases in nine diagnostic categories: this suggested that case-mix explained 27.5% of the variation. Obvious explanations of this are that particular medical services are specific to particular diagnostic groups, for example operating theatres relate only to surgical patients. Also the average length of stay varies between diagnostic groups.

Cost per in-patient week on the other hand is a more appropriate unit for long stay hospitals, especially where the number of deaths and discharges in a year is less than the number of patients treated. However, cost per in-patient week has been the preferred unit for all types of hospitals because it is less sensitive to differences of case-mix, particularly for general services such as catering and laundry, and it is these costs over which the hospital administration can exercise the most control.

For treatment and ward costs, neither cost per case nor cost per in-patient week can be regarded as adequately reflecting the relationship between cost and output, when output is considered in terms of the medical and social consequences. A low average cost might indicate an efficient service or a poor quality service; a high average cost an inefficient, extravagant service or good quality. In the absence of a means of assessing which applies, the conventional NHS approach has been to argue that 'convergence towards the norm' is desirable, namely that unless special factors exist if the costs of one hospital are substantially greater or lower than the national average for that type of hospital, it is a signal that a closer investigation needs to be made. Unfortunately, even though the costs are averaged for 13 categories of hospitals, eg acute, long stay, mentally handicapped, the variations about the means are considerable and the debate at management level usually centres upon the 'special factors'.

3.2 Analysis of average costs

Data of average costs of hospitals are of limited value in assessing the cost-effectiveness of CHs since an analysis of marginal costs is

necessary to compare the cost of the CH service with the alternative. For example, it would be quite wrong to argue that, because the national average cost per in-patient week in 1972/3 was £91. in acute hospitals over 100 beds and only £67. for acute hospitals with under 50 beds, small hospitals are cheaper than large hospitals for all, or indeed any, types of patient. However, as long as the data are confined to hospitals offering treatment and care facilities similar to CHs, average costs should be useful in testing for economies of scale, namely whether it is cheaper to provide CH-type services in larger or smaller units. The Norman White Ward has only 15 beds, and the Wallingford CH has 34 beds (17 general and 17 maternity). Because they need to be located near the community they serve to fulfil their function, it is inevitable that the hospitals should be small by national standards but it would be helpful to know whether cost penalties are attached to particular sizes. Small hospitals of under 100 beds, particularly cottage hospitals with GP beds, provide services sufficiently similar to those of CHs to argue that an analysis of historical costs offers guidance on the relationship between costs and scale.

Data were obtained from the 1970-1 cost returns for 525 hospitals, all with less than 100 beds and all classified as acute or maternity, that is they treat relatively short stay patients. Long stay hospitals - geriatric, chronic sick, psychiatric and other specialised hospitals - were thus excluded. The distribution of the hospitals by size is given in table 2. The hospitals were from all the regions of England and Wales. Very few were from the central London area, which might cause the costs to be higher, and as most input costs are determined

nationally, notably staff salaries, one would not expect substantial regional variations. However, other factors may have an influence on costs, such as the age and condition of the building (although all hospitals in this size range predate the NHS) the local availability of staff, the relative generosity of the Hospital Management Committee (now the Area Health Authority) in supporting small hospitals, and so on. Because of lack of data, it was not possible to allow for these factors.

As mentioned above, Feldstein highlighted case-mix as the most important factor influencing costs for the acute hospitals he studied, in the range of 72 to 1,064 beds. He found that scale had very little effect on costs. When adjusted for differences in case-mix, the average cost function was mildly U shaped, with a minimum at 310 beds. The r^2 for the regression of adjusted costs on size was only 0.308 and that was almost entirely explained by the relation between case-mix and size.

For this study of small hospitals, data on case-mix are not available in such detail. Indeed from a knowledge of the cottage hospitals in the Oxford region, it would seem that beds are not allotted to particular specialties and, on the official returns, SH3, patients are mostly classified as 'maternity', or 'other'. It was not possible to allow for case-mix as explicitly as Feldstein did, except by identifying 'maternity'. On the other hand it is recognised that it is necessary to allow for differences in "medical intensity", that is the range of treatment facilities available.

When the total expenditure of each hospital is plotted against the number of beds, the points should lie on a straight line from the origin if average expenditure per bed is independent of the size of the hospital. However, as can be seen from figure 1, the cost for larger hospitals tends to increase faster than would be expected for a straight line fit, implying that the lower average expenditure is at the lower end of the scale. In other respects the graph offered the prospect of a fairly good regression fit. The use of average costs against the number of beds was discarded because of the problem of the regression fallacy, namely that regressing total expenditure divided by the number of beds against the number of beds would give a spurious negative correlation. However, a problem of using the total expenditure is the possibility of heteroscedasticity, that is the deviation from the regression line increases with scale. A test revealed that this was so. The hospitals were grouped as in table 3 and an average cost per bed, calculated for each group. It can be seen that the variance increases with size. This can be overcome by taking a logarithmic transformation of the data, the variances of which show that the errors are now homoscedastic. (The functional relationship between the log. of total expenditure and beds plus beds squared is illustrated in figure 2.). A linear regression of transformed total expenditure against number of beds gave a satisfactory fit, $r^2 = 0.867$. However, as would appear from figure 2, a quadratic function gave a significantly better fit with $r^2 = 0.895$. The regression equation is:-

$$\log (\text{total expenditure}) = A + B\ \text{beds} + C\ \text{beds}^2$$

where $A = 13.89562$

$B = 0.05105$

$C = -0.00022$

and the standard errors are 0.00183 for B and 0.00002 for C. The size of hospital with the lowest average cost per bed can now be found by minimising the above equation, divided by the number of beds, that is

$$\min y = \frac{\exp.\ (A + Bx + Cx^2)}{x}$$

By differentiation min. y is obtained when

$$x = \frac{-B + \sqrt{B^2 + 8C}}{4C}$$

Substituting the values of B and C, the min. y is found to be 24.96. Thus the hospital size with the lowest cost per bed appears to be 25 beds. Substituting 25 in the regression equation gives a total expenditure of £42,382, and an average cost per bed of £1,695. Despite the high r^2 of the regression, there is nevertheless a considerable variation and at the 95% confidence level, the mean cost per bed for all hospitals with 25 beds falls between £1,659 and £1,732.

Predicted values for different sizes are given in table 4 and the cost curve in figure 3. These show that economies of scale accrue very quickly moving along the scale. A 15 bed hospital has an extra 9.3% cost per bed compared with a 25 bed hospital. Also as size is increased from 25 onwards, average costs rise fairly quickly. A 50 bed hospital is 18.6% more expensive per bed than a 25 bed hospital and a 75 bed hospital 42.4% more expensive still. However, it would be wrong at this stage to conclude that this is evidence of diseconomies of scale. One other possible and seemingly obvious explanation for the rising cost curve is that small hospitals

have a much lower pace of throughput than larger hospitals, that is they treat fewer patients per bed. This could be associated with a longer average length of stay or a lower occupancy rate (ie a longer period when the average bed is vacant). To test this possibility data on the occupation rate, defined as the average number of days in the year a bed was occupied, and average length of stay were added to the regression. The occupation rate proved to have a very weak positive correlation with bed size, r = 0.09258 but this did suggest that, very slightly, larger hospitals used their beds more intensively. Similarly, average length of stay had a slight negative correlation with size, r = -0.09105, indicating that people stay in larger hospitals for a shorter period. Combined with the high occupation rate, it would appear that larger hospitals have a faster turnover of patients, though the effect is slight. When the occupation rate and average length of stay were added to beds and beds^2 and regressed against the log. of total expenditure, r^2 increased to 0.91106, a significant though slight improvement on the previous regression. The values were B = 0.05101 and C = -0.00023 with standard errors of 0.00169 and 0.00002 respectively. Using these values a minimum average cost bed size was found to be 25.44, only slightly higher than before. It is concluded that differences in throughput per bed explained very little of the rising cost curve. Another possible explanation for the low size of the minimum average cost hospital is that very small hospitals provide a low level of medical treatment and admit only the simplest of cases. As hospitals get larger so the range of treatment facilities increases and costs rise. To examine this, total expenditure was divided into the following categories:-

1 Pay of nurses on wards

2 Pay of other staff on wards, eg doctors and domestic staff

3 Other ward costs, eg drugs, dressings, equipment

4 Treatment costs, eg physiotherapy, occupational therapy, X-ray, pathology and operating theatre

5 General services, eg catering, laundry, heating.

Data of each of these were transformed into log values and then regressed against beds and beds^2. The r^2 values, minimum average cost bed size, regression equations and 95% confidence limits for the means are all given in table 5. Predicted average costs for the range of hospital sizes are given in table 4 and the average cost curve illustrated in figure 3.

As can be seen, nurse pay is at the minimum at 35 beds, but does not seem to rise markedly with size after that. However, 10 and 15 bed hospitals have a high average nursing cost. Other staff pay rises faster than nurse pay as hospital size increases and this is probably explained by the greater use of specialist medical staff in larger hospitals and less dependence on GPs. Both ward costs and treatment costs rise very considerably as size increases: the treatment cost in a 75 bed hospital is seven times that of a 25 bed hospital which suggests that the type of medical treatment being given is quite different. Thus the data cannot be used as evidence of diseconomies of scale.

However, diseconomies of scale do seem to exist with general services and the rising cost is perhaps surprising. These services which include catering, laundry, administration, power, heat and light are the very services where one might expect falling average costs to

scale. There are three possible explanations. Firstly as a hospital is increased in size, so at certain critical stages, not the same in all cases, it becomes conventional to employ a specialist to run or manage the service, for example a catering officer as well as a cook, a mechanic and electrician as well as a handyman, and so on. Secondly small hospitals receive support services, such as transport, from larger hospitals but may not be charged for the costs. Thirdly, the rising costs may indicate improved quality.

One important conclusion so far is that very small hospitals, with up to 20 beds have higher average costs than larger hospitals despite low treatment costs. But above this size, apart from general services, which evidence some form of diseconomy to scale, the rising average cost curve seems to be explained in terms of increasing treatment facilities and, presumably a different type of patient. It appears from the analysis that in terms of staff pay, which includes nursing, a 30 to 35 bed hospital has a lower total average cost than a hospital in the 50 to 70 bed range. But this too may result from treating more seriously ill patients in the larger hospitals, as indicated by the rising treatment costs. We need therefore an estimate of staff costs and general service costs which are related to size but unaffected by more intensive treatment in the larger sizes. To examine further the effect of rising treatment costs on other costs, the 525 hospitals were broken down into the following six categories:-

1 Acute, staffed mainly by consultant medical staff (104)

2 Acute with some GP beds and with operating theatres (149)

3 Acute with some GP beds without operating theatres (98)

4 Mainly GP beds with operating theatres and with some maternity beds (48)

5 Mainly GP beds without operating theatres and with some maternity beds (43)

6 Maternity only (83)

The numbers in each category are given in brackets.

The regression analysis used before was applied to each of the six categories of hospitals, ie regressing beds and beds^2 on the logarithmic transformed data of total expenditure and its components. From the equations obtained, predicted average costs per bed were derived and the minima estimated. The r^2 values are given in table 6. These remain high (except for treatment costs in categories 3 and 6 though these are still significant) so that a reliable fit was obtained. However, as shown in table 2 only just over 12% of the total number of hospitals fall in the 60 to 100 bed range and, by the time these are divided into six categories, there are very few in each category. The result is that these few observations have a far greater influence over the regression equation than the hospitals with fewer beds and this affects the predicted values in the upper range. Indeed there are so few in the 80 to 100 bed range that it was decided to ignore predicted values beyond 80 beds. Even so in category 5, for example, the predicted value of total cost at 80 beds is £1,448 which is less than the minimum identified in the lower range at 35 beds, namely £1,472. The curve indicates a falling average cost from 60 beds onwards but because of the few observations beyond 60 beds it is not possible to say where the true minimum is or indeed whether the falling curve is the result of one or two non-typical observations.

Comparing the predicted average costs of categories 2 and 3 (see tables 9 and 10) it can be seen that the existence of an operating theatre in a hospital, as expected, has a considerable effect on treatment costs: the minimum average treatment cost with an operating theatre is £142 (category 2) and without an operating theatre, £15 (category 3). Nevertheless the relationship between costs and size is similar in both cases, with a minimum average cost size of around 25 beds so that the analysis of economies of scale does not seem to be affected by this variable.

The average costs of maternity-only hospitals, category 6, are greater than for all the other hospitals, the main difference being nursing pay. Nevertheless if category 3 is compared with category 5, the existence of some maternity beds in the latter seems to have had very little effect on the average cost of category 5 and over most of the range the average costs of category 5 are lower than category 3. This probably arises because the numbers of maternity beds in GP hospitals are very low.

Category 5 hospitals have no operating theatres and are staffed by GPs and thus have features closest to CHs. The important characteristic of the category 5 hospitals revealed in table 12 is that average other ward costs and treatment costs remain almost constant throughout the range of hospital sizes which would suggest that the type of patient and the type of treatment does not vary with size. Thus it is possible to relate nurse and other staff pay and general service costs to size alone, unbiased by the existence of increasing treatment facilities found in the larger hospitals in the other categories. Under these circumstances the shape of the average cost curve is

much flatter. Nursing costs fall to a minimum at 45 beds but rise very little with the larger hospitals. Other staff pay and general services costs fall to a minimum at 30 beds and then rise slightly. While the minimum total average cost size is 35 beds, a hospital with 60 beds has average costs only 2% higher and beyond that size the costs may fall again, though in the analysis the few observations over 60 beds make the predicted values unreliable. Given the observation that there appears to be little variation in average costs between 30 and 60 beds, then the size of a CH can be selected by reference to the size of the likely catchment population and the geographical location which minimises the cost and time of travelling by patients, visitors and staff.

The most important conclusion to be drawn from the analysis is that substantial cost penalties accrue to hospitals of under 30 beds, with an average cost 10% greater than the minimum at 20 beds, and 22% greater at 15 beds. And as both the CH units being appraised in the Oxford region have less than 20 beds, this may prove to have an important bearing on the analysis.

SECTION 4 CAPITAL COSTS

4.1 Introduction

The Wallingford Community Hospital is the first hospital of its kind to be built since the formation of the NHS. Others are planned for Witney, Milton Keynes and Corby. It is also possible that existing cottage hospitals, for example at Wantage, Didcot, Abingdon and Watlington, will be converted to CHs and indeed the DHSS expects that most CHs will be in this form (DHSS 1975). This section considers the capital costs in the two situations, namely building new CHs and the conversion of existing hospitals, though because of data availability mainly the former.

The costs of building new CHs can be estimated from the actual cost of Wallingford phase I and from the plans for Wallingford phase II and for Witney. Expressed in terms of January 1974 prices, the total cost of Wallingford phases I and II is estimated to be £835,890 (or £765,225 if the estimated costs of converting the previously existing buildings to provide the general practitioners' surgeries and other medical centre facilities are excluded). From this expenditure 72 beds and a 20 place day ward will eventually be provided.

For Witney, the estimated gross works cost is £787,000 in January 1974 prices which, with fees and equipment will probably give a total cost of about £970,000: for this 78 beds and 30 day places will be provided. This excludes the cost of the Health Centre.

Aggregating the Wallingford and Witney hospital costs and dividing by the total number of beds gives a gross works cost of £9,663 per bed and, including fees and equipment approximately £11,500 per bed.

To make use of these figures in the cost-effectiveness comparison it is necessary to estimate the costs which would have been incurred if the equivalent accommodation had been provided at the DGH. Such an analysis would be straightforward if we were considering a new hospital situation on virgin territory. Two strategies could be compared. One strategy would be to have a large DGH for all acute care in the area located centrally. The other would be a smaller DGH with a ring of peripheral CHs. However, in practice such a straighforward situation does not present itself. Hospital building is inevitably a gradual and piece-meal process and the general shortage of capital funds extends the time horizon over which grand strategies can be implemented. CHs are therefore going to be introduced gradually. At the same time it is official policy to include the CH beds in the overall provision. Therefore, for the purpose of this analysis, it is argued that building a CH ward of 15, 34 or 38 beds will obviate the necessity of building either an additional ward of the same number of beds on an existing DGH site or, where additional DGH facilities are already being built anyway, enable them to be built with one less ward. Thus a comparison will be made between the capital costs of a CH ward with the capital costs of a separate DGH ward of the same size.

The total capital cost depends upon the following factors:-

1 The ward costs, that is the cost of building and equipping the wards.

2 The cost of building the supporting facilities such as boilers, kitchens and staff changing areas.

3 The site costs, sometimes called 'on costs' such as drainage, roadways, walls, and communications between wards and supporting facilities.

4 The cost of the land.

5 The amount of land used.

Since the CH does not include treatment facilities such as operating theatres, pathology laboratory or pharmacy, there is no need to consider them in the comparison. (The treatment room and small X-ray room used primarily as emergency facilities within the medical centre, are not essential features of the CH wards).

4.2 Ward costs

While the planning and design of new hospitals is the responsibility of the RHA with central authorization, under a system known as Capricode, the DHSS issues guidance in the form of detailed cost and area allowances which must not be exceeded. In the Oxford region (and in other regions also) it is conventional to build DGH ward facilities to an area 10% below the recommended allowance but at the same cost. This provides scope for quality features to be considered during the lengthy planning process and will be referred to here as " planning drift". But since DGH wards are commonly built to the Capricode costs, these can be used in the analyis as representative DGH costs.

It was the intention of the Oxford Regional Hospital Board to create a new standard of provision of facilities. For example, the official submission for Wallingford phase I states:

"A domestic environment was a priority in the brief and a single storey building satisfied this objective well. Essential objectives for this scheme were:-

a a domestic standard reflected in a below building note level of provision;

b a building engineering solution achieved well below department cost allowances where possible....."

Thus it was an original planning objective to build CHs to a lower cost specification than the DGH equivalent. To assess whether or not this was achieved, a comparison if firstly made of the cost of the ward blocks in phase I with hypothetical DGH equivalents. The actual tender cost of the ward blocks in phase I was £112,000 in December 1970. It is not possible to separate the actual cost of the ward itself from the other components in the block, but it is possible to calculate DGH allowances for all the components as in table 14. In the first column the area for equivalent DGH facilities, extrapolated from Capricode allowances, is given with the corresponding cost allowances in column 2. In column 3 a cost per m^2 is derived by dividing 90% of the notional area into the cost: this allows for the 10% planning drift. The actual areas at Wallingford are given in column 4 and in column 5 are the estimated costs which would be obtained if costs were proportional to area. The sum of column 5 is in fact £112,002, the same as the actual tender cost which, prima facie, would suggest that cost reductions have been achieved by a reduction in the actual area of the accommodation: a 16% cost reduction for the whole block and 12% for the ward itself. Thus the wards cost £9,000 less in January 1971 prices, that is £265 per bed.

To bring these to January 1974 prices an inflation factor of 7% was derived from the Building Cost Information Services of the Royal Institution of Chartered Surveyors. This then gives a saving of £472 per bed.

However, although the above approach supports the assumption that cost reductions are proportional to area reductions, it is more likely that area reductions provide some of the cost reductions and differences in the details of the accommodation give the other cost reductions. To explore the sources of the cost reductions further an exercise was undertaken on the ward accommodation of 38 beds planned for the phase 2 of the Wallingford development. The extension of Wallingford CH facilities is likely to be used predominantly by longer stay elderly patients who would otherwise require specialist geriatric accommodation. Thus for comparative purposes a mixture of specialist geriatric and acute ward accommodation was chosen in the ratio of 60% and 40% respectively. The Capricode areas, interpolated to give the equivalents for 38 beds are given in table 15 with the 10% reduction for planning drift. The corresponding cost allowance is given which indicates that the cost allowance per bed is £4,057 in January 1974 terms. The actual area of the Wallingford development and the estimate of cost was provided by the planning officials of the Oxford RHA. This gives £3,442 per bed, that is a cost difference of 15% or £616, matched by a reduction in area of 20%

The exercise was extended to see if it were possible to identify the components of the total cost difference of £23,420. The area reduction from 23.16m^2 per bed is estimated to have resulted in a

cost reduction of £6,000 on the building elements, including a £540 reduction for floor covering, despite the fact that carpeting is to be used in place of the cheaper welded PVC used in most DGHs. Carpeting was chosen to attain a domestic atmosphere and, for the same reason, a lower ceiling height was used (2.4m compared to the conventional 2.7m) which contributed to the £6,000 reduction. £1,388 was saved by reducing the number of sanitary fittings, notably lavatory basins for medical and nursing use. The largest cost reductions were achieved with electrical and mechanical engineering costs. The DGH cost allowance for these is £44,200 and the estimated cost for the CH ward, is £28,140, representing a difference of £16,060. £4,660 can be attributed to shorter runs resulting from area reductions. The remaining £11,400 represents a reduction in the services as follows:-

a £3,900 for reduced electrical services such as lower standards of illumination to conform to a domestic pattern, fewer wall sockets, simplified bed-head lights;

b £7,500 resulted from the omission of piped medical gasses and the mechanical extract in the treatment room.

While all these features are conventionally available in DGH accommodation, it is argued that they are not required by those patients who can be admitted to a CH, for whom a domestic style is adequate.

It could of course be argued that a CH type ward can be built on a DGH site, with the same specification and building cost and no capital cost difference for the ward would then arise. Indeed where a policy of progressive patient care is practised, by which patients move as

their condition improves to less intensive wards, then it would be feasible to build some wards within a DGH to a lower standard of provision than the main acute wards. However, there are few examples of progressive patient care and it is generally argued by hospital planners that it is invidious to have different standards of provision in the same building which give the impression of inferior quality. Also it reduces the subsequent flexibility of use of wards within the hospital. It is therefore unlikely that a CH type ward would be built as part of a DGH (though a complete CH might be built adjacent to a DGH). Thus an estimated cost reduction of about £550 per bed for ward accommodation is achieved (ie £472 in Wallingford phase I and £616 in phase II) only if a lower standard of provision is accepted for CH wards though not for the DGH alternative.

4.3 Supporting services

It is generally argued that economies of scale enable services such as kitchens and heating boilers to be provided more cheaply with a large building complex. But it is difficult to find evidence for this and the calculation above of the building costs of the kitchen in Wallingford phase I suggested that a reliable cost estimate was made by assuming that cost is proportional to area. The other problem is that the cost of the supporting services for additional ward accommodation at a DGH depends on the degree of under-utilisation of existing capacity. If the capacity is sufficient to serve a new ward, then the additional cost is low, covering just the connections. Nevertheless for the purposes of this hypothetical exercise, it must be assumed that the capacity is in balance at the DGH before the extra ward is added. In that case, additional supporting services are required both for an extra DGH ward and for the CH ward and on the same scale and so there is no general reason why the costs should be different.

4.4 Site costs

In general, site costs represent about 27% of the costs of building a new hospital (excluding the cost of land), and as such are an important element. However, discussion with the professional staff of the planning team of the Oxford RHA revealed that it is not possible to make meaningful statements about site costs in comparing CHs and DGHs. For the CH they would depend primarily on the site conditions - virgin or with existing buildings, sloping or flat, adequate natural drainage or not, access from existing roads or not, and so on. For the DGH the costs might be less if the site is already developed for hospital purposes and if it is just a question of adding another ward on the existing complex. On the other hand, if the ward is spatially separated from existing buildings then expensive communications and service links would be required. It might be necessary to break into existing services (eg drainage, water, electricity) and re-route them. Thus each situation would present its own special problems and a generalised answer is not possible. Since a CH might be more or less expensive under this heading, these costs will have to be excluded from the comparison.

4.5 Land

Prima facie one would expect that the land costs of a CH to be considerably less than comparable DGH facilities because of the differences between city centre land values and peripheral, semi-rural values. For example, analysis of land purchases for hospital purposes (private communication DHSS) suggested the following typical figures, expressed in mid-1971 terms:-

£400,000 per acre for central urban sites
£55,000 " " " intermediate sites
£800 " " " rural sites

However, there are two factors which considerably reduce the apparent cost advantages of rural sites.

Firstly, the site value of a piece of land depends on the alternative use designated by the planning authorities and the £800 per acre for rural sites would apply only for agricultural use. If a hospital is built outside the development zone of a town on land designated as "white" land, that is for institutional use, then a value is usually negotiated at about twice the agricultural value, between £1,500 and £2,000. However, it is likely that a CH would be located within the confines of the town since convenience of access is deemed to be an important feature: thus the alternative use would be residential, commercial or industrial. Even if the land does not actually carry planning permission for such development at the time of purchase, which may be compulsory, under sections 14-22 of the Land Compensation Act 1961 residential, commercial and industrial value must be paid for land where such uses are practical alternatives. The result is that the low value for rural sites quoted above is not feasible and it is necessary to estimate the value of land for residential, commercial and industrial use in peripheral towns and in central areas. A study of land purchased by the Oxford RHA from 1972 to 1974 revealed values of about £30,000 per acre in peripheral towns. The value of land in the central areas is very difficult to assess because of differences between particular sites but the range is £50,000 to £100,000 per acre, the lower part of the range being more likely than the upper part.

The second factor which influences the cost of the land for a particular hospital is the ratio of the area of the floors of the building to

the area of the total plot. Wallingford CH phases I and II have a plot ratio of 0.18 to 1 with an area of 5.55 acres. Witney CH is to be built on 4.65 acres with a plot ratio of 0.22 to 1. Compared with most DGHs this represents a generous use of land. Plot ratios of DGHs vary according to the number of storeys, from 0.5:1 to 5.0:1. The higher the ratio, the more storeys and, after a critical point, the greater the cost of the building. A ratio of 0.66:1 is recommended as the optimum where building costs are minimised (DHSS 1967). With this ratio, for example, a third of the area of the plot would be covered by a two storey building. Two recent DGH developments in the Oxford Region have had plot ratios near to this namely 0.5:1 and 0.74:1.

While it would seem that the Wallingford CH involved the expensive use of land, it is argued by the RHA that the nature of the service being provided made it desirable to have easy access and parking for patients and visitors. For this reason the medical centre and hospital were designed as separate buildings. But, also, before 1974 the cost of land was borne directly by the national Exchequer and was not deducted from the capital funds of the RHA, nor did the RHA benefit from the sale of land already owned by the NHS. Since 1974, land transactions are the financial responsibility of the RHAs and so land costs and plot ratios will need to form an important consideration in their planning calculations.

Taking phase I and II of the Wallingford CH together, the 72 beds are provided on 5.55 acres. If the land value is £30,000 per acre, this gives a cost of £2,313 per bed. If this is compared with the recommended plot ratio of 0.66:1 for DGHs then only 1.5 acres would

be needed for the same floor area. For central sites, at £100,000 per acre, this is £2,083 per bed, and at £50,000 per acre £1,042 per bed, both less than the cost at Wallingford. Thus because of the low plot ratio at Wallingford, despite the lower land values, overall the land cost was greater than for the DGH equivalent. If on the other hand, the plot ratio of 0.66:1 had been used at Wallingford then at £30,000 per acre, the land cost would have been £45,000, that is £625 per bed. And if this is compared with a building with the same plot ratio on a DGH site, using the lower and more likely land value of £50,000 which gives £1,042 per bed, then a cost saving of £417 per bed is made possible.

Alternatively if the more generous plot ratio of 0.18:1 were used for providing additional ward accommodation on a central DGH site, then the cost savings from the lower land value on a peripheral site are much greater. For example:-

5.5 acres at £30,000 per acre costs £166,500 ie £2,312 per bed

5.5 acres at £50,000 per acre costs £275,000 ie £3,819 per bed

5.5 acres at £100,000 per acre costs £555,000 ie £7,708 per bed.

Under these circumstances the capital cost advantages of CHs are very much greater, at least £1,500 per bed. However, since land costs will in future be borne out of the RHA's capital allocation, it seems more likely that the planners will attempt to economise in the use of land and the estimated possible saving of £417 per bed with the plot ratio of 0.66:1 is therefore more likely, though this will entail a less spacious aspect to future CHs than that obtained at Wallingford.

4.6 The inclusion of capital costs in the cost-effectiveness comparison

In this section we have demonstrated that there are two factors which critically influence the capital costs of new CHs compared with DGH equivalents - lower ward standards and plot ratios. Both of these relate to the final quality of care and so must be reconciled to the fundamental cost-effectiveness assumption of 'equal outcome'. It has been argued that capital savings can be achieved from building new CHs only if a lower standard of provision is accepted in CHs but not DGHs. It would seem to be paradoxical to include these savings in a cost-effectiveness comparison when they depend upon the deliberate acceptance of lower quality. The justification is that the lower standard is achieved by eliminating features in a DGH which are not necessary for the types of patients in CH wards - and their exclusion is not a disbenefit.

Secondly it has been shown that the land costs at the Wallingford CH are higher than the DGH equivalent because a low plot ratio was used. The result of this is a pleasant, open environment with gardens and lawns which might create an atmosphere more conducive to medical recovery than the typical crowded DGH site. The above calculations suggest that these benefits involve additional costs of between £230 and £1270 per bed (in 1970 terms). However, to preserve the assumption of 'equal outcome', it is assumed that the higher plot ratio is used when capital costs are incorporated in the overall cost-effectiveness comparison.

Based on the above assumptions, the savings in capital and land costs obtainable in the CH programme are estimated to be about £1000 per bed in 1970 terms - about £550 for ward costs and £450 for land. To convert

a £1,000 capital saving into a current cost per case for comparative purposes, it is necessary to estimate the rate of return the NHS would expect to get from such a capital saving and the potential life of the hospital. The conventional rate of return used in the public sector is the Treasury advised 10% discount rate which is thought to reflect the rate of return the capital resources would otherwise have earned in the private sector. For the life of the hospital building in its present use we can consider possibilities from 20 years to 40 years. At a 10% rate of return, a capital cost saving of £1,000 is equivalent to an annual saving in current expenditure of £117.48 for each year over 20 years. In the Wallingford CH in 1973-4 there were 18 patients per bed per annum, involving 287 in-patient days per bed per annum (see table 17). Dividing these figures into £117.48, and assuming that the patient flow rate remains constant over the 20 years, a cost reduction per case of £6.50 is derived and a cost reduction per in-patient day of 40p. In table 16 these figures are adjusted for different periods of hospital life and also for a 12% rate of return.

4.7 Cost of using existing hospitals

It was pointed out in Section 2 that the DHSS expects that the greater majority of CHs will be adapted from existing hospitals for which there are no alternative uses. Little information is available from the Oxford region on conversion costs but the single example of the Norman White Ward, if it could be generalised, would suggest that considerable savings could be achieved. The Norman White Ward at Peppard Hospital is a converted ward in a former chest hospital. The rest of the hospital is still used for specialist purposes though at

the time of conversion, there was no other alternative use for that particular ward. It was converted in 1970 at a cost of £4,750 that is £317 per bed. This compares with £1,970 per bed in February 1971 for the cost of building equivalent ward accommodation at Wallingford (excluding supporting services, site and land costs). Similarly the CH Day Ward at Peppard was converted in 1972 at a cost of £4,400. This provides 15 places in an area of 300m^2, ie £295 per place. In 1972 it was estimated that a new purpose-built day ward at Corby would cost £51,700 for 30 places in an area of 471m^2, that is at a cost of £1,723 per place and with less area per place.

These calculations do not take into account the opportunity costs of the land or existing buildings which are not known. However, in many cases it is likely that the alternative to conversion is closure, and the opportunity cost would be just the site value. This would depend upon location and plot size but from the estimates above, it might be about £625 per bed which with £317 per bed for conversion gives a total of £942 per bed, in 1970 terms. In other situations the conversion costs may be much higher to bring about a quality comparable with DGH standards. Nevertheless conversion is an attractive option when management teams and planners are faced with both a severely restricted capital budget and the political difficulty of closing existing hospitals. The difference in capital costs can also have a significant effect on the overall cost-effectiveness comparison as is demonstrated in the next section.

SECTION 5 IN-PATIENT SERVICES

5.1 Introduction

This section comprises a cost-effectiveness analysis of the in-patient services of the CH wards at Wallingford and Peppard Hospitals. It is explicitly assumed that there are no signicant differences in the outcome variables, such as medical recovery, social consequences and personal preferences, for the patients in the various alternative situations postulated. The reliability of this assumption and the consequences of alternative assumptions will be discussed.

A cost effectiveness exercise entails a comparison of alternatives, and in this case the CH in-patient services are compared with the alternative form of treatment and care which would have been provided for patients had the CH services not existed. To establish the alternatives, the patients in the CH wards are classified into groups sufficiently homogeneous for the analysis to be undertaken in terms of an average cost for each group.

5.2 Patient groups

Data on the in-patients at the Wallingford CH for the year October 1 1973 to September 30 1974 and at the Norman White Ward, Peppard, for an 18 month period July 1 1972 to December 31 1973 were obtained by examining the hospital admission records and are summarised in table 17. Three main categories of patients were identified:-

1 Post-operative transfers from the DGH

2 Direct medical admissions for whom the alternative was the DGH

3 Direct medical admissions for whom the alternative was care at home.

Inevitably because of considerable inter-personal variations in requirements for health care, it is not easy to classify patients into homogeneous groups and the standard deviations of mean length of stay are high. Also a number of patients did not fall into any of the three categories - 27% at Wallingford and 22% at Peppard. Of these, 37 patients at Wallingford, that is 12% of the total number of patients, and 30 patients at Peppard or 9% of the total, were medical transfers. Full data of the origin of these transfers are not available. Enquiries showed that there was no consistent pattern with respect to the alternative care which would have been provided and so it was not possible to include these patients in the cost-effectiveness study. Similarly, for the remaining "other" patients, the data recorded were insufficiently precise for classification to be made. The study is confined to patients for whom data are reliable.

For the post-operative patient transferred to the CH, the alternative treatment possibility is to remain at the DGH. For the medical patients admitted directly to the CH ward, the alternative may have been the DGH or domiciliary care. The method used to specify the alternative was to ask the GP concerned. Although this was a hypothetical question on which doctors might have differing opinions, inter-doctor variations do not matter so long as each doctor gives the alternative he would have chosen if the CH had not existed. All the doctors concerned are experienced in applying the admission criteria to a DGH without the option of using the CH. Moreover, the effect of the small CH wards on DGH bed availability has been negligible and no other relevant changes have occurred during the

period so that a stable situation existed. The main criterion which the doctors used to identify those for whom the alternative was the DGH, was the need for immediate admission whereas those specified as "alternative home" were planned admissions for whom hospital care was not urgent.

A cost-effectiveness analysis is undertaken in this section for the first two patient groups, the post-operative transfers and the direct medical admissions whose alternative was the DGH. The patients in the third category, the direct admissions for whom the alternative was care at home, will be considered in section 6 with the analysis of day care and domiciliary services.

5.3 Post-operative pre-convalescent transfers

As identified in table 17 over the 18 month period July 1 1972 to December 31 1973, 73 patients were transferred to the Norman White ward from a DGH., namely the Royal Berkshire Hospital, following an operation. These patients represented 22% of the total admissions to the Norman White ward during this period: the average length of stay in the ward was 11.9 days and the total number of in-patient days of these patients was 15% of the total for the ward. In the Wallingford CH., over the first twelve months, October 1 1973 to September 30 1974, 80 patients were in this category and represented 26% of the total number of admissions; the average length of stay was 11.8 days, and the number of days was 19% of the total for the ward.

5.4 The random allocation trial

For part of the period, a random allocation study has been in progress on a sub-group of post-operative patients of the Norman White ward by the medical team in the Health Services Evaluation Group (Bennett 1974).

Under the terms of the study, patients undergoing certain surgical procedures are considered for transfer to the CH at a pre-determined point in the post-operative period. If at that stage, no adverse medical indication is evident, they are either transferred or remain in the DGH according to a random schedule of allocation. In this way two randomly selected groups, the transfers and the non-transfers are available for comparison.

The original intention was to collect data on the medical outcome, social effects, personal preferences and private costs incurred by the two groups of patients. However, to date very few patients have completed the full study procedures (which include a study of recovery up to 42 days after final discharge) so that the available data are insufficient to draw statistically significant conclusions. So far no evidence has been found of different medical consequences for the two groups. Few of the patients in the study were at work so that it has not been possible to observe differences of recovery in terms of return to work. A study of the number of visits to the hospitals by the families and friends of the patients revealed that there was no statistically significant difference between the two groups. Eventually data on functional ability before and after the operation, social activities, doctor consultation rates, emotional state and patient satisfaction in the two groups will be available and will be reported elsewhere. At this stage, in the light of present evidence it seems reasonable to argue that no significant differences in these factors exist, and so proceed to a cost-effectiveness study.

5.5 Length of stay of post-operative patients

The cost of a hospital case is critically influenced by length of stay (Hurst 1975). For a cost comparison of patients, half of whom stay in the DGH throughout their hospitalisation and half of whom are transferred to the CH for the post-operative period, it is important to establish the average length of stay in each alternative. Data of the 20 patients who participated in the pilot random allocation trial at Norman White gives some guide. The group who were transferred had an average total period of hospitalisation of 9.6 days: on average 5.8 days before transfer and 3.8 days in the CH ward. The group who were not transferred had an average total period of hospitalisation of 9.4 days: 5.3 before the possible transfer day and 4.1 after. Thus while the group transferred had a slightly longer stay overall, they had a shorter post-transfer stay. Although the numbers are small, there is no difference of statistical significance between the two groups.

However, the patients in the trial were not typical of the total number of post-operative transfers in the CH ward at Peppard whose average length of stay after transfer was 11.9 days, compared with only 3.8 for those in the trial. The explanation of this is that pre-selection took place since the requirements of the trial excluded certain patients, mainly the very elderly and confused.

For those CH patients not in the trial, it is not possible to know what their length of stay would have been had they not been transferred. Data from the trial would lead us to assume that the length of stay is the same and to test whether this assumption is reasonable, an exercise was undertaken to match retrospectively all the 73 patients who had been transferred to the Norman White Ward between July 1 1972

and December 31 1973 with patients in the Royal Berkshire Hospital who had not been transferred and who fulfilled the following criteria:-

a resident other than in the catchment area of the Norman White Ward

b same sex

c same age (or within 2 years either way)

d had undergone the same surgical procedure under the same consultant, during the same 18 month period.

Of the 73, 3 died during hospitalisation in the CH, 11 were transferred from a hospital other than the Royal Berkshire, and for a further 11 no match fulfilling the above conditions could be found. The remaining 48 were matched and the length of stay compared. For those transferred, the average total period of hospitalisation was 18.5 days, 10.5 days in the Royal Berkshire Hospital and 8.0 days in the Norman White Ward. The control patients had an average length of stay of 11.9 days - considerably less than those transferred and not much more than the time spent by the transferred patients in the Royal Berkshire Hospital before transfer. A difference of such a magnitude suggests that the two groups of patients, those transferred and the control patients, are not comparable and that the CH is not treating the same type of patients as the Royal Berkshire Hospital. Moreover, the comparison is further invalidated by the fact that the length of stay of the 48 CH patients who were matched with non-transfers was less than the average length of stay of the other 25 CH post-operative patients who were not matched so that those who were matched cannot be taken as typical of all the patients.

However, a further examination of the data revealed that only one patient in the control group had a length of stay in the Royal Berkshire Hospital of more than 25 days. The explanation is that as a matter of hospital policy patients are not normally kept in the Royal Berkshire Hospital for more than 25 days and that if, after 25 days, they are considered to be in need of further pre-convalescent care, they are transferred to pre-convalescent wards in other hospitals, such as Blagrave Hospital.

Of the 48 matched transferred CH patients, 11 had a total length of hospitalisation of 25 days or more. If these and their control patients are removed from the analysis, the average total length of stay of the remaining 37 patients is 12.30 days for the CH transfers (7.56 in the Royal Berkshire and 4.73 in the Norman White Ward) and 10.70 days for the controls.

The other 11 CH transfers who had a total length of hospitalisation of more than 25 days, had an average length of stay of 19.18 days in the Norman White Ward which is close to the average length of stay for pre-convalescent patients at Blagrave Hospital, namely 18.10 days. Similarly the 25 CH patients who were not included in the original matching had an average length of stay in the Norman White Ward of 19.20 days.

Thus it seems reasonable to postulate that the post-operative CH transfers comprised two groups, as summarised in table 18. Group A had the shorter length of stay overall, under 25 days, and these were comparable to patients who remained at the Royal Berkshire Hospital throughout the period of hospitalisation. On average the CH transfers spent an extra 1.6 days in hospital but there was a

wide variation between patients and when the pairs of observations were tested for statistical significance, it was found that the difference is not significant at the 5% level. Under these circumstances it is justifiable to assume that the length of stay is the same in the CH as in the alternative.

Group B had the longer total length of stay, over 25 days, and they compare with patients who were transferred from the Royal Berkshire Hospital. On average the CH transfers appear to spend 1.10 days more in hospital than those transferred to Blagrave but, because of lack of data for each patient, it was not possible to test for statistical significance. In the light of the findings for Group A, it would seem reasonable to assume that management policies are similar and that there is no difference in length of stay.

Nationally there are considerable variations in average length of stay between hospitals and because these have not been adequately explained, it is difficult to draw meaningful conclusions about a given situation but, within certain limits, it is probably the case that length of stay is capable of being manipulated by management policy. In part, the national variations can be explained by differences in case-mix but Heasman (1964) demonstrated that for a particular surgical condition, there are variations between regions and hospital groups. Medical and social factors may influence stay for individual patients but as Revans (1964) pointed out, the variations in the means of length of stay of different hospitals in similar environmental situations are so great, this is not the sole explanation. Revans discovered that there was little variation within a condition between consultants in the same hospital. He considered the critical factors were the management policies of the

hospital. If this is true, it supports our assumption that the length of stay is the same for patients in the DGH and CH alternatives since the management policies are discussed and monitored by the consultants and general practitioners concerned. Thus the average length of stay can be considered as a variable which is not fixed in any absolute sense but is capable of being manipulated by management policy. The analysis which follows is based on the assumption that, as a matter of policy, a common average length of stay is maintained and the conclusions are conditional upon this. If, however, the average length of stay in the CH alternative exceeds that in the DGH, the CH costs will be greater, as discussed in the conclusions.

5.6 Direct medical admissions: alternative DGH

The patients admitted directly to the CH wards for whom the alternative was the DGH, comprised the largest single group in the CH wards, 33% of all patients and 39% of in-patient days at Wallingford, and 34% of all patients and 30% of in-patient days at the Norman White Ward. However, these patients represent a less homogeneous group than the post-operative transfers and it was even more difficult to establish whether location of hospitalisation had influenced average length of stay.

Again it is not possible to know what length of stay would have been in the alternative situation. As with the post-operative transfers, it is assumed that the length of stay is the same. Although it is not possible to find proof for this assumption, no evidence has been found which would support an alternative assumption.

5.7 Average costs

It was described in section 3 how published data are available of average costs per in-patient week and these are conventionally used for management purposes in the NHS. Figures for 1972-3 including national averages are given in table 19. Unfortunately, because of the re-organisation of the health service in April 1974 and the introduction of a new costing system, full cost data are not available for 1973-4. For the purposes of this research, it was necessary to obtain data for the relevant hospitals from the Treasurer's Department of the former Hospital Management Committee. The Royal Berkshire hospital is an acute district general hospital with 566 beds whose average costs in 1972- 3 exceeded the national average for that type of hospital. Possible reasons for this are the short length of stay (6.2 days compared with 8.2 for that type of hospital nationally) and a large proportion of maternity cases.

Peppard Hospital with 116 beds was formerly a specialist hospital for chest conditions but more recently has come to be used for the care of pre-convalescent and geriatric patients transferred from the Royal Berkshire Hospital. The costs of the Norman White CH ward are included in the average costs of the hospital and the ward shares the general services of the hospital, though it is managed independently, notably for nursing. For this cost-effectiveness exercise costs specific to the ward have been assessed.

St Mary's Hospital is a long-stay geriatric hospital which though located in Wallingford serves a wide catchment area. The costs are listed in table 19, firstly for comparison with a hospital

which provides nursing care and attention but little treatment and secondly because this type of hospital is one of the possible options for the care of chronic sick patients, discussed in section 6.

While average costs per in-patient week are conventionally used for management purposes in the NHS, they can be misleading for a comparative exercise of this kind. One reason is that the average costs of the Wallingford CH include the costs of the maternity ward which comprises half of the staffed beds. The maternity ward is explicitly excluded from this analysis since it is not a recognised feature of CHs. The low occupancy rate in the maternity ward, only 17.6%, plus the special cost factors associated with maternity, make the published average costs unrepresentative of the general ward. More fundamentally, we need to consider the marginal costs in this exercise, that is the additional costs of treating a particular group of patients in the two situations postulated. For example, for the post-operative transfers we need to compare the additional costs at the CH which result from their transfer with the costs that would have been incurred had they remained at the DGH. In both cases this is after the expensive surgery and treatment have taken place.

5.8 Specification of the appropriate marginal costs

There can be no simple, categorical and generalisable specification of marginal cost for an exercise of this kind. The selection of the appropriate components of marginal costs depends essentially on the particular circumstances of each situation and the assumptions which are made. Marginal costs must be related to the incremental unit

being considered and the time period over which adjustment is to be made. As was assumed in section 4, the proposed choice is between a CH ward and an additional DGH ward and the ward with its supporting services will be considered as the appropriate incremental unit.
For the medical patients admitted directly to the CH wards, a comparison will be made of the costs of the CH ward with the costs of the DGH medical wards to which they would have been admitted had the CH service not been available. These costs cover the care and attention provided by the medical, nursing and domestic staff.
No data were available on the costs of the drugs, dressings or other treatment in either of the postulated alteratives and for practical reasons it was not possible to disaggregate the total cost between patient groups. However, it was established that very little treatment costs were incurred outside the ward by the type of patient considered, medical supervision and nursing care being the essential components provided. For both Wallingford and the Norman White Ward, drugs and dressings were supplied from the central stores which also serves the Royal Berkshire Hospital and, when asked, the superintendents of these stores stated that the supplies to the CH wards were of a level to be expected for the patients concerned and similar to the level provided to the DGH medical wards. It is assumed that the cost of these items is the same for those patients in the CH wards as those in the DGH wards. As these costs represent only 7% of the total ward costs of the Royal Berkshire Hospital, it is unlikely that the conclusions would be sensitive to this assumption.
Although costs have been disaggregated to ward level it may be questioned whether the <u>average</u> of ward costs in the CH, comprising

medical, nursing and domestic salaries, give a reliable estimate for the medical patients in the study, since it is possible that the different groups within the wards make different demands on resources. Unfortunately for practical reasons it was not possible to test this question in a rigorous way since it would have required a detailed time-study of the staff involved, particularly nurses. The nurses when asked for their views suggested that while there was variation between patients according to different personal needs, there was no significant difference between the various groups of patients. Similarly it may be that the average cost of the DGH ward does not give a valid comparison if the type of patient considered suitable for a CH ward is not typical of the <u>average</u> patient in the DGH ward. However, it was not possible to derive quantitative data on this question and it was necessary to use average ward costs per in-patient day. It is possible that this over-states the costs of patients in the DGH ward and this is borne in mind in formulating the conclusions in 5.12.

In the case of the post-operative surgical transfers, we postulate that patients are moved from the DGH on a certain day to a CH ward. The marginal costs are the costs incurred in the CH ward plus differences in transport costs. The estimate of CH ward costs is based as with the medical patients, on the assumption of equal utilisation of resources by all groups of patients per in-patient day in the CH ward.

To calculate the marginal cost at the DGH it is assumed, as before, that the CH ward is the alternative to providing an additional DGH ward, the running costs of which are the same as an existing ward.

One result of providing either a CH ward or an additional DGH ward would be greater throughput of surgical patients and the extent to which this can be achieved depends upon the hospital capacity outside the ward, notably in operating theatres. One might expect the benefits of a more efficient use of the fixed capital at the DGH. However, since these are obtained in both alternatives postulated, it is not necessary to quantify them in this study.

A further difficulty arises with the post-operative patients. By the time the patient is in a fit state to be transferred, the expensive treatment costs and intensive nursing costs have already been incurred since diagnostic service use, surgery and immediate after-care are concentrated in the first few days after admission. In the later stages, the patient has call on "hotel" services (eg catering and laundry) and a reduced level of nursing care. Babson (1973) by direct observation costed resources used by patients for operations of hernia and appendix and found that after the fourth or fifth day, the cost per in-patient day declined to about 75% of the average cost per day. In this study we are concerned with ward costs and not treatment costs outside the ward so that the fall in costs would be much less. However, one might expect the amount of nursing time devoted to a patient to fall as he recovers. In a review of a number of studies of nursing dependency (Barr et al. 1973) it was found that if patients are grouped into three categories - light, medium and heavy - the typical quantity of technical and basic nursing required by patients is in the ratio of 1:2:5. This would

indicate that as a surgical patient passes from the heavy dependency stage immediately after his operation to the medium or light stage so his utilisation of nursing resources falls. However, it is debatable whether nursing costs should be apportioned in the same proportions since part of the nurses' total duty time is left unexplained in these studies. Moreover it is unlikely that the nursing establishments of the wards would be in this ratio if under a different management system, wards consisted entirely of heavy, medium or light dependency patients. Indeed there are no data available which relate nursing dependency to nursing staff ratios and in many studies it is found that the availability of nursing staff determines the amount of nursing given, and hence the category of nursing dependency attributed to the patients, rather than the nursing dependency which determines the staff ratio. The point is summarised as follows (Meredith et al. 1968):-

"As regards nurse staffing, the wide variation, even in acute wards, makes it difficult to isolate particular points of principle. Tradition appears to be a dominant factor and there is no explanation for the great discrepancies encountered in the levels of day and night staffing in terms of the dependency of patients in acute wards. The level of staffing appears to relate mainly to availability, the teaching pattern and finance."

Because of these difficulties, in the absence of a detailed study of nursing dependency in the DGH and CH wards, it has been necessary to use average nursing costs per patient throughout, though it is recalled in the conclusions that this probably over-estimates the costs for the surgical patients in the DGH during the post-transfer period.

Finally, general services represent a difficult component of costs to express in marginal cost terms. An additional acute ward at the DGH is unlikely to have a significant effect on the total costs of services such as staff residences, medical records, general administration, general cleaning and portering, maintenance of grounds or hospital transport unless these are already stretched to full capacity. Even if additional capacity were required, it is improbable that the marginal costs would be the same as the present average costs: they would be higher if capacity can be expanded only in 'lumpy' indivisible units or lower if there are economies of scale. The costs of general services presented in this exercise are relevant to the cost comparison only if it is assumed that in the long run average costs equal marginal costs.

5.9 Ward costs

The relevant ward costs are medical and nurses' salaries and domestic staff pay. Medical pay for the CHs comprises the fees paid to the General Practitioners. At Wallingford these consist of two payments. Firstly there is a "bed fund" which is a fee of £62 per occupied bed and with an occupancy rate of 79% for 17 beds this equals £833. Secondly a clinical assistant fee of £435 pa is paid for medical management. At the Norman White Ward, three clinical assistantship fees are paid, totalling £1305 pa. As there is no reason to suppose that the GPs devote more time and attention to one group of patients compared with others, medical costs are apportioned on the basis of an average cost per in-patient day.

The official cost returns give the medical pay at the Royal Berkshire Hospital which is attributable to the wards, based on an estimate of

the proportion of time spent by medical staff there. As indicated in table 20 this is twice the CH figure. This average figure is inflated by the medical-intensive specialties at the hospital so that it may be an over-estimate for the post-operative and medical cases who can be treated in the CH, but we do not know the extent of the over-estimate. On the other hand the medical costs of the CH are less than at Peppard Hospital, where patients are in general less severely ill than at the DGH, which would suggest that the use of GPs for medical supervision is less expensive, at current methods of payment, than the provision of resident staff and visiting consultants. However, the real cost of GP involvement may be greater as is discussed in the Appendix.

The most important single component of ward costs is nursing pay: indeed in section 3 these costs were found to represent 45% of the total cost in the hospitals studied. It might be thought that a CH should be able to economise in the use of nursing staff and that this should render it the cheaper alternative. Because CH patients on average have a lower nursing dependency than those in an average acute ward, so one might expect both a lower nurse/bed ratio, and a greater proportion of less qualified staff. On the other hand, the study of costs in section 3 revealed that in small hospitals up to 100 beds, nursing cost is sensitive to scale: and both the CH wards studied are small, 17 beds at Wallingford and 15 at the Norman White Ward so that one would expect them to be more expensive than if the CH had 35 beds.

Data were collected of the average numbers and grades of nurses in post during 1973/4 in the two CH wards and in the surgical and medical wards of the Royal Berkshire Hospital. Table 21 summarises the

figures and shows that, contrary to expectations, the CH wards have a higher nurse/bed ratio than the DGH ward as well as a higher ratio of trained to untrained staff. And this is despite the fact that the average nursing dependency in the acute wards is higher than in the CH wards. Some explanations can be advanced for this:-

a Small ward units are uneconomical since a basic number of nurses is required to give 24 hour cover and to allow for staff holidays, sick leave and training periods, regardless of the number of beds in the ward; as shown in section 3, the average nursing cost per bed at 15 beds was 37% greater than the minimum average cost per bed which was obtained at 45 beds.

b In a CH there is no resident medical supervision and so as a matter of policy it is thought necessary to have a greater proportion of senior nursing staff; but as can be seen in table 20 the greater nurse pay costs are not offset completely by the lower medical pay costs.

c A DGH ward is able to make use of the services of the nurses in training.

d For a CH it may be easier to recruit staff, particularly part-time staff, who live locally and would not otherwise be willing to travel to a city centre where the DGH is located: this implies that the DGH staffing ratio is constrained primarily by supply rather than willingness to employ.

To convert the staffing figures to resource costs, it was necessary to take into account the following:-

a the basic salary scales by grades;

b employers' costs for superannuation, national insurance, training etc;

c the point on the salary scale the typical nurse of a particular grade is likely to have reached;

d additional earnings for overtime and unsocial hours.

Basic salary scales are published by the Whitley Council. An estimate of 15% of basic earnings was used for employers' costs. Data published by the Halsbury Committee (DHSS 1974) were used to derive estimates of average earnings, taking into account the point on the salary scale and additional earnings. These data give the average earnings for different grades of nurses in May 1974 and were then expressed as a percentage of the first point on the basic scale and the percentage applied to the basic scales which existed in 1973/4. Assuming that the relationships between average earnings and the basic scale did not change over this period, we have an estimate of total earnings.

To check the reliability of the unit costs, the total numbers of nurses by grade for entire hospitals were obtained and multiplied by the unit costs and the sum compared with the total expenditure given by the Treasurer's Department from the pay rolls. The results were as follows:-

Royal Berkshire Hospital - under-estimate of 3.22%

Peppard Hospital - over-estimate of 2.24%

Blagrave Hospital - over-estimate of 2.25%

St Mary's Hospital - under-estimate of 2.19%

Differences obviously arise between the hospitals because the unit costs are average figures. However, the comparison with total expenditure suggests that the unit costs are reliable and do not vary according to the type of hospital.

This method of comparing costs under-estimates the actual cost of the DGH acute wards since it does not take into account the occasional support given to a particular ward from a reserve pool.

However, at the Royal Berkshire Hospital the pool is never very large, at the most four trained nurses plus recourse to employing six agency nurses. If these figures are taken as the average and their cost divided equally over all 368 general beds, it adds £43 to the average cost per bed. For the purposes of the cost comparison, an average cost of all three surgical wards is taken, and £43 added for the pool, giving £844.17 per bed. This is £25,325 for a 30 bed ward which is £3.40 per in-patient day when divided by the annual number of in-patient days on these three wards. The average nursing costs per bed of the medical wards of the Royal Berkshire Hospital are higher than for the surgical wards at £981 (including £43 for the pool) but when divided by the number of in-patient days the cost is lower at £2.81 because of the high throughput in these wards. The corresponding figure for the Wallingford CH is £5.12 and for the Norman White Ward £5.04.

Domestic staff pay was calculated by taking the number of WTE cleaners and orderlies in the CH wards and in the acute wards and costed at unit costs, including estimated overtime payments of, £1,260 and £1,748 per annum respectively. There is some evidence of substitution with nursing staff in so far as the cost per in-patient day for the CH wards is lower suggesting that in the acute wards, domestic staff undertake some of the duties performed by nurses in the CH wards. The costs of general services are given in table 20 and the Peppard Hospital is used for further comparison. The CH costs are greater per in-patient day than the DGH. But as discussed in section 5.8 there are some reservations about the use of the average figures for general services to reflect marginal costs. The costs of catering,

power light and heat, and maintenance are identified separately as these are probably nearest to being marginal costs for a ward.

5.10 Ambulance costs

Ambulance costs are an important component of total costs for those post-operative patients transferred to the CH who would otherwise have remained at the DGH throughout their period of hospitalisation (Group A identified in table 18). The other post-operative patients (Group B) are transferred by ambulance in both the CH and other alternative and the differences in the cost depend on the distances involved. For the Norman White Ward the distance transported is the same if the patients would otherwise have been transferred to Peppard Hospital. For Wallingford an extra cost is incurred because the distance is greater.

The marginal cost of transporting a few additional post-operative patients between the Royal Berkshire Hospital and the CH is likely to be low in the actual situation which exists at present because the task represents a small proportion of the total work load of the ambulance service. To make meaningful comparisons, it is assumed that the practice of transferring post-operative patients is sufficiently great to require an additional ambulance, which is fully employed. The marginal costs were derived from expenditure of the Berkshire County Council during 1973/4 on:-

salaries of operations staff

the running and maintenance of vehicles

provision of vehicles (annual capital charge)

Thus the overhead costs of the service such as premises and management are not included. The total of the variable costs was divided by the

recorded mileage during the year to give an estimated cost per mile for a stretcher ambulance of 64p. and for a sitting ambulance 30p. The cost per patient transferred depends upon whether a stretcher or sitting ambulance is used, whether another patient is transported at the same time and whether another patient either at the CH or living nearby is available for the return trip. The range of costs is as follows:-

	Stretcher ambulance 1 patient	Sitting ambulance 1 patient	Sitting ambulance + 2 other patients (av. per patient)
<u>To Wallingford CH</u>			
(distance 16 miles)			
Round trip	£20.48	£9.60	£3.20
One way trip	£10.24	£4.80	£1.60
To Norman White Ward			
(distance 6 miles)			
Round trip	£7.68	£3.60	£1.20
One way trip	£3.84	£1.80	£0.60

The ambulance staff were unable to provide data from their own records of journeys specifically undertaken for transferring patients to CH wards and, because of the reorganisation of the service during the study period (the responsibility of the service passed from the County Councils to the new Area Health Authorities) it was not possible to undertake a special study to determine which cost in the range above applies. However, the matron of the surgical wards at the Royal Berkshire Hospital advised that it is official hospital policy to transport post-operative patients in a stretcher ambulance to the CH

wards because of the early stage of recovery when the transfer is made and a sitting ambulance is used only on the rare occasions when a stretcher ambulance is not available. Also, the ambulance control officer advised that hospital transfers are effected when ambulances are not required for emergency cases. The journeys are programmed so that it is almost certain that there would be another patient in the vicinity of the CH to whom the ambulance would then go. Therefore it would seem to be reasonable for the purposes of this analysis to take the cost of a single trip by a stretcher ambulance, £10.24 for Wallingford and £3.84 for the Norman White Ward. However, as is discussed in the conclusions, the ambulance cost is an important component in the cost comparison and the organisational efficiency of the ambulance service has an influence on the viability of the CH programme.

A further complication is that the patients who remain at the Royal Berkshire Hospital throughout their period of hospitalisation incur transport costs when they return home (the cost of travelling to the DGH is common to both groups of patients). Those who are transferred incur costs too though for a shorter distance because they live nearer the CH than the DGH. The journey is usually undertaken in a private car, by the hospital car service, or in a sitting ambulance with other patients. The allowance of 6p per mile paid for the hospital car service gives an estimate of its cost since this is based on private car costs, and the cost per patient mile of a sitting ambulance on a round delivery "tour" is probably about the same. For Wallingford patients an extra 12 miles is likely to be travelled by the DGH patients compared with CH for the home trip, and for the

Norman White Ward patients an extra 4 miles, costing about 72p and 24p respectively. This is subtracted from the earlier figure to give a net estimated cost difference for transporting those patients transferred in Group A of about £9.52 for Wallingford and £3.60 for Norman White Ward.

For those patients transferred to Wallingford in Group B who would otherwise be transferred to Peppard Hospital an excess transfer cost is incurred because the stretcher ambulance journey is longer, though the final journey home by car, hospital car service or sitting ambulance is less. The excess is about 10 miles which at 64p a mile minus 10 miles at 6p a mile is £5.80.per patient.

5.11 Results of cost comparison

It was argued in section 5.8 that it is not possible to have a single categorical notion of marginal costs and, as a result, conclusions must be qualified by the necessary assumptions and a range of conclusions then results. The cost comparisons are presented in tables 23, 24 and 25 for the different patient groups.

Post-operative patients in Group A

As described in section 5.3, this group comprises the patients transferred to the CH on the assessed transfer date for whom the alternative was to remain in the DGH throughout their period of hospitalisation. The average length of stay in the post-transfer period was estimated to be 4.73 days and this is multiplied by the average cost per in-patient day of the relevant ward costs identified in section 5.7 to give a cost per case. This comparison, option 1, is based on the assumption of equal utilisation of resources in the wards by different groups of patients and, for the patients in the DGH,

equal utilisation of resources on different days of hospitalisation. This shows that the Wallingford CH and the Norman White Ward were more expensive than the Royal Berkshire Hospital service by 56.9% and 35.3% respectively. Recalling that in section 5.8 it was pointed out that patients in the DGH at the stage of post-operative pre-convalescence are likely to make a less than average use of resources, the difference may be even greater than these figures suggest.

For option 2, the costs of general services are added on the assumption that in the long run average costs reflect marginal costs. Both the CH wards have higher general service costs than the Royal Berkshire Hospital.

Capital cost differences were identified in section 4 and it was observed that if the CH wards were built to a lower standard of provision than the DGH equivalent and with a plot ratio of 0.66:1, a capital cost saving of about £1,000 per bed could be achieved. This represents a saving of 40p. per in-patient day compared with a DGH ward and is incorporated in the cost comparison for Wallingford in table 23 options 3 and 4. Capital costs do not significantly affect the extent to which the CH costs are higher.

Post-operative patients in Group B

These patients were identified in section 5.3 to have an average length of stay in the CH of 19.18 days. They correspond with patients who, following their operation at the Royal Berkshire Hospital are transferred to another pre-convalescent hospital in the Reading area. Peppard Hospital at present provides this service and the ward costs were calculated in section 5.7. The nursing costs per in-patient day are less than in the CH ward but the medical salary costs greater. The costs per case are between 14% and 38% higher in the CH wards than in the alternative, as shown in table 24.

Direct medical admissions: alternative DGH

In table 25 the same range of options as before is considered for the medical patients admitted directly to the CH wards. No transfer cost is incurred which reduces the cost difference but, nevertheless, the CH is between 19% and 36% more expensive.

The above calculations show that, contrary to expectations the CH is more expensive than the DGH alternative. For decision-making purposes it is useful to explore the differences further, in particular to test whether the DGH should always be the preferred alternative or if changes can be made to bring costs into line.

5.12 Further analysis of nursing costs

In section 5.9 it was observed that the major difference in the costs per in-patient day was the high nursing costs in the CH wards. It could be that the CH figure is too high or the DGH figure is too low. It is beyond the scope of this research to determine what the appropriate level of nurse staffing in a DGH ward <u>should</u> be, taking into account the nursing dependency of the patients and the relationship between the benefits and costs of different numbers of nurses. However, it is helpful to determine whether the staff level found at the Royal Berkshire Hospital is typical of surgical and medical wards in acute hospitals in general. Data are available nationally on the average costs of ward nursing per in-patient week. At the Royal Berkshire Hospital it was £30.53 in 1972-3 whereas the national average for acute hospitals over 100 beds was less, at £24.72. These average costs apply to the whole hospital and are influenced by case mix but, in so far as they are meaningful they would suggest that the costs of the Royal Berkshire Hospital are more likely to be above than <u>below</u> typical costs.

What are ideally required are data of staffing levels on medical and surgical wards in a number of hospitals. Unfortunately such data are not easily available (the availability depending upon the methods of nurse deployment used in a hospital and the nature of data routinely available). The only data it has been possible to collect on a basis comparable to that of the Royal Berkshire Hospital relates to four medical wards at the Radcliffe Infirmary, Oxford, and these are presented in table 22. Despite the fact that the wards are all of the same size, there is a considerable variation in staffing levels, though the range is similar to that at the Royal Berkshire Hospital. The mean cost per bed at the Radcliffe is £928 compared with the mean of the medical wards at the Royal Berkshire of £940.

Other guidance was found in a study by the NHS Central Organisation and Methods Unit (Ministry of Health 1968). An examination was made of all the factors which might influence the level of nurse staffing on a DGH ward and they calculated the following typical establishment for four wards with 100 beds:-

Sisters	6
Staff nurses SEN	21
Students	26
Auxiliaries	14
Total	67

Costed at the unit costs used above, the average cost per bed is £950. Although the evidence is from only two sources both comparisons indicate that the nursing costs on the Royal Berkshire Hospital's wards are not unduly low.

If the nursing costs at the Royal Berkshire Hospital are typical, then it is necessary to look more closely at the CH staffing level. At present the CH costs are considerably greater, for example 51% greater for the surgical patients and 82% greater for medical patients at Wallingford CH compared with the DGH alternative. The gap results in part from the small size of the CH hospitals and, if the cost/size function described in section 3 for hospitals similar to CHs can be used for predictive purposes, it would suggest that expanding the CH to the minimum cost size for nursing would reduce the cost per in-patient day at Wallingford to £3.74. However, this is still 10% greater than the DGH for surgical patients and 33% for medical patients. While there is no absolutely correct level of nurse staffing, there is no doubt that by comparison with other hospitals, the CH are over-staffed. For example, the Abingdon Cottage Hospital, which provides a service similar to that of a CH and has a nursing cost per in-patient week above the national average for that type of hospital (£31.95 compared with £27.55 in 1972-3) had a much lower nurse staffing level than the CH wards. The data are included in table 21. The annual cost per bed at Abingdon was £752, compared with £1,468 at Wallingford and £1,345 at the Norman White Ward. If this staffing level were applied to the CH wards it would give a cost per in-patient day of £2.62 for Wallingford and £2.82 for the Norman White Ward.

All the options considered before are recalculated with this lower nursing cost and presented in tables 26, 27 and 28. For the post-operative patients in Group A the Norman White Ward becomes the cheaper alternative, though the Wallingford CH remains more expensive because of the higher transfer costs. For the Group B patients both

CH wards are cheaper when just ward costs are considered but Wallingford is more expensive when general service costs are included though this excess is almost eliminated by the capital advantage. To achieve this result it would be necessary for the two experimental CHs to be increased in size but it might also be that if the number of nurses per bed were reduced, the quality of care would fall with adverse results in terms of recovery and patient satisfaction, though not below that in other hospitals.

5.13 Further consideration of capital costs

It was argued in section 4 that a capital cost comparison was not relevant for the Norman White Ward since it was converted from an existing ward and we do not know what its alternative use value would be. However, if the ward had no alternative use and the choice were between using it as a CH ward or building a new DGH ward then this would significantly affect the cost comparison. In the capital cost comparison in section 4 it was not possible to assess the cost of supporting services and the comparison of a new CH ward with a new DGH ward was made on the assumption that the cost of supporting services was the same in both cases. Thus we can use the data in section 4 to assess only a <u>minimum</u> cost difference between converting the Norman White Ward and building a new DGH ward, excluding the cost of supporting services. In 1974 terms the difference is £4,026 per bed for building the ward accommodation plus £417 for the different land values minus £564 for conversion costs of the Norman White Ward which sums to £3,879 per bed. At a 10% return over 20 years this is equal to £1.55 per in-patient day. The effect of this on the cost comparisons is demonstrated in tables 29 and 30. While the Norman

White Ward remains more expensive than the DGH alternative the difference is very small and well within the possible range of errors in the figures particularly as the capital cost allowance is a minimum figure. Thus it is likely that even if a small CH ward is more expensive than the DGH equivalent in current costs when the saving in capital costs is taken into account it may nevertheless be cost-effective to choose the CH alternative. This applies, however, only if there is no alternative NHS use for the ward accommodation which is converted.

5.14 Discussion of the results

In all the options considered, the CH wards, as they are at present administered, are considerably more expensive than the DGH alternative - the differences ranging from between 25% and 50% more. The reasons for this are the small scale of the two experimental wards, the high level of nursing staff and, for the transferred patients the ambulance cost involved in the transfer. With the post-operative transfers, the cost difference is greater for the group with the shorter length of stay who would otherwise have been discharged direct to home. For the other post-operative transfers who would have been transferred to another pre-convalescent unit, the greater CH cost arises mainly because of the higher nursing cost. For medical patients even though there are no transfer costs, the CH remains more expensive for all patients even when the lower capital costs identified in section 4, are included in the comparison.

In general the assumptions made have been favourable to the CH and if the assumptions do not hold, it is likely that the cost differences would be greater. For example, in section 5.8 it was assumed that the average DGH ward costs applied to the CH type patients. It is possible

that the cost of the other patients, that is the patients not suitable for admission or transfer to the CH, are greater than the average, in which case the use of the average for the CH patients gives an over-estimate for the 'DGH alternative'. Similarly, we know that the cost per day for surgical patients falls after the day of operation so that the average gives an over-estimate of the cost in the post-transfer period. However, in each case, we do not know the extent of the over-estimate but we can conclude that this makes the cost comparison even less favourable with respect to the CH alternative. Secondly equal length of stay of patients was assumed in the CH and DGH alternatives. No evidence was found to suggest that length of stay differed, but it is possible that patients stay longer in the CH because the pressure on beds is less. If this were true, the CH alternative would be even more expensive, an extra cost of about £6 being added to the CH cost for each extra day.

On the other hand the CH costs and conditions may not be typical. This study relates to only two CH wards and both of these are experimental and, in particular, very small, with only 17 and 15 beds. In section 3 it was demonstrated that average costs of cottage hospitals varied with size and were particularly high for very small units - with 15 beds 22% greater than the minimum, and with 20 beds 10% greater. If the Oxford CHs were built and managed on a larger scale, with a minimum of 35 beds, this would reduce, though not eliminate the cost differences which have been identified.

Finally the analysis has been based on the assumption of equal outcome. It is possible - though it has yet to be demonstrated - that the CH wards result in improved medical outcome for the patients or are

preferred for reasons of convenience and comfort by patients, friends and relatives. These extra benefits may justify the higher cost.

It has been further demonstrated that by cutting the nursing levels and also by using existing hospitals, with <u>minimal</u> conversion costs, the cost differences are reduced and indeed eliminated for medical patients (where no transfer cost is involved). However, such economies might result in a reduction in the quality of service.

Thus for the in-patient CH wards, it would seem that there are three policy options:-

1 accept the higher CH costs in the light of possible higher benefits;

2 reduce the CH costs but possibly lose some of the benefits;

3 abandon the CH programme for the cheaper DGH alternative.

SECTION 6 SHORT STAY AND DAY WARD SERVICES FOR THE CHRONIC SICK

6.1 Introduction

The previous section was concerned with a comparison of CH and DGH services for acute treatment. In this section we consider the two CH services designed to treat and care for the chronic sick, namely:-

1 Short-stay in-patient care for patients who otherwise would be treated at home: this entails a comparison of the cost of CH in-patient care with domiciliary care. (13% of the patients in the Wallingford CH were classified as having been admitted as an alternative to treatment at home and the corresponding figure at the Norman White Ward was 21%. The mean lengths of stay were 12.7 days and 17.5 days respectively).

2 Day-ward services: in each hospital there is a 20 place day ward. (In the Wallingford CH there were 3,560 attendances between October 1 1973 and September 30 1974 of which 1,018 were in-patients and 2,542 out-patients. At the Norman White Ward there were 3,196 attendances between March 1 1973 and February 28 1974). A way is suggested in this section of deciding in principle whether the day-ward is cost-effective in terms of reduced subsequent long term institutional care.

Although the care of the chronic sick represents a small proportion of the total work load of the two experimental CH units studied, in the future this is likely to comprise the main growth area. The reasons for this are long term demographic and morbidity changes. For example, in the 1971 census there were 6.4 million people in England and Wales aged 65 and over and about 9% of these received domiciliary nursing care (DHSS 1971). By 1981 it is estimated

(Registrar-General 1971) that the population aged 65 and over will rise to 7.3 million, that is an increase of 14% and the success of improved treatment of acute conditions may well result in a greater proportionate increase in the level of chronic sickness for which rehabilitation and nursing support will be required. Indeed the disabling conditions of old age are unlikely to improve despite general medical progress: diseases such as arthritis, heart complaints and bronchitis will continue since these are diseases of old age whose causal agents are often environmental. Unlike the TB bacillus or polio virus they are not amenable to pharmaceutical control: instead the treatment is often continuous with emphasis on caring and rehabilitation. To meet the rising number of such patients and also to fulfil increasing expectations of what can and should be done for them, an expansion of health care facilities will be required. A number of possibilities is open to the planners, ranging from the permanent admission of patients to specialist long stay hospitals, 'Part III' local authority welfare homes to the provision of varying levels of domiciliary support to enable patients to remain within their own homes. The appropriateness of each type of care obviously varies with the physical and mental condition of the person as well as the degree of voluntary support which is available at home. It is likely that a significant number of people are just on the margin between permanent hospital and domiciliary care: the Oxford CH programme is designed to influence the balance between these two patterns of care.

The in-patient and day care services provide nursing care, medical surveillance and rehabilitation with the long-term objective of restoring a patient to the level of health at which he can be supported at home, thereby forstalling the deterioration which might otherwise entail long stay admission to a specialist hospital. In the day wards, in particular, assessment and training are provided in the functions essential to daily living - mobility, self-care and domestic activities. The treatment is designed to restore failing locomotor, manipulative and social skills as well as to instill sufficient confidence to motivate the patient to achieve an element of independence. The critical question which needs to be resolved by medical research is whether these services do succeed in sustaining a patient at a higher level of functional ability than would otherwise occur and so delay the time when it is necessary to admit him to long term hospital care.

6.2 The analytical method

Two cost-effectiveness comparisons are made in this section. Firstly, a comparison is made of the cost of domiciliary care with the cost of an episode of in-patient care in the CH. It is recognised that the benefits are unlikely to be the same in the two situations since one would expect the CH service to result in improved medical condition and also there may be social advantages such as a reduced burden on the patients' family and friends. However, a detailed assessment of the benefits is not available and possibly they will never be fully analysed since it is difficult to assess the rate of deterioration the patients would have suffered if they had not received the episode of treatment. Thus we confine the comparison to costs and leave it

as a matter of judgement to decide if the benefits justify the extra costs.

Secondly, for the day-ward services it is argued that if the additional costs of long term hospital care, compared with domiciliary care, can be avoided in the future by expenditure on the CH service today, then the CH service is cost-effective. Again medical and social benefits are likely to follow from the CH services but if the above test is met then the benefits can be counted as a bonus.

For both of the cost comparisons, it is necessary to establish the likely range of costs of supporting a chronic sick patient at home. A study was therefore made of the domiciliary services in the catchment area of the Wallingford CH in 1972, the year before the hospital opened. This study is described in section 6.3 and the other costs related to domiciliary care are considered in section 6.4. Representative costs for local authority homes and for hospital care are given in sections 6.5 and 6.6 respectively. Finally in section 6.7 the costs of the CH day ward are calculated: the costs of the in-patient CH services have been discussed already in section 5. Having set out the relevant ranges of costs, it is possible to proceed to the cost-effectiveness comparison, of the CH in-patient services in 6.8 and the CH day ward in 6.9.

6.3 Costs of Domiciliary Nursing Care .

The district nursing service was studied in two practices in the catchment area of the Wallingford CH. Practice A consisted of five principals with a list of 13,418 and the attached nursing team also served a single practice of 2,660. During 1972, the nursing team comprised four full-time district nurses, one of whom was an SEN,

with a part-time SRN relief giving 4.33 Whole Time Equivalent nurses, and two part-time auxillary nurses, giving 0.65 WTE. During the year, 11,010 home visits were recorded by the district nurses and 2,028 by the auxillary nurses, and the total number of patients visited was 563. The nurses also held surgery and clinic sessions. One full-time district midwife also worked in the area but because of reorganisation of her activities during the study period, she was not included in the analysis.

Practice B consisted of three principals, with a total list of 6,469 and had attached 2.0 WTE district nurses, one of whom was also the district midwife, and also one part-time auxillary nurse, 0.36 WTE. 4,971 nursing visits were recorded by the district nurses and 968 by the auxillary nurse. The total number of patients visited was 178. Surgery and clinic sessions were also held in the Health Centre.

Both practices had staffing levels near to the national average of 3,065 population per qualified home nurse/midwife but, as is indicated in table 31, the level of service for those aged 65 and over in the two areas was higher than the national average.

The costs of employing and supporting a district nurse and an auxillary nurse, given in table 32, were derived from the accounts of the Health Departments of the county councils which administered the services. The differences between practices A and B are explained by the facts that the county enclosing practice B employed a number of district nurse/midwives whose salaries were slightly higher than those of a district nurse, and also travelling costs were greater in B.

To compare these costs with national averages, the total cost of the home nursing service (DHSS 1971) was divided by the number of district nurses (DHSS 1971) and an average cost per WTE of £2,066 was derived close to that in practice A.

To derive a total cost of the nursing service in each practice, the average cost per nurse was multiplied by the number of WTE nurses employed and this gave £9,041 for the district nurses and £681 for the auxillary nurses in practice A and £4,712 and £420 respectively in practice B. The next task was to apportion these costs to units of service, namely a home visit and session attendance. This was done on the basis of time devoted to the various activities. To obtain this information the nurses undertook a work-study by filling in a diary sheet each day over a period of two weeks. The figures so derived were applied to the total number of working days officially recorded for 1972, on the assumption that the work pattern during the sample weeks gave an indication of the work throughout the year. In this way the total number of hours devoted to each activity was calculated. Such an approximation technique is, of course, subject to possible error, because of the small number of sample days, possible inaccuracy in the annual data and the problem that the act of diary keeping might influence the nurses' behaviour. However, as shown in table 33 an indication of the reliability of the reconciliation between the sample fortnight and the annual data is that the average time per visit during the sample did not vary significantly from the estimated average time per visit during the year as a whole for the full-time staff. For the part-time staff the technique was less accurate because the sample was much smaller.

From the work-study the average working day was calculated: this excluded meal breaks but included travelling time. This working day was then divided into the time spent on visiting, including travelling, surgery or Health Centre sessions and clinic sessions, and "other time" which includes administration and staff meetings. Travelling time was

included within the time of the visits because of the practical difficulty of asking nurses in the very simple work-study to note the time they entered and left their cars, and also because it can be argued that this is a necessary time which must be committed to make the visit and the cost of this time should be attributed to the visit. However, it means that comparisons with nursing services in other areas where distances vary are more difficult and it was one of the points raised about the development of attachment schemes that abandoning precise geographical areas would increase travelling time (Social Science Research Unit 1969 and Gregory & Hindle 1972).

The percentage of time spent on the various activities during the sample fortnight is given in table 33. A comparison with results of other studies is difficult because of differences of definition of terms. Two published studies have been made of the old geographical district system before attachment to general practitioners was introduced. In a report of an O. & M. study in Bolton (Gallaher et al. 1970) no reference is made to clinics or surgery attendances and it is claimed that 90% of the time is spent visiting and travelling and only 10% on administration. The full-time nurses in the Wallingford practice recorded a far greater percentage of time spent on administration.

In a study of six different areas before 1966 Hockey (1966) derived the following percentages:-

with patient	65%
travelling	21%
administration, etc.	14%

Although the 'administration' category is greater than in the other study it is still not as great as in the Wallingford study, though it is possible that the full-time district nurses are undertaking administration on behalf of the part-time nurses. Alternatively, the greater time spent on administration may be a feature of the attachment system or a trend towards greater record keeping in an increasingly statistics conscious age. One wonders if a higher, cost-effective level of patient contact time might be achieved by additional clerical help.

The distribution of the number of visits over the week, given in table 34, evidence a peaking effect which was also observed by Hockey (Hockey 1972). While the arrangement of clinics and bi-weekly visits may explain this, it does appear that at weekends not only were fewer nurses on duty but also fewer visits per nurse were made. This may reflect the natural desire of the nurses to fulfil their family responsibilities and enjoy recreation. And while the nursing service will need to call increasingly on married women, this factor may impose a severe constraint to the extension of a comprehensive service.

Table 35 shows how the time allocations for practice A were used to apportion the total cost between the various activities and to derive a cost per visit or session attendance. By costing only patient-contact time and travelling, the cost of administration is automatically distributed pro rata to the other activities. For practice A the estimated cost per district nurse visit was 78p. and for B 81p. The cost per clinic attendance was 47p. in A and 49p in B. The cost per auxillary nurse visit was 34p. in A. It would be wrong to claim great precision for these figures. For example, a distortion arises in so

far as travelling costs are included in total costs and hence apportioned to clinic sessions as well as to visiting. Travelling costs are likely to be less per unit of time for clinic sessions than for visiting. This slightly inflates the cost of clinics but as the proportion of time involved on clinics is so small it has a negligible effect on the visiting costs. No other comparable data on district nursing costs are available except for the EMTA (1973) which uses arbitary weights for clinics and visits. For the English counties in 1972 a range of 45p. to 1.51p. for a district nurse visit is quoted: the calculated costs for A and B fall close to the mean of these figures.

In order to relate the items of service to different categories of patients, two samples, each of 75 patients, in the two practices during 1972 were divided into the groups shown in table 36. The level of service for those patients recently discharged from hospital or receiving short term treatment did not vary significantly between patients and so is relatively easy to cost. However, there was a considerable variation in the service provided to the largest category, long term chronic sick patients and it is with these that the analysis is concerned. In practice A, 14 received only baths, given by an auxillary nurse, the average being 35.4 during the year at a cost of £12. The remaining patients in A and the 42 patients in B were divided respectively into quartiles according to the number of nursing visits received and the average number of visits was calculated for each quartile and costed as in table 37.

The 4th quartile includes the patients on the borderline between domiciliary care and long term hospitalisation. On average these cost

£132 per annum in practice A and £108 in practice B. These costs are used in the following analysis.

6.4 Other costs of domiciliary care

Nursing costs are only part of the cost of supporting a chronic sick patient at home. One problem of assessing the full costs per patient is that because of confidentiality, data on the services provided are not available for individual patients. It is necessary, therefore, to estimate the typical level of service for this type of patient. For example, not all the patients benefitted from the home help service but the typical level for those clients in practice A who received continuous support was 4 hours per week, which at a cost of 50p. per hour gives an annual cost of £104. The variation around this modal value was small, the first quartile receiving on average 2.6 hours, second quartile 3.7 hours, third quartile 5.0 hours and fourth quartile 7.6 hours. Less than 3% received the maximum of 10 hours. As there appears to be no direct relationship between the number of nursing visits and the level of home help support, it can be argued that the modal value best reflects the typical level of service.

Most of the long term patients received the occupational therapy service, the modal number of visits in practice B being 2 per year. Only 20% of those visited received 3 visits, and 10% 4 visits while none received more than 4 visits. The estimated cost per visit was £2.68 and the average cost per patient of home aids was £4. giving a total cost per patient of £10.70.

The Social Services Department in practice A also sponsors a 'meals-on-wheels' service on two days of the week. The cash cost of this was 17p. per meal in 1972 but as this involves the use of volunteers, it

poses a special difficulty in costing. If it is argued that the volunteers would not be otherwise producing a 'social benefit' then the cost of their labour is zero, but if they would have been supporting another service the 'cost' is the loss to the other service. For practical reasons the former was assumed.

To calculate the cost of domiciliary visits by the general practitioners, the doctors in Wallingford were asked to give an approximate estimate of the number of times in a year they are likely to visit a chronic sick patient who is receiving constant nursing care and attention. Apart from urgent visits during periods of illness, an average estimate of six visits per annum was given. The cost per visit is calculated in Appendix A to be £2.14 in 1973-4, and deflated to 1972 terms this becomes £1.82, giving an annual cost per patient of about £11.

No data are readily available on the cost of drugs to this category of patient. An approximate figure can be obtained by assuming that the cost for chronic sick patients at home is similar to that of patients in a hospital for the chronic sick, namely 35p. per week, £18.20 annually. In fact dispensing costs for those patients at home may be higher.

Summing all the estimates gives the following annual costs for a patient in the top quartile of nursing dependency in practice A:

Nursing services	£132
Occupational therapist	£ 11
Home help	£104
Meals-on-wheels	£ 18
General practitioner	£ 11
Drugs	£ 18
	£294

This annual cost of £294 and £5.64 per week applies to those patients in the top quartile for the nursing service and with the modal values for the other services. For those patients who receive a daily nursing visit, plus modal values for other services, the cost would be £8.57 per week.

In making a comparison with the costs of supporting a chronic sick patient permanently in hospital it is necessary to consider the other costs borne by a patient and his family when at home. An estimate of typical household costs can be derived from the Family Expenditure Survey (Department of Employment and Productivity 1973). A figure of £7.15 is calculated for a single householder aged 65 and over within the modal income range of £8 to £10. This excludes expenditure on housing which is considered separately below. For a person living with a family, expenditure is likely to be less but to simplify the analysis the higher estimate will be used for all patients.

Domiciliary care is, of course, always likely to appear cheaper than institutional care in resource terms if we ignore the contribution made by the family and friends of a patient in providing the care and attention necessary to support him at home. Consequential costs such as job opportunities foregone, leisure sacrificed, changes in the pattern of family life, strain and anxiety are not quantifiable in money terms but may well be deemed more important to the people concerned than the simple resource costs. The only guide to the value placed on such voluntary labour by central decision makers is the constant attendance allowance paid to a member of the family who is obliged to provide continuous support to a sick person. In 1972 this was, on average, £5.00. per week. This is not a resource cost

but a transfer payment, that is it does not represent the value of the output foregone. Moreover it is only paid in those cases where the patient is so severely disabled that he needs constant attention throughout the day and night or if continual supervision is necessary to avoid substantial danger to himself or others. Because the allowance is paid in few cases, it cannot be considered typical of the patients being studied.

An alternative approach would be to argue that the resource cost of a woman staying at home to look after a sick relative is the opportunity cost, that is the wage she might otherwise be earning. For example, the average weekly earnings for a woman under 60 was £18.05 in 1972 (Department of Employment & Productivity 1973). Unfortunately it is not known how many of the relatives of patients in this study would have worked if they had been free to do so. However, there are data which suggest that the number is very few. A study has been made (R Williams 1975) of 144 people living in Wallingford aged 65 and over who are in receipt of some form of domiciliary care from the health services or social services. These were living as follows:-

alone	79	55%
with spouse	30	21%
with spouse and children	5	3%
with one child	10	7%
with two children or one child and grandchildren	10	7%
with others	10	7%

Only 20 patients without a spouse lived with potentially economically active relatives, that is under the age of 65. And of these 20, 11 lived in

a household where all the other members worked, 3 patients lived where one or more member was not at work and 3 where none of the other members were at work. There were missing data with 3. This suggests that in only 6 households, that is 4% of patients, (or possibly 9 because of the missing data) did the possibility arise of a relative not working but we do not know if they would have chosen to do so had it not been for the need to care for the patient. The other possibility is that for the 79 patients living alone, a relative living nearby was deterred from work, but even if the proportion were the same as for the group not living alone, this represents a small proportion of the total. It would thus appear that the daughter deprived of work to care for a sick parent is not a common phenomenon.

Capital costs involved with domiciliary care are relevant to the cost comparisons if it is the case that when a chronic sick patient is admitted to institutional care, the house or rooms he would otherwise have been occupying are released for alternative use. In the simple case, this applies if the person is living in a house by himself which is sold when he enters long term care, either in hospital or local authority home: or if rented accommodation is re-let. But it also applies if a person is living with a family and, by moving into hospital, a room is then made available for use by other members of the family, even though no financial transaction takes place.

An estimate of housing costs is given in the Family Expenditure Survey. For a single householder in the modal income range in 1972 of £8 - 10, £2.19 per week was estimated to have been spent on housing. This is a weighted mean of actual and imputed rents, and is strongly influenced by the number of elderly people who live in rent controlled housing.

Also it is doubtful if the imputed rents which are based on rateable values, reflect realistic current prices. For example, house prices in the Wallingford area in 1972 were estimated to have been as follows (Parker's Official Guide to Home Values January 1973).

	£1972 prices	weekly cost living alone	weekly cost shared
3 beds detached	14,250	27.98	5.60
3 beds semi.	11,100	21.79	4.36
3 beds terraced	9,450	18.55	3.71
2 beds semi.	9,550	18.75	4.69
2 beds terraced	8,600	16.88	4.22

From these figures a weekly notional capital cost can be calculated at 10% over 40 years. Using a random one in six sample Williams (R Willaims 1975) collected data of the residences of people aged 65 and over in the catchment area of the Wallingford CH. Of 176 people in the sample, 53 or 30% were living alone and of these 40% were owner-occupiers and 34% lived in council houses. No information is available on the value of these houses but it is likely that the mean value falls in the lower end of the range given above. £9,000 is arbitrarily chosen as a representative value for illustrative purposes, with a weekly capital cost of £17.67.

The other 123, or 70% of Williams' sample were living with other people. To estimate an approximate value of the accommodation, it is argued that the patient who would otherwise be in a hospital or home, occupies a bedroom which represents one fifth of a three bedroomed house and one quarter of a two bedroomed house. This gives a series of costs, as presented above, from which £4.50 can serve as a representative figure.

The range of costs of domiciliary care, listed in table 40 is from £17.35 to £38.27 per week (in 1972 terms) and the variation within the range depends upon the possible combination of factors involved. Despite the disadvantage of using modal values for the domiciliary care packages, the variation in the level of provision of NHS resources has a far less significant effect on the total cost than the cost of voluntary help and the capital cost of housing. If the value of the support of the patient's family is assessed in opportunity cost terms by taking the average weekly female earnings, the cost of domiciliary care is more than doubled, for example from £12.85 per week to £30.90. If the "constant attendance allowance" is taken as an official expression of the family support, a much lower total is obtained, £17.85. However, while the choice of the appropriate cost is obviously important where it is applicable, it seems that the proportion of cases where a relative gives up work to look after a patient is very low. As a result the lower cost estimate is more likely to be typical than the higher cost estimate.

Secondly the selection of the appropriate capital cost for housing has an important influence on the cost comparison. The admission of a patient to long term institutional care may result in the release of housing accommodation for alternative use and, in the case of a patient who would otherwise be living alone in a house, the representative capital cost of £17.67 per week exceeds the current cost at £12.85. The effect is less when a patient shares accommodation which is the case for the greater majority of patients.

6.5 Cost of local authority residential care

To estimate costs of maintaining an elderly person in a local authority residential home, data of expenditure on thirteen homes run by the Social Services Department of Oxfordshire County Council were obtained for 1971-2 and 1972-3. The average of these for the calendar year 1972 was £16.57 per resident week, excluding debt charges and of this £11.33, 68% comprised staff pay. If a resident was chronically ill, some though not all of the domiciliary services would be provided. The Home Help and Meals-on-Wheels services would not be necessary but a package comprising nursing, occupational therapist, general practitioner visits and drugs as identified in section 6.3 would be. Costed as before, this gives £3.30 per week, making £19.87 per week for a chronic sick patient.

Wager (1972) examined the capital costs of a number of local authority houses built in Essex and found that the unit cost varied with size. The unit cost of a 60 place home was 20% less than in a 40 place home. If we take his estimate for a 50 place home of £2,821 per place in 1969/70 and adjust to mid 1972 prices, we have £3,690. At a 10% return over 40 years this is equivalent to a weekly cost of £7.24 which is considerably less than the cost of a geriatric hospital. It is also less than the capital cost for a person living in a house by himself though more than if a person has only a bedroom in a shared family house.

The costs of domiciliary care are compared with the costs of local authority accommodation in table 40. Domiciliary care is cheaper than a local authority home when a person is living with others and when no cost is included for family support. The position is reversed,

however, when a person is living alone in a house with a high capital value or when a person lives with a family and a wife or daughter is then unable to go out to work. In terms of dependency, the people in local authority homes near Wallingford had characteristics similar to those receiving care in their own homes: indeed a number were included in the upper quartile receiving the district nursing service (see section 6.3). Since the costs in a local authority home fall within the range of costs of domiciliary care, the appropriate choice for each person, in so far as it is influenced by costs, should be determined by reference to the opportunity costs of the housing occupied and family support. For the purposes of the following comparison with long stay hospital care, local authority homes will be considered as a possible option within the general description of domiciliary care.

6.6 Costs of long term hospital care

The comparable average cost of in-patient hospital care can be estimated from the published costs per in-patient week for long stay hospitals. For 1971-2 it was £34.86 and for 1972-3 £40.25. To derive an estimate for the calendar year 1972, a quarter of the former figure and three-quarters of the latter figure were taken, giving £38.90. This comprises:

a	nursing	£15.40	40%
b	medical & treatment costs	£ 4.20	11%
c	general services	£19.30	49%

The corresponding figures for domiciliary care, ignoring the value of the services of family and friends are:-

a	nursing	£ 2.54	20%
b	medical & treatment costs	£ 0.77	6%
c	general services	£ 9.50	74%

This indicates the extent to which nursing at home is supplemented by family and friends as well as the considerable difference in the costs of general services. It is not, however, suggested that patients in hospital receive exactly the same quantity or quality of care as those who remain at home.

An estimate of the capital costs of long term hospital accommodation was derived by costing a hypothetical geriatric hospital with 100 beds at the December 1973 official cost allowance. Details of the items are given in table 38. With site costs, fees and equipment the total building cost is about £12,500 per bed. The floor area is an average 53m^2 per bed and with the recommended plot ratio of 0.66:1 the area of land needed is 80m^2 per bed which at £30,000 per acre is £595 per bed. The total replacement cost of a geriatric hospital is in the order of £13,100 per bed. Although this is not the value of existing geriatric hospitals, we are postulating a situation where it is necessary to care for an increasing number of chronic sick, so it is legitimate to use the cost of additional accommodation. £13,100 deflated to mid-1972 prices is equivalent to £8,880 which at 10% over 40 years is £17.43 per week. This is, in fact, close to the representative figure suggested above for domiciliary care where a patient is living alone in a house.

6.7 Costs of the Wallingford CH Day Ward

The estimated costs of the day ward at Wallingford are given in table 39. Medical salaries comprise the payment of a clinical assistantship. The other staff costs have been derived by taking the mid points of the appropriate salary scales. There is some doubt about the reliability of the cost of supplies and equipment and maintenance since the actual costs at Wallingford relate to the first six months of the operation of the day ward, when initial stocks of supplies were purchased and when immediate alterations were undertaken. For the purposes of this exercise half of the actual annual costs incurred on these items are taken. The transport cost was obtained by examing the records of the ward clerk who arranges the travelling. Most of the patients are brought to the day ward by the volunteer car service for which an allowance of 5.25p. per mile was paid. This covers the average vehicle cost but does not include the value of the drivers' time. However, since they are volunteers it is assumed that the opportunity cost is zero. A few patients also travelled by sitting ambulance: the total ambulance mileage was estimated and costed at 30p. per mile, as derived in section 5. The capital cost was calculated by taking the actual cost as identified in section 4, updating it to 1973-4 prices and then expressing it at 10% over 40 years.

The total annual cost of the Wallingford day ward is estimated to have been £22,856 in 1973-4. To compare with the other calculations in this section which are expressed in 1972 terms this is deflated by the recommended DHSS factor of 11%, giving £20,342. As indicated in section 6.1 there were 3,560 attendances in the day ward and the average cost per attendance was therefore £5.71.

6.8 Cost comparison of CH in-patient service

The previous sections were concerned with establishing the relevant range of costs of the various alternatives. It is now possible to proceed to the two cost-effectiveness analyses. The first comprises a cost comparison of the CH in-patient service with the cost of the domiciliary care which would otherwise have been provided for the patients.

The cost per in-patient day in the Wallingford CH was estimated in section 5 (table 20) to be £13.75 in 1973-4. This gives a weekly cost of £81.86 in 1972 terms. Unlike the other CH patients considered in section 5, most of these in-patients also attended the day ward during their in-patient stay and an average of three attendances cost £17.14. An estimated capital cost of the in-patient accommodation must also be added to this comparison and an estimate of £8,000 per bed, including land, in 1972 terms can be derived from the data in section 4. This is equivalent to £17.64 per in-patient week. The sum of these three is £116.64 per week.

The cost of the domiciliary care which would have been provided had the patients not been in the CH ward can be estimated from the calculations in sections 6.3 and 6.4. If a patient receives the observed modal package of services, the cost is £12.85. A patient more seriously ill might receive a daily visit from a district nurse, increasing the cost to £15.72 and if the general practitioner were to visit each day as well the total cost would be £28.25.

A capital cost for the domiciliary alternative need not be considered in this analysis since the patient would return home afterwards and the accommodation would not normally be put to an alternative use

during the short hospital stay. On the other hand, the 'cost' of family support may be relevant in some cases and, at the higher opportunity cost rate, this gives a total cost of £30.90 for the observed package or £46.30 for daily visits.

No data are available of the relative benefits from the CH service and it is recognised that the cost comparison gives only part of what should ideally be a cost-benefit comparison. However, the cost differences are considerable, from between £13 and £46 per week for domiciliary care to about £116 per week for the CH service. Until benefits can be quantified and valued, it will remain a matter of judgement whether differences of this order can be justified. It can be observed in passing, however, that there is considerable scope for increasing the level of domiciliary services before the cost of the CH service is reached. Indeed it may be that the benefits could be achieved more cheaply in other ways, for example by extending the peripatetic occupational therapy service or by providing a night nursing service. Alternatively there may be ways of providing additional medical supervision in local authority homes.

6.9 Cost-effectiveness criteria for the CH ward

The costs of supporting a chronic sick patient in a long stay hospital are compared with the range of costs of providing domiciliary care in table 40. Even when allowance is made for family support and the capital costs of housing, long stay hospital care is the most expensive service under all assumptions. Indeed it is twice as expensive as domiciliary care except where the higher cost of family support or the higher capital cost are used.

It is not suggested that the choice between domiciliary care and long stay hospital care should be based solely upon costs. Indeed a long stay hospital provides a caring service for the whole twenty-four hours of the day for patients who have reached a high level of dependency. The question which is posed is whether the CH day ward service can forstall deterioration and so postpone the stage when high dependency occurs.

The range of costs for domiciliary care was £905 per annum to £1,995 per annum compared with £2,971 per annum for long stay hospital care. The difference between the two forms of care is a range £2,066 to £976 per annum. We argue that by preventing the deterioration in the level of dependency of a patient so that he remains at home for one year rather than be permanently hospitalised, resource costs of between £2,066 and £976 can be saved. Thus the CH day ward costs can be regarded as investment expenditure, yielding a return in terms of cost savings in the future. Since the cost savings accrue at different points of time in the future, they must be discounted to be compared in common terms. If the sum of the discounted cost savings equals or exceeds the cost of the CH day ward service, the CH service is justified in cost terms alone, regardless of the value of the medical and social benefits obtained. More formally if:-

$$CHa \leq \frac{x_1 S}{1+r} + \frac{x_2 S}{(1+r)^2} + \frac{x_3 S}{(1+r)^2} \quad \cdots\cdots \quad \frac{xn S}{(1+r)^n}$$

where

CHa is the CH day ward expenditure in year a.

X is the number of patients not admitted to long stay care as the result of the CH service in each of the following years

S is the average cost difference between domiciliary and hospital care appropriate to the X patients

r is the public sector discount rate, conventionally 10%

n is the number of years over which the improvement applies.

The number of patients in the different years who would otherwise be in a long stay hospital may vary so that S is not a constant term. Indeed a range of combinations of patients and years of hospitalisation 'saved' will justify a given level of expenditure. For example, the expenditure at Wallingford for the 2,542 out-patient attendances at the day ward was £14,525 in 1972. Using the two extremes of possible cost savings per patient year saved, namely £2,066 and £976, we have a number of combinations of patients and years which justify the expenditure, as follows:-

1 where S, the average cost saving, is £2,066 pa.

x, number of patients	n, number of years
1	12
2	4
3	2
4	2
5 or more	1

2 where S, the average cost saving, is £976 pa

x, number of patients	n, number of years
2	14
3	7
4	4
5	3
6	2
7	2
8	2
9 or more	1

Thus, for example, where the lower estimate of domiciliary costs applies and the cost difference with long stay hospital care is the greater, the CH expenditure is justified if it results in one patient not entering hospital over twelve years, or two patients over four years, or three patients over two years, and so on. Since the expenditure on the CH day ward is incurred every year, it is necessary for the combination of cost savings to be achieved each year.

It is not possible to decide from present evidence whether the CH day ward can achieve these objectives. To test this would require a randomised control trial where one group of patients receives the CH service and another group does not and data are collected on the eventual dates of admission to long stay care. Alternatively it may be possible to undertake a study of admission rates to long stay hospitals from patients in the Wallingford CH catchment area before and then after the CH was opened. Allowance would need to be made for long term trends of admission rates generally and also

for the effect of changing provision of services on admission criteria, both in Wallingford and elsewhere. This is properly the role of an epidemiologist and the only guide offered here is that in 1972 out of a population of people aged 65 and over in the Wallingford catchment area of 3,229 only 29 were in long stay hospital care. In the first year of operation of the CH day ward 170 out-patients were treated and if between five and nine of these do not need to enter a long stay hospital for a year as the result of the care, in cost terms alone, the day ward is justified.

Moreover it must be emphasised that the objectives specified are maximum levels since no account is taken of the intrinsic value of the medical and social improvement to the patients and the benefits the service may confer on the family and friends. Also the service may result in keeping patients alive for longer than would otherwise be the case. Unfortunately, these benefits have not been quantified nor, if they were, do we have a mechanism for converting them into values to be compared with costs. It may be acceptable to operate the CH day ward at a lower level of attainment in terms of subsequent cost savings than those specified above if the difference is thought to be justified in terms of the value of the medical and social benefits.

6.10 Summary of conclusions

It has not been possible to include the relative benefits of hospitals and domiciliary care and it is recognised that the average patient in hospital care has probably a higher level of dependency. The critical question is whether the introduction of the CH service can influence the proportion of patients in the two dependency states.

If the CH in-patient service is considered separately, the cost is much higher than the alternative domiciliary service and there is considerable scope for extending the domiciliary service before the costs are equated. It is a matter of judgement whether the benefits of short stay admission justify the extra cost.

It is argued that the primary objective of the CH day ward is to forstall the deterioration of a patient and so postpone the time when admission to long stay hospital care is necessary. The cost difference between domiciliary care and hospital care is so great that a substantial level of expenditure on CH ward services can be justified in cost terms alone if it leads to a reduced burden on the hospital services in the future.

SECTION 7 SUMMARY OF CONCLUSIONS

In the introduction to this study it was argued that a full cost-benefit analysis was not possible because of the practical problems of quantifying and valuing benefits: indeed a major constraint on any evaluation of health care activities is shortage of data on outcome. Instead a cost-effectiveness analysis has been undertaken, on the assumption of constant benefits from the alternatives considered. This assumption is more tenable in some parts of the study than others. It is for the policy maker to judge whether resource economy is as important as the possible, though unquantified, benefits. In this section the issues which emerge from the study are summarised.

It has not been possible to come to a final, definitive conclusion that the Oxford CH programme is or is not cost-effective. Three types of conclusions can be made. Firstly, it has been possible to look at individual parts of the programme and decide whether each part or service is cost-effective. Secondly, qualified conclusions have been drawn about ways in which the programme could be adjusted to give resource economies or to achieve greater benefits. Thirdly, where the assumption of equal outcome is clearly inappropriate and where differences in benefits are of greater interest to the decision maker then cost comparisons alone, the relevant questions have been identified which need to be resolved either by observation and professional judgement or by further research by epidemiologists and other related disciplines.

The study has been confined to the two experimental CH wards at Wallingford and Peppard hospitals. It has been assumed that these serve as prototypes for future CHs and that the cost-effectiveness conclusions are generalisable. However, there is one important aspect where this may not be so, namely scale.

Both of these experimental wards are very small, with 17 and 15 beds. In section 3 in a study of cottage hospitals, it was shown that the average revenue cost per bed for such small units is considerably greater than the minimum average cost. The minimum cost size is 35 beds but there is little variation in average cost between 35 and 60 beds. The policy consequence of this is that, unless there are other overriding considerations, future CHs should be built with no fewer than 35 beds.

From a study of the capital costs of the two experimental units it was possible to demonstrate the influence of capital costs on the cost-effectiveness comparison. Firstly, in the study of Wallingford CH, a purpose-built new hospital, it was shown that the capital cost of the ward was less than that of a new ward built to DGH standards. The economy was achieved by a reduction in area per bed and a 'domestic' standard of provision: it was suggested that for the type of patient concerned this economy did not represent disbenefits. On the other hand, despite lower land values in Wallingford, the land cost per bed was in fact higher than typical for DGHs because a low plot ratio had been used. This gives benefits in the form of a pleasant, open-plan site with gardens but at a higher cost.

The second feature of capital costs to emerge from the study is the low capital outlay required to convert the Norman White Ward at Peppard. There are a large number of cottage hospitals suitable for conversion into CHs. Where there is no alternative use for these hospitals, so that the opportunity cost is just the land value, such a low conversion cost offers a considerable capital cost advantage compared with building new DGH accommodation. When this capital advantage is converted into current cost equivalents, it has

the effect of making the overall cost-effectiveness comparison with DGH services favourable for CHs. However, it has not been possible to resolve whether such a low conversion cost is compatible with the standards of care of new DGH accommodation; it will obviously depend on the condition of the individual cottage hospitals. This is a question on which professional judgement could be exercised or further research initiated.

The cost-effectiveness study of the CH services entailed a comparison with alternatives. For some patients the alternative was the DGH and for others, the chronic sick, the alternative was domiciliary care.

The post-operative surgical patients were transferred from the DGH to the CH for pre-convalescent care. There were two distinguishable groups, the short stay (average 4.73 days in the CH) and long stay (average 19.18 days in the CH). With the short stay, the CH service was considerably more expensive than the DGH service for three main reasons - the small size of the CH ward, the high nursing cost and the ambulance cost of the transfer. The long stay patients would have been transferred anyway, had the CH not existed, to another pre-convalescent hospital, so the transfer cost in this case was common to both sides of the comparison. As a result, although the CH service was still the more expensive, the difference was less than with short stay patients.

The cost of treating medical patients in the CH was also compared with DGH treatment. The CH cost exceeded the DGH cost and the main reason was the high nursing cost.

The policy implication of this part of the study is that the experimental CH units, as at present administered, are not cost-effective. However, it was observed that the cost difference could be eliminated by operating with a lower nursing complement. This might entail a lower quality of care in the

CH though the extent of the disbenefit is not known. Indeed this is an important area where there is need for further research, comparing the benefits from alternative numbers of nurses.

As noted above, the CH service is also cost-effective if an existing hospital, with no alternative use, can be converted at low cost: again it might entail a lower quality of service.

Finally, the conclusions obtain only on the assumption of equal length of stay in both DGH and CH. It would be another useful research question to see if benefits from a longer length of stay in the CH compensated for the additional cost which would be involved.

It has been demonstrated that the CH units are not cost-effective but under certain circumstances could be made to be so. Further implications can be drawn from the study about the balance of types of patients, in cost-effectiveness terms. Firstly the CH service should be used for medical patients rather than post-operative patients because no transfer cost is involved. Secondly, if it is to be used for post-operative patients, it is better to admit the longer stay group who would have been transferred anyway to another pre-convalescent unit.

It is an inevitable criticism of this study that undue concentration has been placed on costs while benefits are ignored. The benefits are qualitative and can be expressed only in terms of personal preferences - for example preferences for small, hospital units with a friendly and unstressed atmosphere, located near to home which is convenient for visitors, staffed by local people, with supervision by GPs who are well known to the patients. Such features are likely to be preferred particularly by elderly patients. Younger patients may hold different views and prefer the bustle of a busy DGH ward, and the sense of anonymity from being treated by staff unknown previously. There may also

be doubts that in the event of a medical complication, the CH could not offer the same assurance as the DGH. All these questions have yet to be resolved and the cost-effective comparison serves to provide a framework against which the qualitative aspects can be judged.

In view of these benefits, it might be thought the CH is best suited for the care of the chronic sick rather than for the treatment of acute illness. However, in the Oxford programme it is specified that the CH is <u>not</u> intended to serve as a long stay geriatric institution but should have positive rehabilitative objectives. In this respect the CH is providing a new type of health care facility. A comparison was made of the cost of in-patient admission to the CH with the costs of domiciliary care and this showed the CH service to be far more expensive. But, of course, quite different benefits are expected to flow from the in-patient admission in terms primarily of improving the functional ability of the patients. However, the cost differences are so great that one wonders if other less expensive ways should not be considered for treating chronic sick patients within the domiciliary package.

Lastly in the absence of the availability of data on outcome from the day-ward, a cost-effectiveness test was proposed. By comparing the costs of long term hospital care with domiciliary care, it is argued that the day-ward is cost-effective if the medical outcome is such that some patients can be sustained longer in domiciliary care and so reduce the pressures for admission to institutional care. This is another question which, in principle, is capable of being resolved by further research.

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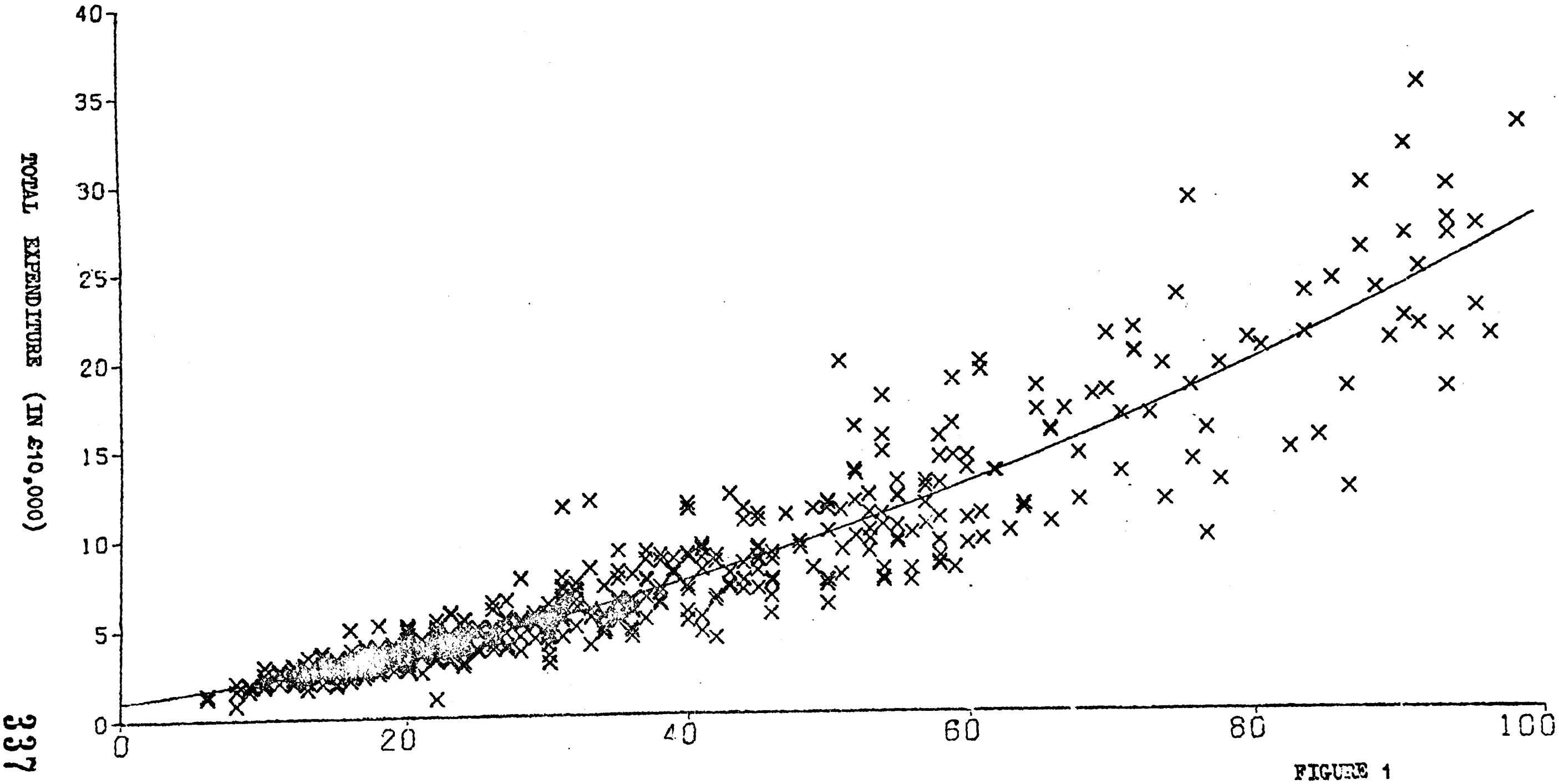

NO. OF BEDS
TOTAL EXPENDITURE (IN £10,000)
0
5
10
15
20
25
30
35
40
0
20
40
60
80
100

FIGURE 1

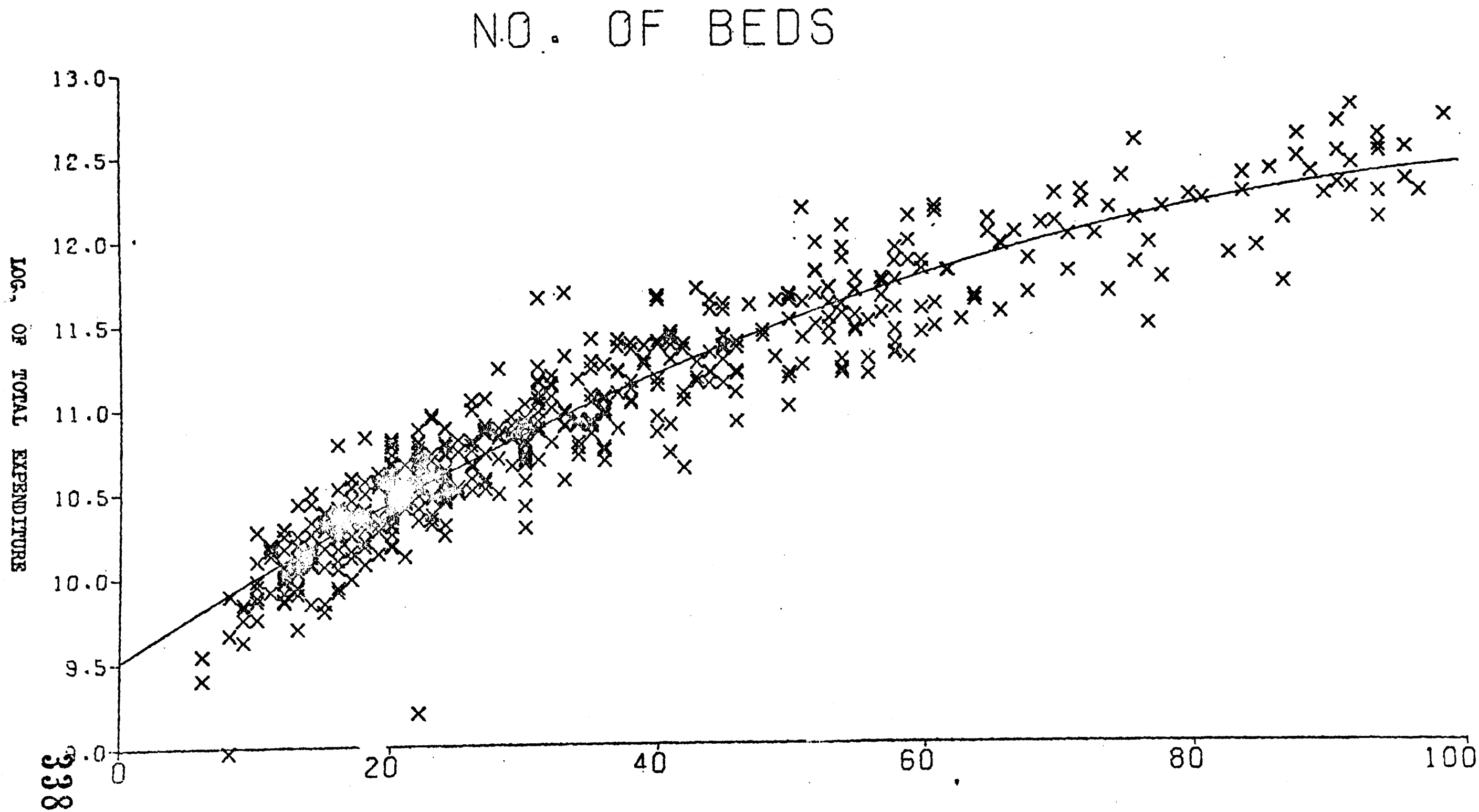

N.O. OF BEDS
LOG OF TOTAL EXPENDITURE
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
0
20
40
60
80
100

FIGURE 2

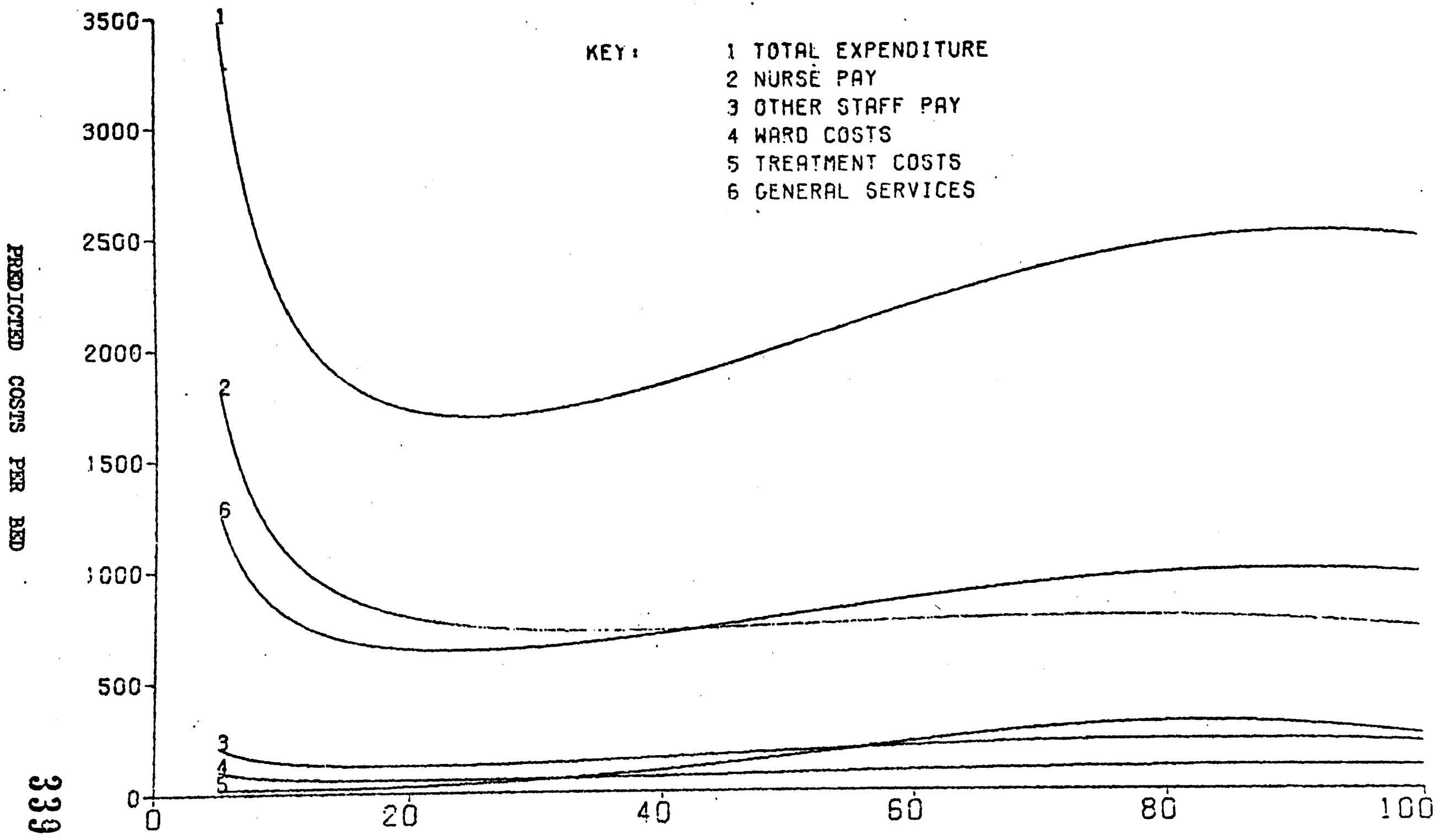

NO. OF BEDS
KEY:
1 TOTAL EXPENDITURE
2 NURSE PAY
3 OTHER STAFF PAY
4 WARD COSTS
5 TREATMENT COSTS
6 GENERAL SERVICES
PREDICTED COSTS PER RED
3500
3000
2500
2000
1500
1000
500
0
0
20
40
60
80
100

FIGURE 3

DISTRIBUTION OF NUMBER OF HOSPITALS* BY SIZE

No. of Beds	1959 %	1966 %	1969 %	1973 %
Under 50	44.4	42.5	40.6	38.5
50 - 249	42.1	43.6	44.4	45.4
250 - 499	9.6	9.9	10.5	10.7
500 - 999	3.5	3.9	4.2	5.1
1000 - 1999	0.5	0.2	0.3	0.4
Total number	2653	2522	2453	2280

DISTRIBUTION OF BEDS* BY HOSPITAL SIZE

No. of Beds	1959 %	1966 %	1969 %	1973 %
Under 50	9.4	9.2	8.3	7.7
50 - 249	39.9	40.4	38.8	37.6
250 - 499	27.4	27.8	28.6	27.5
500 - 999	19.0	20.8	21.7	23.7
1000 - 1999	4.3	1.8	2.7	3.5
Total number (thousands)	318	313	316	314

* non-psychiatric

Source: DHSS 1974

DISTRIBUTION BY SIZE OF THE HOSPITALS IN THE ANALYSIS*

No. of beds	No. of hospitals	%
1 - 10	16	3.0
11 - 20	144	27.4
21 - 30	124	23.6
31 - 40	75	14.3
41 - 50	49	9.3
51 - 60	52	9.9
61 - 70	21	4.0
71 - 80	17	3.2
81 - 90	12	2.3
91 - 100	15	2.9
Total	525	

* in Section 3

TRANSFORMATION OF DATA (ALL HOSPITALS)

Size of hospital	Average cost per bed £	Variance	Log of average cost per bed + K	Variance (x 10^4)
5 - 14	1975	2813	2.983	657
15 - 24	1812	6375	2.897	577
25 - 34	1807	20833	2.894	567
35 - 44	1884	33803	2.936	616
45 - 54	2031	86829	3.011	751
55 - 64	2018	91865	3.005	599
65 - 74	2390	101405	3.174	421
75 - 84	2354	267589	3.159	873
85 - 94	2622	324364	3.267	671
95 - 100	2649	285845	3.227	412

PREDICTED VALUES OF AVERAGE COST PER BED (£) 1970 (ALL HOSPITALS)

No. of beds	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
Total cost	2212	1852	1725	[1695]	1717	1768	1839	1921	2011	2102	2192	2276	2351	2415	2464	2497	2511	2505
Nurses pay	1098	881	788	745	726	[721]	724	732	742	752	762	770	775	777	775	768	757	742
Other staff pay	140	124	[122]	126	133	143	154	165	177	189	199	209	217	222	226	226	224	219
Ward costs	67	59	[57]	58	61	65	69	74	80	85	90	95	99	103	105	107	107	107
Treatment costs	[21]	25	32	42	57	75	97	124	154	186	218	248	273	292	301	301	290	271
General services	806	683	644	[639]	653	678	710	747	785	824	862	897	928	953	972	983	986	980

RESULTS OF QUADRATIC REGRESSION (ALL HOSPITALS)

	r^2	A	Co-efficients in equation* + B beds	+ C beds^2	Minimum average cost bed size	Average cost for that size £	95% confidence limits of mean average cost of all hospitals of minimum cost size £
Total cost	0.89486	14.12091	0.05105 (0.00183)	-0.00022 (0.00002)	25	1695	1659 - 1732
Nurse pay	0.83823	13.51002	0.04182 (0.00187)	-0.00019 (0.00002)	35	721	702 - 740
Other staff pay	0.51063	11.22683	0.06534 (0.00620)	-0.00032 (0.00006)	19	122	112 - 133
Ward costs	0.71194	10.52884	0.06133 (0.00393)	-0.00028 (0.00004)	20	57	54 - 60
Treatment costs	0.47943	8.64999	0.13557 (0.01239)	-0.00075 (0.00013)	8	20	15 - 27
General services	0.87812	13.08428	0.05398 (0.00206)	-0.00024 (0.00002)	23	638	622 - 654

* standard errors given in brackets

Table 5

r^2 FOR QUADRATIC REGRESSIONS

	Six categories of hospitals					
	1	2	3	4	5	6
	Acute	Acute + some GP beds + OTs	Acute + some GP beds - OTs	GP beds + OTs + maternity	GP beds - OTs but + maternity	Maternity only
No. of hospitals	(104)	(149)	(98)	(48)	(43)	(83)
Total Cost	0.858	0.883	0.842	0.847	0.761	0.769
Nurse pay	0.833	0.846	0.759	0.789	0.679	0.663
Other staff pay	0.657	0.636	0.132	0.732	0.354	0.289
Ward costs	0.695	0.689	0.342	0.580	0.384	0.637
Treatment costs	0.450	0.514	0.129	0.463	0.304	0.148
General services	0.834	0.845	0.837	0.790	0.742	0.739

Table 6

Table 7

Six categories of hospitals

	1		2		3		4		5		6	
	Acute only		Acute + GP beds + OTs		Acute + GP beds - OTs		Mainly GP beds + OTs + maternity		Mainly GP beds - OTs + maternity		Maternity only	
	Min bed size	Av cost £	Min bed size	Av cost £	Min bed size	Av cost £	Min bed size	Av Cost £	Min bed size	Av Cost £	Min bed size	Av cost £
Total cost	23.5	1752	26.6	1774	24.0	1591	35.0	1752	37.0	1471	19.3	1890
Nurse pay	32.2	682	31.4	721	28.1	747	44.0	732	44.1	636	24.6	910
Other staff pay	14.7	113	24.6	130	12.8	117	20.3	110	26.6	128	15.0	120
Ward costs	19.3	57	20.6	61	25.4	52	39.0	71	26.7	46	11.0	55
Treatment costs	6.4	12	18.6	142	13.5	15	22.7	98	15.5	19	18.7	12
General services	23.6	689	26.2	658	22.3	598	33.9	671	28.4	591	16.9	700

PREDICTED VALUES OF AVERAGE COST PER BED (£) 1970

Category 1 - Acute

Bed size	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Total cost	2219	1879	1768	[1754]	1791	1858	1944	2042	2146	2251	2352	2446	2528	2594	2642
Nurse Pay	1004	812	731	696	[683	683]	691	704	719	734	749	762	773	780	784
Other staff pay	120	[113]	118	128	141	157	175	193	211	228	244	256	265	269	269
Ward costs	67	59	[58]	59	62	67	72	77	83	89	94	99	104	108	111
Treatment costs	[14]	19	27	41	60	86	121	164	214	267	323	372	411	433	436
General services	875	740	696	[690]	704	730	763	801	841	882	921	957	988	1014	1032

PREDICTED VALUES OF AVERAGE COST PER BED (£) 1970

Category 2 - Acute + some GP beds + CTs

Bed size	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Total cost	2353	1964	1820	[1776]	1782	1815	1863	1918	1973	2024	2066	2096	2112	2111	2093
Nurse pay	1013	833	761	731	[722]	723	730	738	746	751	753	749	740	725	703
Other staff pay	168	141	132	[130]	131	136	141	148	155	163	170	177	183	189	193
Hard costs	72	63	[61]	62	64	67	71	75	78	82	84	86	87	86	85
Treatment costs	162	145	[142]	147	155	166	179	192	206	218	230	240	248	254	256
General services	866	725	674	[659]	662	675	694	714	735	753	768	778	782	780	770

PREDICTED VALUES OF AVERAGE COST PER BED (£) 1970

Category 3 - Acute with GP beds - OTs

Bed size	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Total cost	1994	1702	1607	[1591]	1614	1655	1703	1750	1791	1820	1833	1828	1803	1757	1691
Nurse pay	964	818	766	749	[748]	752	756	757	752	739	717	689	648	603	551
Other staff pay	120	[118]	127	140	154	170	183	194	200	202	197	187	173	154	133
Ward costs	69	57	53	52	[52]	54	56	59	63	66	70	75	79	83	87
Treatment costs	16	[15]	17	19	22	26	31	36	43	51	60	70	81	92	105
General services	728	629	[600]	601	615	637	661	686	707	724	734	737	731	717	693

PREDICTED VALUES OF AVERAGE COST PER BED (£) 1970

Category 4 - Mainly GP beds + OTs + maternity

Bed size	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Total cost	2768	2192	1940	1819	1766	[1752]	1763	1790	1823	1874	1925	1977	2031	2082	2131
Nurse pay	1294	1004	871	801	763	743	734	[732]	735	741	749	758	766	774	781
Other staff pay	130	113	[110]	112	117	124	133	143	153	164	174	185	194	202	209
Ward costs	126	97	84	77	73	[71	71]	72	73	75	77	80	84	87	91
Treatment costs	126	105	[99	99]	102	107	115	124	134	145	158	172	187	203	220
General services	1043	829	736	692	674	[671]	677	690	707	727	750	773	796	819	841

PREDICTED VALUES OF AVERAGE COST PER BED (£) 1970

Category 5 - Mainly GP beds, - OTs but + maternity

Bed size	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Total cost	2234	1800	1613	1525	1485	1472	1473	1481	1490	1499	1504	1502	1493	1475	1448
Nurse pay	1126	873	757	696	663	646	638	636	638	644	650	658	665	672	678
Other staff pay	168	141	131	128	129	131	133	136	139	140	141	140	139	135	131
Ward costs	60	51	47	46	46	47	48	49	49	49	49	49	47	46	43
Treatment costs	20	19	20	21	22	23	24	24	24	23	22	20	18	15	13
General Services	792	661	611	593	591	597	606	616	624	630	631	627	617	602	581

PREDICTED VALUES OF AVERAGE COST PER BED (£) 1970

Category 6 - Maternity only

Bed size	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Total cost	2172	1931	[1891]	1935	2019	2122	2229	2330	2414	2474	2504	2498	2456	2376	2261
Nurse pay	1144	977	921	[910]	920	939	961	982	998	1005	1003	990	966	930	883
Other staff pay	130	[120]	124	132	143	155	166	175	183	186	186	182	174	163	148
Ward costs	[55]	57	64	75	88	102	117	132	145	156	164	167	165	159	148
Treatment costs	15	13	[12]	13	14	16	19	23	27	34	43	54	70	90	119
General services	769	[704]	707	740	789	844	901	954	999	1033	1051	1052	1035	1000	947

WALLINGFORD PHASE 1 COMPARED TO DGH STANDARDS (£ JANUARY 1971)

	1	2	3	4	
	Notional DGH equivalent area m^2	Departmental allowance	Costs per m^2	Actual area m^2	Col 3 x 4
		£	£*		
Wards 34 beds	855.0	76,000	98.8	678.4	67,002
Day Ward 15 places	316.0	20,000	70.3	312.3	21,962
Kitchen 130 meals	269.5	24,500	101.0	125.5	12,678
Staff dining room 50 staff	96.6	7,400	85.1	65.0	5,533
Staff changing 100 places	92.9	4,900	58.6	82.7	4,847
Totals	1,630.0	132,800		1,263.9	112,022

Actual tender cost £112,000

* derived by dividing 90% of column 1 into column 2, to allow 10% for "planning drift"

WARD COSTS

WALLINGFORD PHASE 2 COMPARED TO DGH STANDARDS (£ JANUARY 1974)

	Area m^2	Area per bed m^2	Cost £	Cost per bed £
Acute DGH standard 38 beds	913	21.6*	153,000	4,026
Geriatric DGH standard 38 beds	1,020	24.2*	155,000	4,079
Mixture 60% geriatric 40% acute	977	23.2*	154,200	4,057
Achieved CH design	704	18.5	130,780	3,442

* having deducted 10% for "planning drift"

EFFECT OF CAPITAL SAVING IN CURRENT TERMS

Expected life of hospital in present use	10% rate of return		12% rate of return	
	Cost per case	Cost per in-patient day	Cost per case	Cost per in-patient day
	£	£	£	£
20	6.5	0.40	7.4	0.46
25	6.1	0.37	7.1	0.43
30	5.9	0.36	6.9	0.42
35	5.8	0.35	6.8	0.42
40	5.7	0.35	6.7	0.41

CH IN-PATIENT STATISTICS

	No. of patients	% of total	Av length stay (days)	Standard deviation	Total No. of days	% of total
Wallingford CH general ward for period 1 October 1973 - 30 September 1974						
Post-operative transfers	80	26%	11.8	13.1	943	19%
Direct admissions: alternative DGH	99	33%	19.0	18.5	1883	39%
Direct admissions: alternative home	40	13%	12.7	11.5	507	10%
Others	83	27%	18.6	-	1542	32%
Total	302	-	16.1	16.5	4875	-
Norman White Ward for period 1 July 1972 - 31 December 1973						
Post-operative transfers	73	22%	11.9	22.0	866	15%
Direct admissions: alternative DGH	111	34%	16.4	19.6	1824	30%
Direct admissions: alternative home	70	22%	17.5	20.0	1222	20%
Others	72	22%	29.2	-	2099	35%
Total	326	-	18.4		6011	

Table 17

POST-OPERATIVE PRE-CONVALESCENT PATIENTS

NORMAN WHITE WARD 1972/3

	No. of patients	Av length of stay DGH	Av length of stay CH	Total average length stay	Av length of stay of control patients
Group A	37	7.56	4.73	12.30	10.70
Group B matched	11	20.27	19.18	39.45	38.37
Group B unmatched	25	-	19.20	-	-

Table 18

AVERAGE COST PER IN-PATIENT WEEK

	1972/3	1973/4			
	Total	Total	Ward cost	Treatment costs	General services
Wallingford CH	-	128.86	71.09	5.43	52.34
Royal Berkshire	107.96	125.29	57.59	25.13	42.56
Peppard Hospital	85.39	86.78	37.78	3.97	45.03
St Mary's	34.14	41.33	22.33	0.87	18.13
National average acute hospitals over 100 beds (excluding teaching hospitals)	91.54	108.19	------ not available ----		
National average pre-convalescent hospitals	45.44	53.13	----- not available ----		

AVERAGE COST PER IN-PATIENT DAY (£) 1973/4

	Wallingford	Norman White	Royal Berkshire surgical	Royal Berkshire medical	Peppard Hospital
Medical pay	0.26	0.33	0.73	0.73	0.45
Nurse pay	5.12	5.04	3.40	2.81	3.57
Domestic pay	0.89	1.01	1.15	1.15	0.74
Ward	6.27	6.38	5.28	4.69	4.76
General services of which:	7.48	6.43	6.08	6.08	6.43
Catering	1.92	1.65	1.53	1.53	1.65
Power, light & heat	0.70	0.69	0.40	0.40	0.69
Maintenance	1.12	0.29	0.54	0.29	0.54
Total Cost	13.75	12.81	11.36	10.77	11.19

WARD NURSING

Staff in post 1973/4	Av cost £	Wallingford CH general ward	Norman White Ward	Royal Berkshire (surgical) Nuffield Wards i	ii	iii	Royal Berkshire (medical) Sidmouth	Adelaide	Abingdon Cottage Hospital
Day Staff									
Sister	2,200	4.5	3	2	2	2	2	2	1
Staff nurse	1,582	1.4	1	2.5	2.5	2.5	3.2	2.8	1.5
SEN	1,856	2.2	1	-	-	-	1	-	1
Student/pupil	1,059	-	-	8	8	9	9	9	-
Auxiliary	1,287	6.8	3	1.3	1.3	0.7	1.6	1	7
Night Staff									
Sister	2,200	*	1.8	0.66	0.66	0.66	0.4	0.4	1
Student/pupil	1,059	*	-	2	2	2	2	2	1 Staff
Auxiliary	1,287	*	1.8	-	-	-	0.5	0.5	2
No. beds in ward		17	15	30	27	26	23	30	29
Total cost		£24,950	£20,176	£22,070	£22,070	£22,357	£26,550	£23,290	£21,794
Cost per bed		£1,468	£1,345	£736	£817	£860	£1,154	£776	£752
Nurses: beds		1:1.14	1:1.29	1:1.82	1:1.64	1:1.54	1:1.17	1:1.69	1:2.0
Trained/untrained		1:0.84	1:0.71	1:2.19	1:2.19	1:2.27	1:1.98	1:2.40	1:1.64

* included in day staff

WARD NURSING: RADCLIFFE INFIRMARY

Staff in post 1973/4	Lichfield (male medical)	Rowney (male medical)	Collier (female medical)	Alexandra (female medical)
Day Staff				
Sister	1	2	2	1
Staff nurse	3.2	3.2	2.5	5.3
Student	8	7	9	7
Auxiliary			1.4	1.2
Night Staff				
Sister	0.28	0.28	0.28	0.28
Staff nurse	1	1	2	3
Student	3	2	1	1
No. of beds in ward	25	25	25	25
Total Cost	£21,109	£21,191	£24,527	£25,963
Cost per bed	£844	£848	£981	£1,039
Nurses: beds	1:1.52	1:1.61	1:1.38	1:1.33
Trained:untrained	1:2.01	1:1.39	1:1.68	1:0.96

COST COMPARISON FOR POST-OPERATIVE PATIENTS IN GROUP A (£) 1973/4

AVERAGE LENGTH OF STAY AFTER TRANSFER DATE 4.73 DAYS

	Cost per day	Cost per case	Transport	Total	% difference above DGH cost
Option 1 (ward costs only)					
Wallingford CH	6.27	29.66	9.52	39.18	+ 57
Norman White Ward	6.38	30.18	3.60	33.78	+ 35
DGH (surgical)	5.28	24.97	-	24.97	
Option 2 (ward & general services costs)					
Wallingford CH	13.75	65.04	9.52	74.56	+ 39
Norman White Ward	12.81	60.59	3.60	64.19	+ 19
DGH (surgical)	11.36	53.73	-	53.73	
Option 3 (ward costs with capital advantage)					
Wallingford CH	5.87	27.77	9.52	37.29	+ 49
DGH (surgical)	5.28	24.97	-	24.97	
Option 4 (ward & general services costs with capital advantage)					
Wallingford CH	13.35	63.15	9.52	72.67	+ 35
DGH (surgical)	11.36	53.73	-	53.73	

Table 23

COST COMPARISON FOR POST-OPERATIVE PATIENTS IN GROUP B (£) 1973/4

AVERAGE LENGTH OF STAY AFTER TRANSFER DATE: 19.18 DAYS

	Cost per day	Cost per case	Transport	Total	% difference above 'other'
Option 1 (ward costs only)					
Wallingford CH	6.27	120.26	5.80	126.06	+ 38
Norman White Ward	6.38	122.37	-	122.37	+ 34
'Other' pre-convalescent ward	4.76	91.30	-	91.30	
Option 2 (ward & general services costs)					
Wallingford CH	13.75	263.73	5.80	269.53	+ 26
Norman White Ward	12.81	245.70	-	245.70	+ 14
'Other' pre-convalescent ward	11.19	214.62	-	214.62	

Table 24

COST COMPARISON FOR MEDICAL PATIENTS (£) 1973/4

AVERAGE LENGTH OF STAY 13.88 DAYS

	Cost per day	Cost per case	% difference above DGH
Option 1 (ward costs only)			
Wallingford CH	6.27	87.03	+ 34
Norman White Ward	6.38	88.55	+ 36
DGH (medical)	4.69	65.10	
Option 2 (ward & general services costs)			
Wallingford CH	13.75	190.85	+ 28
Norman White Ward	12.81	177.80	+ 19
DGH (Medical)	10.77	149.49	
Option 3 (ward costs + capital advantage)			
Wallingford CH	5.87	81.48	+ 25
DGH (medical)	4.69	65.10	
Option 4 (ward costs & general services costs with capital advantage)			
Wallingford CH	13.35	185.30	+ 24
DGH (medical)	10.77	149.49	

Table 25

COST COMPARISON FOR POST-OPERATIVE PATIENTS IN GROUP A WITH REVISED NURSING COSTS (£) 1973/4

AVERAGE LENGTH OF STAY AFTER TRANSFER DATE 4.73 DAYS

	Cost per day	Cost per case	Transport	Total	% difference above DGH cost
Option 1 (ward costs only)					
Wallingford CH	3.77	17.83	9.52	27.35	+ 10
Norman White Ward	4.16	19.68	3.60	23.28	- 7
DGH (surgical)	5.28	24.97	-	24.97	
Option 2 (ward & general services costs)					
Wallingford CH	11.25	53.21	9.52	62.73	+ 17
Norman White Ward	10.59	50.09	3.60	53.69	0
DGH (surgical)	11.36	53.73	-	53.73	
Option 3 (ward costs with capital advantage)					
Wallingford CH	3.37	15.94	9.52	25.46	+ 2
DGH (surgical)	5.28	24.97	-	24.97	
Option 4 (ward & general services with capital advantage)					
Wallingford CH	10.85	51.32	9.52	60.84	+ 13
DGH (surgical)	11.36	53.73	-	53.73	

Table 26

COST COMPARISON FOR POST-OPERATIVE PATIENTS IN GROUP B WITH REVISED NURSING COST (£) 1973/4

AVERAGE LENGTH OF STAY AFTER TRANSFER DATE 19.18 DAYS

	Cost per day	Cost per case	Transport	Total	% difference above 'other'
Option 1 (ward costs only)					
Wallingford CH	3.77	72.31	5.80	78.11	- 14
Norman White Ward	4.16	79.79	-	79.79	- 13
'Other' pre-convalescent ward	4.76	91.30	-	91.30	
Option 2 (ward & general services costs)					
Wallingford CH	11.25	215.78	5.80	221.58	+ 3
Norman White Ward	10.59	203.12	-	203.12	- 5
'Other' pre-convalescent ward	11.19	214.62	-	214.62	

COST COMPARISON FOR MEDICAL PATIENTS WITH REVISED NURSING COST (£) 1973/4

AVERAGE LENGTH OF STAY 13.88 DAYS

	Cost per day	Cost per case	% difference above DGH
Option 1 (ward costs only)			
Wallingford CH	3.77	52.33	- 20
Norman White Ward	4.16	57.74	- 11
DGH (medical)	4.69	65.10	
Option 2 (ward & general services costs)			
Wallingford CH	11.25	156.15	+ 4
Norman White Ward	10.59	146.99	- 2
DGH (medical)	10.77	149.49	
Option 3 (ward costs with capital advantage)			
Wallingford CH	3.37	46.78	- 28
DGH (medical)	4.69	65.10	
Option 4 (ward & general services costs with capital advantage)			
Wallingford CH	10.85	150.60	+ 1
DGH (medical)	10.77	149.49	

COST COMPARISON FOR POST-OPERATIVE PATIENTS IN GROUP A TAKING INTO ACCOUNT REVISED CAPITAL DIFFERENCE (£) 1973/4

	Cost per day	Cost per case	Transport	Total	% difference above DGH cost
Group A					
Option 1 (ward costs only)					
Norman White Ward	4.83	22.85	3.60	26.45	+ 6
DGH (surgical)	5.28	24.97	-	24.97	
Option 2 (ward & general services costs)					
Norman White Ward	11.26	53.26	3.60	56.86	+ 6
DGH (surgical)	11.36	53.73	-	53.73	

COST COMPARISON FOR MEDICAL PATIENTS TAKING INTO ACCOUNT REVISED CAPITAL DIFFERENCE (£) 1973/4

	Cost per day	Cost per case	% difference above DGH
Option 1 (ward costs only)			
Norman White Ward	4.83	67.04	+ 3
DGH (medical)	4.69	65.10	
Option 2 (ward + general services costs)			
Norman White Ward	11.26	156.29	+ 5
DGH (medical)	10.77	149.49	

% OF POPULATION RECEIVING HOME NURSING IN 1972

	England*	Practice A	Practice B
Total	2.2	3.5	2.8
0 - 64	1.1	1.1	1.3
65 & over	9.5	22.4	17.8

*DHSS 1973

COSTS OF MIDWIFERY & DISTRICT NURSING SERVICE 1972

	Practice A £	Practice B £
Variable Costs per District Nurse/Midwife		
Salaries, National Insurance, superannuation	1,621	1,701
Uniforms	33	45
Medical supplies	96	101
Transport	237	396
Average variable costs	1,987	2,243
Variable Costs per Auxillary Nurse*		
Salaries	945	945
Uniforms	5	25
Transport	98	198
	1,048	1,168

*based on a 40 hour week

% ALLOCATION OF WORKING DAY DURING SAMPLE FORTNIGHT

	Practice A			Practice B	
	FT DN	PT DN	PT aux	FT DN/MW	PT aux
Visiting including travelling	77.6	89.3	97.0	74.7	79.1
Health Centre/ Clinic & surgery sessions	4.6	1.1	0	6.1	13.5
Administration, etc	17.8	9.6	3.0	19.1	7.4
Average recorded working day (excluding meal breaks)	8 hrs 16m	4 hrs 33m	4 hrs 33m	8 hrs* 11m	3 hrs 35
Average time per visit during study period (including travelling)	35.9m	45.0m	50.0m	27.9m	34.0m
Average estimated time per visit over year	35.7m	37.0m	34.3m	27.0m	33.0m

* No allowance for time 'on call' but not actually on duty

DISTRIBUTION OF VISITS OVER WEEK DURING WORK-STUDY

	Practice A		Practice B	
	Staff* on duty	No. of visits	Staff* on duty	No. of visits
Sunday	1.5	9	1.0	7
Monday	4.5	50	2.5	37
Tuesday	5.5	68	2.5	29
Wednesday	5.5	51	1.5	21
Thursday	3.5	41	2.5	32
Friday	4.5	54	1.5	22
Saturday	2.0	16	1.0	9

* PT staff counted as .5 WTE

UNIT COSTS IN PRACTICE A

	(£) 1972	
District nurses		
Total	9041	
No. of hours of patient contact		6907
Cost per hour	1.31	
Time spent visiting*		6557
Cost of visiting	8583	
No. of visits		11,010
Cost per visit	0.78	
Time spent in surgery		143
Cost of surgery time	187	
No. of surgery attendances		647
Cost per surgery attendance	0.29	
Time spent in clinics		207
Cost of clinic time	271	
No. of attendances at clinic		571
Cost per clinic attendance	0.47	
Auxillary nurses		
Total cost	681	
No. of hours in patient contact*		1,161
Cost per hour	0.60	
No. of visits		2,028
Cost per visit	0.34	

*including travelling

CATEGORIES OF PATIENTS IN SAMPLES

		Practice A			Practice B		
		No. of patients	Average No. of visits	Average cost	No. of patients	Average No. of visits	Average cost
1	Long term chronic sick	50	**	**	42	**	**
2	Recent hospital discharges	7	3.7	£2.75	4	6.2	£4.80
3	Short term treatment*	18	6.0	£4.40	29	4.6	£3.50

* requested by GP

** see table 37

LONG TERM CHRONIC SICK PATIENTS (VISITS PER PATIENT PER ANNUM)

		Practice A	Practice 8
1st quartile	Average nurse visits	9.0	12.6
	Average auxillary visits	12.3	1.0
	Average annual cost	£11	£10
2nd quartile	Average nurse visits	23.3	24.0
	Average auxillary visits	2.5	2.4
	Average annual cost	£18	£19
3rd quartile	Average nurse visits	55.3	70.2
	Average auxillary visits	8.3	-
	Average annual cost	£44	£54
4th quartile	Average nurse visits	178.0	138.6
	Average auxillary visits	-	4.4
	Average annual cost	£132	£108

ESTIMATED CAPITAL COST OF A HYPOTHETICAL GERIATRIC HOSPITAL WITH 100 BEDS

	£ December 1973
Wards	358,700
200 meal kitchen	73,000
Staff dining (100 meals)	12,800
Non-resident staff rooms	32,000
Day hall	72,000
Administration block	12,500
Entrance	17,000
Mortuary	23,000
Boiler house	70,000
	671,000
On costs (site costs)	335,500
Fees and equipment	252,000
Total	1,258,500

ESTIMATED ANNUAL COSTS OF WALLINGFORD DAY WARD

	(£) 1973/4
Medical salaries	435
1 Nursing Sister, full-time	2,200
1 Auxillary nurse, full-time	1,287
1 Physiotherapist, 18 hours	786
1 Occupational therapist, 28 hours	1,223
1 Ward clerk, 30 hours	1,465
1 aid, 18 hours	579
1 aid, 34 hours	1,094
	£9,069
Supplies and equipment	2,216*
Power, heat and light	1,412
Maintenance	1,131*
Transport	1,740
Capital cost	7,288
Total	£22,856

* estimate

COST COMPARISON (£) 1972

	Costs per week			Annual total cost
	Current	Capital	Total	
Long stay hospital	38.90	18.09	56.99	2,971
Local authority home (Plus nursing & medical care)	19.87	7.24	27.11	1,414
Domiciliary care				
Observed number of nursing visits, higher capital value	12.85	17.67	30.52	1,591
Observed number of nursing visits, lower capital value	12.85	4.50	17.35	905
Daily nursing visits, higher capital value	15.72	17.67	33.39	1,741
Daily nursing visits, lower capital value	15.72	4.50	20.22	1,054
Observed number of nursing visits and constant attendance allowance	17.85	4.50	22.35	1,165
Daily nursing visits and constant attendance allowance	20.72	4.50	25.22	1,315
Observed number of nursing visits and opportunity cost of help	30.90	4.50	35.40	1,846
Daily nursing visits and opportunity cost of help	33.77	4.50	38.27	1,995

APPENDIX THE PROBLEM OF MEASURING GENERAL PRACTITIONER COSTS

A.1. The General Practitioner service and the CH

The principle of a General Practitioner system of primary care is that of providing a personal and continuing service by a doctor whose range of knowledge and experience of medicine is sufficiently broad to fulfil the following requirements:-

1 to provide prompt treatment for those conditions for which primary care is the most effective in terms of medical outcome, bearing in mind the delays which necessarily occur in obtaining specialist services;

2 for those conditions for which primary care is not sufficient, to select the most appropriate form of specialist care and, subsequently, to ensure that post-specialist care is provided;

3 to act as a general adviser to a patient and his family particularly in situations of chronic disease, or ill-health caused by psychological or social factors;

4 to play some role, at present not clearly defined, in the area of preventive medicine, for example by the identification of the possibility of disease in the pre-symptomatic stage.

Emphasis is placed on the continuous nature of General Practitioners' work: by contrast the acute hospitals exist for the treatment of specific and usually discrete periods of illness. In some cases, however, such as geriatric and psychiatric hospitals this distinction is less clear.

Over the past 20 years the GP service has undergone a number of significant changes. The development of sulphonamides and antibiotics has increased the productivity of GPs in so far as they can

now treat quickly and effectively many diseases which previously killed patients or necessitated long and expensive secondary care or time-consuming primary care. At the same time the organisation of general practice has been changing. Firstly, there has been the trend towards the formation of larger practice groups. Encouraged by special grants, the number of GPs working alone has fallen from 70% in 1948 to 23% in 1968 and also in 1968 50% of all GPs were in groups of three or more principals, 10% in groups of five or more (Royal College of General Practitioners 1970). Secondly, health centres have been provided in increasing numbers for GP surgeries: by 1971 it is estimated that in England and Wales, 13% of GPs were using them. Thirdly, in many parts of the country, district nurses and health visitors have been attached to a GP practice to serve, primarily, the practice's patients, under the guidance of the GPs as "the clinical leader of the domiciliary team" (Central Health Services Council 1963). A fourth element is the access to and control over hospital beds, usually in cottage hospitals by GPs. The Community Hospital programme exemplifies all these features. The local GPs control the use of the hospital beds and some of them have their surgeries in the medical centre on the site. The domiciliary team of nurses and other para-medical staff also have their offices and hold clinic sessions there. At the Norman White Ward, an additional aspect is the full integration of the district nursing and ward nursing team.

An essential feature of the CH concept as planned in the Oxford region is that it should be staffed by GPs. The advantages claimed for this are that it enables GPs to provide a more complete service

and the greater responsibility enhances the patient-doctor relationship and increases professional expertise and job satisfaction. If the programme is to be extended nationally it will be important that a sufficient incentive is provided to encourage GPs generally to participate.

A.2. The problem of measuring the real cost of GP participation

When the costs of the CH were calculated in section 5, the actual fees paid were used as the cost of the medical service provided by GPs. It was observed that this cost was less than the medical cost at the DGH. The question which is now being asked is whether these actual fees are an appropriate cost since they were arbitrarily fixed without knowledge either on the part of the GPs or the hospital authorities of the implications of CHs in terms of work-load. Because it was an experimental situation the GPs involved did not seriously consider the financial implications. However, for a national CH programme, it will be important to determine the appropriate fees in a more rational manner and in such a way to provide an incentive for GP participation. In economic terms, the <u>real</u> cost of GP involvement is the activity which is forgone as the result of the time spent in CH, either in terms of another service or in terms of GP leisure time. This appendix comprises a study to establish the effect on work load of introducing the Oxfordshire CHs and for this the first requirement is to find an appropriate measure of work load.

A.3. List size

The measure of work-load conventionally used in the NHS is the number of people on a GP's list and the number of consultations per patient. For example it was officially argued (Ministry of Health 1950) that

the work-load of GPs increased at the start of the NHS by 13% between 1947-8 and 1948-9 because there were a number of women and children who had not been covered by the National Health Insurance Scheme before 1947 and who for the first time were given free access to primary care. Titmuss (1958), on the other hand, argued that in the early 1950s the work-load declined compared to the 1930s because of the reduction in the average size of lists, improved geographical distribution, internal administrative improvements and increases in the number of supporting staff. The average list size which was 2441 in England and Wales in 1951, fell to 2293 in 1961 but rose again to 2445 in 1971 (DHSS 1973). However, because of the changes in the GP service it is difficult to estimate what effect this has had on work-load in terms of the nature and level of service provided to the patient. As a result list size is an imperfect guide to work-load. In fact the practice list at Wallingford in January 1974 was 13,730, that is an average of 2745 per principal. While this is greater than the national average and also greater than the recommended norm of 2500 for urban doctors and 2000 for country doctors (Porrit Report 1962) it is not possible to conclude that this actual work-load is necessarily greater than the national average.

A.4. Consultation rates

A more appropriate unit of measurement would seem to be consultation rates, that is the number of surgery attendances or home visits. There is evidence to suggest that, nationally, the average consultation rates per head are falling. For example, the Royal

College of General Practitioners quotes data (1973) from 14 practices which give a mean trend reduction of 15% in surgery consultations and 60% in home visits between 1949 and 1971. However, studies have revealed such wide variations in consultation rates that it is difficult to draw generalised conclusions. The most extensive study derived from the National Morbidity Survey (Logan and Cushion 1958) showed wide regional variations from 2.64 per patient per annum in East Anglia to 4.0 in Wales, with the highest rate for an individual practice of 9.16 and the lowest rate of 0.96.

The variation may result from a number of factors such as regional epidemiological differences, the provision of supporting domiciliary and hospital services, the location and organisation of surgeries and, perhaps also the size of the GP's list. Moreover as Last writes (1967)

"There is some evidence of Parkinson's Law of General Practice. Work expands to fill the time available or, in this case, the frequency with which patients are seen is inversely proportional to the number for whom the general practitioner is responsible."

Also, two doctors with the same circumstances may have different consultation rates because of different professional attitudes, notably towards follow-up consultations and willingness to visit at home. Patients who choose to consult a doctor more than average tend to select those doctors who are likely to tolerate or encourage them.

Because consultation rates nationally are influenced by a large number of factors, it is not easy to form meaningful conclusions from

an analysis of them. However, in this study of Wallingford it has been possible to hold all the factors constant except for the introduction of the CH and the move of the surgeries to the medical centre. In particular the practice list and the individual GPs involved have remained the same during the period studied. It is therefore argued that an analysis of consultant rates with a consideration of the average time per consultation is necessary to give a meaningful indication of work-load.

A.5. The Wallingford GP study

To obtain details of consultation rates in the Wallingford practice, data were collected on patient-doctor contacts, namely surgery consultations, home visits and telephone calls before and after the Wallingford CH was opened. Firstly, over the period 7 October 1972 to 20 May 1973 before the CH was opened, twenty one days comprising three calendar weeks were selected randomly, that is by random numbers three Mondays, three Tuesdays, three Wednesdays and so on were found, distributed randomly over the period. Secondly, the exercise was repeated for a further three weeks, similarly selected, between 6 October 1973 and 19 May 1974, after the CH opened. In this way the periods are exactly matched as far as the seasons of the year are concerned. Thirdly, to compare with consultation rates after both doctors and patients had settled in to the new regime, data on a further three week period have been obtained, from 25 May 1974 to 7 January 1975. The three periods will be designated as follows:-

Period A	7 October 1972 -	20 May 1973	before CH opened
Period B	6 October 1973 -	19 May 1974	after CH opened
Period C	25 May 1974 -	7 January 1975	after CH opened

In period A there were 1455 surgery attendances, that is 97 per doctor week: details are given in Table A.1. After the CH was opened in period B, there were 1515 surgery attendances, that is 101 per doctor-week, an increase of 4%. This is a small increase which may have occurred by chance though the higher rate continued in period C, with 1518 attendances, again 101 per doctor-week. If this is a genuine increase, it may be due to a more convenient location of the surgeries or to a slight change of attitudes on the part of patients and doctors. Surgery premises are more attractive for example. The distribution of the surgery consultations by the days of the week is given in table A.1. The pattern does not appear to have changed between the periods, except that Saturday attendances have declined with a compensating increase on Fridays.

A more significant change is that the home visiting rate fell after the CH was opened. In period A, 534 home visits were recorded, that is 35.6 per doctor-week: details are given in table A.2. In period B the total was 444, 29.6 per doctor-week, a fall of 16%. Also in period C the lower visiting rate continued, with 450 visits, 30.0 per doctor-week. Because of the substantial change it would seem to be reasonable to associate this reduction with the opening of the CH and the availability of in-patient and day-ward facilities in which the doctor is able to see the patient, so reducing the need to visit at home. However, to be certain of the effect one should ideally have data over a longer period both before and after the CH was opened: unfortunately it is not now possible to collect data retrospectively.

The distribution of visits by day of the week is given in table A.2 and, as with surgery consultations, it indicates a reduction on Saturdays.

A.6. Patient contact time in Wallingford

Consultation rates reflect only one aspect of the work-load since it is within the discretion of each doctor to vary the amount of time on each consultation. The few studies which have been undertaken reveal a wide variation in the total working week. Eimerl and Pearson (1966) showed that some GPs worked less than 30 hours per week on their practice while others worked more than 55 hours, with a modal value of 40 hours. Unfortunately they did not consider other relevant factors, in particular the list sizes, to be able to offer an explanation for the differences. Manning (1967) estimated an average 57 hour week with a high list size of 3240 whereas Wood (1962) had an average working week of 73 hours, including Sundays, with a list size of only 2500. Faced with such differences and changes through time, such figures can have little general significance.

To assess the effect of the CH on the time spent by the Wallingford GPs on their various practice activities, they undertook a time-study on the days on which the consultation details were collected. This entailed marking on a sheet on each day the time particular activities, such as surgery consultations, started and finished. By comparing the time with the number of consultations, it was possible to calculate an average time per consultation.

The average amount of time per doctor spent on the various activities before and after the CH was opened is given in table A.3. The average

was derived by dividing the total time by five, the number of doctors, and so rest days are included in the figures. Since the average time per week does not include time spent on breaks between the identified activities, it does not represent the total time committed during the day and is not comparable to a'standard'working week conventionally given for some other professions.

"Surgery consultations" covers the total time spent in surgery seeing patients and "clinical work without patient contact" is the time spent on the telephone, writing letters and repeat prescriptions when a patient was not actually present. "Home visiting" covers the total visiting period, including travelling. "Other" includes night visits, dental gases, innoculations etc. The total working week includes the time spent on night visits but does not cover the period a doctor was 'on call' but not doing any of the other activities.

As is shown in table A.3 in period A before the CH was opened, the average doctor-week was 37 hours and 17 minutes overall and deducting hospital sessions, which are additional duties and paid separately, gives a total time spent on the practice responsibilities of 32 hours and 39 minutes, of 30 hours 13 minutes if post-graduate study is also excluded.

After the CH was opened and during period B 2 hours and 33 minutes per week were spent in the CH hospital but other changes occurred as well. An additional 23 minutes were spent in the surgery which corresponds with the increase in the number of surgery consultations and the average time per consultation remained remarkably constant - 7.57 minutes before and 7.51 after. Home visiting time fell by 1 hour and 49 minutes, a considerable reduction but one which reflected the

change in the number of home visits. The average time per visit scarcely changed, 19.7 minutes before and 19.9 minutes after. On the other hand, clinical work without patient contact rose by 41 minutes and time spent on administration rose by 7 minutes but time on 'others' fell by 35 minutes. If all these changes are attributable to the CH, then, while overall 2 hours 33 minutes were spent in the CH, this was offset by reductions of 73 minutes to give a net increase of 1 hour 20 minutes in the working week. Alternatively, if only the changes in surgery hours, home visiting and clinical work without patient contact are considered, and the other changes are caused by other factors, then the CH involved a net increase of 1 hour 48 minutes.

The data also show that, after the CH was opened, the average week rose to 38 hours 54 minutes, that is an extra 1 hour 37 minutes overall, but only 1 hour 20 minutes resulted from the CH. Post-graduate study fell by 20 minutes but the other main change arose when one member of the practice undertook an additional hospital session in the period after the CH was opened and this, averaged over the other doctors, represented an additional 37 minutes per doctor-week. This was a discretionary decision to undertake additional duties, despite the extra work-load entailed with the CH. The importance of this is that the opening of the CH did not cause the members of the practice to reduce their other practice activities but to cut back their leisure time. It would appear, therefore, that the real cost of GP participation in the CH is not the loss of another service but the sacrifice of leisure time for which the GPs might reasonably expect financial compensation.

A different pattern of time allocations emerged in period C and it may be that, having become accustomed to the impact of the CH, the GPs settled down to a less stressed pattern of activities. The average doctor-week increased to 39 hours and 41 minutes, 47 minutes more than during period B. In period C time spent in surgery increased by 50 minutes despite the fact that there was no change in the number of consultations. This had the effect of increasing the average time per consultation from 7.5 minutes to 8.0 minutes. Similarly time spent on home visits increased compared with period B and the time per visit rose from 19.9 minutes to 21.3 minutes. Time spent on "clinical work without patient contact" also increased. In contrast, the time spent on post-graduate study and "other" was less.

The time spent in the CH during period C was less than in period B, 2 hours and 18 minutes compared with 2 hours and 33 minutes. Unlike the comparison between B and A, more time was spent on practice duties (ie excluding hospital sessions and post-graduate study) in period C than in A, that is an additional 33 minutes and if this increase is to be attributed to the CH, then the CH resulted in an increased work time of 2 hours 51 minutes. It may be that after the first period of adjustment, the GPs found they could fulfil their commitments to the CH in less time and then spend more time on other practice duties. Despite the detailed information which was collected, it has not been possible to fully explain the impact of the CH on other practice duties. It may be that other factors were also influencing the situation. We have, therefore, a range of estimates of the additional time worked as the result of the CH, as follows:-

a) in period B 2 hours 33 minutes actually in the CH or 1 hour 20 minutes when the reduction in other activities is included.

b) in period C 2 hours 18 minutes in the CH or 2 hours 51 minutes if the additional practice duties are included.

A.7. Average cost of GP time

Having shown that the 'real cost' of the GP resources in the CH is additional time which is sacrificed leisure, then it becomes meaningful to convert the 'real cost' into money terms, that is the money value of the leisure time sacrificed. The appropriate rate is that rate acceptable to employer and employee. In most market situations, one would expect the marginal rate for additional services to exceed the average rate because of diminishing marginal utility of earnings. An average rate can be calculated by taking the gross fees of the practice and dividing by the total number of hours spent on practice duties during the year. This can then be compared with actual marginal rate being paid with the present arrangement of fees.

An estimate, given in table A.4. is made of the fees which would normally accrue to a practice such as that at Wallingford. The main item of payment in the present system is the capitation fee which is a relic of the old health insurance schemes devised towards the end of the last century by insurance companies which wanted a simple method of assessing their risks and financial commitments. These fees are the same for all practices and the total was calculated by multiplying the rate by the number of patients on the list. However, fees are also paid for items of service and these had to be estimated. Fees for night

visits were calculated by taking the number of night visits made during the recording periods and grossing up to give annual estimates. Fees for the other items such as vaccinations, immunisations, cervical cytology tests and the treatment of temporary residents were estimated from the published total fees for such services for the whole area, taking the fees for each item as a percentage of the total fees, assuming that the proportions do not vary significantly between GPs. Allowing for five weeks holiday per doctor which did not fall during the study period A, the total time in the practice spent on surgery consultations, home visits, clinical work without patient contact and 'other' is estimated to have been 6658 hours. Dividing these into the gross fees gives a cost per hour of patient 'contact' time of £7.21. By excluding time spent on administration and post graduate study from the divisor, the cost of these is automatically apportioned pro rata to the 'contact' activities. Costing the number of hours in the surgery at this rate, and dividing by the number of consultations, gives a cost per consultation of 82p. and, similarly for home visiting time, a cost per visit of £2.14.

Using the average cost per hour of £7.21 to apply to the time spent on CH duties, we have one estimate of the total cost per year of the GP service to the CH. From the four calculations of the time involved in the CH given at the end of section A.6. we have the following: £4,319 or £2,257 from period B and £3,897 or £4,831 from period C.

The fees paid for the CH services were shared with the other practices which utilise the Wallingford CH. The fees accruing to the Wallingford practice itself are calculated in the following way:-

a) £62 for each occupied bed, shared equally by all eleven GPs, five shares going to the Wallingford practice: £378

b) two sessions at clinical assistant rates for minor accident services, shared by seven GPs, five shares going to Wallingford practice: £621

c) one session at clinical assistant rate for day ward services, shared by eleven GPs, five shares going to Wallingford practice: £198

d) one session at clinical assistant rate for medical management duties: £435.

This gives a total fee of £1,632 per annum to the Wallingford practice, considerably less than the costs estimated by taking the average cost of patient contact time.

If the total fees paid to the Wallingford practice are divided by the various estimates of number of hours entailed by the CH, namely 599 or 313 as in period B and 540 or 670 in period C, we have the following hourly rates:- £2.72 or £5.21 and £3.02 or £2.44 respectively. All these are substantially below the <u>average</u> rate for normal practice duties of £7.21 per hour.

A.8. Conclusion

The success of the CH programme as being developed in the Oxford Region is critically dependent upon the active participation of GPs. This participation is not costless. The study has shown that the time actually spent in the CH is partially offset by a reduction in other practice duties, notably a reduced number of home visits. However, it is clear that the GPs are sacrificing leisure time to participate in the CH experiment. When this time is related to the actual fees paid,

the marginal rate is considerably less than the average rate estimated for non CH practice duties. Many GPs may be willing to undertake the extra work entailed and the additional responsibility of managing hospital beds irrespective of financial reward. However, since the financial incentive is so small, this may severely constrain the extension of the CH service nationally.

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SURGERY CONSULTATIONS BY DAY OF WEEK

(AVERAGE NUMBER PER WEEK FOR PRACTICE)

Period	A		B		C	
Monday	98	20.2%	102	20.2%	111	21.9%
Tuesday	83	17.1%	85	16.8%	96	19.0%
Wednesday	85	17.5%	82	16.2%	61	12.1%
Thursday	70	14.4%	68	13.5%	87	17.2%
Friday	87	17.9%	118	23.4%	103	20.4%
Saturday	62	12.8%	50	10.0%	48	9.5%
Sunday	-		-		-	
Total	485		505		506	

HOME VISITS BY DAY OF WEEK

(AVERAGE NUMBER PER WEEK FOR PRACTICE)

Period	A		B		C	
Monday	43	24.2%	36	24.3%	45	30.0%
Tuesday	37	20.8%	23	15.5%	25	16.7%
Wednesday	23	12.9%	20	13.5%	22	14.7%
Thursday	22	12.4%	22	14.9%	17	11.3%
Friday	31	17.4%	30	20.3%	22	14.7%
Saturday	11	6.2%	11	7.4%	13	8.7%
Sunday	11	6.2%	6	4.1%	6	4.0%
Total	178		148		150	

DISTRIBUTION OF TIME (PER DOCTOR WEEK)

	Period	A	B	C
a	Surgery	12h 15m	12h 38m	13h 28m
b	Home units	11h 37m	9h 48m	10h 40m
c	Clinical without patient contact	2h 10m	2h 51m	3h 17m
d	Administration	1h 53m	2h 0m	2h 4m
e	Post-graduate study	2h 26m	2h 6m	1h 24m
f	Hospital sessions	4h 38m	5h 15m	5h 13m
g	Other	2h 18m	1h 43m	1h 17m
h	CH ward (day time)		2h 2m	2h 11m
i	CH ward (night time)		18m	0
j	Day ward		13m	7m
k	TOTAL DAY	37h 17m	38h 54m	39h 41m
	Total practice time (ie k minus e f h i and j)	30h 13m	29h 0m	30h 46m

ESTIMATED GROSS PRACTICE FEES 1974/5

	£
Basic practice allowance (5 principals)	9,075
Additions to basic allowance	1,350
For seniority (2 principals)	1,120
Standard capitation fees	
aged over 65 1,590 x £2.10	3,339
65 and under 12,140 x £1.50	18,210
Supplementary capitation fees 8,730 x £0.28	2,444
Night units 295 x £3	885
Supplementary practice allowance (5 principals)	1,750
Maternity allowance 70 complete	1,523
150 partial	2,175
Additional fees for services (temporary residents, vaccinations etc)	1,659
Plus additional cost of ancillary staff	3,033
Allowance for rent, rates etc	1,471
	£48,034

POST SCRIPT: CONSEQUENCES OF APPLIED RESEARCH

It was argued in the introduction to the thesis that the basic weakness of the allocation processes in the NHS is the dependence on the concept of 'need'. 'Need' has never been defined in universally accepted terms but has been identified variously by ad hoc judgements, often by doctors and others at the point of delivery of service. Moreover it has never been clear how much of a person's 'need' should be met, whether for example all the 'needs' of some people should be met before some of the 'needs' of others. (This debate is particularly relevant to services for the acutely ill and services for the chronically sick.) As the research described in this thesis progressed, it was interesting to observe the reaction of administrators in the NHS to the suggestion that, within limitations, decisions could be improved if taken in the light of specified objectives, researched relationships and a consideration of resource constraints. It became clear that 'needology' allowed scope for individual professional judgement, personal interpretation and the pursuit of different priorities. Moreover past decisions could not be questioned because there were no objective criteria. The relative success of parts of the health service depended upon the skill and integrity of each administrator. For all these reasons, it is not difficult to understand the wide variety of medical practices, levels of service and standards of care which have baffled analysts.

There are two essential pre-conditions for the establishment of a more rational allocation mechanism, firstly an appropriate incentive and secondly knowledge of the consequences of decisions.

Until 1971, and then only for revenue expenditure, no attempt was made to distribute resources geographically to field administrators by objective

means. Allocations tended to be the previous year's sum with an increment determined by special pleading. Lower tier authorities depended upon the patronage of higher tier authorities and to improve their position they used the language of 'needology' and argued that they 'needed' more. The successful administrator was not the one who most efficiently met the real 'need' in his area, in terms of maximising benefits, but who demonstrated that his area's 'need' was greater than elsewhere and so improved his allocation of resources. Indeed, instead of ordering priorities so as to maximise benefits from the resources available, often administrators arranged services so that the marginal programme - that is the one about to be expanded or cut - had the highest priority for which the most eloquent case could be made. Re-organisation of the health service in 1974 was accompanied by a detailed examination and lengthy discussion of priorities but so long as the primary incentive of administrators was to increase their share of resources available, irrational distortions were inevitable. The solution to this problem is to allocate resources by a formula comprising objective criteria over which the recipient authorities have no control. Once administrators realise that they cannot improve their relative position by their decisions, the only incentive is to maximise the benefits from the resources available.

A formula must of course be seen to be fair, and accommodate the existing complexities of the pattern of services. Part A of this thesis was an attempt to explore the relationships between services and populations. Complexities were examined in the form of weighting the populations, boundary cross-overs, and the special costs of regional specialties and teaching hospitals. A formula based on these variables does not completely

eliminate the possibility that an authority can improve its position - it might for example deliberately encourage the import of patients to increase its catchment population. But the scope for special pleading is substantially reduced and in accepting this formula principle for allocations to regional and area levels, the NHS is now moving towards not only a more equitable system but also a more rational one.

The second pre-condition for a rational allocation mechanism is knowledge of the benefits from health service intervention. As described in Part B of this thesis we know little about the outcomes of health care and, even where information is available, we have yet to solve the problems of measuring them in an additive and comparative form. It may well be that the problems are so complex that we shall never be in a position to fully appraise benefits. Some people argue that we should wait for the perfection of measurement techniques before we apply appraisal to decision-making. The alternative is to proceed with the limited knowledge available, at least to make administrators more informed of the consequences of their decisions. The study of CHs in Part B was based on the latter idea. It has the deficiency that benefits are assumed to be constant while costs are examined in depth. The merit, however, is that the study defines the boundaries within which value judgements can be made. More specifically, the study shows that while the CH in-patient services are more expensive than their alternatives, as a policy decision it would be possible to change the operational policies to bring the costs into line.

Other issues envolved from the research, not identified as essential to the original targets. For example, the detailed study of the costs of domiciliary care in part B and the costing of certain clinical hospital

specialties in part A have had "spin-off" uses not foreseen at the time the projects were conceived.

While it is not necessary for research to have practical consequences, applied research in economics is inevitably focused by its very nature on decision-making choices. The NHS is going through a period of transformation. Paradoxically, severe financial constraints, associated with national economic problems, are creating an awareness of the need for a more scientific approach to resource allocation since it is now realised that problems will no longer be solved by acquiring more resources. Administrators are becoming receptive to a more rational approach. It remains to be seen whether the results of research will be expressed in the improved quality of decisions.