Pharmacoeconomics and its role in the growth of the biotechnology industry

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Abstract

Assuming a constant stream of new biotechnology products in the future, three key issues are likely to influence the growth of the biotechnology industry in an increasingly competitive healthcare market: (a) biotechnology products are more expensive than comparable traditional pharmaceuticals; (b) many biotechnology products target small patient populations for which they may provide the only therapy that substantially improves their condition; (c) the physiological and pathophysiological effects of some biotechnology products are not completely understood, which may require additional resources to characterise and manage patient risks. We show how these issues can be addressed with the help of pharmacoeconomic tools and how they will probably affect the growth of the biotechnology industry.

PHARMACOECONOMICS IN THE BIOTECHNOLOGY INDUSTRY

Pharmacoeconomics has experienced a substantial rise within the healthcare industry over the past few years. Researchers from a wide range of disciplines have developed new techniques to evaluate the economic impact of pharmaceuticals in clinical care. Clinicians, pharmacists, economists, epidemiologists and operations researchers have contributed to this field. Given the economic reality that resources are limited and needs and expectations are infinite, *medical* economists try to find solutions on how these resources can be allocated optimally, to maximise the production of health or what society perceives as health.

Pharmacoeconomists differentiate *allocation* efficiency and *production* efficiency. From the perspective of a health insurance plan, allocation efficiency is reached when those drug classes or clinical programmes are covered that will produce most health per expenditure. This requires a common monetary metric of health gains across the broad spectrum of diseases, conditions and health outcomes (see section on cost–benefit analysis). Once it is decided to cover a specific treatment or clinical programme, economists try to identify the most cost-effective product within a class of comparable choices using cost-effectiveness and cost–utility analyses (see below). Both allocation and production efficiency are two critically important concepts for the economic success of biotech products.

This paper will provide a rationale for why pharmacoeconomics is critically important for the growth of the biotechnology industry, explains fundamental economic tools for evaluating biotechnology products, and concludes with a strategic outlook for the biotechnology industry.

SCARCITY – THE DRIVING FORCE FOR RATIONAL ALLOCATION OF RESOURCES

The fundamental aim of any healthcare system is to maximise the health and welfare of its population, but because resources will always be scarce in relation to the healthcare needs, a series of choices must be made. Decision makers responsible for allocating resources need

to prioritise between competing uses in order to maximise benefits (or health gains) under budgetary constraints.[1,2]

Prioritisation takes place on different levels of the healthcare system. On the health authority level and senior health plan management level, planners decide on the specialty and service mix they wish to purchase for their beneficiaries, with the goal of optimising resource allocation to health programmes. This allocation process is often a mix of rational thinking and a political agenda.[3] In the increasingly privatised hospital market, decisions are made about the purchase of medicines and equipment with the goal of maximising profits. At the level of the individual physicians, prioritisation is increasingly influenced by medical audits and other forms of peer review, with more clinical guidelines. These constraints usually impose the payers' view on the economics of medicines upon individual physicians. This is not to say that it is generally bad to impose such constraints on the health delivery system, as long as such decisions are based on hard evidence. Pharmacoeconomics can help to make better-informed choices.

Pharmacoeconomics helps to make better decisions

Third party payers are increasingly asking drug makers to provide economic evaluations for coverage decisions

Pharmacoeconomics and the difference between biotechnology products and traditional pharmaceuticals

Without simplifying the wide area of biotechnology products too much, there appear to be several critical differences between traditional small molecule pharmaceuticals and biotechnology products:

- Biotechnology products are usually more expensive than comparable traditional pharmaceuticals if they are available.
- Many biotechnology products are targeting small to moderate size patient populations for which in some instances they provide the only medication that substantially improves the underlying condition.
- Although knowledge in molecular biology and immunology is rapidly increasing, the physiological and pathophysiological effects of biotechnology products may not be completely understood; it therefore may require additional resources to characterise and manage patient risks.

More expensive medicines need to be proven that they are 'value for money'

These key differences are the reason why pharmacoeconomics is critically important to the biotechnology industry. Expensive products must demonstrate their cost-effectiveness compared with less costly traditional pharmaceuticals, and the biotechnology industry must demonstrate that it is efficient to allocate more funds to relatively small groups of very sick patients who may benefit from biotechnology products.

Because of the high price of biotechnology products, payments for them will in most instances be made through third-party payers. For the reasons described above, drug benefit plans – whether privately or governmentally funded – increasingly demand economic evaluations for coverage decisions.[4]

Despite some methodological challenges that will be described below, economic analyses are and will therefore be critical to the rational allocation of resources by manufacturers, providers and payers. Economic studies may provide answers to many, but not all, questions (Table 1). The drive to use new expensive technologies rationally will require increased efforts in health technology assessment, a better appraisal of patient preferences, and more rigorous pharmacoeconomic analyses.

Cost containment and the evolution of managed care in Europe

All European countries have common objectives concerning healthcare, most importantly the provision of quality healthcare at an affordable cost. They also face similar problems: a dramatic demographic change (growth of the

Table 1: Questions that an economic study can answer

Among many others, the following questions are most important for pharmacoeconomic research:
- Which technology should be included in a limited list of services that can be covered/provided?
- Which of several technologies is the most cost-effective even if it means higher upfront costs?
- What are the relative costs and benefits of comparable technologies?
- What is the cost per quality adjusted year of life saved by using a specific clinical strategy?
- What effect will the results of a particular technology have on a patient's life expectancy and quality of life?

number and proportion of elderly people in their populations), a change in disease patterns (a shift towards more chronic and multifaceted illness), the continuing development of new and expensive health technologies and societal changes with increased expectations. These factors require new approaches by the healthcare industry to manage its cost. Because of their wide-ranging potential but also because of their costs, biotechnology products will be granted particular scrutiny.

The biotech industry must be prepared to meet the challenges of managed care

In the context of increasing cost containment, many European healthcare systems have adopted some form of 'managed care'.[5] It is noteworthy that there has been tremendous change in the organisational structure of managed care plans or networks over the past two decades. Additionally, there has also been considerable confusion and controversy over the definition of a managed care organisation (MCO) by stakeholders and healthcare analysts. The Institute of Medicine has provided a good rough-and-ready definition whereby managed care should serve to: (1) control costs through improved efficiency and coordination; (2) reduce unnecessary or inappropriate utilisation; (3) increase access to preventive care; and (4) maintain or improve the quality of healthcare.[6]

It is expected that managed care will increasingly diffuse in healthcare systems worldwide

Several factors contribute to the diffusion of managed care in Europe. The most important are: (1) the overall economic environment, (2) socioeconomic factors, (3) the prevailing governmental framework, (4) the healthcare structure and (5) consumer expectations.[7,8] The extent to which these contribute to managed care are displayed in Tables 2 and 3.

Some elements are essential when a healthcare system is evolving towards managed care. First, an increasing professionalism concerning the purchase of the components of healthcare has to be established. This certainly means a change in attitudes of payers and providers. Secondly, a greater control over access to healthcare, particularly secondary and tertiary care, will have to evolve. Thirdly, an increasing professionalism concerning the management of the total input/outcome equation over the spectrum of healthcare has to be developed.

Based on experiences in the USA, it is often argued that managed care organisations can survive only if they: (1) look beyond profits, (2) provide appropriate standards of care, (3) support teaching, (4) support research, (5) support care for the poor and (6) grant sufficient physician autonomy.[9]

In conclusion, many aspects of managed care are here to stay and will

Table 2: Factors contributing to the diffusion of managed care in selected European countries

	Germany	France	Italy	Spain	UK
Economic environment	✓	✓	✓	✓	✓
Socioeconomic factors	✓	✓	✓	✓	✓
Governmental regulatory framework	–	×	×	×	✓
Healthcare structure	✓	×	×	×	–
Consumer attitudes	✓	×	×	×	✓

Table 3: Some factors contributing to the diffusion of managed care in selected European countries (OECD Data, 1998)[10]

	Who pays for healthcare?*	Who is the agent for the delivery of care?	What is the key consumer philosophy?
Germany	Government 6.4 Private 24.2	Health insurance Private insurers	Quality of care
France	Government 2.4 Private 24.0	Government Mutual private insurers	Freedom of choice
Italy	Government 71.9 Private 28.0	Public health authorities	Free healthcare provision
Spain	Government 62.3 Private 29.5	Public health authorities Small input from private insurers	Free healthcare provision
UK	Government 79.9 Private 20.1	Public health authorities Small input from private insurers	Free healthcare provision Strong loyalty to the NHS

*In percentage of total healthcare expenditure

further develop in European healthcare systems that are currently financed and run by governmental or quasi-governmental agencies. The economics of biotechnology products will be particularly scrutinised by MCOs and negotiating reimbursement arrangements for expensive new biotechnology products will be critical for the growth of the biotechnology industry.[11] However, in a competitive healthcare market the same organisations will increase their competitiveness when carefully investing in new technologies that may provide treatment for rare but grave diseases and sometimes save costs.

It is essential that the biotech industry understands the concepts of pharmacoeconomics

To fully understand the relations between payer and providers on one side and the biotechnology industry on the other requires an understanding of the fundamentals of pharmacoeconomics as the basis for decision making in modern managed care environments.

SOME PHARMACOECONOMICS EVALUATION TECHNIQUES

Good pharmaeconomic evidence may avoid the exclusion of new products from coverage through third party payers

Economic evaluation is a method to assess and evaluate costs of health interventions and the health outcomes associated with these interventions. Its central function is to show the relative value of alternative interventions for improving health. Analyses provide information that can help decision makers in a variety of settings to weigh alternatives and decide which one serves their programmatic needs best. Such analyses are just one of the many factors on which the ranking of provided services are based. The role of the economic evaluation is to supplement these qualitative factors by providing standardised, quantitative estimates of the likely increment in cost per unit of health benefit achieved.

A growing demand for cost-effectiveness and economic evaluation[11] is not a threat to patients: properly used, it would help to provide more cost-effective services to more beneficiaries, which ultimately will extend more lives and improve the quality of more lives. Nor should the application of its methods constitute a threat to practitioners' freedom to exercise their best professional judgment in individual cases or to the patients' rights to autonomy. But these freedoms and rights can best be exercised only in the presence of the sort of information required to develop a knowledge-based culture of critical evaluation in medicine.

Economic evaluation is not only about alternatives and costs. It is also about consequences and especially about the good and the bad consequences for patients and the society in general. Cost-effectiveness methods, when properly and responsibly applied, have a major

contribution to make by enabling better-informed decisions to be made.

The major components of an economic evaluation

Economic evaluation is principally an input/output relationship

All economic studies investigate the balance between inputs (the consumption of resources) and outcomes (improvements in the state of health of individuals and/or society).

Although the unit price of a drug is often a prime factor in decision making, economic outcomes research provides a more comprehensive interpretation of cost. This is accomplished by determining the overall cost of a given diagnostic or therapeutic process from the initiation of diagnosis until a final outcome is achieved. The approach used by health economists is to consider costs as opportunity costs, ie they define a cost to be the consumption of a resource that could otherwise be used for another purpose. Once the resource has been used, the opportunity to use it for another purpose is lost. The various types of costs can be grouped under the following categories:

- direct medical costs;
- direct non-medical costs; and
- indirect costs.

Direct medical costs

The identification and valuation of costs is imperative and needs to be comprehensive

Interpretations of what belongs in each of these categories varies in the economics literature. Direct medical costs are defined as those resources used by the provider in the delivery of medical care. As an example, direct medical costs for a hospital include:

- drugs;
- laboratory tests;
- medical supplies;
- use of diagnostic equipment – magnetic resonance imaging, computerised axial tomography (CAT) scans and X-ray, for example;
- medical staff time for personnel such as physicians, nurses, pharmacists, physical therapists and laboratory technicians; and
- room and board – the cost of supplies, equipment and personnel required for routine patient-related services such as food, laundry and housekeeping.

These are examples of costs that can be directly related to the care of patients. Other costs of operating a hospital include plant maintenance and repairs, utilities, telephone, accounting, legal fees, insurance, taxes, real estate costs and interest expense. In general, most economic studies do not factor general operating costs into the monetary value assigned to the cost of resources expended for a given medicine.

Length of stay is an important cost factor from a hospital's perspective, especially when payment is determined by diagnosis-related groups (DRGs). Hospital costs such as room and board are directly tied to increasing length of stay, regardless of the reason. The cost of laboratory tests, supplies and medical staff time vary with the medical condition being treated, but are multiplied by length of stay.

Direct non-medical costs

Economics literature generally defines direct non-medical costs as out-of-pocket expenses paid by patients for items outside the healthcare sector. This category includes such costs as:

- travel to and from the hospital, clinic or doctor's office;
- travel and lodging for family members who live elsewhere;
- out-of-pocket contributions for domestic help or home nursing services; and

- treatments that are not considered mainstream and not covered by third-party payers.

Although these costs are generally classified as 'non-medical', they are directly related to the underlying condition, they must be paid by patients and often constitute a substantial proportion of medical expenditures. What makes them 'non-medical' is that they are not costs incurred by the healthcare provider, and are somewhat difficult to measure. For example:

- A patient's inability to afford competent follow-up care at home may result in poor compliance with drug therapies and eventual treatment failure. This may lead to additional hospital stays or office visits, which affect the provider's bottom line.

Providers of healthcare need to be aware of the potential economics of modern biotech products

- High transportation costs may lead to missed appointments for necessary follow-up visits, which can result in deterioration of a patient's medical condition and increased treatment costs for the provider.

- Unpaid assistance by family members in providing home healthcare.

Even though these costs may not be directly incurred by the provider, they can be used in selling situations by making the provider aware of their potential economic impact. It may also be possible to use these costs to encourage payers (eg employers, insurance companies) to discuss the use of a more cost-effective test with the healthcare provider.

Several types of economic evaluations can be performed to demonstrate value for money

Indirect costs

One definition of indirect costs is the overall economic impact of illness on the patient's life. These include:

- loss of earnings due to temporary, partial or permanent disability; and

- loss of income to family members who forfeit paid employment in order to remain at home and care for the patient.

Like direct non-medical costs, indirect costs are real to the patient, often abstract to the provider – but may have an impact on the provider's direct medical costs. For example, patients who cannot earn income may not be able to pay their bills – including medical bills. Economic hardship may result in poor compliance with drug therapies as patients reduce doses or fail to refill prescriptions in order to save money. The medical provider may have to bear the additional costs of managing complications. Economic hardship may also result in missed follow-up appointments, leading to the same types of problems for providers as described previously with direct non-medical costs.

Types of formal economic evaluations

The most common methods employed by medical economists are classical research designs such as cost–benefit, cost-effectiveness and cost–utility analyses.

Cost–benefit analysis (CBA)

As applied to healthcare, CBA measures all costs and benefits of competing therapies in terms of monetary units. For individual therapies, net benefits can be calculated by simply subtracting the costs from the benefits. If net benefits are positive, the intervention is worth undertaking from the economic perspective. Differences in net benefits of competing therapies or programmes (eg intensive care unit versus new diagnostic equipment or preventive measures) can in theory be readily compared for an efficient allocation of resources. However, CBA requires assigning monetary values to life and to health improvements measured in a variety of dimensions including quality of life. This presents equal benefit issues as well as substantial measurement problems. For these reasons, CBAs have not been widely

used for evaluating drug therapies and the optimal allocation of resources.[12]

Cost-effectiveness analysis (CEA)

Cost-effectiveness analyses enable the comparison of products within the same indication

Cost-effectiveness studies measure changes in the cost of all relevant treatment alternatives. The differences in outcomes are measured in some natural units such as actual lives saved, years of lives saved, events prevented or children immunised. CEAs can also be applied equally to cases where the outcome is in terms of quality of life. CEA is useful in comparing different therapies that have the same outcome units, eg increase of life expectancy, but the treatments do not have the same effectiveness, ie one drug may lead to greater gains in life expectancy than another. The measure compared is the cost of therapy divided by the units of effectiveness and, hence, a lower number signifies a more cost-effective outcome.

This type of study has the advantage that it does not require the conversion of health outcomes to monetary units and thereby avoids equal benefit and other difficult issues of the valuation of benefits. It is therefore among the most frequently used tools to identify the most efficient strategy to reach a specific health target (production efficiency). It has the disadvantage of not permitting comparisons across programmes (see CBA). In other words, the cost-effectiveness of a drug that aims to reduce infant mortality cannot be compared with a drug designed to improve the functional status of senior citizens.[13] Rather, the value for money of an intervention is assessed by comparing the cost-effectiveness ratio with a threshold ratio, which corresponds to the decision maker's willingness to pay for health gain. Moreover, it cannot compare outcomes measured in clinical units with quality of life measures.

Cost–utility analysis (CUA)

Cost-utility, the gold standard valuation technique takes subjective health outcomes into consideration

CUA compares the added costs of therapy with the number of quality-adjusted life years (QALY) gained. The quality adjustment weight is a utility value which can be measured as part of clinical trials or independently. The advantage of CUA is that therapies that produce improvement in different or multiple health outcomes can be more readily compared. The QALY measure is calculated by multiplying the length of time in a specific health state by the perceived utility of that health status (on a scale from 0 to 1). Many analysts are more comfortable with QALYs as a measure of the consequence of medical care than with the monetary units.

CUA is an improvement over CEA because it can measure the effects of multiple outcomes (such as the impact of vaccines on both morbidity and mortality or the impact on both pain and physical functional status). Cost per QALY can be computed and compared across different treatment scenarios. This is especially useful when only a limited and fixed budget is available and allocation among competing programmes/therapies has to be optimised. A comprehensive overview of QALY estimates has been published by Tengs.[14]

Using pharmacoeconomics analyses for decision making by drug benefit plans

The use of economic evidence in decisions about medical technologies has become more widespread internationally. In countries such as Australia, the UK, Denmark, Finland, Norway, Portugal, Belgium, the Netherlands and some Canadian provinces, value for money is a consideration in purchasing and pricing decisions. Of these countries, Australia, Finland and Portugal have a national requirement for evidence on cost-effectiveness before reimbursement of prescription drugs or other health technologies.[15]

An extremely important aspect is the fact that the quality of pharmacoeconomic studies is increasingly being scrutinised by policy makers and institutions.[16] Since pharmacoeconomics is a fairly new field, many aspects are still unstructured

compared with the highly standardised guideline for good clinical practice (GCP) for the conduct of randomised controlled trials.

Checklists have been developed in order to facilitate the appraisal of the quality of economic analyses and assist in minimising possible bias.[17] These criteria are also being increasingly used in the peer review process by many biomedical journals and discussed accordingly.

Peer-reviewed, high quality biomedical journals are increasingly interested in economic evaluations

The right timing of economic studies during drug development and early marketing

Timing the start of pharmacoeconomic studies during the development and marketing phase of biotechnology products follows a critical pathway that is parallel to the clinical management pathway.[18] There are various opportunities to perform different types of pharmacoeconomic studies. Yet, while there is a wide range of tools available for pharmacoeconomic research, each study must be selected and adapted with careful consideration of its objectives.

Pharmaeconomic studies should start after Phase II of drug development

Assessing the economic burden of the target condition is of great value in Phase II of drug development to assess the potential market size of a candidate molecule and pricing ranges of competitor drugs. Generally, clinical trials at this stage are of very limited or no value for economic analyses because the number of patients included is too small and the inclusion criteria too narrow for meaningful conclusions. It is possible to undertake prospective pharmacoeconomic studies in Phase III trials as soon as the number of patients included is large enough. However, it is in the pre-marketing period, just after the drug application, that pharmacoeconomic study should be performed in order to support the reimbursement and price negotiation process.

Economic data should be collected during Phase III & IV trials

Phases IIIb and Phase IV are the best points to initiate full pharmacoeconomic studies, provided that they reflect routine clinical practice to some extent. Including economic parameters in a trial protocol forces one to consider the nature and constraints of such studies for early pharmacoeconomic assessments. Payers may additionally require budget impact analyses for their financial planning before agreeing to cover a new product.[19]

Collecting economics data alongside Phase III and IV clinical trials

As described above, it may be practical and cost-effective to gather certain data during a clinical trial, which is otherwise designed to measure the efficacy and adverse effects of a compound under study. However, generating economic data in Phase III is not without some controversy.

There are some researchers who point out that clinical trials measure efficacy – the performance of the drug in controlled circumstances. However, as the name cost-*effectiveness* suggests, such studies are aimed at determining the costs and benefits under routine clinical practice conditions. Although drug regulatory authorities such as the Food and Drug Administration and European Agency for the Evaluation of Medicinal Products require the use of placebos as comparators in approval trials, this rarely provides useful information for economic analyses, particularly for the measurement of costs.

At the time Phase III trials begin, a new compound may be compared against the existing 'gold standard'. However, by the time the new product gets to market, there may be other products that are more appropriate comparators but that were not on the market when the trials started. This situation is compounded by the economist's view that the comparator product should be the one that is most likely to be replaced in practice. Most drug benefit plans recognise this limitation and offer conditional reimbursement approval. The period of conditional approval should be used for updated pharmacoeconomic assessment.

The process of collecting costs during clinical trials merits special attention.

There are certain costs incurred on the patient's behalf as a result of procedures that would not normally accrue. These costs, called 'protocol-driven costs', must be isolated and not included in the analysis. This does not cause serious problems, however, because these same added costs are being incurred in both arms of the trial and hence would cancel each other out.

The true economics of a drug are apparent after market introduction

Post-marketing studies and pharmacoeconomics

A pharmacoeconomic evaluation has a different focus from the clinical trial in two respects. *First*, an economic evaluation is concerned more with extrapolating what happens in routine clinical care than what happens under controlled trial conditions. *Secondly*, an economic study attempts to measure different outcomes. While a clinical trial focuses on medical indicators, an economic study is designed to measure the effects on resource consumption, production and/or quality of life.

Randomised clinical trials address efficacy and not effectiveness

Therefore, the design aspects of a clinical trial may often introduce a bias in the measurement of the effect. The simple fact of randomising patients in two comparison groups invariably differentiates such studies from actual prescribing practice, where physicians try to prescribe the most appropriate drug to a patient conditional on the patient's history of disease and prognosis. Observational post-marketing pharmacoeconomic studies might be seen as a better alternative to randomised clinical trials.[20]

Effectiveness is a key parameter for payers and insurers

Through post-marketing pharmacoeconomic studies it is also possible to obtain a comparative evaluation of strategy that could not be compared in randomised clinical trials for ethical reasons. For example, an observation of patients with myocardial infarctions will necessarily include patients who are not treated with thrombolytic drugs because of their specific medical condition as well as patients treated with different types of thrombolytic drugs. Such a randomised clinical trial comparing a thrombolytic strategy versus a non-thrombolytic strategy would be declared unethical.

Data obtained from a physician's office computer are a very valuable tool in performing pharmacoeconomic studies because they provide the best representation of routine care. Generally, data are recorded almost in real time for each patient consulting for any disease condition and are generally collected for the physician's clinical use and thus less prone to biased reporting.

Pharmacoeconomic studies in the hospital sector

In Europe, the increasingly privatised hospital sector currently represents a market that is least restrained by governmental agencies and subject to the most competition compared with other sectors providing healthcare. With the increased use of modern biotechnology products in hospitals, it is advisable to conduct pharmacoeconomic studies for the hospital sector.

The economic perspective within hospitals might differ considerably from the perspective of a social security system or the societal perspective. Hospital decision makers are held accountable for maximising operational profits while providing optimal care and retaining referring physicians by optimally allocating internal resources. For example, a new biotechnology therapy may involve once-a-day dosing rather than continuous intravenous administration, thus freeing up nursing time to pursue other activities.[21]

Before performing such pharmacoeconomic studies, researchers must decide on the best effectiveness measure depending on the expected magnitude of treatment effects and its measurability. A pharmacoeconomic protocol designed to observe the reduction in the number of days spent in hospital would not be effective in

measuring the decrease in alternative drug consumption. On the other hand, a pharmacoeconomic study with the intended objective of measuring the reduced preparation time of an antibiotic would be completely meaningless if a medical practitioner knows that the side effects of the comparator drug are different in term of costs and consequences.

Expensive biotech products in the hospital sector need tailored approaches for pharmacoeconomic appraisals

These authors suggest that pharmacoeconomic studies should not be performed in the hospital sector without specific discussions of the study objective among a panel of hospital professionals, including cost and outcome measures as well as the decisions that will be based on its findings. It is also worth noting that practice patterns may vary widely from hospital to hospital, so that results from a single hospital may lack generalisability.

Randomised clinical trials versus observational studies

Decision-makers will increasingly look at data from observational studies

There is much criticism of randomised clinical trials, especially over the fact that randomised clinical trials do not represent routine care. This is not an important issue when studying the efficacy of a new product for the purpose of regulatory approval. However, pharmacoeconomic studies aim to assess the economic consequences of new technologies in general practice.

In pragmatic randomised trials, therefore, a new compound is not evaluated against a placebo or a reference drug (gold standard), but against any treatment used in real medical practice to treat the target condition (usual care). The evaluation is not made on the basis of one criterion – the efficacy – but on the basis of a whole set of items, as in routine care.

Observational studies reflect the performance of drugs under everyday conditions

Pharmacoeconomic researchers and health policy decision makers prefer pragmatic trials that focus on a drug's effectiveness over classical randomised placebo controlled trials with highly standardised protocols that focus on efficacy.

STRATEGIC OUTLOOK FOR PHARMACOECONOMICS IN THE BIOTECHNOLOGY INDUSTRY

Pharmacoeconomics will become one of the most significant strategic success factors for the biotechnology industry in an era of increasing cost containment efforts. The challenge will not only be to meet the requirements of governmental agencies and payers who are increasingly asking for economic assessments of commercial products, but also to address the value of medical economics to clinicians. It will become increasingly more necessary for clinicians to understand and apply economic analyses both in practice and in research.[22]

Instead of waiting for policy analysts, third-party payers or governmental agencies to hand down decisions about the services deemed worth their cost, physicians might also become practising clinical economists. Clinicians need to integrate economic thinking into their decision making if medical care is to be rational but not rationed.

Biotechnology and pharmaceutical companies can contribute significantly to this process by expanding economic research on their products, by providing training and know-how to medical professionals and by encouraging customers to acknowledge the validity of such research.

Since the biotechnology industry must convince payers that it is worth paying for their often more expensive products, solid pharmacoeconomic research will eventually be a necessary but not sufficient indicator for successful biotechnology companies, ranked second behind developing innovative products.

Potential financial impact of pharmacogenetics

Pharmacogenetics as a novel diagnostic tool has the potential to decrease cost for healthcare purchasers by improving effectiveness and drug safety.[23] Prescribers and pharmacists would

prescribe medications they know to be effective for an individual with a certain genotype. A perfect pharmacogenetic test would enable the selection of a drug that could provide significant cost savings, an increase in the effectiveness of the initially prescribed therapy, a reduced number of physician visits, eliminating the cost of prescribing ineffective pharmaceutical products and eliminating avoidable toxicity. Healthcare payers may also impose specific requirements for drug product payment requiring diagnostic tests as a form of 'prior authorisation' to payment. Identification of a patient with a genotype that reduces the success of preferred therapy could place the patient at risk for denial of future coverage – an expansion of the challenges of 'pre-existing conditions' to include the likelihood of drug effectiveness.[24]

Clarifying the economic[25] and ethical issues[23] of pharmacogenetic screening is critically important for future growth.

CONCLUSION

Only those companies which manage reimbursement issues successfully will survive the era of increasing healthcare cost containment.

References

1. Harris, A., Buxton, M., O'Brien, B., Rutten, F. and Drummond, M. (2001), 'Using economic evidence in reimbursement decisions for health technologies: Experience of 4 countries', *Expert Rev. Pharmacoeconomics Outcomes Res.*, Vol. 1, pp. 7–12.
2. Birkett, D. J., Mitchell, A. S. and McManus, P. (2001), 'A cost-effectiveness approach to drug subsidy and pricing in Australia', *Health Affairs*, Vol. 20, pp. 104–114.
3. Rice, T. (1998), 'The Economics of Health Reconsidered', Health Administration Press, Chicago, IL.
4. PausJenssen, A. M., Singer, P. A. and Detsky, A. S. (2003), 'Ontario's formulary committee. How recommendations are made', *PharmacoEconomics*, Vol. 21, pp. 285–294.
5. Ess, S., Schneeweiss, S. and Szucs, T. (2003), 'European healthcare policies for controlling drug expenditure', *PharmacoEconomics*, Vol. 21, pp. 89–103.
6. Institute of Medicine (1997), 'Managing Managed Care: Quality Improvement in Behavioral Health', National Academy Press, Washington, DC.
7. Navarro, R. P. (1998), 'Exporting managed care: Importing quality lessons', *Manag. Care Interface*, Vol. 11, pp. 61–62.
8. Feachem, R. G., Sekhri, N. K. and White, K. L. (2002), 'Getting more for their dollar: A comparison of the NHS with California's Kaiser Permanente', *BMJ*, Vol. 324, pp. 135–141.
9. Shortell, S. M. and Kaluzny, A.D. (1997), 'Essentials of Health Care Management', Delmar, Albany, NY.
10. OECD Health Data 2002, Credes, Paris.
11. Bleecker, G. C. (1993), 'Reimbursement and pharmacoeconomic perspectives in biotechnology', *Am. J. Hosp. Pharm.*, Vol. 50, pp. S27–S30.
12. Weatherly, H., Drummond, M. and Smith, D. (2002), 'Using evidence in the development of local health policies. Some evidence from the United Kingdom', *Int. J. Tech. Assess. Health Care*, Vol. 18, pp. 771–781.
13. Drummond, M. F., O'Brien, B., Stoddart, G. L. and Torrance, G. W. (1997). 'Methods for the Evaluation of Health Care Programs', 2nd edn, Oxford Medical Publications, Oxford.
14. Weinstein, M. C. (1996), 'From cost-effectiveness ratios to resource allocation: Where to draw the line?', in Sloan, F. A., (Ed), 'Valuing Health Care', Cambridge University Press, Cambridge.
15. Tengs, T. (2000), 'One thousand quality-of life estimates', *Med. Care*, Vol. 38, pp. 592–637.
16. Harris, A., Buxton, M., O'Brien, B., Rutten, F. and Drummond, M. (2003), 'Using economic evidence in reimbursement decisions for health technologies: Experience of 4 countries' (URL: http://www.future-drugs.com; accessed 1st April, 2003).
17. Hill, S. R., Mitchell, A. S. and Henry, D. A. (2000), 'Problems with the interpretation of pharmacoeconomic analyses: A review of submissions to the Australian Pharmaceutical Benefits Scheme', *J. Am. Med. Assoc.*, Vol. 283, pp. 2116–2121.
18. Gold, M. R., Siegel, J. E., Russell, L. B. and Weinstein, M.C. (1996), 'Cost-Effectiveness in Health and Medicine', Oxford University Press, New York.
19. Cookson, R. and Hutton, J. (2003), 'Regulating the economic evaluation of pharmaceuticals and medical devices: A European perspective', *Health Policy*, Vol. 63, pp. 167–178.
20. Nuijten, M. J. C. and Rutten, F. (2002),

'Combining a budgetary-impact analysis and a cost-effectiveness analysis using decision-analytic modeling techniques', *PharmacoEconomics*, Vol. 20, pp. 855–867.

21. Buxton, M. J., Drummond, M. F., van Hout, B. A. *et al.* (1997), 'Modelling in economic evaluation. An unavoidable fact of life', *Health Economics*, Vol. 6, pp. 217–227.

22. Lee, R. H. (2000), 'Economics for Healthcare Managers', Health Administration Press, Washington, DC.

23. van Rijkom, J., Leufkens, H., Crommelin, D., Rutten, F. and Broekmans, A. (1999), 'Assessment of biotechnology drugs: What are the issues?', *Health Policy*, Vol. 47, pp. 255–274).

24. Robertson, J. A., Brody, B., Buchanan, A., Kahn, J. and McPerson, E. (2002), 'Pharmacogenetic challenges for the health care system', *Health Affairs*, Vol. 21, pp. 155–167.

25. Foot, E., Bieber, F., Kroll, W. *et al.* (2001), 'Impact of pharmacogenetics on health care and health economics', *Int. J. Pharm. Med.*, Vol. 15, pp. 95–100.

26. Morgan, S., Hurley, J., Miller, F. and Giacomini, M. (2003), 'Predictive genetic tests and health system costs', *Can. Med. Assoc. J.*, Vol. 168, pp. 989–991.