Molecular biology and genetic engineering

Finally, I would like to dwell on a new factor of great importance in the implementation of medical discoveries—namely, the question of control and direction of the remarkable advances in molecular biology and genetic engineering of recent years. In a few years the human genome will have been mapped out and it will be known with precision where exactly the genes are that control the determination of sex, that determine the inheritance of all inherited disorders, that will predispose an individual to common acquired disorders such as hypertension, rheumatoid arthritis, diabetes, cancer, and indeed to which specific types and sites of cancer. The question is, what is to be done with all this knowledge and latent power? We already have in laboratories forms of life, bacterial and otherwise, whose genetic structure has been spliced with genetic material to enable us to manufacture products that will be of benefit in therapeutics, and there are animals whose genetic structure has been modified to produce substances of benefit in medicine. There can only be a wide basis of support for these developments, and equally there would be a wide basis of support, although not universal, for the detection in utero of the major inherited disorders that cause serious congenital abnormalities, but there is understandable concern about extension of the process to permit genetic manipulation in humans to lessen the chances of acquiring some diseases in later life or to modify or improve in other ways the genetic structure of the individual. Such issues undoubtedly require the most detailed and continuing ethical scrutiny. They cannot be determined solely by the scientists or clinicians involved in the discoveries, nor can we assume that a generally cautious and careful approach would necessarily always prevail. Comprehensive consultation and consideration and continuing discussion and debate are undoubtedly required. Whether this should be achieved by a series of commissions to tackle relatively specific issues, such as we have had already in respect of in vitro fertilisation, or whether it would be better accomplished under the aegis of a standing national body on bioethics is uncertain. The precise format is open to discussion; the need is imperative.

In conclusion

Looking back over my time in the profession, many of the advances that are now part of everyday practice were quite unforeseen when I was a student. The medical profession has made major contributions to these advances and has been remarkably adept and forceful in promoting their implementation. The advances have brought greatly improved care to many patients, even though they have contributed, inevitably, to the rising cost of medicine. I have no doubt that further advances will be made, and as we get nearer and nearer a complete understanding of the molecular and genetic fabric of human life, at least in its physical aspects, ethical considerations as to how we are to use these new tools will become increasingly important. I am confident that if the profession continues to attract lively and inquiring minds, if we are vigilant in maintaining ethical standards, if we are careful to listen to and, indeed, to seek public opinion, then the next few decades will see advances just as remarkable as those that have occurred during the past decades.

Economics, health, and the economics of health

Charles Normand

Economics is the study of scarcity and choice. The tools used by economists are designed to help with the decisions about how to allocate scarce resources to infinite wants. Resources are always scarce, and choices always have to be made. The only thing that varies is how scarce are the resources, and how difficult the choices. Although spending continues to rise in real terms, the problem of scarcity and the need to choose has become a visible feature of the debate about health services in the United Kingdom.

Markets, uncertainty, and insurance

The most common method of allocation of goods and services is the market. There is something fascinating in the way that exchange in the market can make people better off as less desired goods are traded for more desired ones. In general economists argue that voluntary trading makes both parties better off—both sacrifice something of less value for something of greater value. It is therefore important to have good reasons to prevent or discourage such trading.

Markets can fail for a variety of reasons. One is the lack of information, or an asymmetry of information between the parties. For markets to work well, both parties to an exchange must be well informed about the characteristics and quality of the goods being traded.

Other types of market failure come from externalities and from public good characteristics. An externality is a good or bad effect of a good or service which falls on third parties. For example, an undesired effect of driving a car is the noise and air pollution experienced by other people. An example of external benefits is the effect of immunisation—my immunity to an infectious disease makes me less likely to spread the disease to others, as well as affording me protection.

Markets may also fail to work well if there is a significant degree of monopoly power. This is especially the case when producers are natural monopolies such as those who supply gas and water. Restriction of entry into professions introduces monopoly. Although these restrictions are claimed to be (and in most cases are) to protect the public from incompetent practice, they also have the effect of restricting competition.

The great uncertainty about need for health services, and the great cost of services, makes it inevitable that people will choose to provide services through a system of insurance, whether private, social, or national (or through general taxation). Insurance is expensive to administer, since there are many contributors and many claims. A policy question is therefore that of the cheapest way of providing this insurance cover. If incentives and efficiency are not taken into account then payment for health services from general taxation, as in Canada, Sweden, and Britain, involves the lowest expenditure on raising the funds.

Insurance works best when all parties are well informed about the risks and the risks and outcomes are well defined. It is therefore not surprising that insurance does not work perfectly in the area of health and social care. Apparently similar individuals might in fact represent very different risks. This can lead to incomplete markets, with some people failing to find insurance.[1] There is enough evidence that, left to itself,

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the insurance market will fail to provide universal access to health care. This is sufficient to justify some role for regulation and government intervention.

Equity

Although not formally a market failure, equity in access to important goods and services is an important source of concern. The distribution of income results from inheritance, skills and aptitudes, education, hard work, and luck. These may be seen as an adequate basis for access to meals in restaurants or foreign holidays, but many would argue that "essential" goods, such as health services, should take more account of need. This is a slightly difficult argument to sustain—food, clothing, and housing are more essential, but we do not choose to provide these by collective action. To sustain the argument we need to establish that health and health services have peculiar characteristics. Otherwise we should pursue any objectives for social justice through the tax and benefit system.

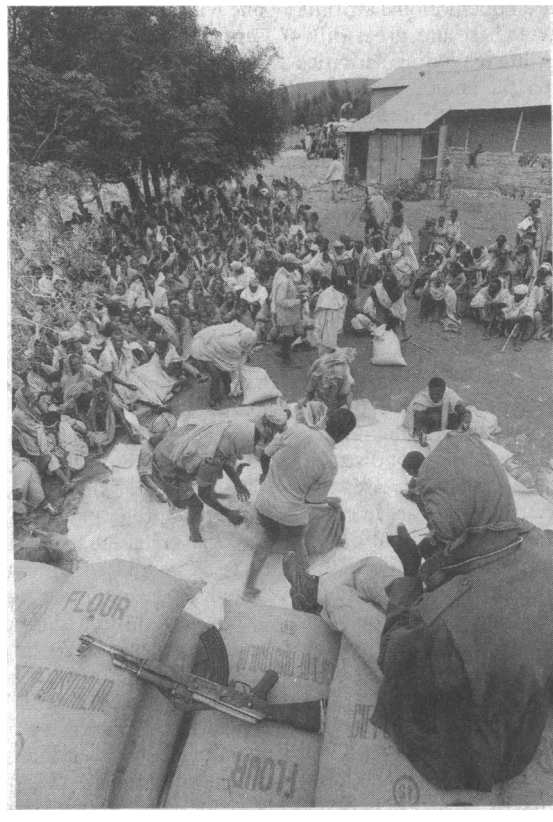
Some writers have considered equity directly, and others have also suggested a related idea of humanitarian spillover (or caring externality)—that is, my welfare is increased if I know that others' needs are being met.[2] This interpretation has the advantage that we can continue to consider consumers as self seeking, but they happen to want other people to be well.

Nature has conspired to make equity a particular problem in health. Poor health is more common in people from lower socioeconomic classes and is concentrated among elderly people. Thus those with the greatest needs are also those who are least able to pay (at least at the time when care is needed). Although we can pay insurance at times when we are earning to cover times when we are not, there are real difficulties (not confined to health care) in ensuring that rights bought in the past can be enforced in the future. Take the case of people with pensions that are not fully index linked—they thought they were guaranteed a reasonable standard of living, but this "right" is not delivered when they come to claim it some years later.

There is a question whether sufficient arguments can be assembled that can justify health services being taken out of the market. Although there are externality and public good characteristics in health, especially in public health, most health care is for the benefit of individuals and has no significant externalities.

My own view is that the combination of great uncertainty about and individuals' need for care, the cost and poor performance of health insurance markets, the important role of health in a person's ability to enjoy other things, and the quite extraordinary suffering that can accompany need for services make health different from many goods. Even in the United States there is now a consensus in favour of a safety net for universal access to health care,[3] although there is no consensus about the form this safety net should take.

Market failure and equity are the reasons why in all countries the state has a role in preventive and curative health services. This role generates a need for collective decisions; economics can assist in deciding on the pattern of services, priorities, and structures. This paper is concerned with the contribution already made by economics, and the contribution to be made in the future. This requires that economists develop new areas of research and develop existing areas.



NEIL COOPER/PANOS PICTURES

Resources are always scarce, and choices always have to be made (guns or butter is the classic economic example). The only thing that varies is how scarce are the resources, and how difficult the choices

Health and the economies of health

Health and the generation of good health are highly complex matters, and the intention here is simply to draw attention to some interesting features that have an immediate relevance to the application of economics.

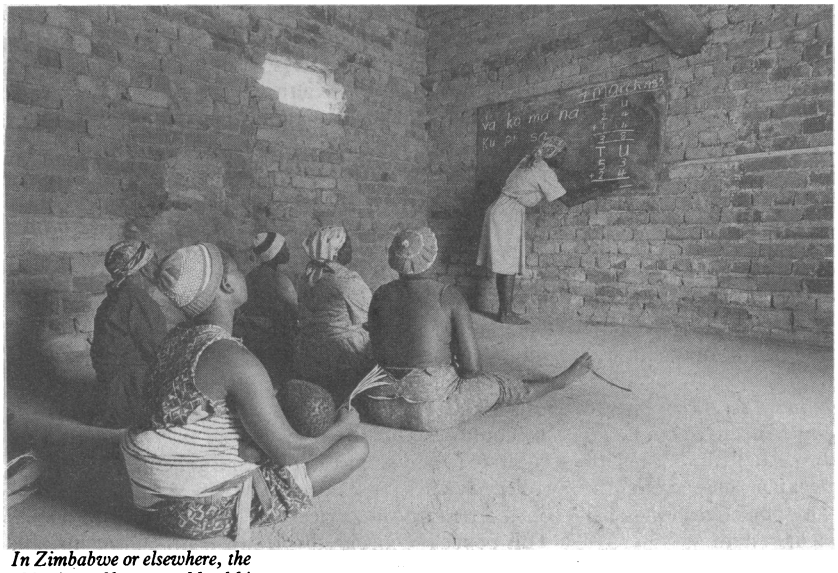
There is little dispute that the major advances in life expectancy and health status in the Western world have come about mainly as a result of public health measures, with a smaller role for curative services. Alongside health services the objectives of longer and healthier life may be met by better health and safety measures, road improvements, encouragement of public transport, education, pollution control, campaigns against tobacco and alcohol misuse, and better housing. Some interest has been shown in the relative priority of these and curative services,[4] but we know little about the relative merits of curative services and preventive measures.

Although there are some health care interventions that aim to extend life, and some do so in a dramatic way, health care in Western countries is mainly concerned with treating non-life threatening diseases, reducing pain and discomfort, improving mobility and independence, and generally improving quality of life—all very important and useful activities, if somewhat undramatic. The presence of a small part of the service that aims to extend life has distracted attention from these important objectives. Much of the emotion of the public debate on health service priorities seems to stem from a belief that a much higher proportion of effort is directed at life extending activities.

It is useful to avoid the term saving life and to consider, rather, the extent to which treatments extend life. This allows us to focus on the difference between those treatments that prevent premature death and those that add, at most, a small margin. All things being equal, most people would argue that the former are more important.

Health services technology moves fast. Surgery is becoming less invasive and can often be done on a day basis, sometimes under local anaesthetic. Some non-surgical techniques are replacing surgery. Great advances have been made in genetics, and cheap and accurate screening and diagnostic tests are becoming possible. Gene therapy for some conditions seems likely.[5]

It is tempting to assume that these technical developments, along with developments in scanning technologies, are concerned with life extending treatments.



BRUCE PATON/PANOS PICTURES

In Zimbabwe or elsewhere, the objectives of longer and healthier life may be met by education among other things

Once again this is only partially the case. Take the example of magnetic resonance imaging—the equipment can provide good quality images, and the technique avoids the use of ionising radiation. Its uses are particularly related to neurosciences and orthopaedics but may extend to diagnosing heart diseases. The evidence suggests, however, that few people will in fact live longer as a result of magnetic resonance imaging, although many may be spared the pain and distress of myelography or arthroscopy, and surgeons may operate with increased confidence. Perhaps the most dramatic technical development has been in joint replacement. Significant improvements in mobility and reductions of pain have been possible, although the treatment does not affect life expectancy.

The aim of the preceding sections is to suggest that health services are largely in the business of improving comfort, health status, and quality of life, and only to a lesser extent in the business of extending life. Other services are also concerned with extending life, and these may sometimes be more effective than health care. The importance of these points is that there is no reason why we should not take an unemotional attitude to most issues in health care. There are great difficulties in gauging the value of life extending activities against others, but more often the choice is between different developments that improve health and quality of life, but do little to extend life.

Improvements in life expectancy and reductions in the birth rate have combined to increase the average age of the population in Western countries. This has put pressure on resources for health services as demands have grown; many people with chronic conditions need more treatment and care.

Fallacies in the public debate

Some popular fallacies have appeared in the public debate on health and health services. The main ones are: (*a*) that prevention and early treatment of diseases saves money; (*b*) that technical progress increases the cost of services; and (*c*) that health services are in some senses unproductive and can therefore only be afforded if the "wealth creating" parts of the economy do well.

The first of these is easy to dismiss. Interventions that prevent or cure a disease can be justified on grounds of longer life and quality of life, but the person is likely to proceed to needing treatment and care for subsequent disease and disability. There are a few exceptions to this, such as early treatment for congenital dislocation of the hip,[6] but most interventions lead to higher costs in the long run, although these higher costs may be fully justified by greater benefits.

There is more serious confusion about the effects of technological developments. It is often argued that developments lead to an increase in the costs of health services, and this has sometimes been quantified. Taking advantage of changes in technology is justified only if they lower cost or improve the service. They cannot be justified if the same service is provided at a higher cost. It is therefore important to understand that technical progress in itself cannot be the cause of increased costs, but can and may be a source of reduced costs. Better machines can do the job more quickly, with less staff time, and therefore save money.

What is common is that machines are replaced with more reliable, safer, or more effective ones, or that completely new devices become available. As a general rule additional expenditure is justified only if the outcomes for patients are better. Take the example of magnetic resonance imaging again. It is expensive to buy and run. However, myelograms, arthroscopies, arthrograms, and computed tomography are also expensive, and fewer of these are needed if magnetic resonance imaging is available. The evidence is quite clear—magnetic resonance imaging could be introduced to produce a better service at lower cost than the present pattern of services. Further uses of magnetic resonance imaging providing additional and even better services at a higher cost might also be justified. These developments may be expensive. However, the view that technological development is in itself a cause of increasing cost in the provision of health services is wrong. Developments involving new ideas and technologies should take their place alongside other candidates for enhancing services, judged on their ability to extend life and improve its quality.

It is not clear why the idea has been spread that some economic activities are wealth creating and others consume the wealth. There is no economic justification for the view. What matters is that we may be devoting more resources to health care than is desired by the population, rather than what proportion of national income we choose to devote to health services —or, for that matter, to food or clothing. Some economic arguments suggest that an economy with a concentration on health services might grow more slowly than one with, say, an emphasis on manufacturing.[7] Health services are labour intensive; they are difficult (but not impossible) to export; and productivity growth is normally slower than in manufacturing

A related fallacy is that the country cannot afford to spend more on health services, so that it is necessary to find additional funds from patients and other private sources. Unfortunately this idea has spread in central and eastern Europe, is popular in developing countries, and enjoys the blessing of the World Bank. It is, however, completely wrong. Insofar as there is a macroeconomic argument (that is, more spending on health services may reduce the rate of economic growth) it may matter how much of a country's resources are used for health care, but it does not matter how this is financed. This is not to say that people who pay for health services are indifferent to the payment method. They may prefer systems that are visible, so that they know how the money is spent. They may prefer payment systems that prevent control by local or national politicians. But the point is that there is no macroeconomic reason for choosing one system of raising funds over another.

The brief discussion of economics, health, and health care leads on to the possible roles for economics in the priorities for and structure and provision of health services. The aging population will increase the demands for existing services. New technologies may introduce new possibilities, or lower the costs so as to change the priorities for provision. Decisions need to be made about the relative priority of preventive and

curative services and the priority of health spending against other programmes. It is important also to know more about the choices in how we provide services, especially locations, scale, and choice of process.

Economics and setting priorities

If we accept, as we must, that choices have to be made, we need a basis for identifying these priorities. A simple rule is that services should be chosen to maximise the benefit for any given level of spending. However, this begs questions about how we measure the benefits and costs.

Welfare economics is largely based on the ideas of Vilfredo Pareto. His central idea was that a society is better off if no one is made worse off, and at least someone is better off. This elegant idea is a bit unhelpful since almost all actions make someone worse off, if only because they pay more tax. But if someone is worse off and another better off how can we be sure that the one who is better off is significantly better off than the worse off one is worse off? At one level the answer is that we cannot, and interpersonal comparisons cannot really be justified. This problem has its most elegant (if complicated) exposition in a book by Arrow.[8] Attempts to escape from this constraint have suggested that all is well if gainers could compensate the losers and still be better off. Scitovsky shows that, to be quite sure, compensation must actually be paid.[9]

It is important to understand that whereas the tools of applied welfare economics are powerful and useful, they are located in an area of theoretical debate. It will never be possible to be fully confident that the right answers are given. Like medicine and physics, economics is a theoretical discipline, with its foundations in debate and incomplete understanding.

As practical people, economists accept the limitations of the tools they use. If we are attempting to choose the best programme of care we try to calculate the costs and benefits of the possible components so as to choose the combination that yields the greatest benefit for any cost. It is difficult to measure the costs, and even more difficult to measure the benefits.

Health services generate benefits in terms of longer life and better health, although health care may more often be concerned with better health and quality of life. Data on increases in life expectancy after treatment are often of poor quality. Many popular treatments have never had systematic evaluation of their efficacy, and there are ethical problems with doing so now (although it might be argued that there are also ethical problems with carrying on with treatments that have not been properly evaluated).

NEIL BENSON/GREY PANTHERS

The aging population will increase the demands for existing services. Maggie Kuhn, founder of the Grey Panther movement in the United States

Better health is also hard to measure, and given that this is the central objective of health services, it is important to try to assess changes that result from interventions. The importance or otherwise of the presence of identifiable disease is not clear. A recent survey of elderly people found little correlation between dependency and the presence of diseases.[10]

Enter the QALY

As well as difficulties in measuring improvements in life expectancy and quality of life, there is the difficult problem of how these two objectives should be compared. What should be the trade off between longer life and better health? Put in a more concrete form, should we devote resources to treatments (such as hip replacements) that improve health, or to ones which lead to longer life? Some would argue that this is really a political question. A small industry has developed around the issue, and various strategies have been developed to elicit the views of the people on the appropriate trade off. The holy grail in this quest is the quality adjusted life year (QALY). A QALY is defined as a year of full quality life. Poor health may reduce the "quality" of a year, so that the value of a sick or disabled year might be 0·9 or 0·7. Treatments are justified if they generate QALYs, either by helping people to live longer or by improving the quality of existing expected years.

My position in this debate is best described as enthusiastic, cautious, and sceptical. As Ghandi said of British civilisation, QALYs would be a good thing. The arguments about the methods used to assess the weighting of poor health are best left, at this stage, to the psychologists, economists, and political scientists. Other problems may further complicate the quest for QALYs, but are none the less important.

QALYs are, in some senses, quite democratic. In most formulations a year is a year is a year, without regard to the person enjoying it. Each year can be viewed in isolation from all others. In this sense there is no past and no future. The effects on quality are measured on the basis of the degree of handicap or pain without explicit consideration of the causes of these.

A simple example may help to illustrate the problem. Take two scenarios. In one the person will enjoy near perfect ability to live and work and will be free from pain for the next year but will thereafter die. In the other the person has a year of restricted activity and some pain but at the end will return to a full and normal life. Consider our emotions about each of these years. In the first we would have considerable difficulty in concentrating on the good quality of life. In the second our ability to cope would be sustained by the knowledge that we are "investing" in future good health. QALYs, as currently calculated, suggest the year in the first scenario is better. I disagree. The unavoidable conclusion is that assessment of the quality of years must be located in a knowledge of the likely disease process, a point recognised by McGuire *et al.*[2]

Cairns and others have attempted to develop output measures that recognise the importance of the context of a disease process and consider the possibility of mapping from one set of disease specific measures to another.[11] Another approach has been to describe scenarios, and assess packages of years against each other. Without challenging the view that we should be neutral about whose year is under discussion, I believe that it is important to understand the context of a year if we are to make sensible judgments about its quality.

A related problem with the current approach to QALYs is the failure to take into account the ability to learn. Restriction in activity can initially interrupt the whole of someone's life. With time and experience the problem can be managed, and a fuller life led. This will

involve changing lifestyle, adapting the home, and developing new interests. For example, someone with angina may need to change jobs, develop new activities, give up smoking, and change diet. With these changes a more normal life may be possible.

These comments about the deficiencies in the current work on estimating QALYs may seem a bit negative. The question arises of whether these problems are important empirically. In essence the assumption that the QALYfiers are making is that the effect on quality of a year is constant regardless of the likely sequence of events and the scope for learning over time. Although difficult, this is in principle a researchable question. If evidence were found to support the assumption then it would be possible to have more confidence in estimates of the value of QALYs.

QALYs have developed mainly in the context of a desire to compare outcomes of acute interventions and to set priorities in hospital services. In principle the same approach can be taken in preventive and continuing care services. The changing age structure of the population is likely to increase the number of people requiring some support, although it is difficult to predict the levels of morbidity and dependency. Services for elderly people are often referred to as "priority" in the plans of health authorities, although there is a danger of devaluing the term. The need to choose between acute and continuing care services is growing, and we need tools to help us. There is a widespread belief that the balance of resources should shift from acute care to continuing care, but it never seems easy to justify such a move. A more robust attitude to "shroud waving" is detectable in managers and politicians, but there still seems to be no way of preventing the relative growth of the acute sector. It is again important to understand that a large part of acute medical care is concerned with comfort and the quality of life, so there is a comparability with many of the elements of continuing care services.

One reason for the difficulty in moving the balance of resources is the difficulty in measuring and comparing the outputs of care. In both acute and continuing care the aim is to extend life and improve its quality. However, the measures of quality used in continuing care are typically very different from the health status indicators used in comparing acute interventions. Measurement of quality of life in continuing care has tended to concentrate on dimensions such as independence, privacy, dignity, and choice.[10 12] One component of quality of life may be dependency (as measured by ability to perform tasks), but there are other components. Again it can be argued that the comparison of benefits of these kinds is essentially a political process, but the counterargument is surely that the political process has allowed the present priorities to prevail. The logic of the QALYfiers is that QALYs should be developed to allow priorities to be set between acute and continuing care. This would expand the research programme considerably.

BRENDA PRINCE/FORMAT

Health services generate benefits in terms of longer life and better health

Economics and health services

Reforms in the NHS have generated a large body of analysis.[13] Responsibility for setting priorities has been separated from the role of hospitals as providers. Hospitals now face the task of providing care of a specified quality at a given price.

Economics has a long tradition of addressing such issues, but little of this has been brought to bear on health services. It is only a slight simplification to characterise doctors as believing that there is a single desirable method of providing a service. Ratios of beds; theatre sessions; and medical, nursing, and technical staff are thought of as largely fixed. Economists have been trained to see things very differently—a service can be provided in many different ways, using different mixes of staff and facilities. The choice can be made given knowledge of the technical possibilities and the costs of the different components of care.

Choice of technique is now firmly on the agenda, but little work is going on in this area. It is not difficult to understand why. To study the production process it is important to be clear about what is being produced. Hospitals produce a wide range of services. Even when divided into specialties the range of work is large. A ward classified as general medicine may be treating people with acute cardiological or respiratory problems or may be providing long stay care. Care measurement systems, such as diagnosis related groups (DRGs)[14] go some way to correcting this but still can leave a wide diversity of treatment within any category. Two hospitals that seem to have different costs and approaches to care are likely to be in some senses in different businesses. If economics is to assist in the choices of how to supply services more work is needed.

Economies of scale

Perhaps the most serious deficiency in our understanding of the provision of health services is scale. Hospitals have got bigger over the past 20 years. More patients are treated in each specialty in each hospital. There is a widespread belief in the existence of economies of scale in hospital services, but there is almost no evidence of these. Most examples of moves from small to large hospitals show an increase in cost per case. This should not be taken to imply that small is necessarily cheap, since the mix and quality of services may also change, but it is a little surprising. Theoretically there are reasons to expect economies of scale in many parts of hospital services. Expensive staff and equipment can be shared, fewer spare beds are needed to handle variations in demand, special skills can be developed, and there may be lower management costs. However, small hospitals tend to have low cost habits. Flexible working arrangements are common, liaison with local primary care services tends to be good, and space is often limited. Even if the standards in a larger hospital are higher, the question must be whether they are sufficiently better to justify the higher cost and more difficult access for patients.

It is important to distinguish between two possible sources of scale economies—the size of the hospital and the size of individual departments. In the entire hospital the gains may come from shared use of diagnostic services, management, catering, and some shared use of staff. Gains in the quality of services may come from the presence of good support from other specialties. However, it is clear that some of these gains are possible without a large hospital. Already catering and some pathology services are provided off site in many hospitals, and some management has always been. A large hospital may be able to offer a wide range of specialties on the same site. This is often cited as an advantage, but without strong supporting evidence.[15 16] It is therefore unlikely that the size of the hospital will in itself improve the quality of care or lower costs.

Size of individual departments in the hospital could be more important. Medical and nursing staff may be able to cover more people; equipment can be shared and facilities used more intensively. On the face of it these effects are likely to be strongest where high technology equipment is used, such as intensive care or cardiology. Take the example of neonatal intensive care: night time medical cover may be less per cot in large units, and some of the more expensive equipment might be shared; also it may be possible to retain the same degree of assurance that a cot will be available with fewer cots in total if these are concentrated on fewer sites. Evidence is as yet poor, but there is some

JOHN RAE

Measurement of quality of life in continuing care has tended to concentrate on dimensions such as independence, privacy, dignity, and choice

suggestion that larger units are slightly cheaper.[17]

Given the diversity of services provided in hospitals, and the limited links between departments, it is best to consider them as conglomerates rather than as firms (or as suggested by Peter West, a shed with lots of small workshops in it). The hospital may offer some services to and exercise some control over departments, but the departments are fairly autonomous. The appropriate level to study "firms" is the specialty or department, or nowadays the clinical directorate.

If, as I suspect, scope for improved quality and lower costs from larger hospitals is limited, this has some important consequences for policy. Rationalisation may not be rational. Further concentration on fewer sites may offer little gain, and worsen access. It would be a pity to devote considerable resources to make the service no better and less popular.

The research agenda

As the science of choice, economics should provide the framework within which we can analyse what services should be supplied, for whom, how, and when. This does not imply that other disciplines have a lesser role, but that economics provides the framework and some of the analysis.

Priorities for what should be provided depend on the costs and the benefits. Costs depend on how the services are provided, and we need to know whether the methods are appropriate as well as whether there is inefficiency and waste. This is discussed below. We also need to be better at measuring the benefits. Although there are major exercises to try to elicit values for changes in health status, there is a need for more research on the importance or otherwise for the measurement of quality of life of the causes of disability and ill health. There is also a need to develop the work to encompass the care of people with continuing needs, especially in the light of the aging of the population.

Provision of health services involves production processes that use professional and supporting staff, facilities and equipment. We know remarkably little about these. Between 70% and 80% of spending on health services is directly on staff. Staff turnover is rapid in some areas, and for some staff groups.[18] This high turnover can be expensive in terms of recruitment, induction, training and lost productivity.[19] This may be a result of pay or poor working conditions, and may be within or outside the control of mangement. We need to know more.

Assessment of new technology has become more formal, with systematic evaluation of some developments before they are adopted. Despite this, it has often been difficult to prevent adoption of untried equipment and techniques. Although preventing the adoption of inappropriate technologies would be a good thing, it is important to look more closely at the use of those technologies that have been adopted. It is striking that medical equipment is usually cheap relative to the cost of using it. It is likely that considerable gains could be made from a better understanding of health service production processes.

Research is urgently needed to investigate the degree to which it is possible to vary the methods of producing health services, and whether there are advantages in larger or smaller scale production. This should take relatively small parts of the service at a time. It is unlikely that the size of the hospital as a whole is very important, but the scale of individual specialties and departments may be.

The most important resource in research is the researcher. Recruitment of good researchers to university posts is difficult in many disciplines, especially in those where alternative, well paid opportunities exist. Too few economists are being trained in the economics of health, and too few retained within the subdiscipline. It is becoming increasingly difficult to persuade economists that a career in research is attractive.

The research agenda outlined above would develop the scope of the economics of health from a concern mainly with priorities in spending, to covering also the ways in which services are provided, and by whom. Research of this kind requires an understanding of economic theory. It also requires participation of disciplines from the medical and social sciences. It is therefore appropriate that some part of the proposed developments should come from an institution where these are available. A postgraduate medical school with a remit and mission to guide public health throughout the world and with a commitment to collaboration between different intellectual disciplines is well placed to develop this research programme. However, a growing interest in the economics of health at the London Schools of Hygiene and Tropical Medicine should not be at the expense of the existing groups of economists in York, Aberdeen, and Brunel or of the many individuals in universities, research centres, and health authorities who contribute.

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