

## Effectiveness and efficiency\*

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**SUMMARY.** This paper proposes that doctors need to accept the technical meaning of terms used in economics such as effectiveness, efficiency, cost, input, process, cost benefit and outcome. The usefulness of these terms is discussed, with examples, and it is agreed that effectiveness and efficiency are best examined by those whose behaviour must alter as a result of the analysis.

### Introduction

**M**Y title is stolen from Cochrane's Rock Carling monograph which was published almost 10 years ago (Cochrane, 1972). Since that time, randomized controlled trials have been used extensively to investigate the value of therapies. More recently, but still on a modest scale, the value of investigations, of admitting patients to hospital or of following them up in outpatient departments have been examined, often with surprising results (Cochrane *et al.*, 1980; Oosterlee and Dudley, 1979).

The last decade has seen a greater emphasis on audit and on examining the quality of care. In the United States, this has led to the institution of the Professional Standards Review Organization and to advocacy of recertification of doctors. The Royal College of General Practitioners has been particularly concerned with the notion of audit and the quality of care. However, 'audit' is an unpopular and emotive word, probably in part because of its association with examination by an external auditor who determines the nature of good or bad. Doctors have been understandably fearful of standards laid down by senior academics who are out of touch with the realities of day-to-day practice.

### Aim

This paper sets out to examine some of the problems which surround measurements of effectiveness and ef-

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iciency and suggests that these terms are a proper and preferable substitute for audit and the examination of the quality of care.

### Definitions

It is neither possible nor useful to examine these issues without using the technical language of economics. As this is, despite the welcome growth and influence of departments of health economics, still unfamiliar and neglected in medical education, some definitions may be useful.

*Effectiveness* is a measure of the success in achieving a clearly stated objective.

*Cost* is the price which has to be paid in achieving the objective. It can and should include subjective phenomena such as distress or discomfort.

*Efficiency* is cost effectiveness. The efficient solution is that which is most effective at least cost.

*Inputs* are the raw material which will be subjected to various activities in order to achieve the desired objective. In health the inputs are most commonly populations of patients at risk or suffering from specific diseases.

*Process* is the sum of the activities to which inputs are subjected in order to achieve the objective.

*Cost benefit* is not the subject of this paper but is sometimes confused with cost effectiveness. Cost benefit attempts to quantify the benefits and costs of different things. Neither inputs, processes or outcomes are fixed: it is the resource available which is predetermined and fixed. Cost benefit seeks, for example, to compare the costs and benefits of purchasing a whole body scanner rather than building a home for the elderly.

*Outcomes.* The measurement of effectiveness depends in the first instance upon the definition of outcome. The analogy with education is close: it is impossible to assess the results of teaching without setting educational objectives. Furthermore, just as the setting of educational objectives influences a curriculum, the choice of outcome influences process.

*Goals.* Medical institutions, hospitals and group prac-

tices should set broad goals. The setting of these goals or aims may well involve lay boards and community health councils. They could include such things as: "services should be accessible, open, sensitive and responsive" or "patients have the right to the exercise of autonomy". Such goals must be distinguished from measurable and clear-cut objectives or outcomes. Effectiveness, the evaluation of care, can be assessed only in relation to defined objectives; the achievement of goals can be assessed only by the cumulative monitoring of effectiveness in achieving specific objectives.

## **Discussion**

### *Outcomes*

The most commonly used outcomes in medicine are mortality and recovery. Mortality is useful only when it is substantial, and, conversely, recovery useful only when it is not the rule. As perinatal mortality falls below 15 per 1,000 births, it becomes progressively more useless as an outcome measure and must be replaced by morbidity.

In many instances the outcome which is desired may be either difficult to measure or delayed and has to be replaced by a substitute or indicator: for example, dependence on tranquillizers might be used as an indicator of the effectiveness of group therapy for anxiety states, or return to work as an indicator of social well-being. It is almost certainly permissible to use rates of uptake of immunization against diphtheria as an indicator of success in controlling diphtheria. Such data are more readily available and more reliable than incidence data. On the other hand, uptake of BCG may be a poor indicator of control of tuberculosis.

There are particular dangers in the choice of indicators in diseases with lengthy incubation periods. Some have recently advocated screening for carcinoma of the colon; it is easy to use the detection of precancerous lesions as an indicator, without ever bothering to establish that this is a valid measure of diminished mortality. Outcome indicators should be acceptable only when they have been shown to be valid, that is they truly reflect the real outcome which is desired.

Outcomes may conflict. It is clearly desirable that no patient in hospital should have a sleepless night and that no patient should become dependent on hypnotics. It is desirable that patients with rheumatoid arthritis should suffer minimal residual joint deformity and also continue in useful employment, objectives which may be mutually exclusive.

Not only may outcomes conflict but they may have to be ordered, arranged in a hierarchy. Safe surgery must not be prejudiced by diversion of resources to provide more attractive food, even though more attractive food may aid recovery.

Some of the emotional resistance to effectiveness as a measure of quality of care (an elusive notion) stems

from a misconception that, because outcomes are usually expressed in quantifiable terms, they are inappropriate to the study of quality. There seems to be a deep-seated fear that techniques based upon statistical measures would distort 'truth' and are by definition unsuited to our examination of care. But surely if *caritas* is of value, and if that value is real, then it must be demonstrable. If allaying anxiety and providing reassurance, if treating people with dignity and recognizing their right of autonomy are important, then the outcomes, in terms of hastened recovery or reduced dependence on drugs, must be measurable, though not necessarily expressed in numerical form.

A legitimate objective in caring for the elderly is that the care provided should be acceptable to them and that it should meet their perceived needs and wants. It is perfectly possible to assess these and similar subjective responses of patients.

### *Costs*

All process incurs costs. Some of these costs can be readily expressed in monetary terms, but there are difficulties in deciding the appropriate proportion of staff time to be devoted to particular tasks and in deciding the apportionment of capital costs. It is even more difficult to attach a monetary value to suffering, distress, inconvenience or the risk, particularly if it is small, of serious side-effects or death.

There has been a tendency, now diminishing, to neglect costs to patients and to concentrate on costs incurred by health services. Costs to patients such as travel, time off work or the employment of baby sitters or child minders must be included.

### *Efficiency*

The relationship between costs and effectiveness is seldom linear; it is more usually an asymptotic curve. This is an expression of a law of diminishing returns and recognizes that, in most instances, complete effectiveness is an unobtainable goal. The curve may sometimes be more S-shaped, very small amounts of resource producing negligible effects.

Because of this relationship between costs and effectiveness, efficient use of resource demands an outcome definition which recognizes that very high degrees of effectiveness are prohibitively expensive. This is easily illustrated in the case of immunization programmes, where, in the case of diphtheria, 80 per cent effectiveness is probably sufficient to achieve herd immunity and to prevent the spread of the disease.

It is much more difficult to decide what are adequate levels of diagnostic accuracy when, as in some instances, failure to achieve the right diagnosis may be serious or even fatal. Ultimately, values must be attached to human life. Failure to confront this issue, and the assumption that lives must be saved at all costs, may lead to wasteful expenditure and poor value for money.

Because resources are finite, whatever their nature, somebody, often the doctor, must decide and, where possible, these decisions should be made rationally. The measurement of effectiveness and the estimation of costs are an essential prelude to wise decisions but do not remove the necessity of making judgements.

### *Process*

It is process which costs money and uses resources. If expenditure is to be justified, it must improve outcome.

Generally speaking, surgeons are aware of the effect of their interventions in terms of mortality and recovery, doctors of the results of drug therapy. By contrast, the contribution of certain ritualized investigations, of hospital admission and length of stay, attendance at outpatients or the ministrations of state registered nurses and physiotherapists is nothing like so clear. The value of counselling or psychotherapy is open to question: perhaps they are a poor substitute for talking to friends.

It is the negative aspect of much of the necessary research into process that makes it unattractive. It must be more appealing to demonstrate the value of a new therapy, or even a new investigation, than to demonstrate the futility of follow-up outpatient clinics.

Some process concerns hidden outcomes. Much process in the private sector seems to be concerned with the outcome that the patient should become a satisfied customer and should return accompanied by friends. Some may consider this desirable, not only for doctors but also for patients. On the other hand, some process in the public sector seems designed to achieve the outcome that the patient should be dissuaded from returning, especially with friends.

### *Knowledge and behaviour*

Those who advocate health education as a panacea for our ills sometimes seem to assume that knowledge of the dangers of smoking, motorcycles or promiscuity will ensure more prudent behaviour. The evidence is that such knowledge is a totally inadequate spur to altered behaviour. Yet new knowledge, unless it is reflected in altered behaviours, is only of academic interest. While new knowledge of effective therapy is quickly translated into action (too quickly in the case of many drugs), new knowledge about the value of routine x-rays has much less impact.

If the examination of costs and effectiveness is to produce change, it is best carried out by those whose behaviour has to alter. The problem of audit is the presence in the background of an auditor. One response to this is the advocacy of self-audit or (rather more threatening) peer review. It would be better still if doctors had as an essential part of their image the thrifty use of resources. Unfortunately, since the advent of the NHS and almost universal health insurance, neither doctors nor patients profit individually to any real extent from thrift.

A recurrent theme in the recent series in the *British Medical Journal* (1979), 'If I was forced to cut', was the devolution of financial autonomy to units and departments so that saving would accrue; little attention was paid to ensuring that the saving would be spent wisely. Nor was attention paid to the fact that this 'devolution' would mean giving more power to the profession rather than to elected representatives.

If better use is to be made of available resources, those responsible for spending, mostly doctors, must themselves undertake the necessary studies to establish not only the effectiveness but also the efficiency of what they do.

### *Reallocation*

Because of the present economic and political climate, improvement in health services in the future must be achieved by greater efficiency rather than by the allocation of greater resources. There remains the major problem of how to reallocate the savings which might result from improved cost effectiveness. This is a problem because health services are labour intensive, and significant reallocation implies at best transfer of labour or at worst redundancies, which will themselves be expensive. The present relationship between trade unions and management gives little ground for optimism that transfers can be achieved painlessly.

In certain circumstances, such as with the elderly, transfer of resources might need to occur not only within health services but, in the case of home helps and sheltered housing, from health to local authorities. It should not be sufficient simply to transfer the cost to another heading (for example, from health to social services) without ensuring that such a transfer will provide for greater efficiency.

### *Acceptability*

Recommendations which stem from the study of effectiveness and efficiency are valuable only if they are acceptable and can be implemented. Change has to be acceptable not only to providers but also to consumers, and this presupposes the existence of a forum in which discussion may take place.

Improved efficiency often implies change in behaviour; this can seldom be achieved by edict and usually requires conviction. One of the great strengths of self-audit is the conviction which the results carry for those who undertake the task.

### **Conclusion**

If our health services are to improve there must be, despite the unfavourable economic climate—indeed because of it—a much greater awareness of and investment in the study of effectiveness and efficiency. This investment can be translated into useful action only if the recommendations which follow are acceptable.

The College has already done much to promote audit.

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Because of the misunderstandings which surround this term, but also because it is often loosely defined, we should begin again to examine the effectiveness and efficiency of what we do and try to ensure that our results are seen as acceptable, not only to ourselves but also to the people whom we serve.

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## Ventilatory control and sudden infant death syndrome

Since a defective ventilatory-control mechanism may have a role in the sudden infant death syndrome (SIDS), and hereditary factors influence the degree of ventilatory drive, ventilatory responsiveness to carbon dioxide with and without increased airway resistance was measured in 12 parents of SIDS victims and 12 control parents matched for age and size. SIDS parents had significantly lower ventilatory response with added resistance ( $p < 0.05$ ) and without it ( $p < 0.01$ ) and significantly lower respiratory drive with added resistance and without it. Control parents had significantly increased respiratory drive when the resistance was added, whereas SIDS parents did not. The data suggest that a low ventilatory response to carbon dioxide and a diminished compensatory response to increased airway resistance may increase a potential parent's risk of having a child susceptible to SIDS.

Source: Schiffman, P. L. *et al.* (1980). Ventilatory control in parents of victims of sudden-infant-death syndrome. *New England Journal of Medicine*, 302, 486-491.