Health service performance indicators

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SUMMARY
The development of statistical indicators for monitoring performance throughout the National Health Service began in 1981. In recent years, computer software packages containing performance indicators have been amended to include Health and Social Services Boards in Northern Ireland. Although this information is available to anyone with an interest in service provision, the main purpose of the indicator packages is to provide a framework and discipline for ensuring proper accountability to a higher tier authority. Efficiency and effectiveness are concepts central to performance appraisal. Most performance indicators are concerned with the input of resources or treatment activity rather than health outcome. Consequently the context within which the accountability review procedure operates is predetermined towards efficiency. The validity of the review process is limited by the accuracy of the indicators and the manner in which they are interpreted. The scale at which performance indicators function and the constraints associated with their use as an analytic tool are illustrated using data from a mental illness hospital in Northern Ireland.

INTRODUCTION
Accountability for spending public funds is fundamental to our democracy. In periods of economic recession, fiscal restraint is coupled with a concern for efficiency and a greater degree of parliamentary scrutiny. Recently, a great deal of attention has been directed at obtaining full value for money in the Health Service. Potentially the demand for health care is unlimited, but unfortunately resources are not. The constraint on new monies means that improvements in health care must be financed by savings made elsewhere in the Health Service. Consequently it is of paramount importance to define, measure and improve the performance of health service organisations.

This movement towards greater efficiency has coincided with the advent of micro-computers. The capacity of micro-computers to process large amounts of data, combined with their low cost, has provided statisticians with a useful instrument for interactive analysis. Management information can be readily presented in an easily accessible and visually attractive manner.

THE ACCOUNTABILITY REVIEW PROCEDURE
Today the high cost of developing new medicines and medical equipment, greater longevity among patients with serious illnesses, and high public expectations, have created a heavy demand for resources that has coincided with...
a fixed budget.\(^1\) This has generated a need for good information to enable choices to be made between competing resource demands.

The accountability review procedure originated from the 1981 Report of the House of Commons Public Accounts Committee which called for more stringent monitoring of expenditure in the National Health Service.\(^2\) Performance indicators are central to this procedure which is applied annually to Health and Social Services Boards in Northern Ireland. Review meetings are attended by a minister, senior civil servants, the Board chairman and his supporting officers.

Preparation for the review involves analysis of strategic plans and outturn reports to establish regional objectives and priorities for the provision of health care. The performance of services targeted for review is evaluated using statistical indicators. These highlight exceptionally poor or good performance by comparing the standard of service provision with that achieved by others. This allows an agenda outlining the main issues for discussion to be formulated. The purpose of the review is to agree upon specific policies and standards and to decide upon a programme for implementation and development in the year ahead.

**EFFICIENCY AND EFFECTIVENESS**

The present Government's commitment to obtaining value for money in health care provision, is expressed in a determination to obtain greater efficiency and effectiveness. These terms are defined as follows:

1. Efficiency is the ratio of output to resource input, and the aim is to improve output for the same or a lower cost.
2. Effectiveness refers to the extent to which the objectives of a policy programme or treatment are achieved and is concerned with medical outcome.

In theory, measurement of performance should be based on effectiveness in the first instance. Once it has been ascertained that a service is having the desired effect, for example eradicating smallpox by vaccination, then effort can be directed at improving the efficiency of the service. Unfortunately developing measures to determine whether health care objectives have been achieved is difficult because a clear relationship does not exist between resource input and outcome in the form of improved health or reduced need.\(^3\) The health statistics available at present provide a great deal of information on inputs and activity, but virtually no data are available on outcomes. Consequently the accountability review process relies on indicators that focus on efficiency rather than effectiveness.

Efforts to curtail costs and boost productivity are made in the absence of knowledge about their impact upon the general health and well-being of the population. Simply increasing input or activity does not automatically guarantee better results, in fact the opposite may be true.

The seriousness of the situation has been succinctly summarised by Culyer who recognises that: 'The lack of acceptable outcome measures to define need, and measure the extent of our success in meeting it, is chronic and a major impediment both to research and policy formulation in health services.'\(^4\) A start must be made on measuring outcome.

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PERFORMANCE INDICATORS

A performance indicator is a salient piece of statistical information that is sensitive to real variations in performance. Indicators can be used by anybody with an interest or involvement in service delivery, planning, the allocation of resources or the monitoring of performance. During the accountability review process performance indicators are used to show what has been achieved, to identify services which require improvement, and to help administrators and professionals decide if action is appropriate. Performance indicators are the starting point in the investigation, they enable the Department of Health and Social Services to question the Health and Social Services Boards. As such they must be relevant, accurate, consistent and readily available. Indicators do not measure performance; they simply point to performance which may require attention. Only a detailed systematic investigation can prove that resources are being used ineffectively or inefficiently.

Performance indicators are calculated from data that have been available for many years. They can be classified as indicators of input, activity/process, or outcome:

1. Input indicators: invariably these refer to available resources in the form of staff, finance, equipment or buildings. Input indicators are commonly used when no others are available, but tell little about performance on their own. Examples are the ratio of part-time to full-time staff expressed in whole time equivalents or overtime costs as a percentage of total salary costs.

2. Activity/process indicators: are normally defined in terms of patient treatment or care. They are readily available for hospital services although not for community services. An example is the ratio of nursing staff to average daily occupied beds.

3. Outcome indicators: attempt to assess health improvements for patients or the result of medical interventions on the population. The number of vaccination payments to general medical practitioners per head of population is an example of an outcome indicator based on medical intervention.

Performance indicators were developed to allow clinicians and managers to compare their service with that achieved by others or over a period of time. Relative standards are set by ranking indicator values for individual regions, districts or hospitals against the national distribution. This helps to identify services with values lying in the extremities of the distribution. Conceptually and statistically this procedure for pinpointing exceptional performance is straightforward, it is also robust to data inaccuracies.

When statistical information is collated from a variety of sources it is inevitable that values for some data items will be inaccurate or incomplete, no matter how stringent the validation process. However, a gross error would be required to significantly alter the position of a district or hospital on a national distribution. A single indicator looks at performance in a narrow perspective. Like other statistics it may be directly or indirectly affected by factors outside its scope. Consequently groups of interrelated indicators need to be examined to identify fully all the facets of a problem. Examining indicators in groups rather than singly also helps circumvent the problem of inaccurate values.

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PERFORMANCE INDICATOR SOFTWARE PACKAGES

Two computer software packages have been developed to display performance indicators in a visually attractive, informative and easily accessible manner:

1. The Department of Health and Social Security package contains approximately 425 indicators covering eight client or service groups including acute services, children, the elderly, mental illness, mental handicap, support services, estate management and manpower. Information on 14 Regional and 191 District Health Authorities in England is available from 1983 onwards. An abridged Northern Ireland version of the package containing 1985 data was issued for training purposes in 1987. Since then, complete Northern Ireland editions have been published for 1986 and 1987. Comparisons between health authorities are facilitated by box plots, histograms, outlier reports and tables of ranks and values.

2. The Inter-Authority Comparisons and Consultancy (Yates) package provides a range of indicators on patient flow, waiting lists, in-patient treatment, day case treatment and out-patients for 34 specialties. Histograms and profiles enable comparisons to be made across 16 Regional Health Authorities (including Northern Ireland and Wales) and 216 districts. Mental handicap and mental illness specialties have an additional subset of 20 indicators which allow performance to be compared between hospitals and over a period of time. 'District' information on Northern Ireland is available from 1983 to 1986. Inter-hospital indicators for mental handicap and mental illness hospitals in Northern Ireland cover the periods 1979–1986 and 1977–1986 respectively.

HOW TO APPLY AND INTERPRET PERFORMANCE INDICATORS

Literally hundreds of performance indicators are available for analysis using the Department of Health and Social Security and Yates software packages. Although an individual performance indicator cannot be used as a definitive measure of performance it is possible to monitor achievement using groups of crude indicators. These provide the starting point for an investigation. Performance indicators give an overview of the service under review and make problem areas easier to identify. In essence they generate questions about performance which can only be answered correctly by referring to local knowledge and more detailed data sources.

Yates and Vickerstaff and Yates have identified six crude indicators which are sensitive to performance variations in mental handicap and mental illness hospitals. Using data from the 1985 and 1986 Yates packages, the indicators can be applied to mental illness hospitals in Northern Ireland to illustrate the process of interpreting performance. The indicators are:

1. Size of hospital (measured by total number of in-patients): some large hospitals can be more impersonal than smaller ones and this may make communication between patients and staff difficult. Large hospitals have traditionally served wide catchment areas and this can present problems for integrating patients into the community.

2. Percentage of patients over 65: a large number of elderly patients increase nurse workload. If a substantial proportion of patients in this age group cannot be rehabilitated this may place high demands on staff morale.
3. Patients per consultant: if support staff provision is inadequate a consultant may experience difficulty in supervising his patients as this ratio rises.

4. Patients per nurse: as the number of patients attended by a nurse increases, the level of nursing care may be reduced.

5. Patients per therapist (includes occupational therapists, physiotherapists, speech therapists, remedial gymnasts, PE instructors, industrial work therapists and handicrafts staff): a high ratio suggests that the rehabilitative services provided are insufficient.

6. Length of stay: exceptionally long average stays for curable diseases may indicate that some patients are becoming 'institutionalised' and that success in rehabilitation is low. This may be combined with little short-term care provision.

The patients per nurse ratio is a suitable indicator for illustrating the performance analysis process. The impact of changes in nurse staffing on the overall level of treatment and attention in a unit are readily understood and appreciated. Patient/nurse ratio values for all mental illness hospitals in England, Wales and Northern Ireland in 1985 can be displayed in a histogram (Fig 1). From this, the position of hospitals in Northern Ireland can be examined against the national distribution. Two hospitals (Holywell and Purdysburn) have a value greater than or equal to 1.4 and lie to the right of the distribution.* It is of interest to see how these hospitals perform on the other five key indicators listed above.

* The 1985 data set is used for illustration purposes only. In 1986 the patients-per-nurse ratio for Holywell and Purdysburn was 1.25 and 1.28 respectively. This removes both hospitals from the critical area at the right hand side of the national distribution.
Unfortunately a histogram only portrays one indicator at a time. To enable simultaneous comparison of several indicators for one hospital each separate histogram is converted into a percentile bar by ranking all valid values in ascending order. A percentage rank is then calculated by taking the rank value of each hospital as a percentage of the total number of hospitals with valid values. This fixes the position of a hospital relative to all other hospitals, and compresses the distribution by eliminating the influence of values lying in the tails of the distribution.

A number of percentile bars can be displayed at one time in a diagram known as a 'profile'. Fig 2 is a multi-indicator profile for Holywell Hospital. At a glance it can be seen that this unit performs well on all the key indicators except nurse staffing. A shaded square on the percentile bar draws attention to performance which should be investigated. This symbol denotes that the value for the indicator lies in an extreme portion of the distribution of all values, arbitrarily this is fixed at 15% of the distribution. With staffing ratios it is only necessary to emphasise bad staffing and the 15% critical area is located on the right hand side of the distribution.

| INDICATOR                  | VALUE FOR       | POSITION RELATIVE |
|----------------------------|-----------------|-------------------|
|               | HOLYWELL        | TO OTHER HOSPITALS|
| min-max (mean)          |                 |                   |
| Size of hospital 54-1153 (470.18) | 458 |                   |
| % Patients over 65 5.81-100 (57.85) | 50.44 |                   |
| Patients per consultant 12.9- none* (84.12) | 61.07 |                   |
| Patients per nurse 0.48-1.71 (1.15) | 1.4 |                   |
| Patients per therapist 6.69- none* (25.42) | 21.03 |                   |
| Length of stay 27.73-2654 (209.39) | 133 |                   |

It is important to indicate that some hospitals in the distribution do not have consultants or therapists. Mathematically it is impossible to divide by zero. Rather than remove these hospitals from the analysis the value 'none' is used to denote infinity. They are assigned an exceptionally large fictitious value which forces them to the extreme right hand side of the distribution.

Fig 2. Multi-indicator profile for Holywell Hospital, 1985.

Before accepting the patient/nurse ratio value an administrator or clinician in this hospital should initially question the accuracy of the indicator, for example:

1. A crude ratio does not show the number of trained nursing staff or the mix of nursing skills.
2. Dependency levels vary among patients and if staffing has been adjusted to accommodate this the indicator will give a false impression.
3. Non-ward nursing workload cannot be distinguished from total nurse workload using this ratio.

Assuming that the limitations associated with the indicator have been considered and that they still do not explain the poor staffing level, then a second set of questions are generated, for example:

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A high ratio may result from too many patients rather than understaffing. Are rehabilitative services adequate?

2. Does the lower staffing reflect a large number of low dependency patients in this hospital?

3. Or is staff recruitment difficult because there is a large proportion of high dependency patients?

At this point it is also of interest to know whether poor nurse staffing occurred in one year only. Fig 3 is a multi-year profile which shows the position of Holywell relative to all other hospitals in England, Wales and Northern Ireland over a ten year interval from 1977 to 1986. In absolute terms the patient/nurse ratio has improved from 2.2 to 1.25 during this period. However, almost all mental illness hospitals in Britain have improved staffing over the last decade. Compared with other hospitals nationally, a relative improvement in the performance of Holywell occurred between 1980 and 1983 and again in 1986. How was this achieved?

| YEAR | NO. OF HOSPITALS | VALUE FOR HOLYWELL | POSITION RELATIVE TO OTHER HOSPITALS |
|------|-----------------|--------------------|-------------------------------------|
| 1977 | 132             | 2.2                |                                     |
| 1978 | 132             | 2.19               |                                     |
| 1979 | 133             | 1.95               |                                     |
| 1980 | 131             | 1.55               |                                     |
| 1981 | 131             | 1.51               |                                     |
| 1982 | 131             | 1.43               |                                     |
| 1983 | 128             | 1.35               |                                     |
| 1984 | 128             | 1.51               |                                     |
| 1985 | 122             | 1.4                |                                     |
| 1986 | 118             | 1.25               |                                     |

Fig 3. Patients per nurse multi-year profile for Holywell Hospital, 1986.

The problem of nurse staffing at Holywell Hospital has been identified but not answered by the analysis of performance indicators. Indicators simply facilitate systematic investigation. Spatial and temporal analysis of value distributions must be interpreted in a local context by administrators and professionals with an awareness of the policies, priorities and problems operating on the ground. As the first tier in the investigative process, performance indicators function at a level of generalisation which may fail to identify certain specific types of problem. However, exceptionally poor performance will virtually always be represented at this scale and can be detected.

CONCLUSION

Ultimately the continuing development and application of performance indicators should enable health authorities to set their own standards. This will entail a movement away from merely observing the position of a hospital, district or region on a national distribution, towards measuring achievement in reaching specified objectives. Implicitly this requires accurate indicators of health outcome. However, very often the effects of health care provision cannot be distinguished from social change or economic factors. Therefore in the future it may be necessary to restrict performance monitoring to the Health Service itself, rather
than to attempt to measure the result of interventions on the health of the population.

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