CASPE
RESEARCH

King Edward's Hospital Fund,
14, Palace Court, Bayswater,
London W2 4HS,
Telephone : 01-229 8739

Output Measurement for Health Services

esearch are exploring Clinical Acco[illegible]bility, Service Planning and Evaluation in the N.H.S.

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CASPE RESEARCH PROJECT

King's Fund College

Output Measurement
for
Health Services

Report of a Day Seminar held
on Wednesday 17th November 1982

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INTRODUCTION

Dr. Iden Wickings welcomed those present. He said that the topic of the day's discussion was one of formidable difficulty and this was partly due to different views about what a health service's output might be. Some authorities spoke of output when they were really referring to throughput in relation to allocated resources; others referred to output but only used data collected at a particular moment in time; some authorities concentrated on final out-comes of treatment, whereas others took such an Olympian view that they regarded the health service's contribution to any measure of human well-being as almost an irrelevance. It seemed probable that no one measure could be developed that would have utility for all viewpoints.

This did not mean that those with a responsibility for the evaluation of individual treatment programmes, particular clinical services or whole health care systems did not need to have some measure of output in their minds. Many investigators had used or constructed particular indicators which would illuminate the comparative success of the system they were studying. It had seemed to the CASPE Research Team that it would be useful to gather together a number of research workers with interests in this field to see what work was in hand and whether there were common features which were important.

In addition to the question of whether there were common features which would emerge during the day, the CASPE Research Team had some interest in whether the variety of approaches being used could be conceived of as orthogonal vectors. For example, if the output of a particular health service activity was quantified in several quite independent ways and the findings were consonent, then the relative output might be evaluated with more confidence.

It was important to realise that any measure of output was relative. In this fact lay the potential danger behind any attempt to produce an all-embracing measure. Not only was output a relative concept, but it was inevitably multi-factorial. This would be amply demonstrated during the day. He hoped that at the very least the seminar would encourage thought about the topic. The proceedings of the seminar would be published by CASPE Research. All those present would receive a copy of the report which would also be made more widely available in the health service. In due course he hoped that CASPE Research would mount another seminar on output measurement in which some of the different approaches that would be described during the day might all be related to a common service or health care system. Such a focussed seminar would need considerable preparation but might prove illuminating, and he would welcome hearing from anyone who was interested in the idea.

WHAT IS OUTPUT AND WHY DO WE NEED TO MEASURE IT?

1. Introduction

Professor Alan Williams of the Institute of Social and Economic Research, York University, stated that the prime objective of measuring output was to ensure that the resources available to the health service were used in such a way as to guarantee that people were as healthy as possible. He regarded this as "the problem of efficiency" in the health service. He suggested that it would be useful to start the day's proceedings by reviewing how the NHS currently tried to measure efficiency.

2. Current methods of measuring efficiency

The typical method of tackling this problem was to study such data as bed use, length of stay, cost per patient day and case-mix, but experience indicated that little progress had been achieved using this approach. This point was illustrated with reference to the diagrams contained in Figure 1:-

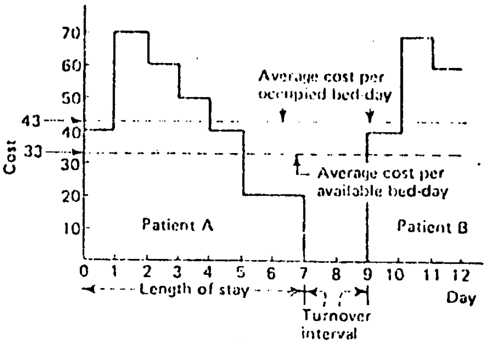
Diagram 1(a) shows a classic profile of an admission whereby costs increased by day 2,but relate largely to hotel expenses only by day 6. The patient is discharged and the process begins again.

The generally accepted idea is that a reduction in such statistics as turnover interval, cost per bed day, etc. is desirable and provides an indication of the efficiency of the firm concerned. However, if a clinician was encouraged to reduce his length of stay what would be the result?

Diagram 1(b) shows a reduced length of stay,but the turnover interval has remained the same and the average cost per bed day has slightly increased. If the clinician's reaction to these data is to reduce the turnover interval, he would find, as shown in

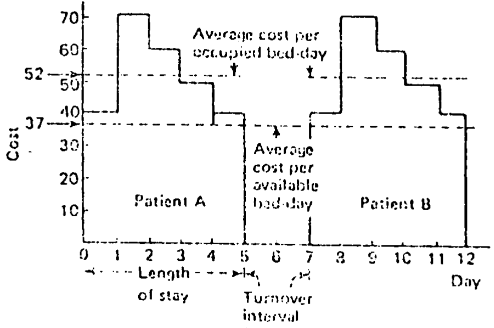
Diagram 1(c) that a reduced turnover interval results in a substantially increased average cost per available bed day.

Diagram
1(a)



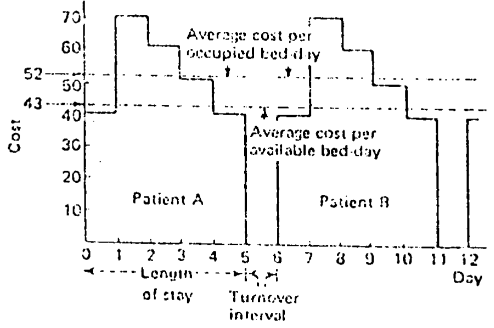
(a) Bed occupancy rate = $\frac{7}{9}$ = 77.8%

Diagram
1(b)



(b) Bed occupancy rate = $\frac{5}{7}$ = 71.4%

Diagram
1(c)



(c) Bed occupancy rate = $\frac{5}{6}$ = 83.3%

Figure 9.1 Three patterns of bed occupancy

(<u>From</u>: Alan Williams: "The Economics of Health"
in D.H. Gowland(editor) <u>Modern Economic Analyses 2</u>
Butterworths, 1982)

<u>Figure 1 - Current methods of measuring efficiency</u>

This type of low level data sends out conflicting signals and the only option open is to decide that one signal, say cost per case, is more important than another. The basic fault of such indicators stems from the fact that they are measures of activity and not measures of output, and they provide no indication of whether the patient's health has improved or deteriorated between admission and discharge. Professor Williams considered them to be quite useless and clearly demonstrated that the development of true output measurement in the NHS had hardly begun.

He went on to consider how improvements could be achieved and suggested that "input", "throughput" and "output" needed clarification:

(1)	"Input"	referred to the resources available, including cash, buildings, etc.
(2)	"Throughput"	referred to activity and a lot of the measures referred to in Figure 1 were throughput measures.
(3)	"Output"	referred to achievement in terms of health improvement for patients.

The purpose of the seminar was to concentrate on number (3). Consideration should be given to what was meant by health. It was suggested that health had two dimensions: the length of life and the quality of life. The length of life could be measured unambiguously, but the quality of life was much more difficult to measure. Key factors of the quality of life which were relevant to the health service were:

Factor 1.	Physical mobility
Factor 2.	The capacity for self care
Factor 3.	Freedom from pain and distress
Factor 4.	Social adjustment

By combining the length and quality of life it would be feasible to think in terms of "Quality Adjusted Life Years". If life expectancy could be increased while all four factors were held constant or improved, then an unambiguous improvement was being achieved. The value of extra years' life expectancy would diminish however if one or more of these quality factors could not be assured. This led to the need for quality adjusted life years.

3. Quality Adjusted Life Years

The target for measuring the effectiveness and efficiency of health services should be to establish measures of quality adjusted life years. It was noted that the four key factors for quality of life had not included specific reference to morbidity or symptoms or the absence of these. Being healthy was not the same as the absence of pathology.

It needed to be recognised that in the practice of medicine and delivery of health services, it may not only be the patients' quality of life that required measurement. The management of care in senile dementia, for example, was as much influenced by the consequences of the treatment, or lack of treatment, on the relatives as on the patient.

In working towards quality adjusted life years a distinction needed to be drawn between

(i) those elements that are factual, i.e. measuring what changes in these variables it is possible to bring about by treatment of one kind or another, and

(ii) those elements that are essentially concerned with evaluation, i.e. what those changes are actually worth.

4. Measuring Value

As soon as evaluation featured in any discussion it was necessary to determine 'value to whom' and 'how such values were to be established'. Health care was presumably of value to all the people affected by its delivery but to date very little effort had been made to find out to what extent different types of care were valued by patients and their families.

Even if the above hurdle could be overcome, the problems of measurement would still remain. One way to look at the effect of health care was to judge the productivity and income earning capacity of suitable patients.

This approach had ethical implications and did not seem acceptable if it was the only method used. However, if improving people's health resulted in increased productivity which outweighed the cost of resources used in treatment, then this could be regarded as a straightforward economic investment, in which the health gains per se came "free".

Perhaps more effort should be put into establishing the risks people were willing to take with their health in their pursuit of earning more money or saving time, such as the way they drive. The problems with such measures are that they are based on the assumption that

(1) people are the best judges of their own welfare, and

(2) willingness and ability to pay are relevant (since the risks people take depends upon their wealth).

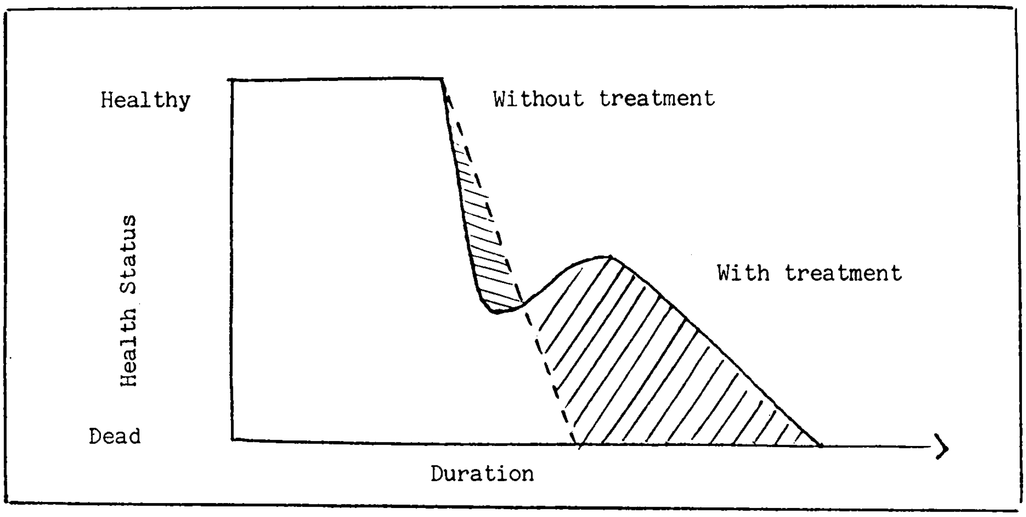
Even if the first assumption was not challenged, however, there remained the difficulty that if the health service was run on the ethic that personal ability to pay should not be taken into account, then it would be pointless to use values derived from the second assumption.

An alternative was to undertake psychometric studies to establish what relative subjective values people placed on the "good things in life". This approach had the advantage that it did not explicitly depend upon people's wealth.

5. Use of Output Measures

Professor Williams went on to discuss circumstances in which output measures might be used, on the assumption that all the problems previously referred to could be overcome. It was suggested that many studies into the effects of health care had failed to take sufficient notice of what happens during the course of treatment. When a patient visits his doctor an implicit estimate is made of his quality adjusted life expectancy following treatment. The treatment itself might be very unpleasant and the patient might experience a quality of life that for a while was much worse than his state of health in the absence of treatment. Some clinicians felt compelled to take some positive action and therefore administered treatment despite the fact that it might not be either successful or cost effective in the long term. Output measurements could be used to plot an individual's life expectancy and quality of life as illustrated overleaf:

Figure 2 An individual's life expectation being affected by treatment



However, the real problem in measurement of health care was not concerned with individual patients. If measures were to be used for a group of patients a social-ethical judgement was required. Should one year of healthy life expectancy be regarded as of equal value to everyone? If not, what alternative principle would be acceptable? If it was also possible to measure the effectiveness of treatment for particular groups of people, it would presumably be possible to select only those patients who would receive maximum benefit from that treatment. This would raise further ethical issues.

If the information he had described could be obtained it might be related to the use of resources in the following manner. A policy decision could be taken concerning the maximum amount of resources to be devoted to achieving each quality adjusted life year. Consideration might then be given to whether any treatment or activity that exceeded the agreed maximum cost should be provided, or alternatively whether more cost-effective treatments should be supplied.

6. Responsibility for development and use of output measures

Brief consideration was given to who might take responsibility for the development and use of such measures. Professor Williams suggested the following division of labour:-

(i) Considerable epidemiological work was required to establish the effectiveness of treatments and what the prognoses were for different patient groups in terms of life expectancy and the four quality factors listed earlier. It would be important for epidemiologists to undertake this work in conjunction with other disciplines, such as sociology and psychology;

(ii) Economists and Psychologists should be involved in establishing people's personal valuations concerning health care;

(iii) Politicians would have the responsibility for expressing the social ethic to be used for making judgements about priorities;

(iv) Clinicians would have the difficult task of assimilating all the data thus made available in order to improve their management of clinical practice in the public interest.

DISCUSSION

1. David Taylor suggested that the graph in Figure 2 should be amended to include those occasions when death was welcomed, or in suicide. He took issue with the suggestion that quality adjusted life years could be regarded as of equal value to everyone as this was not how people behaved in practice.

   Professor Williams accepted the first point. In relation to the value of life years, he suggested that it depended upon the community concerned and he believed this was a feasible suggestion for the population being served by the NHS.

2. William Laing pointed out that health authorities had not been mentioned and he thought it impractical to suggest that they could plan services in terms of producing "x" number of quality adjusted life years. Professor Williams stated that health authorities were responsible for making judgements about the best way to extend life and relieve suffering. They should want to know how people's health was influenced by the service provided and, for example, how the balance should be struck between relatives suffering at home with the demented elderly and the need for hernia operations, At present there was no way of documenting information that would enable, let alone encourage, authorities to think in these terms.

3. Ray Flux questioned the capacity of health authorities to implement policies when it was the clinician who made the decision concerning admissions. Professor Williams agreed that it was currently regarded as a purely clinical matter to decide upon caseload, but ultimately this would need to be an issue for the health authorities to determine

as a matter of policy. The increasing resource constraints made it no longer appropriate for this difficult task to be left solely to clinicians.

OUTPUT MEASUREMENT FOR HEALTH SERVICES: WHAT IS POSSIBLE

1. Introduction

Dr. Alan Fenton Lewis, Senior Medical Officer at the DHSS, suggested that when resources were scarce and any prospect of growth firmly denied, the spotlight moved to the only variable that could be influenced - output. Even the fictitious Minister for Administrative Affairs, Jim Hacker, had been discomfited when a schoolgirl reporter said "I do not want to know what you do, what have you personally achieved?" Although output measures presented a problem, it was not always easy to say what should be done. When it came to health care, there were good examples of what was possible, but many more of what seemed impossible. If the word impossible was regarded as a challenge, then the stimulus was considerable.

2. Categorising health care

The reality of the health service meant that it was unable to meet all the needs of the population. It had been claimed in fact that no country could afford such a luxury and difficult choices therefore would have to be made. There was however no doubt that output had to be maximised for a given input. The ratio of output to input was known as efficiency, a term with a very precise meaning but one that was frequently abused. The denominator, input, was usually known, whilst the numerator, output, was seldom known and there was therefore a tendency to provide all sorts of spurious ratios affecting to represent efficiency. Paraphrasing St. Paul, Dr. Fenton Lewis remarked: "We have these three, input, activity and output, but the most difficult of these is output."

Input led to activity, and the ratio of activity to input had been defined by Dr. Fenton Lewis & Dr. John Modle as a "stage 1 indicator"(1) This definition was used to show its incompleteness and to stop others calling it 'efficiency'. It indicated the resources consumed by a unit of activity and nothing else. Curious tricks could be played by choosing activity measures to suit the case in question, for example, occupied bed days as opposed to admission spells in hospital. The former implied that the filling of a hospital bed was an objective in itself, whilst the admission spell indicated an objective that was incomplete until the patient had been discharged or perhaps cured. Manipulation did not stop there because both stage 1 indicators could be distorted, the former by artificially reducing the turnover interval - "keeping the bed warm" - and the latter by readmitting patients for short spells. Monitoring stage 1 indicators undoubtedly had a place in management - they may be the only indicators available - but it had to be acknowledged that these did not enable either output or efficiency to be monitored.

The stage 2 indicator was the ratio of output to activity. Its use was largely to establish the qualitative identity of various activities for which stage 1 indicators may be monitored. The following example was used to illustrate this point.

> Two surgeons are restricted in some curious way to operating upon hernia and nothing else. Surgeon A has a high throughput and short duration of stay, Surgeon B a low throughput and longer duration of stay. It is clear that Surgeon B will require a larger resource input for every hernia he repairs, but his overall cost per bed day will be lower because the treatment element is spread over a greater number of days for each case. If activity is measured in occupied bed-days, then the stage 1 indicator (occupied bed-days per unit input) is in favour of Surgeon B which may seem rather a curious and certainly perverse answer. This can be demonstrated by examining the stage 2 indicator which shows that the activities of the two surgeons are not qualitatively identical, as they differ in the number of bed-days required to give one unit of output, a repaired hernia. Redefining activity in terms of cases treated does of course give an answer in favour of Surgeon A and a reassuring stage 2 indicator showing that one hernia is repaired for every patient admitted or very nearly so. This of course poses another question: what if the surgeons have differing failure rates? If we redefine the output as a satisfactorily repaired hernia, i.e. one that does not break down and generate a readmission within a follow-up period, then the stage 2 indicator will be sensitive on this issue as well.

Effectiveness in terms of the real objective must also be included. The real objective was to restore the patient to health, although some aspects of health care, such as terminal care, could not meet this criterion. On this basis, the retention of fit patients in hospital beds to provide an artificially low turnover interval was a totally ineffective activity, although the splitting of a period of hospitalisation into two or more separate spells (which in Hospital Activity Analysis are not linked) might be very effective in that it would please the patient and empty beds over the weekend. However, it would certainly distort the activity statistics and it would be very unwise to base any local performance indicator upon measures where local pratices can quite reasonably vary considerably.

Application was rather more serious. There were therapeutic regimes in medicine and in surgery characterised more than anything else by a lack of evidence of benefit to the patient. There was also much circumstantial evidence to suggest that what was more common was the application of a treatment, say hysterectomy, to conditions where it was inappropriate. Dr. Fenton Lewis said that he would be returning to the subject of application at a later stage, because he was convinced that this was the key to many of the difficult problems that arose in measuring output.

3. Output and outcome

Drs. Fenton Lewis and Modle originally proposed a very simplistic distinction between these two terms. The word output was restricted to instances where the benefit was apparently attributable to an identifiable health care activity, such as an operation or the administration of a drug. Where benefits arose from the result of many factors, for example good housing, clean air, abolition of poverty, the use of the word outcome was proposed, recognising that it was usually not possible to estimate the proportion of the benefit attributable to health care or to any other component. It followed that most activities of the medical profession could only produce output if there existed an effective treatment for the patient's condition, again with the exception of important activities such as terminal care where the benefit may accrue as much to the relatives as to the patient. Rutstein (2) measured the quality of care for diseases characterised by unnecessary and untimely mortality, that is diseases where medical treatment was effective in preventing death. Thus for tuberculosis the diminution in the death rate could be claimed as an output measure for health care, but hardly so for rheumatoid arthritis. This dichotomous distinction between output and outcome had to be modified to cover a continuum of transition between the two extremes. In addition, the distinction between them might vary for individual health caring professions. There were times when the medical profession was relatively impotent, but where the benefits of good nursing care were at their greatest. It followed that no case could be established for additional resources in any form of health care unless there existed a true output measure for that care. Unfortunately it did not follow that it was possible to measure this output in a way that would convince the Treasury.

Reference was made to an article by Julian Tudor Hart in the British Medical Journal called "Measurement of omission" (3). This made the point that what was omitted was the complement of what was done and that either action or inaction might be of benefit to the patient. Although thalidomide and practolol were initially found to be very effective drugs, there eventually appeared from their side-effects a pattern of human misery that proved horrendous and more than cancelled any good that may have been done for others. The output measure for those practitioners who avoided prescribing these drugs, whatever their reason, must therefore benefit from this act of omission. This example also demonstrated that one needs sometimes to be content with measurement of the complement of output that would be deemed good. Thus those who suffered side-effects could be counted rather than the much greater number that did not, those who died rather than those who survived.

4. Iatrogenic disease

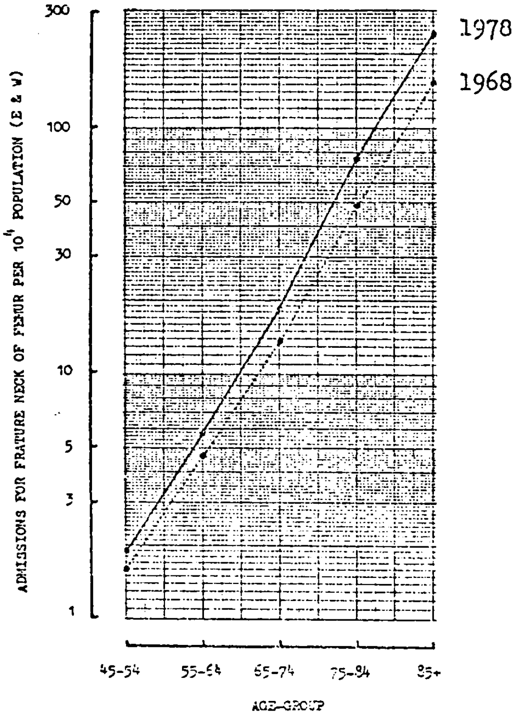
When a doctor and patient came together, the patient had a reasonable expectation that he would be made better. Often capacity to do this was limited and sadly the doctor-patient contact could sometimes result in an adverse effect on the patient as with the drug example above. The Association of Anaesthetists recently completed a comprehensive study of hospital deaths following anaesthesia (4). As expected, most deaths were avoidable and attributable to human error, but this enquiry provided a firm measure of the extent that anaesthetic administration caused death: around 1 in every 10,000 anaesthetics. The thoroughness and honesty of the study had been instructive to that specialty and it was hoped would set an example to others.

Other adverse effects might result from drug therapy, but not in general from the way in which it was prescribed by the profession. The existence of heroin and cocaine, both valuable medicinal substances, permitted a degree of abuse and of evil practices that led to many deaths and destroyed lives. There was much heart-searching about the necessity to retain these drugs for medicinal purposes, but in general these were adverse outcome measures and quite different from other aspects of iatrogenic disease. There had, however, over the years been an alarming increase in the number of admissions to hospital for adverse effects of medicinal and non-medicinal substances, some 29,000 in 1961, rising to 111,000 in 1978. It was debatable whether these admissions established a parallel increase in the incidence of such adverse effects, but it would be wrong to dismiss the evidence as an artifact.

Meniscectomy, removal of the semi-lunar cartilage in the knee joint, was an operation once very common in orthopaedic surgery, but now of declining popularity. These menisci transmit weight and absorb energy, acting as shock absorbers, in the knee joint. Other joints appear to manage without them, but in the knee their load transmitting function appears essential and their removal leads almost inevitably to osteoarthritis. It was now commonly accepted that they should never be removed completely and, more importantly, that one should certainly never remove a normal cartilage, a practice now rendered much less likely by the use of the arthroscope as a diagnostic tool. In England and Wales in 1968 there were 17,800 such operations, in 1974 15,600 and in 1978 13,500, a trend downwards that could hardly reflect a decrease in the number of torn cartilages. The output measured as long-term freedom from osteoarthritis was thus very different from the immediate benefit of the operation.

The increase in admissions for fracture of the neck of the femur was mainly due to increased age-specific admission rates (see Figure 3)(5).

Figure (3) - Admissions For Fracture Neck of Femur

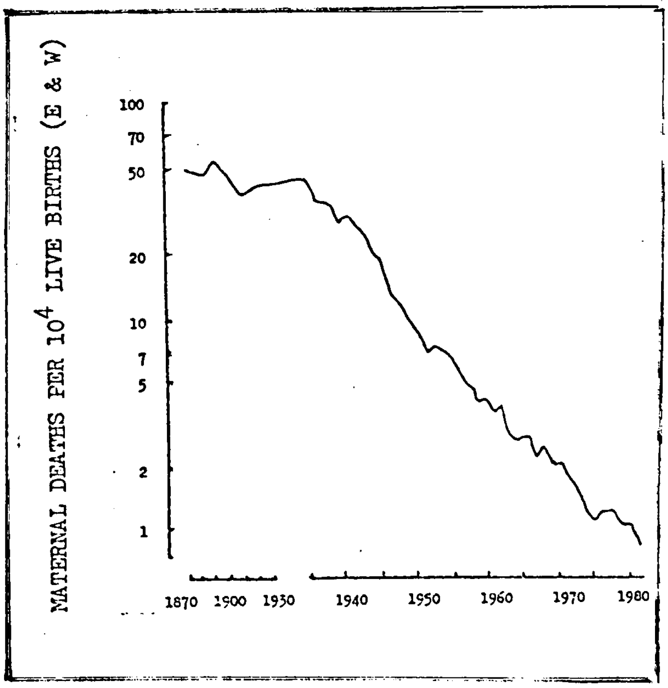


This increase probably reflected an increase in fracture incidence rates - this finding has been confirmed in other countries - and this change was presumably an outcome of the impact of modern society. It might even be iatrogenic, perhaps the impact of the wide use of diuretics upon mineral metabolism. Thus the distinction between <u>output</u> and <u>outcome</u> became critically important when there was blame to be allocated rather than credit. Fortunately, NHS provision for fracture of the neck of the femur was adequate. All known fractures were admitted and there existed a very effective surgical treatment. However, in the absence of population morbidity data, the increase in population dependence on hospital care as judged by this one demand-led condition had suggested the hypothesis that age-specific dependency was increasing, a view supported by the divergence of the 1968 and 1978 lines. In the terminology of Rachel Rosser, this was a reduction in the expectation of life free from morbidity, or as described by Alan Williams, a loss of quality-adjusted life years.

5. The contribution of health care to outcome

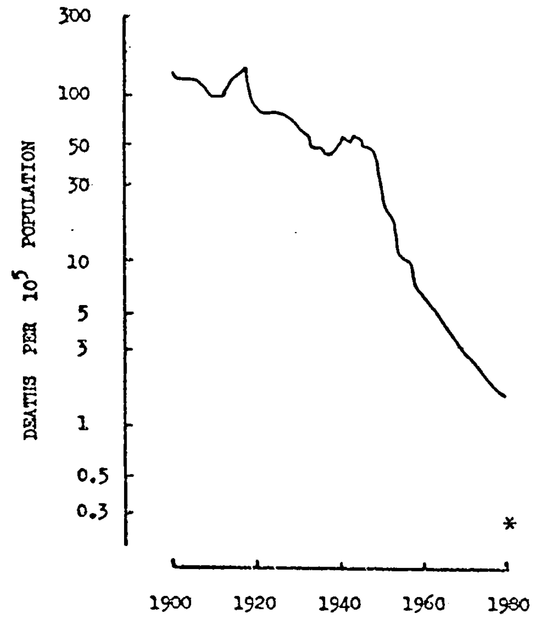
Reference was made to Figure 4 which illustrated maternal mortality rates for England and Wales since 1870. There was almost a plateau until 1935 since when there has been a steady reduction in the maternal death rate to the present value of less than 1 in every 10,000 births, a 45-fold reduction in as many years. It was difficult to find any explanation that coincided with the change of slope in 1935 and it seemed that a chain of events followed a reaction of public conscience to this unnecessary slaughter. Even the impact of penicillin was buried in the momentum maintained over these 45 years and the contribution of sulphonamides was self evidently relatively small. This single well-maintained downward trend did not help when trying to separate the many factors that must have contributed to this improvement over so many years. With no disrespect to obstetricians and midwives, it was necessary to describe this as an outcome measure rather than an output measure. The present-day more sophisticated approach to analysing such deaths might, however, permit the separation of these components.

Figure (4) - Maternal Mortality Rates 1870 - 1980



For tuberculosis, the reduction in mortality over the last 80 years has been nearly 100-fold (see Figure 5), but all other features of this improvement contrast strongly with maternal mortality. Apart from the disturbance associated with the two world wars, the downward trend for the first 45 years of this century was much lower than subsequently. Antibiotics developed in the late 1940s proved highly effective against tuberculosis (tuberculous meningitis was transformed almost overnight from a disease with a 100% fatality rate) and it was clearly reasonable to infer that the enhanced progress of the last 35 years rested much more with advances in medical and surgical treatment than previously. It was therefore posible to make some estimate of the relative contribution of specific medical advances, a contribution superimposed upon more general public health and social changes.

Figure (5) - Tuberculosis Mortality Rates 1900 - 1980



(* = rate for 15-44 age group 1980)

An even more sensitive output measure exists when the **deaths** of younger adults were considered alone. Prior to 1945, the mortality of those aged 15-44 did not differ materially from those shown in the graph in Figure (5), but by 1980 this age-group had a mortality rate only one-seventh of that for all age groups. Thus the death rate for all ages was dominated by deaths associated with tuberculosis in the elderly, a legacy of an earlier period. This technique of focussing down on selected groups was an important method of improving the sensitivity of output measures and often of distinguishing them from outcome measures.

Dentists do not seem to have had the same problem in identifying true output measures. From a national study of adult health (6), the number of sound and untreated teeth per adult **had** increased from 1968 to 1978 as did other measures of good dentition (see Figure 6).

Figure (6) - Increases in measures of good dentition

	Sound and untreated teeth	Missing teeth
1968	12.8	10.1
1978	13.2	8.8

	Natural teeth only	Partial denture with natural teeth	Edentulous	Total
1968	41	22	37	100 %
1978	51	20	29	100 %

The survey data also helped to identify separately the impact of regular surgery attendance, although the interpretation of such figures needed considerable care.

Figure (7) - Percentage of adults with 18 or more sound & untreated teeth

	Regular attenders	Attend when in trouble
1968	13	31
1978	18	33

The higher base-line for those who only attend when in trouble referred only to the existence of sound and untreated teeth and said nothing of those that were missing. Clearly such non-attenders had a greater risk that their caries would progress to make extraction inevitable than those who attended regularly. A paper on this subject by Aubrey Sheiham "Is there a scientific basis for six-monthly dental examinations?" (7) caused quite a disturbance in the dental profession when he showed that there was probably an optimum interval between such visits for every individual that avoided the risk of over-treatment. The dental profession was to be congratulated for producing such good measures of output and for being able to demonstrate its own efficacy.

For the most common of all symptoms, low back pain, the operation of laminectomy existed. It was noted that laminectomy rates in this country were 0.8 per 10,000 population, but as high as 7.0 in the USA with other countries occupying an intermediate position. Such a variation was not easily explainable in terms of need and clearly represented interaction with the level of provision. But which level was correct? Were such figures useful as measures of output without knowledge of the appropriateness of the application and the efficacy of the treatment? Perhaps the impossible had now been reached.

Outcome measures in resource allocation

Lest the foregoing be found depressing, the following was given as an example of what was possible and could be implemented. The hospital revenue resources allocation formula (8), (simplified slightly by the omission of a small correction factor in the denominator) was quoted as:-

$$\sum_{i} \sum_{k} \left[\frac{\left(\sum_{j} \frac{RP_{jk} \; NB_{ijk}}{NP_{jk}} \right) \left(\sum_{j} RD_{ijk} \; \sum_{j} \frac{NP_{jk}}{ND_{ijk} \; RP_{jk}} \right)}{RP_{..} \; NB_{...} / \; NP_{..}} \right]$$

Where RP and NP are the regional and national populations, RD and ND the regional and national deaths, NB the national occupied beds, all summed across i conditions, j age-groups and k sexes.

Dr Fenton Lewis gave the following interpretation:-
"The denominator is invariable and we will ignore it in this discussion. The term on the righthand of the numerator is the Standardised Mortality Ratio (SMR) and the lefthand term simply sums the regional population across the age-sex cells with a weight equal to the cell-specific national bed usage. This term may be rewritten

$$\sum_{j} \sum_{k} NB_{jk} \; \frac{RP_{jk}}{NP_{jk}}$$

and it now sums occupied beds with a weight equal to the ratio of regional to national population in each cell. Thus this formula, without the SMR bases the allocation upon an activity measure, bed usage, with no recognition of local needs other than that due to age-structure.

The addition of the SMR produces nested summation which prevents simplification, but to a first approximation the formula becomes

$$\sum_{i} \sum_{j} \sum_{k} NB_{ijk} \cdot \frac{RD_{ijk}}{ND_{ijk}}$$

where beds are summed with a weight now equal to the cell ratio of regional to national deaths. This weight is a locally derived outcome measure, surely better than an activity measure, which has the additional advantage that the use of death registration data allows summation across an added dimension, the condition causing death. It is easy to dwell upon the imperfections of this additional step, but it does provide an index of geographical relativity in the prevalence of disease affecting those who die and of those who survive. It is another example of focussing down to give sensitivity and has provided a locally produced outcome measure that is non-manipulable. The change represents an important landmark in the use of output measures in decision making.

DISCUSSION

During the discussion that followed participants expressed the opinion that the DHSS appeared to be taking the view that no satisfactory output measures could be developed because of the complex nature of health services. Dr. Fenton Lewis did not accept this and had not intended to give that impression. He pointed out, however, that his example relating to the removal of cartilage from the knee demonstrated the difficulties. When this operation was carried out, the immediate outcome for the patient was relief of pain, but he may return to his doctor in 10 years' time suffering from osteoarthritis. The dangers of side effects were often appreciated too late, and what constituted a satisfactory & immediate output measure was seen in the longterm to be far from satisfactory.

ADMINISTRATIVE SYSTEMS OF OUTPUT MEASUREMENT

1. Introduction

Dr. Iden Wickings, Director of CASPE Research, said he was using the term 'administrative systems' to denote measures which were designed with the ultimate intention of describing output in relation to resource usage. In particular he was interested in systems which did not pretend to measure output comprehensively, since as Alan Williams had shown this was an exceptionally complex task, but which were intended to help managers or clinicians make better informed choices from the resourcing options available to them. He and James Coles, the Assistant Director of CASPE Research, would therefore describe two research projects in which attempts had been made, or were about to be made, to relate 'output' to a costed 'input'. He emphasised the importance of such measures being developed in order that the consequences of tighter controls over resource consumption which were now an international phenomenon in health care, could be monitored.

2. Standardised Recovery Curves

In 1973/74, the King Edward's Hospital Fund had supported a research project (Coles, Davison, Neal & Wickings (9), which examined the concept of 'standard 'recovery curves' - an averaged path towards recovery or discharge that patients (standardised for age, sex, social class and diagnosis) followed. Attempts were made to measure different health states much as described by Rachel Rosser - particularly her earlier work (Rosser & Watts, 10) and by others (Grogono and Woodgate, 11).and to plot these on a curve over time (see Figure 8). This project was established as a control to a larger clinical budgeting experiment being undertaken at Westminster Hospital (Coles, Davison and Wickings, 12). It had been decided, because of the possible effects of a clinical budgeting experiment, that care should be taken to ensure that the recovery of patients had not been affected adversely. This led to the project now being described, but other considerations had also been in mind.

Amongst the possible uses for Standardised Recovery Curves (SRCs), the research team had envisaged:-

(i) comparisons between treatment regimes;

(ii) analyses of whether better recovery curves were associated with greater resource consumption or vice-versa;

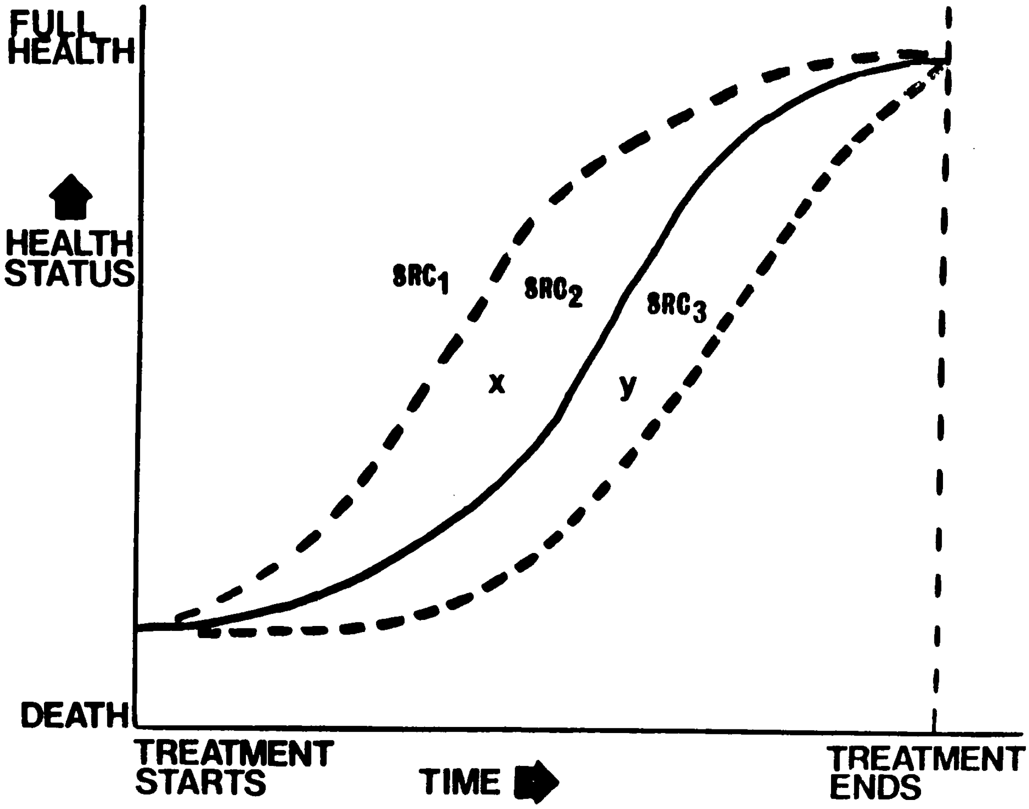
(iii) controls to record 'outputs' which could be employed when other aspects of care or provision were being changed (such as alterations to clinical policies, resources or facilities).

It had been hoped that SRCs could be readily constructed for the clinical teams at Westminster Hospital, who had volunteered their cooperation. In fact, this had proved impractical due to the difficulties encountered in obtaining consistent recordings of health status across different observers. Given time, such difficulties could probably have been overcome, and other researchers claimed reasonable inter-observer consistency. Consequently the CASPE Research team are still interested in the idea, and James Coles would later describe how such a system might cope with the varied case mix of a hospital, department or individual consultant.

One of the main conclusions of the project testing standard recovery curves was that the health status indicators being used at the time took too little account of the prognosis of the individual patient. However, it was all too easy to criticise such measures for imprecision, when they might be sufficiently accurate to illuminate different resourcing options. Dr. Wickings considered that, if a clinical team used more resources than another team, yet both teams treated a comparable case-mix with comparable standardised recovery curves, then the burden of proof would lie on the more costly team to show that their results were actually better.

In Figure 8, for example, a clinical team that produced the 'better' curve (SRC1) would have reasonable grounds to justify higher resource consumption than teams with curves (SRC2) or (SRC3):-

Figure 8 - Standardised Recovery Curve (SRC)



3. Demonstration of Computerised Display of Patient Recovery Curves

James Coles, Assistant Director, CASPE Research, gave a description of the way in which the theoretical concepts of standard recovery curves might be applied in practice in a health authority. He explained that the methods described were not designed to be used to look at an individual's whole lifespan, but at specific instances of medical care: from the point that a patient entered the hospital system to the time that he is supposed to have reached some relatively stable state, e.g. discharge or transfer of care back to the G.P. On the assumption that measuring health was possible, despite all the difficulties described by Alan Williams, the recording of health status could be undertaken either on the basis of a national standard or in terms of a local agreement with clinicians. The clinical budgeting studies being coordinated by CASPE were concerned with the DMT reaching agreement with each consultant upon the level of resources required for a planned workload. Mr Coles suggested that it would be feasible to agree locally upon criteria for measuring health status which could be incorporated in these agreements. Such a system would require the health status of each patient to be recorded routinely and consistently. The individual responsible for this task would require sufficient expertise on the ward concerned and would probably be either the clinician or a member of the trained nursing staff. It would not be appropriate for such details to be recorded routinely on HAA.

Production of computerised patient recovery curves

The agreed criteria for measuring health could be incorporated into a computerised system to enable a comparison to be made between actual recovery rates with the standard recovery curves. The program developed for demonstration purposes in this presentation had been based on the following assumptions: -

(1) There were five diagnostic categories for which SRCs had been agreed and these covered the whole caseload of the clinical firm.

(2) During the month 50 patients were treated with the following breakdown of diagnoses:

12 patients	:	diagnosis 01
6 patients	:	diagnosis 02
15 patients	:	diagnosis 03
10 patients	:	diagnosis 04
7 patients	:	diagnosis 05

(3) The health status of each patient was measured as soon after admission as practicable, but within 24 hours, and thereafter on alternate days.

(4) The standard curve for case-mix was calculated at the end of the month while the actual curve was obtained from a running total - Figure 12.

Examples of SRCs for the different diagnoses can be seen in Figure 9. It was noted that some of the curves may not reflect an improving standard of health status, but a static or gradually deteriorating condition.

Although the demonstration program had been limited to five diagnostic categories, it was likely that in practice a further breakdown would be required. For example, a 25-year old man suffering from a broken neck of the femur might be expected to recover much quicker than an elderly patient. Differential SRCs relating to age and perhaps to social class, would thus be required.

A second data file stored information about each clinician's patients and this linked with the diagnoses enabled a comparison to be made between actual and standard recovery curves. (See Figure 10).

Mr. Coles explained that the computer system required to produce such information was not cumbersome. The hardware used was the Apple II Europlus computer with two disk drives. Visicalc software is amenable to storing the health status measurements of individual patients and files can easily be transferred to draw figures as shown using Business Graphics software.

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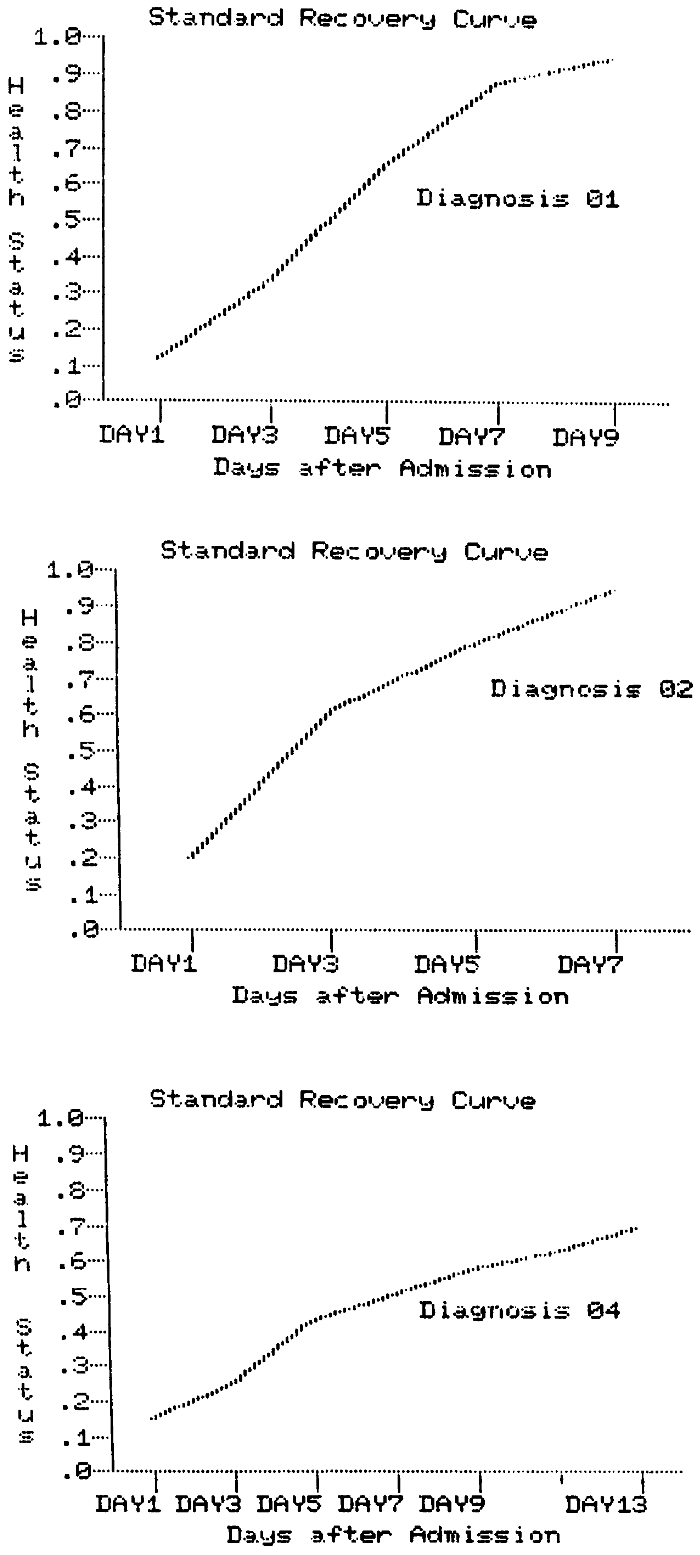
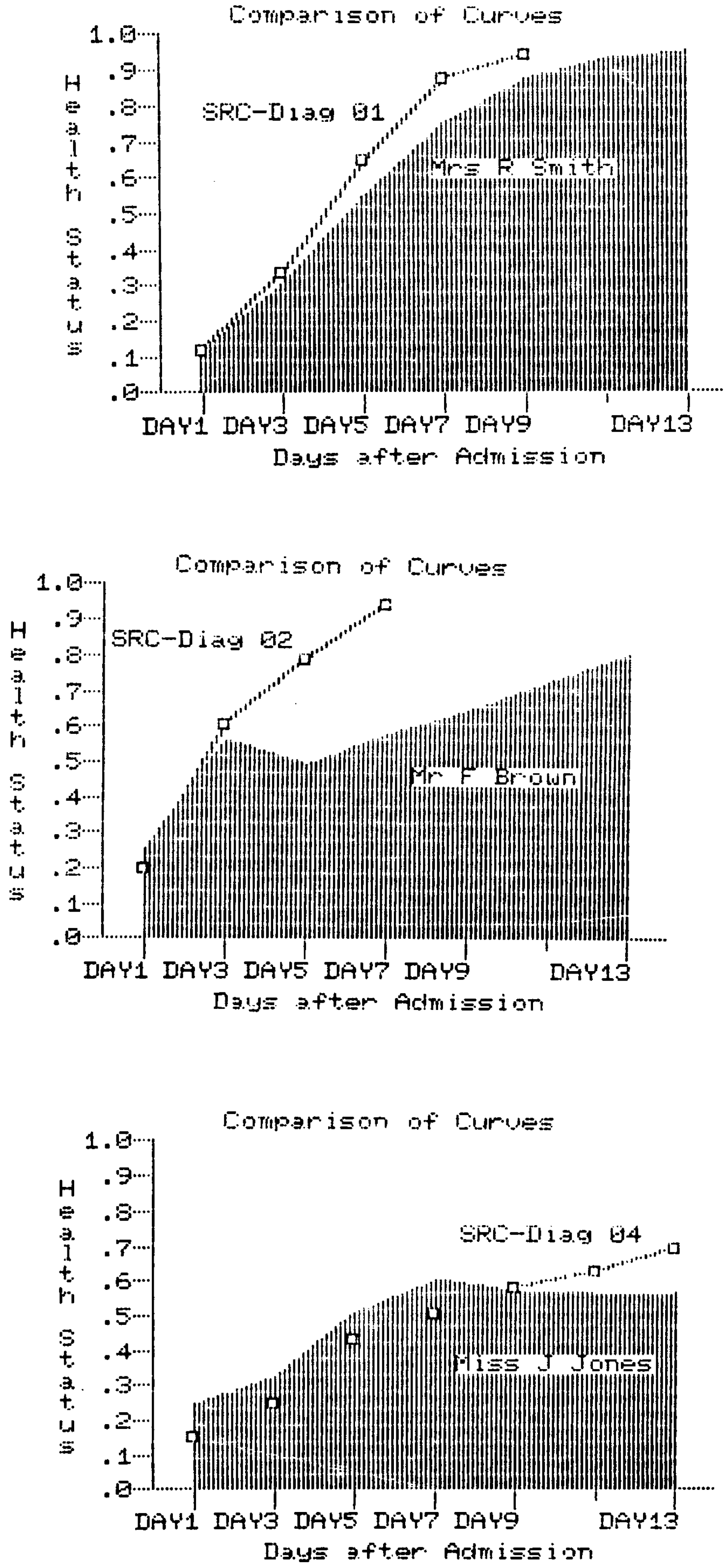
Figure 9 - Examples of a Computerised Display of Standard Recovery Curves



NOTE:

The SRC shown could be a national average for the standardised diagnostic category for persons of a given age, sex and social class, or an SRC determined in some other way.

Figure 10 - Examples Comparing Actual data with SRCs



NOTE:

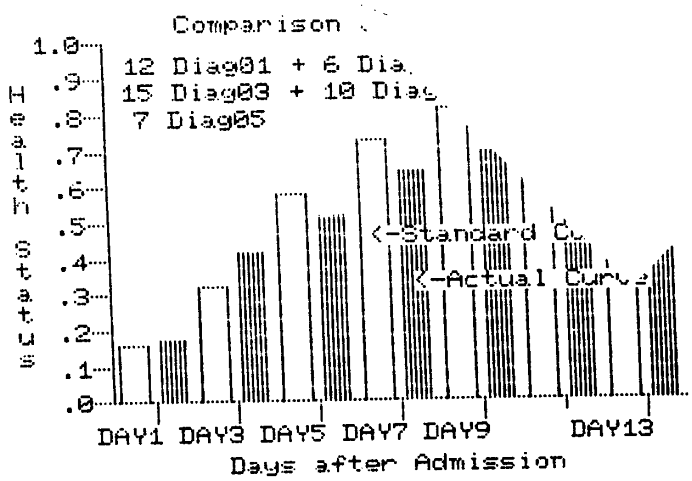
The shaded area shows the actual recovery curve achieved by the clinical team concerned for the specific patients shown contrasted with the SRC.

Use of Standard Recovery Curves

It was unlikely that such graphs would be produced routinely, but ad hoc reports could prove useful for the clinician wishing to make a particular study of his clinical management. SRCs would also prove useful when considering the resource implications of a long length of stay; to monitor whether the additional benefits to patient care of a longer length of stay were achieved and whether they were gained at the expense of other patients' care.

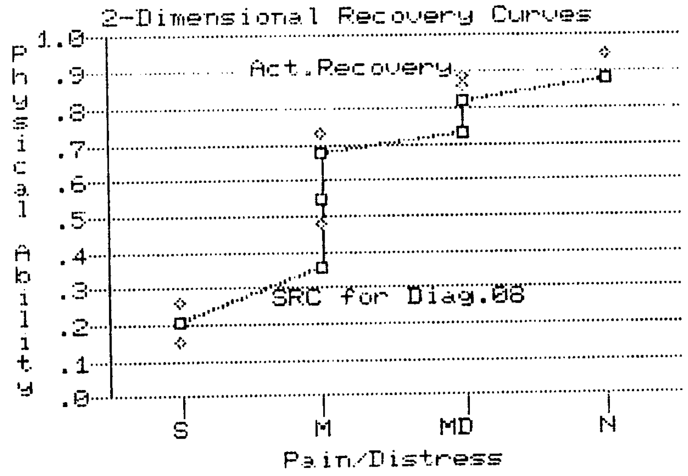
It was accepted that comparisons might be misleading when applied to individual patients and consideration needed to be given to how one could aggregate patient care. It was likely that clinicians would wish to review patients within a diagnostic group or age mix. The use of the Visicalc software made it practical to program the computer to produce the type of comparative data shown in Figure 11 and other patient groupings as required locally.

Figure 11 - Comparison of Curves



Finally, Mr. Coles referred to the diagram shown in Figure 12, which related a clinician's case mix to standard recovery curves using the two dimensions developed by Dr. Rosser. Although more difficult to visualise it was suggested that this type of information would encourage discussion about trade-off between physical recovery and pain/distress, e.g. whether additional nursing cover might improve the 'scoring' on this latter axis.

Figure 12 - Relating case-mix to SRCs

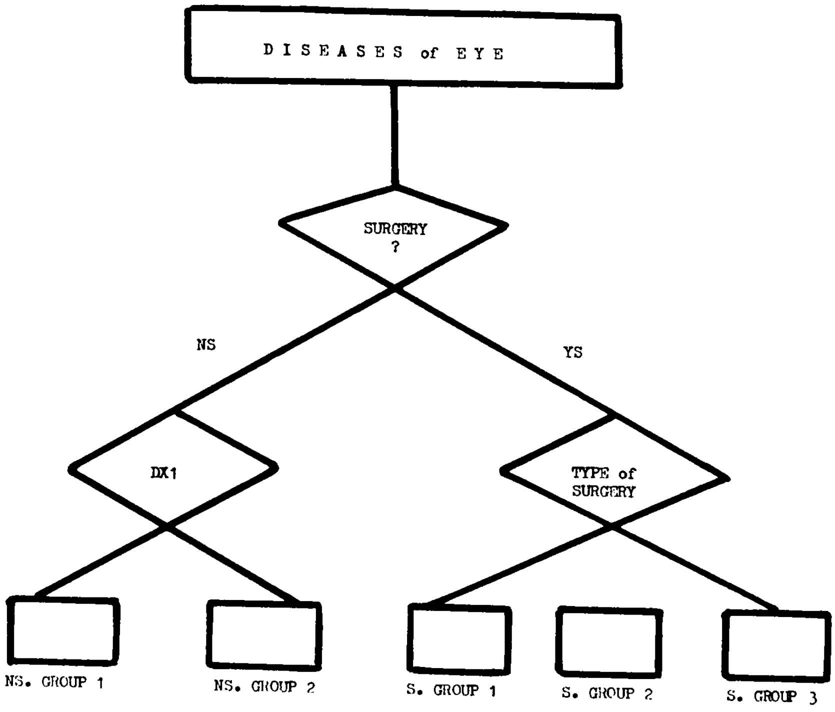


'S' = severe 'M' = moderate 'MD' = mild 'N' = none

4. Diagnostic Related Groups

Dr. Wickings then described a Research project which the CASPE Unit were about to embark upon. Research had been carried out at Yale University which had developed a classification system for diagnoses based on the I.C.D. which in the U.K. could be obtained from Hospital Activity Analyses. For each discipline the treatments had been divided into groups. These groups were determined along a clinically relevant and a resource relevant algorithm. For example, in Figure 13,'S Group 1' might require limited resources, whilst 'S Group 3' routinely required substantial resources.

Figure 13 - Diagnostic Related Groups



The Office of the Chief Scientist, DHSS, had authorised a four year project to see whether it would be useful to incorporate Diagnostic Related Groups (DRGs) in the main research being undertaken by CASPE. One of the problems associated with clinical budgeting and planning of services was whether the involvement of clinicians in resource planning would influence their case-mix. It was often suggested by clinicians that given the opportunity, such as via a clinical budget, they could 'cheat' the system by choosing to admit cases which required few resources and use the 'savings' thus achieved to fund an expensive item of equipment. The administrative systems developed by CASPE to date would only identify such practices with difficulty and the use of DRGs was being explored as a possible solution.

It was planned to see whether the resource assumptions made in Yale would apply in the UK. In the USA it had been found, not surprisingly, that the most significant factors in the cost of these particular groups were the principal procedure carried out and the patient's length of stay. On the assumption that the same finding emerges from the UK study and that the dollar cost could be converted to sterling cost, it would be possible to develop a model for each clinical team in sterling costed DRGs and to see whether there were any changes brought about by the use of clinical budgets to case-mix. If the same factors were not equally important in the U.K. then it would be possible to produce a U.K. set of DRGs whilst still using a similar methodology to that developed at Yale.

DISCUSSION

1. Professor McColl pointed out that regardless of whether it was the outcome of a hernia or a myocardial infarct being measured, it was essential to take account of how ill the patient was prior to admission and thus how difficult it was to achieve results. Dr. Wickings agreed that this had been omitted from the demonstration model, but said that provided the initial data base was sufficiently large, there was no reason why SRCs could not be produced for many categories or sub-groups of patients which took such factors into account.

2. Mr. Laing expressed concern that if the recovery curves were developed from a low level of average performance it would make all clinicians appear to be performing well. Mr. Coles suggested that this would depend upon

how the information was used. If recovery curves were calculated on a national basis individual clinicians could be compared against those standards. However, he believed it made more sense to have a locally agreed plan about what constituted an acceptable SRC. For example, discussions could be held with the Orthopaedic surgeons on a group or individual basis to obtain a commitment on the time they would expect a routine case to recover. This opened the way for discussion concerning those patients which did not fall within these categories. It was accepted that the standard initially established may not be correct and thus recovery curves would be set too low. However, this problem was likely to be resolved over time.

3. Several persons expressed the need for caution in interpretation. Dr. Wickings agreed that such information needed to be interpreted with care and administrators would always need the assistance of District Medical Officers. However, the NHS was being increasingly affected by the need to switch resources from one area to another. At the moment decisions were being taken without evidence to demonstrate the consequences of the choices made. It would be an advantage to every one if it were possible to demonstrate to health authorities and others that where clinicians were giving a 'poor performance' they were perhaps under-funded and thus consideration needed to be given to allocating more resources. Conversely, if better performance was not associated with instances of higher costs, there would be a prima facie case for transferring resources.

HEALTH INDICATORS: PSYCHOMETRIC STUDIES OF THE SEVERITY OF ILLNESS

1. Introduction

Dr. Rachel Rosser, Reader and Consultant in Psychiatry at Charing Cross Hospital, explained that she became interested in health indicators whilst working as a general physician in acute medicine. The design of the indicators had been influenced by the problems she had experienced, such as pressure on beds, the decision to discharge one patient to permit the admission of another, and priorities in allocating her own time and the resources at the disposal of a junior doctor.

However, the move from a general physician to a psychiatrist's post had led her to question the appropriateness of using these measures as a guideline to the disposal of the resources at her command. Although her current unit was in an acute specialty, the patients treated suffered from personality disorders, neurotic illnesses, psychosomatic conditions, etc. It was a field in which treatment was at an early stage of development and a large proportion of the work related to interventions of relatively low efficacy and support or longterm management. By applying her health indicator to this unit, Dr. Rosser had found the output to be very low. This had prompted her to question the unit's objectives. Was she in the business of curing, or of caring (which could be evaluated by measuring daily changes of her patients' conditions), or was she in the area of research and development? The same measure of output would not be applicable to all these activities. As a result of applying health indicators in their work, she hoped clinicians would be confronted with such questions about their own objectives and modify their practice accordingly. For example, a unit which justifies its low impact on patients' states on the grounds that it is primarily a research or development unit, should be organised and funded differently from a service unit.

As an enthusiast for the whole concept of measuring health status Dr. Rosser accepted that it was unlikely that she would question the relevance of such measures to the same extent as clinicians upon whom they were imposed. Nevertheless, she had considered the extent to which health indicators could be developed to reflect clinical activity accurately and to answer specific questions about the efficacy of interventions. These measures needed to be both sufficiently sophisticated to represent the outcome of complex clinical practice and sufficiently simple to be used as management tools to guide policy for patient care.

2. Design

It was suggested that the approach to adopt when designing health indicators was to use descriptions which could be rendered increasingly more complex, and to place values upon them which enabled the descriptive material to be distilled and converted into a numerical summary. To achieve this end depended upon whether satisfactory measures of value could be developed. If they could, every health state could be expressed numerically and the numbers combined or aggregated in one of a variety of appropriate ways. Dr Rosser commented that regrettably many of these ideas were still theoretical and during the past 10-15 years but a few steps in the valuation process had been achieved.

The stages of designing a health indicator were described as follows:-

The study commenced in the knowledge that only extremely crude measures of outcome were routinely available which did little more than distinguish whether patients were dead or alive on discharge from treatment. In addition there were plentiful data based on epidemiological measures of illness in the community. There was a considerable gap between these two types of data. It was recognised that measures to evaluate health services would need to be applicable across diagnoses, and particularly in times of resource constraint, to enable the value of activity in one unit to be compared to the value of activity in another.

The data of the type shown in Figure 14 were used by Florence Nightingale to highlight the differences in mortality between inner London and urban hospitals. Her statistical system was quite elaborate and Dr. Rosser felt that in some respects it had yet to be bettered. This type of data collection ceased in 1967, but Dr. Rosser was fortunate in having the opportunity to analyse the returns for two years in one London Teaching Hospital.

She posed the question: " Was it more or less risky to be admitted to this hospital in 1967 than in 1959? The proportion of patients "relieved" had increased - the proportion "unrelieved" had decreased. However, whether the measures applied were judged to indicate an improvement or a deterioration in the outcome of hospital care depended upon the value assigned to death compared with relief and with persistence of illness. It would also have been of interest to know how ill the patients were on admission and to what extent their condition had improved on discharge.

Dr. Rosser decided to establish studies in the same hospital in order to develop a slightly more complex classification than "relieved" and "unrelieved". These classifications needed to be simple to enable values to be placed upon them subsequently; to be used consistently by clinicians with varying backgrounds, and to be applied to patients of different types at their admission and on discharge.

Figure 14 - DATA IN FLORENCE NIGHTINGALE'S FORMAT

	Hospital Data	
	1959	1967
SURGICAL		
Relieved	83.0	84.7
Unrelieved	12.7	9.7
Dead	4.3	5.6
MEDICAL		
Relieved	70.4	76.2
Unrelieved	22.2	14.6
Dead	7.4	9.2
DEATHS		
WL Cases	1.3	2.3
Emergencies	7.0	9.8
Emergency Ops	4.0	6.0

3. Disability and Distress

The classification was developed under the broad headings of 'Disability and Distress' (see Figure 15). 'Disability' refers to mobility and social function and 'Distress' covered all subjectively unpleasant experiences, such as pain. On the assumption that the totally unconscious patient does not suffer, the categories give a maximum of 29 different combinations of health states.

Figure 15 - CLASSIFICATION OF STATES OF ILLNESS

DISABILITY AND DISTRESS

DISABILITY

1. No disability
2. Slight social disability
3. Severe social disability and/or slight impairment of performance at work. Able to do housework except very heavy work.
4. Choice of work or performance at work very severely limited. Housewives and old people able to do light housework only, but able to go out shopping.
5. Unable to undertake any paid employment. Unable to continue any education. Old people confined to home except for escorted outings and short walks and unable to go shopping. Housewives able only to perform a few simple tasks.
6. Confined to chair or to wheelchair or able to move around in the home only with support from an assistant.
7. Confined to bed.
8. Unconscious.

DISTRESS

1. No distress.
2. Mild.
3. Moderate.
4. Severe.

This classification had been applied in several studies. In the 1971 study the patients were classified by the doctors who admitted and discharged the patients following considerable training of the doctors concerned and the undertaking of reliability studies. In other studies consultants, doctors in training, nursing and other paramedical staff have been involved. A high return rate, of the order of 99%, was obtained.

In Figure 16 the states of disability and distress have been placed in rank order and demonstrate the changing health status of patients between the time of their admission and the first Outpatient attendance. It was noted in Figure 16(a) that 19% of patients had been admitted in a state of no disability and no distress. These largely fell within the category of elective operations and presumably included patients for whom the main purpose of admission was an intervention intended to improve prognosis. The measures could only show a continuation or deterioration from this state. The remaining patients in the study were spread throughout most of the other states. A substantially different distribution could be seen in Figure 16(b) which illustrated a significant trend towards improvement in the health of the patients concerned. Finally in Figure 16(c) the percentage of patients described as having no disability and no distress has risen to 45. However, between discharge and follow-up, the proportion of patients in the more severe states had also increased.

This exercise had improved upon the Florence Nightingale type of data in that it gave a more descriptive statement of the improvement occurring in hospital admissions. However, the degree of improvement or deterioration could not be identified until the severity of these states could be assessed against some sort of scale..

The techniques used to develop such a scale drew upon psychological research concerning the measurement of perception of physical stimuli such as light and sound. A sample of 70 people were chosen with differing experience of illness. These included

20 healthy volunteers
Doctors with considerable postgraduate experience
Experienced medical and psychiatric nurses
Severely ill medical and psychiatric patients

Each of the 29 health states were written out on cards. During an interview each subject was asked to take six states and place them in order of severity and subsequently to record the ratios, i.e. how many times worse one state was compared to another. Finally, the remaining 23 states were ranked and ratios placed upon them. The results of this exercise, which can be seen in Figure 17, illustrated the trade-off between disability and distress and appeared to comfirm the appropriateness of much clinical practice which was concerned with establishing individual patients' trade-offs.

Attention was drawn to the fact that the ratio between the most severe state and the mildest state was nearly 750. It might be thought that this figure was somewhat high. However, the range of the scale is in fact somewhat narrow when considered in the light of current patterns of resource allocation in the NHS. A patient in disability state 1 and distress state 2 might be suffering from a mild common cold for example, and would at most receive a single consultation with his GP. A patient in state 7-4 might receive weeks of intensive care. The range of the scale has been limited by the omission of prognosis. The subjects had been asked to make assumptions about prognosis. At first they assumed that all the conditions were transient and treatable, later they assumed that they were permanent. The ratios in both studies were almost the same. As yet, little is known about the range of a scale of both transient and permanent states and Dr. Rosser's group is in the process of studying this.

Dr. Rosser suggested that the meaning of all these figures could not be established until they were used on a comparative basis. Figure 18* illustrates what happened when different firms were compared on two criteria: the number of patients treated and the percentage contribution made to the overall improvement of the patients. It could be seen that Medicine II was ranked top and Surgery III ranked bottom on both criteria. It was also noted that Surgery I's throughput was considerable, but it had little effect in improving health status, whereas Surgery II had few patients, but changed their status considerably.

Figure 16 - STUDY OF OUTPUT OF A HOSPITAL: STATES OF PATIENTS TREATED DURING 1 MONTH

(a)

DISABILITY STATE	DISTRESS STATE			
	1	2	3	4
1	19	12	3	1
2	10	12	3	1
3	1	3	1	1
4	3	3	5	1
5	1	3	4	2
6	1	1	2	0
7	1	2	3	1
8	0	0	0	0

Percentage of patients in each sickness state on admission

(b)

DISABILITY STATE	DISTRESS STATE			
	1	2	3	4
1	33	10	1	0
2	21	11	1	0
3	2	3	1	0
4	3	4	1	0
5	3	2	2	1
6	0	0	1	0
7	0	0	0	0
8	0	0	0	0

Percentage of patients in each sickness state on discharge

(c)

DISABILITY STATE	DISTRESS STATE			
	1	2	3	4
1	45	7	0	0
2	7	11	2	0
3	3	4	2	0
4	1	2	2	0
5	2	8	1	0
6	1	1	1	0
7	0	0	0	0
8	0	0	0	0

Percentage of patients in each sickness state at first OP Attendance after discharge

Figure 17 - GEOMETRIC MEAN SCALE

DISABILITY STATE	DISTRESS STATE 1	2	3	4
1		1.00	2.97	13.2
2	2.01	3.38	6.61	24.6
3	4.67	6.52	10.9	50.0
4	8.14	11.2	16.2	55.8
5	13.7	16.7	27.3	100
6	35.5	47.0	107	274
7	108	156	343	733
8	609			
Death = 619				

Figure 18 - EFFECT ON PRESENT STATE FOR ONE MONTH

	N (Patients Treated)	Rank	% of EPS	Rank
SURGERY I	33	2	9.2	4
SURGERY II	23	5	19.1	3
SURGERY III	8	6	2.6	6*
MEDICINE I	28	4	0.7	7
MEDICINE II	37	1	42.2	1*
MEDICINE III	5	7	5.3	5
PSYCHIATRY	29	3	20.9	2

4. Use of Output Measures

Consideration was given to problems which might arise if this principle of measurement was adopted. It was noted that whatever descriptions were used, values would be placed upon them that were not necessarily the clinicians' values. They could not be used in the same way as diagnostic indicators. Dr. Rosser referred to work undertaken in the London School of Hygiene which suggested it was not possible to identify the precise cause of differences in outcome, even when the differences were substantial.

She suggested that the type of data described would prove useful to clinicians for internal audit purposes. Even where doctors did not agree with the values placed upon the health states, such information helped to promote debate concerning a firm's current clinical practice. For example, in Figure 18 where Medicine I appears to be doing so badly, this could be the result of discharging patients earlier than the other firms. The data had also prompted considerable discussion of admission policy because it highlighted substantial differences in the admission states of patients on three firms which worked very closely together.

5. Further Analysis of Scales of Valuations

The information obtained during the studies referred to was analysed to see how the scales of the 70 subjects differed in relation to their personal experience of illness, background and various psychological measures. The most important predictor of scale values was found to be the subject's current experience of illness, and the proximity of an individual to illness is associated with the number of states he considers to be worse than death (see Figure 19).

This result has implications for ethical decisions and public policy. For example, a recent debate concerned a Down's syndrome baby taken into care by the Social Services because her parents refused permission for life-saving surgery. On the assumption that Down's syndrome children would be in states between 5.2 and 4.1 for most of their lives, the social workers were correctly representing the social conscience in that most people would regard such permanent states as preferable to death. However, the parents of such a child, being that much nearer to the experience of illness, might not. Thus conflict could have been predicted. It was notable that the ensuing discussion in the media focussed on the ethics of the decision and ignored the difficulties of measuring the valuations which underlay the conflict. No ethical debate would be necessary if there was general agreement that the states of Down's children are preferable to death.

6. Studies of Further Descriptors

Dr. Rosser mentioned her team's current research, which would soon be published. More than 80 descriptors of states of illness have been studied, and the 40 most important have been scaled. Disability, distress and loss of consciousness (originally subsumed under disability) persist as key descriptors, although there is evidence that the concept of distress should be extended specifically to include breathlessness and that disability should include machine-dependence. As expected, prognosis emerges as another crucial descriptor, and there is also a need to study the modifying impact of certain diagnoses on valuations of global descriptors. These new studies pave the way for more complex profiles of illness, which can be used to complement, rather than to replace, simple global indicators. They also reveal that characteristics of the ill person other than state of illness, such as age, sex or marital status, have little impact on judgements about the severity of the illness per se.

Dr. Rosser hoped that increasing knowledge concerning the way people perceive future illness and the factors that affect perception, would cast light on some of the reasons for people's resistance to health education directed towards long-term risks, and would permit more rational allocation of resources between acute interventions and primary preventive measures.

Figure 19 - STUDY OF THE VALUATION OF DEATH

	Nos. of states worse than death by Rater Group				
	0	1-2	3-10	11+	Total
Medical Patients	1	1	4	4	10
Psychiatric Patients	2	6	2	-	10
Medical Nurses	3	2	4	1	10
Psychiatric Nurses	-	4	2	3	9
Healthy Volunteers	11	2	5	2	20
Doctors	4	2	2	2	10

Conclusion

As a clinician, Dr. Rosser was in favour of using health indicators. However, putting herself in the position of a manager she expressed doubts about the priority which she would give to introducing sophisticated measures of health care, bearing in mind the current management structure and limited information routinely made available to medical staff. She suggested that only when, as a routine, each clinical team was required to comment regularly on its mean length of stay, case mix etc., and was provided with the data (which are already collected), would health authorities be able to justify the cost, albeit modest, involved in introducing new measures of outcome. Until the time such measures, simple as they are to introduce, were likely to remain in the area of research, and service data collected on outcome are likely to remain inferior to those available in some London teaching hospitals 100 years ago.

OUTCOME AFTER RESCUE PROCEDURES - HOW AND WHEN TO ASSESS

1. Introduction

Professor Bryan Jennett, Consultant Neurosurgeon, Institute of Neurological Sciences, University of Glasgow, began his presentation by referring to the effects of shortage of resources in the NHS. In the hospital this resulted in confrontations between acute and chronic services, or high technology versus personal care. It was encapsulated in the slogan: "Curing or caring". Professor Jennett had been concerned about the damaging effects of this over-simplification and several years ago had suggested the following somewhat more complex summary of the doctor's role:

Figure 20

Doctors Activities

1. Diagnosis
2. Cure
3. Palliation
4. Rescue
5. Care
6. Prognosis/advice

Much of the clinical practice in hospitals was neither "cure" nor "care" but might more accurately be defined as "rescue". Rescue procedures were of necessity concerned with threat to life conditions.

Figure 21

Rescue Procedures

1. May give only a temporary respite
2. May leave patients with a very serious disability
3. Use restricted resources

In the longterm the value of some rescue procedures was questionable (see Figure 21) This, together with the fact that many specialist teams, (often at Regional level) cannot cope with all the demands made upon their service, and the ever increasing constraints on the level of resources available, prompted the need to discuss whether some rescue procedures were justified.

2. Assessment of Outcome

Consideration was given to the factors of outcome that might be looked at in relation to rescue procedures. Professor Jennett pointed out that one of the dangers in evaluating such procedures was to overemphasise the removal of the threat to life. Once this was achieved, there was often a reluctance to ask further questions about the quality of life that had been restored to the patient.

The way in which outcome was assessed depended very much upon the viewpoint of whoever was making the judgement. An accurate assessment of outcome after severe head injury, for example, requires knowledge of a patient's state of health before and after the accident has occurred. The patient can only recall what he was like before the accident. The doctor, however, has a different view of the situation - he remembers that the patient was nearly dead and that is where his comparisons begin. The family is able to see both views and tends to share the doctor's optimistic view in the early stages, but subsequently comes to share the patient's more pessimistic view when permanent disability has to be accepted.

This difference in perception has implications for what is regarded as a good outcome. The fact that a patient may have been restored to a "normal" state for the population corrected for age is not of great interest to his family. They want him restored to his own pre-morbidity normal state of health, and personality.

In cases where disability results from brain damage there is an added dimension to be considered: the mental plus physical disability combine to give the social disability. The mental disability is very much more serious in terms of the social implications. In a busy outpatient clinic it is the physical impairment that is obvious and upon which most effort tends to be concentrated, or there may be little or no physical disability. Often the doctor fails to find out that the patient's personality has changed and the burden that consequently falls on the family. Studies carried out to establish how families view the burden of disability have shown that personality changes and loss of memory are ranked higher than the neurological deficits (e.g. hemiplegia, double vision, anosmia.)

In assessing outcome, much lip service is paid to the importance of the quality of life. In an attempt to focus attention on specific components that contribute to this, the following list has been drawn up (Fig. 22)

Figure 22

Quality of Life

- Activities of Daily Living (ADL)
- Mobility/life organisation
- Social Relationships
- Work (level)
- Present Satisfaction
- Future Prospects

Age was also an important factor to take into account. The length of time that a disability will persist contributes to the distress caused to both patient and family. It was a quite different prospect for a young person to find himself facing forty years of disability than for an elderly person to have a stroke. It was usually when this prospect was realised that the family changed their view about how satisfactory was the outcome of the rescue procedure. Now the patient's sanity rather than his survival becomes the key factor.

The quality of life for some patients after severe brain damage was so poor that even sensitive observers and caring relatives sometimes openly declared that death would have been a preferable outcome. To test how widely this concept might be accepted, the following question has been posed to a very sophisticated and well informed audience in California and to a class of fourth year medical students in Glasgow.

Figure 23(a)

Which is Worse?

Vegetative survival/death

Conscious but dependent/vegetative survival

The answers, anonymously recorded on paper, are as follows: -

Figure 23 (b)

WHICH IS WORSE?

Outcome	Sample	For Patients	For Family
Vegetative	San Francisco	87%	86%
Worse than death	Glasgow Students	88%	94%
Severe disability	San Francisco	44%	18%
Worse than Vegetative	Glasgow Students	41%	14%

It had been interesting to observe that both audiences gave corresponding answers: vegetative survival was judged to be worse than death; and 40% also considered that severe mental and neurological disability in a conscious patient might be even worse. Both audiences perceived a difference in the way the patient and his family would view such situations.

It is good practice to define a limited number of outcomes in clear terms. This was done some years ago for victims of severe brain damage (whether traumatic or not) and this 'Glasgow Outcome Scale' (Figure 24) was not widely used in many countries.

Figure 24

GLASGOW OUTCOME SCALE

Dead	-
Vegetative State	Not sentient - reflex activity only
Severe Disability	Dependent for some activity
Moderate Disability	Independent but disabled
Good Recovery	Can do everything - but may have minor sequelae

How long after the episode of brain damage the outcome was assessed was also important. Therapeutic teams involved in rescue (e.g. intensive care staff) were apt to assess patients on discharge from their unit: others took discharge from hospital as a practical end-joint. On the other hand there were those involved in rehabilitation units who held out hope for late recovery that was unrealistic. Systematic studies of large numbers of head injured patients showed that most patients (90%) had reached their final state on the Glasgow scale within 6 months, two thirds of them within 3 months. No patient who was severely disabled at three months had made a good recovery. Professor Jennett suggested that it was unrealistic to plan services or to raise patients' family expectations by taking the view that the patient's brain might "switch on" sometime in the future.

Whilst 6 months was reasonable for pronouncing the likely ultimate outcome it was useful to make an interim assessment of the patient's condition after one month, predicting

a) Potential recovery
b) Permanent handicap likely but independence expected
c) Permanent hospital care probably needed.

Comparative studies undertaken on patients in coma from head injuries and from non-traumatic conditions in the U.K. and U.S.A. had demonstrated that the mortality rate was very similar, despite the more elaborate and expensive management regimes in U.S.A. The main determining factor on eventual outcome was the severity of the patient's condition on admission.

3. Allocation of Restricted Resources

In times of resource constraint clinicians should be giving some consideration to eventual outcome of rescue procedures to ensure that the resources available are used to the best advantage. For example consideration should be given to the selection of patients admitted to the ITU. As it is an emergency situation it would be necessary for guidelines to be drawn up in advance, and in close cooperation with all the clinicians concerned, covering such factors as:

a) bed availability
b) agreed categories of patient
c) discharge criteria:
    cured;
    dead;
    completed treatment of intensive nature;
d) alternative care available.

Difficult decisions need to be taken concerning what should be regarded as appropriate treatment. Professor Jennett's definition was as follows:-

> "appropriate treatment is that which is
> both necessary and effective."

It was generally supposed that doctors would make wise choices about whom to treat and what treatment to administer when resources were restricted. In fact they often did not, because of the many pressures imposed by other doctors, health professionals and the community. There was a tendency to undertake a disproportionate amount of rescue work without giving consideration to the probability of its success. This point was illustrated by the fact that during industrial action in the NHS priority was given to patients suffering from cancer, many of whom would not qualify as 'appropriate'.

DISCUSSION

A lengthy discussion took place concerning the clinician's role in preventative medicine in relation to head injuries.

Dr. McCarthy suggested that opportunities that existed for doctors in both hospital and community to prevent head injuries should be taken into account when discussing outcome measures.

Professor Jennett did not underestimate the value of prevention but, bearing in mind the many demands upon a clinician's time, he suggested that their role should primarily be to define the risks, such as they had done regarding smoking and seat belts. It was disheartening to find how difficult it was to persuade people to take appropriate measures to reduce these risks. But that was a social and political, rather than a medical challenge, in his view.

Other participants expressed the view that doctors should take a more active role in trying to exert pressure to bring about preventative measures.

THE UK CARDIAC SURGICAL REGISTER

1. Introduction

Mr Terence English, Consultant Cardiothoracic Surgeon, Papworth Hospital, explained that the establishment of a UK Cardiac Surgical Register could be described as a type of output measurement in that it was defining how many operations are performed in cardiac surgery each year and what was the rational average mortality for these operations.

Some years after being appointed to his consultant post, Mr English had come to realise with surprise that very little was known about the number of operations undertaken and the units where they were performed. There were of course occasional informed exchanges of information between units and the reputation of some units was higher than others. He subsequently learnt of the Australian Register for cardiac surgery which had been introduced at the beginning of cardiac surgery's development in that country. The Register had had a profound influence on the way the specialty had been planned and developed with regard to controlling the number of units practising cardiac surgery, and appeared to have had a considerable benefit on the quality of the work performed.

In 1976 Mr English was appointed to the Executive of the Society of Thoracic and Cardiovascular Surgeons. He began to consider how he might introduce a similar Register for the UK during his tenure of office. He obtained a copy of the form used by the Australian Heart Foundation and sought permission from the Executive to undertake a pilot study. The Executive were advised of the type of data concerning mortality that would be collected and that the information would be treated as confidential. Approval was given for a pilot study. At the time, Mr English did not make it known that it was his ultimate intention to circulate every cardiothoracic unit in the UK and make it rather more than a pilot study !

2. Aim of the Project

There were 46 units in the UK which performed open heart surgery. The aim of establishing a register was to collect and publish data on the volume, type, distribution and mortality of cardiac operations each year.

It was hoped that the information thus made available would encourage surgeons to monitor the work they were undertaking and in particular to

(i) help rationalise the use of existing resources and the planning of future cardiac surgical services, and

(ii) improve the quality of surgical results by the annual publication of national mortality figures for common cardiac operations with which individual surgeons could compare their own results.

3. The Pilot Study

The design of the form to record the relevant data was of crucial importance. If it was made too complex the response from busy clinicians was likely to be negligible. If it was over-simplified the data obtained would be inadequate. It was decided to use the Australian form with minor amendments for the pilot study.

It was recognised that the cooperation of colleagues would only be obtained if the data were treated in confidence. A system was therefore introduced whereby completed forms were returned to the Secretary of the Society who removed the front page identifying the clinicians concerned before passing on the remaining pages, including a code number, to Mr English. As a result of the feedback obtained during the pilot study the original form was considerably amended and improved.

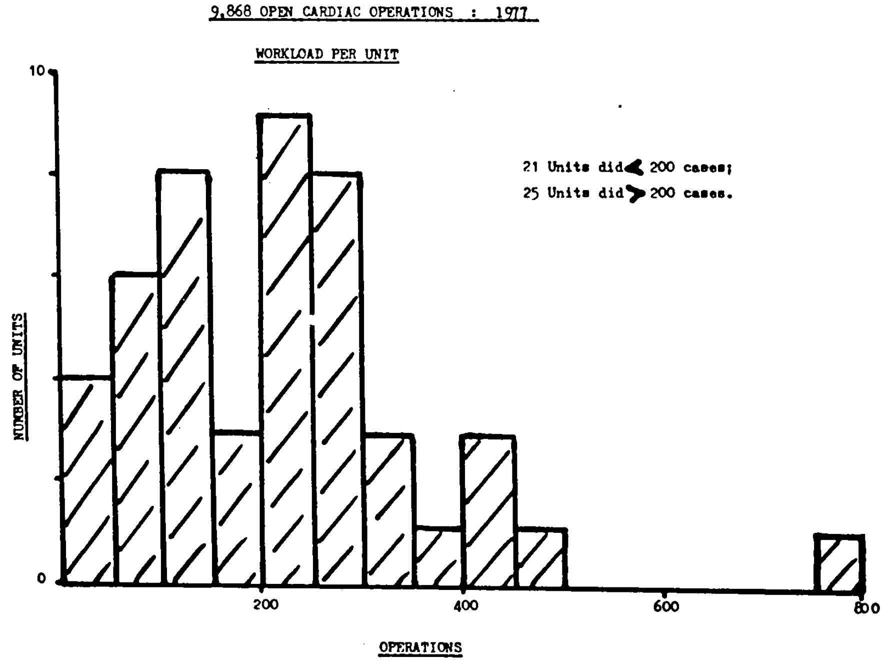
4. Establishment of Register

In March 1977 forms were distributed to all NHS hospitals in which open cardiac surgery was practised in England, Wales, Scotland and Northern Ireland seeking information on work undertaken during 1976. Two thirds of the forms had been returned by the final deadline. These results were analysed and presented to the Society. Considerable interest and enthusiasm was generated by this report and it was accepted in principle that an annual register should be established and that all units should cooperate accordingly. Mr. English felt that it would be more appropriate for an independent body to carry out future analyses and arrangements were made for BUPA Medical Research to undertake this task.

For 1977 the workload of all but two of the returns had been received by the time the information was presented to the Society. Members agreed that the information should be published indicating that it had incorporated all units with the exception of hospitals "X" and "Y". The Secretary informed the hospitals concerned accordingly, and promptly received the outstanding returns! Since that occasion, all returns have been received each year, although it had proved an uphill struggle to see that this is achieved.

The type of information which is now circulated to all units annually and which cardiac surgeons have found of interest is illustrated by the histogram in Figure 25. This indicates the number of large and small units undertaking cardiac surgery and highlights the fact that a few units do not perform sufficient operations to obtain the expertise required.

Figure 25: - Open Cardiac Operations



An examination of the data for ischaemic and congenital heart disease revealed the following information:

Figure 26 - ISCHAEMIC & CONGENITAL HEART DISEASE

Ischaemic Heart Disease	16 units performed $<$ 50 ops. 23 units performed $>$ 50 ops.
Congenital Heart Disease	45 out of the 46 units undertook some ops. 32 units performed $<$ 50 ops. 13 units performed $>$ 50 ops.

It had been noted with surprise that nine units treating ischaemic heart diseases had undertaken less than 25 cases per annum.

The Society's Executive had agreed at their meeting in September 1982 that an analysis of the first five years of the Register should be published following the receipt of the returns for 1982. The question of confidentiality had been further discussed at this meeting. Mr English was in favour of identifying individual units but the general concensus was that confidentiality should be retained.

5. Analysis of Data

Mr English illustrated the types of data made available (see Figures 27 - 31) He drew particular attention to the following:-

Cardiac Operations 1977-1980

During this period the total number of cardiac operations increased by 2000 and all related to coronary surgery. More resources were required for this area of cardiac surgery. It was noted that a total of 5000 operations were performed for a population of 55 million. In the U.S.A. over 100,000 coronary operations per year are now being undertaken for their population of 210 million.

"Open" Valve and Congenital Heart Surgery

The number of operations performed each year had remained fairly constant.

Figure 27

Cardiac Operations

U.K. 1977 - 1980

	Total		Valve		I.H.D.		Congenital	
	No.	D%	No	D%	No	D%	No	D%
1977	11,606	9.8	4,421	9.5	3,041	9.3	2,111	11.1
1978	11,934	9.7	4,489	10.5	3,345	7.4	2,076	13.8
1979	12,165	9.6	4,487	9.8	3,688	8.4	2,046	12.2
1980	13,742	8.0	4,521	7.4	5,011	6.1	2,009	12.4
Total	49,447	9.2	17,918	9.3	15,085	7.6	8,242	12.4

Figure 28

Operations for Ischaemic Heart Disease

U.K. 1977 - 1980

	Coronary bypass grafts		A.V.R. + C.A.B.G.		Aneurysmectomy ± C.A.B.G.		Repair V.S.D. ± C.A.B.G.	
	No	D%	No	D%	No	D%	No	D%
1977	2306	6.4	197	11.7	327	17.0	30	40.0
1978	2645	5.1	206	13.1	270	14.0	33	24.2
1979	2942	6.0	238	10.5	257	17.1	36	39.0
1980	4059	3.7	326	12.0	300	13.3	58	25.9
Total	11,852	5.1	967	11.8	1,154	15.5	157	31.2

Figure 29

"Open" Valve Operations

U.K. 1977 - 1980

	Mitral		Aortic		Double	
	No.	D.%	No.	D.%	No.	D.%
1977	1905	7.0	1614	8.6	789	17.0
1978	1997	9.6	1613	7.9	773	16.2
1979	1980	8.6	1660	7.4	737	16.0
1980	1954	7.7	1666	5.0	790	10.9
Total	7836	8.2	6553	7.3	3089	15.0

Figure 30

Operations for Congenital Heart Disease (Open)

U.K. 1977 - 1980

	A.S.D.		V.S.D.		Fallot's T.		"Simple" T.G.A.	
1977	No	D%	No	D%	No	D%	No	D%
1978								
1977	561	2.1	303	9.2	295	15.3	94	17.0
1978	534	1.5	317	10.1	238	20.2	115	19.1
1979	550	0.7	274	8.8	234	10.7	118	7.6
1980	477	0.2	272	9.6	254	13.0	113	8.0
Total	2,122	1.2	1,166	9.4	1,021	17.0	440	13.0

Figure 31

Annual Workload per Cardiac Surgical Unit

U.K. 1977 - 1980

Open Heart Operations per Unit

	Total		Congenital		
	<200	>200	<50	>50	>100
1977 (46)	21	25	32	13	4
1978 (45)	21	24	30	14	5
1979 (44)	18	26	13	13	5
1980 (43)	16	27	26	15	6

Mortality Rates

The Register provided the opportunity to study mortality rates associated with different procedures. For example, it was noted that the mortality rate doubled if aortic valve replacement was combined with coronary bypass grafting and that a high mortality rate was associated with resection of ventricular aneurysm.

The scattergrams showed no real correlation between mortality and the overall number of operations performed (Figure 32), but did suggest that there was a correlation between mortality and numbers of operations performed for ischaemic heart disease (Figure 33).

6. Conclusion

Mr English believed that the effort required to maintain the Register was worthwhile in terms of the interest shown by his colleagues and the potential benefits for developing and improving the quality of cardiac services. It was, however, essential to obtain a complete return each year and this was a difficult task.

DISCUSSION

1. Professor Jennett congratulated Mr. English on his achievement in making so much progress with a national register. He suggested that the difficulties of overcoming such problems as confidentiality should not be underestimated.

2. It was noted that detailed analysis of case-mix could not be undertaken without breaking confidentiality. There were exceptions when it was known that certain units with very long waiting lists only admitted patients below the age of 60. It was possible to argue that such units should have a lower mortality rate, bearing in mind the younger age of patients and that the DHSS should have responsibility for such monitoring. Mr. English noted, however, that some of his colleagues became anxious at any suggestion that the DHSS should have detailed information about their clinical practice.

Figure 32

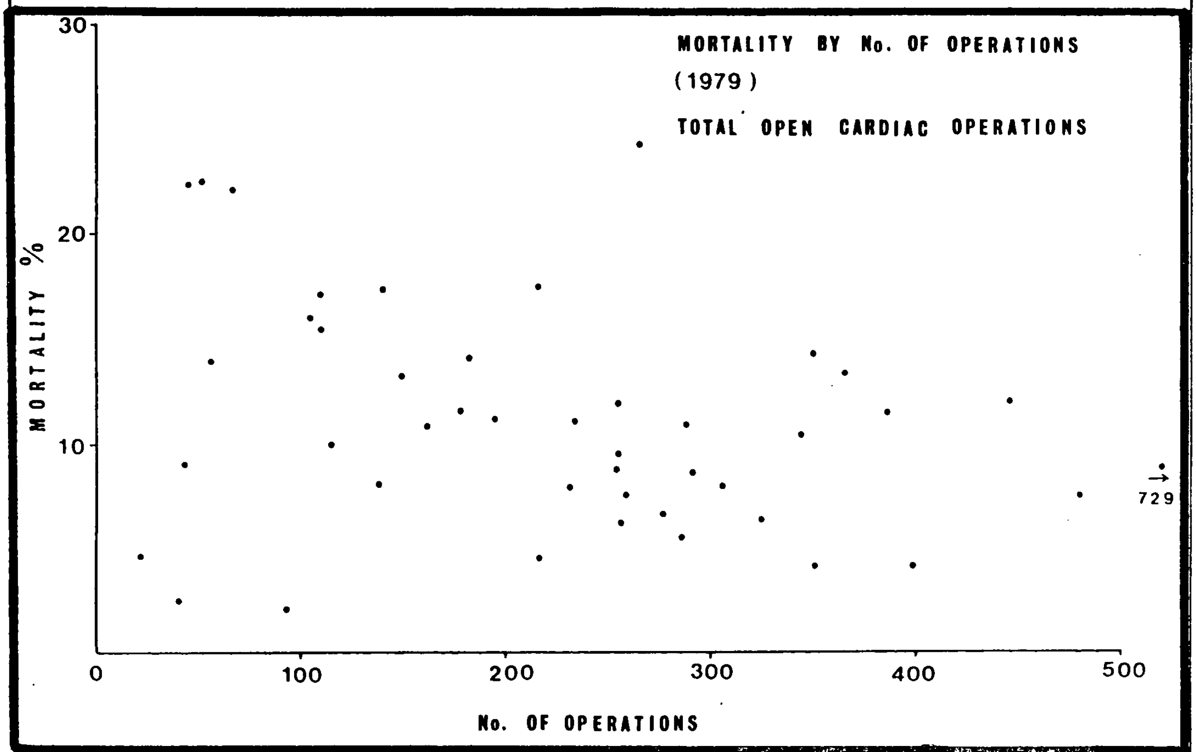
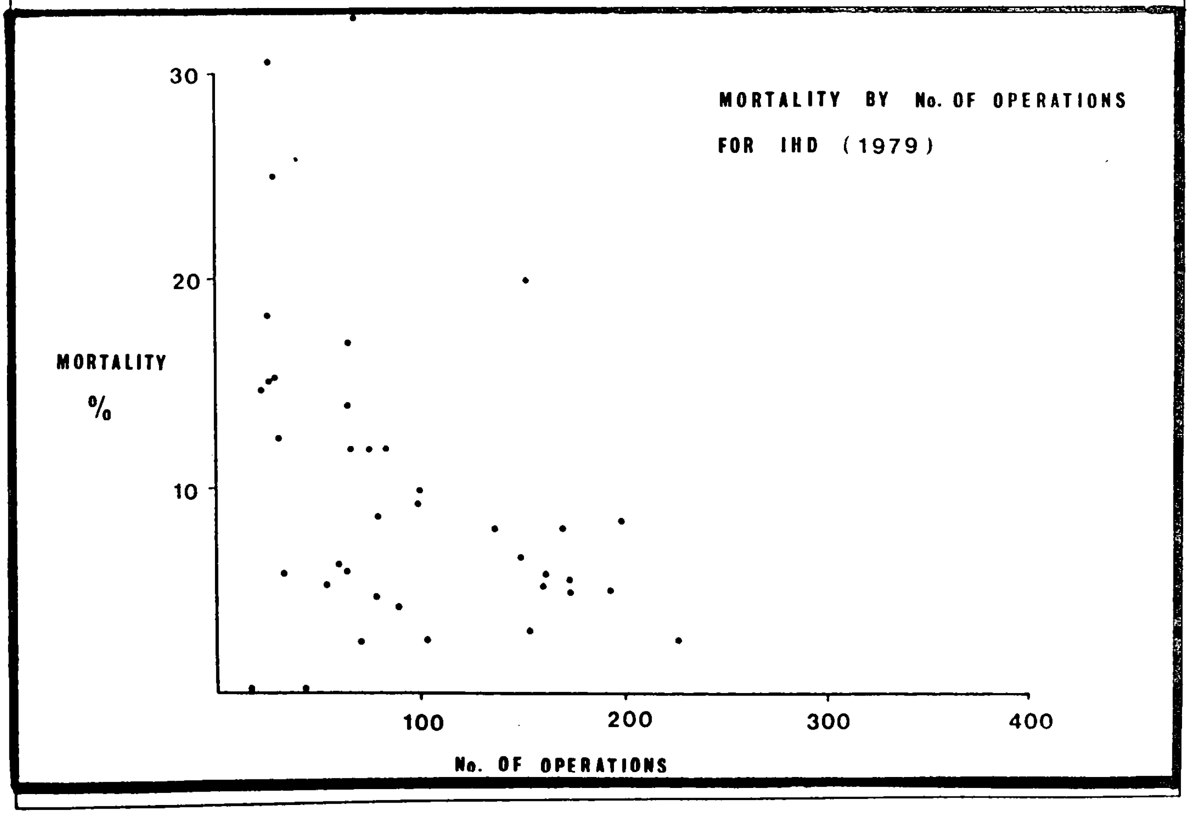


Figure 33



3. Mr. Laing referred to the point made concerning the lower percentage of cardiac operations performed in the UK for ischaemic heart diseases compared to other countries. Evidence had initially shown the same to be true in relation to renal failure. However, when the EDTA register was established,the difference in the number of operations was concentrated amongst the elderly population. The number of operations performed on patients under the age of 40 compared favourably with other countries. Mr. English explained that information on age was not included on the returns and it had not been possible to undertake a similar exercise.

4. Mr. English was asked whether he expected comparisons of data from the Register to result in the workload of all units to increase, or that some of the smaller units would close. He confirmed that some of the smaller units had closed.

   It was also noted that the profession had requested an analysis of the data on a regional basis, so that, for example, if the North East Thames Region was shown to undertake less operations than the national norm, the relevant units could apply for more resources. The Region might agree, but require an amalgamation of units to make the service more cost effective. The society had agreed that such data should be made available to both clinicians and the Regional Health Authorities as soon as it was available, but that it should remain anonymous.

5. It was noted that the profession needed to find ways to help clinicians to improve the quality of services in units where the results were not as good as they might be. Mr. English confirmed that about 8-10 of his colleagues were prepared to break confidentiality and exchange information about their services and it was hoped that more would follow this example in due course.

General Discussion

Mr. Tom Evans, Director of the King's Fund College, said that he would not attempt to draw together the very many aspects of output measurement that had been considered during the course of the day's proceedings. Instead, he planned to pose a problem which he hoped would aid further discussion.

He noted that there had been an implicit assumption on the part of all speakers that it was no longer acceptable to be oblivious of output issues and that the time had come to grasp the nettle. Much of the work referred to had been longterm and somewhat speculative. Mr. Evans had listened to the presentations from both an academic interest, as a student of management, and from a practical viewpoint as a member of a health authority. If output could no longer be ignored, consideration had to be given to the way in which it might be approached. He suggested that a distinction needed to be drawn between:-

(i) the large problem: how to assess which services the NHS should be providing and which specific areas of health care should receive additional resources, and

(ii) the small problem: how to assess the efficiency and effectiveness of the services currently provided.

In relation to the 'large problem' it was interesting to look at the approach put forward by Alan Williams which advocated the development of a complete statement of the services required. Whilst this did not seem a practical proposition for the immediate future there lay within it the kernel of a way of thinking that should be encouraged within the health service. Thus the type of issues raised by Alan Williams could be pushed to the fore and seen as an ultimate objective. As a health authority member, Mr. Evans had been very impressed with the way the NHS operated, considering what a chaotic exercise it appeared to be. However, some form of parameters needed to be defined to identify the critical areas that should be concentrated upon. He was not suggesting that a comprehensive system for measuring output could be adopted immediately, but some simple broad-brush indicators were required.

It was important in relation to the small problem to generate

(i) an appropriate interest amongst doctors in the quality of their clinical practice. This did not necessarily have to be related to resource allocation, and

(ii) some control over the resources being allocated and the way they are used.

One of the difficulties currently experienced by health authorities and managers was that when a clinician's performance appeared to be at variance from what was believed to be acceptable, the evidence was so confused that it gave any practitioner plenty of scope to think up excuses. Authorities needed to be able to define indicators of good practice so that the clinician had to explain the reasons for variance.

Mr. Evans posed the following question: "How do we proceed from this point in a reasonable, practical, managerial sense?"

Professor Williams suggested that it depended upon who 'we' were. An epidemiologist or clinician working on clinical trials could explain the notion of output or outcome in the social behaviour categories that had been discussed. He had gained the impression that there was a lot of consensus in broad terms about which were the more effective and more cost effective treatments within each specialty. If this was true it would be worth exploring on a national basis the criteria used to form such judgements and determine the treatments which are thought to be of only marginal benefit. These areas could be concentrated upon as the basis for determining whether extra resources should be given to specialty 'X' as opposed to specialty 'Y'. However, members of a health authority should wish to know in broad terms what these values meant to different states of health.

Professor Jennett agreed that only the clinicians could judge the effectiveness of treatments and it was their responsibility to provide the evidence.

Mr. English agreed that it was up to clinicians to define the treatment being given and possibly relate it to cost effectiveness. Referring to

Professor Williams' comments about marginal activity, he suggested that the crux of the problem was who should be responsible for comparing the activities of various specialist or non-specialist groups?

Professor Williams suggested that it should be the health authorities' responsibility, but in practice it was the clinicians'. This state of affairs could only be changed if information was made available to health authorities so that they were able to judge which of the options open to them would provide most benefit to patient care.

Mr. Evans noted that whilst people were expressing an interest in such problems, health authorities were in no way developing a systematic approach. It was debatable as to where authorities should begin and to what should be given priority. He thought it unlikely that his own authority would give a high priority to funding the development of health indicators from their limited resources. As a first step clinicians should be encouraged to look at these issues from their own viewpoint.

Dr. Rosser referred to the dilemma which faced those clinicians expected to turn a patient away because they could achieve less with that patient than with another. A doctor was trained to do the best for each patient, regardless of any information on the marginal cost of a small improvement.

Professor Jennett suggested that one way to handle this difficulty was by consensus. For example, renal dialysis surgeons had established policies concerning criteria for admission and thus had taken the weight of decision off the individual clinician.

Professor Williams reaffirmed that the only way to get some of the marginal procedures identified was to fund research to confirm or disprove the general feeling that many treatments were of little benefit. Assuming that it was possible to get clinicians to agree upon treatment policies, he wondered whether health authorities would uphold these policies and thus take the burden of responsibility away from clinicians?

****

Dr. Wickings concluded by expressing his gratitude to the speakers for their ideas on handling a very difficult subject, and thanked the King's Fund for the facilities provided for the seminar.

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LIST OF PARTICIPANTS

J. Aitken Esq	Senior Nursing Officer, Personnel, Southend Health Authority
J. Appleby Esq	Research Officer, NHS Financial Information Project (South Birmingham Health Authority)
A. Bacon Esq	Assistant Secretary, DHSS
D. Berriman Esq	Chairman Lewisham & North Southwark Health Authority
G. Best Esq	Fellow in Analytical Methods and Planning King's Fund College
Professor A.J Buller	Chairman, Evaluation Group for PACTs Research Project and recently Chief Scientist, DHSS
G W Burns Esq	District Nursing Officer East Birmingham Health Authority
S Cang Esq	Acting Director, Health Services Organisation Research Unit BIOSS, Brunel University
J M Coles Esq (Speaker)	Assistant Director CASPE Research
Mrs R Dowie	Health Services Research Unit University of Kent at Canterbury
T A H English Esq (Speaker)	Consultant Cardiothoracic Surgeon Papworth Hospital
Mrs J Evans	Nursing Officer DHSS
T C Evans Esq	Director King's Fund College
Dr A Fenton Lewis (Speaker)	Senior Medical Officer DHSS
Miss J Flindall	District Nursing Officer Oxford Health Authority
R Flux Esq	Research Assistant King's Fund College
Mrs C Greenhalgh	Research Officer, NHS Financial Information Project (Coventry Health Authority)
P A Griffiths Esq	District Administrator Lewisham & North Southwark Health Authority
Mrs J Hinds	Secretary to the National Staff Committee of the Administrative and Clerical Staff, DHSS

Professor W Holland	Professor of Clinical Epidemiology and Social Medicine St Thomas' Hospital
Mrs L Howard	Research Assistant CASPE Research
Ms A Jamieson	Research Associate (Nursing Management) King's Fund College
Professor B Jennett (Speaker)	Institute of Neurological Sciences University of Glasgow
W Laing Esq	Royal Institute of Public Administration
Ms K Lowson	CASPE Research Team Leader Oldham Health Authority
Dr A Mason	Senior Medical Officer DHSS
R Maxwell Esq	Secretary King Edward's Hospital Fund
Dr M McCarthy	Department of Community Medicine University College Hospital
Professor I McColl	Professor of Surgery Guy's Hospital
M Murphy Esq	Department of Community Medicine (Information & Research) North West Thames RHA
Miss J A Plant	Chief Nursing Officer Lewisham & North Southwark Health Authority
Dr R M Rosser (Speaker)	Consultant Psychiatrist Charing Cross Hospital
Dr H Sanderson	Senior Lecturer London School of Hygiene and Tropical Medicine
Dr P Simpson	Senior Medical Officer DHSS
R Stern Esq	CASPE Research Team Leader Southend Health Authority
D Taylor Esq	Office of Health Economics
R Thorne Esq	District Administrator Oldham Health Authority
Dr H Waters	Hon Senior Registrar, Institute of Psychiatry The Bethlem Royal Hospital and Maudsley Hospital
Dr J M Weddell	Regional Specialist in Community Medicine (Information and Research) North West Thames RHA

Mrs J Westcott	CASPE Research Team Leader East Birmingham Health Authority
Miss C Wheatcroft	Research Assistant CASPE Research
Dr H I Wickings (Speaker)	Director, CASPE Research and King's Fund Fellow in Health Systems and Policy
Professor A Williams	Institute of Social and Economic Research University of York
Dr G P A Winyard	District Medical Officer Lewisham & North Southwark Health Authority