**Lecture 1 Dr. Haider Raheem**

**Basic Principles of Pharmacoeconomics**

**Pharmacoeconomics – What is it?**

In the case of pharmaceutical interventions, pharmacoeconomics attempts to find whether the added benefit of one intervention is worth the added cost of that intervention. Pharmacoeconomics has been defined as the description and analysis of the costs of drug therapy to health care systems and society. It identifies, measures, and compares the costs and consequences of pharmaceutical products and services.

**Why is pharmacoeconomics important?**

The United States spent about $2.7 trillion on health care in 2010, for an average of about $8,000 per person, or about 17% of the gross domestic product (GDP). About 12% (over $900 per person) of health care expenditures were for medications. Two medications that were approved by the U.S. FDA in 2012 (Kalydeco® for cystic fibrosis and Gattex® for short bowel syndrome) are planned to be priced at about $300,000 per year. It has been argued that these medications save enough—by decreasing the number of hospital admissions or the need for parental nutrition—to offset their high cost. Clinicians want their patients to receive the best care and outcomes available, and payers want to manage rising costs.

**Some basics**

Those who plan, provide, receive, or pay for health services face an incessant barrage of questions such as the following.

 ◆ Should clinicians check the blood pressure of each adult who walks into their offices?

 ◆ Should planners launch a scoliosis screening programme in secondary schools?

 ◆ Should individuals be encouraged to request annual check-ups?

 ◆ Should local health departments free scarce nursing personnel from well-baby clinics so that they can carry out home visits on lapsed hypertensives?

 ◆ Should hospital administrators purchase each and every piece of new diagnostic equipment?

 ◆ Should a new, expensive drug be listed on the formulary?

These are examples of general, recurring questions about who should do what to whom, with what health care resources, and with what relation to other health services.

 Since the effects of choosing one course of action over another will not only have effects on health, but also on health care resources as well as other effects outside health care, informing health care decisions requires consideration of costs and benefits. For this reason, this type of evaluation is most commonly referred to as *economic* *evaluation*.

**The features of economic evaluation**

Economic evaluation, regardless of the activities (including health services) to which it is applied, has two features. First, it deals with both the inputs and outputs, which can be described as the *costs* and *consequences*, of alternative courses of action. Few of us would be prepared to pay a specific price for a package whose contents were unknown. Conversely, few of us would accept a package, even if its contents were known and desired, until we knew the specific price being asked. In both cases, it is the linkage of costs (what must be given up) and consequences (the overall benefits expected to be received) that allows us to reach our decision.

 Second, economic evaluation concerns itself with choices. Resources are limited, and our consequent inability to produce all desired outputs (including efficacious therapies), necessitates that choices must, and will, be made in all areas of human activity.

 These two characteristics of economic evaluation lead us to define economic evaluation as *the comparative analysis of alternative courses of action in terms of both their* *costs and consequences*. Therefore, the basic tasks of any economic evaluation are to identify, measure, value, and compare the costs and consequences of the alternatives being considered.



**Fig. 1.1 Economic evaluation always involves a comparative analysis of alternative courses of action.**

 Figure 1.1 illustrates that an economic evaluation is usually formulated in terms of a choice between competing alternatives. Here we consider a choice between two alternatives, A and B. The comparator to Programme A, the programme of interest, does not have to be an active treatment. It could be doing nothing. Even when two active treatments are being compared, it may still be important to consider the baseline of doing nothing, or a low-cost option. This is because the comparator (Programme B) may itself be inefficient. (It is important that the evaluation considers all relevant alternatives).

 However, the general rule when assessing programmes A and B is that the *difference* in costs is compared with the *difference* in consequences, in an incremental analysis.

 However, not all of the studies measuring costs constitute economic evaluations. The large literature on *cost of illness*, or *burden of illness*, falls into this category. These studies describe the cost of disease to society but are not full economic evaluations because alternatives are not compared.

 Some studies do compare alternatives but just consider costs. An example of such a study is that by Lowson *et al*. (1981) on the comparative costs of three methods of providing long-term oxygen therapy in the home: oxygen cylinders, liquid oxygen, and the oxygen concentrator (a machine that extracts oxygen from air). Such studies are called *cost analyses*. The authors argued that a cost analysis was sufficient as the relative effectiveness of the three methods was not a contentious issue. However, a full economic evaluation would explicitly consider the relative consequences of the alternatives and compare them with the relative costs.

**Do all economic evaluations use the same techniques?**

The identification of various types of costs and their subsequent measurement in monetary units is similar across most economic evaluations; however, the nature of the consequences stemming from the alternatives being examined may differ considerably.

**1: cost-effectiveness analysis**

Suppose that our interest is the prolongation of life after renal failure and that we are comparing the costs and consequences of hospital dialysis with kidney transplantation. In this case the outcome of interest—life-years gained—is common to both programmes; however, the programmes may have differential success in achieving this outcome, as well as differential costs. Consequently, we would not automatically lean towards the least-cost programme unless, of course, it also resulted in a greater prolongation of life. In comparing these alternatives, we would normally calculate this prolongation and estimate incremental cost per unit of effect (that is, the extra cost per life-year gained of the more effective and more costly option). Such analyses, in which costs are related to a single, common effect that may differ in magnitude between the alternative programmes, are usually referred to as *cost-effectiveness analyses (CEAs)*. Note that the results of such comparisons may be stated either in terms of incremental cost per unit of effect, as in this example, or in terms of effects per unit of cost (life-years gained per dollar spent).

 It is sometimes argued that if the two or more alternatives under consideration achieve the given outcome to the same extent, a *cost-minimization analysis* (CMA) can be performed. However, it is not appropriate to view CMA as a form of full economic evaluation.

**The death of cost-minimization analysis?**

Economic evaluations are sometimes referred to in the literature as *cost-minimization analyses (CMAs)*. Typically this is used to describe the situation where the consequencesof two or more treatments or programmes are broadly equivalent, so thedifference between them reduces to a comparison of costs.



**Fig. 1.2 The death of cost-minimization analysis?**

 It can be seen from Figure 1.2 that there are nine possible outcomes when one therapy is being compared with another. In two of the cases (boxes 4 and 6) it might be argued that the choice between the treatment and control depends on cost because the effectiveness of the two therapies is the same.

 However, Briggs and O’Brien (2001) point out that, because of the uncertainty around the estimates of costs and effects, the results of a given study rarely fit neatly into one of the nine squares shown in the diagram. Also, because of this uncertainty, CMA is not a unique study design that can be determined in advance.

 The only possible application of CMA is in situations where a prior view has been taken, based on previous research or professional opinion, that the two options are equivalent in terms of effectiveness. It is likely only to be justifiable in situations where the two therapies embody a near-identical technology (e.g. drugs of the same pharmacological class).

**2: cost–utility analysis**

Another term you might encounter in the economic evaluation literature is *cost–utility analysi*s *(CUA)*. These studies are essentially a variant of cost-effectiveness and are often referred to as such. The only difference is that they use, for the consequences, a generic measure of health gain. As we will argue later, this offers the potential to compare programmes in different areas of health care, such as treatments for heart disease and cancer, and to assess the opportunity cost (on the budget) of adopting programmes.

 The estimation of preferences for health states is viewed as a particularly useful technique because it allows for health-related *quality-of-life* adjustments to a given set of treatment outcomes, while simultaneously providing a generic outcome measure for comparison of costs and outcomes in different programmes. The generic outcome, usually expressed as quality adjusted life-years (QALYs), is arrived at in each case by adjusting the length of time affected through the health outcome by the preference weight (on a scale of 0 to 1) of the resulting level of health status.

**QALYs gained from an intervention**

In the conventional approach to QALYs the quality-adjustment weight for each health state is multiplied by the time in the state and then summed to calculate the number of QALYs. The advantage of the QALY as a measure of health output is that it can simultaneously capture gains from reduced morbidity (quality gains) and reduced mortality (quantity gains) and integrate these into a single measure.



**Fig. 1.3 QALYs gained from an intervention.**

 A simple example is displayed in Figure 1.3, in which outcomes are assumed to occur with certainty. Without the health intervention an individual’s health-related quality of life would deteriorate according to the lower curve and the individual would die at time Death 1. With the health intervention the individual would deteriorate more slowly, live longer, and die at time Death 2. The area between the two curves is the number of QALYs gained by the intervention. For instruction purposes the area can be divided into two parts, A and B, as shown. Then part A is the amount of QALY gained due to quality improvements (i.e. the quality gain during time that the person would have otherwise been alive anyhow), and part B is the amount of QALY gained due to quantity improvements (i.e. the amount of life extension, but adjusted by the quality of that life extension).

**3: cost–benefit analysis**

Is there a form of economic evaluation that can address whether it is worthwhile expanding the budget?

 One approach would be to broaden the concept of value and to express the consequences of an intervention in monetary terms in order to facilitate comparison to programme costs. This, of course, requires us to translate effects such as disability days avoided, life-years gained, medical complications avoided, or QALYs gained, into a monetary value that can be interpreted alongside costs. This type of analysis is called *cost–benefit analysis* (CBA) and has a long track record in areas of economic analysis outside health such as transport and environment. The results of such analyses might be stated either in the form of a ratio of costs to benefits, or as a simple sum (possibly negative) representing the net benefit (loss) of one programme over another.

Table 1.1 Measurement of costs and consequences in economic evaluation.





**Fig. 1.4 Four methods of analysis**



**Fig. 1.5 Types of economic evaluation**

**Use of economic evaluation in health care decision-making**

Over the past 20 years, two factors have led to an increased prominence of economic evaluation within health care decision-making. First, increasing pressures on health care budgets have led to a shift in focus from merely assessing clinical effectiveness, to one on assessing both clinical effectiveness *and* cost-effectiveness. Secondly, decision-making processes have emerged in several jurisdictions that enable the results of economic evaluations to be used as an integral part of funding, reimbursement, or coverage decisions.

 In 1991 the Commonwealth of Australia announced that, from January 1993, economic analyses would be required in submissions to the Pharmaceutical Benefits Advisory Committee, the body that advises the minister on the listing of drugs on the national formulary of publicly subsidized drugs, the Pharmaceutical Benefits Schedule (PBS).

 Since that time, this policy has become fairly widespread, with approximately half the countries in the European Union, plus Canada and New Zealand, requesting economic analyses of pharmaceuticals, and sometimes other health technologies, to varying degrees. In the last years several payers in the United States and countries in Latin America and Asia have also expressed an interest in receiving economic data.

**Costing terms**

According to economic theory, the “true” cost of a resource is its **opportunity cost**—the value of the best-forgone option or the “next best option”—not necessarily the amount of money that changes hands. Resources committed to one product or service cannot be used for other products or services (opportunities). For example, if volunteers are used to help staff a new clinic, even though no money changes hands (i.e., volunteers are not paid), there is an opportunity cost associated with their help because they could be providing other services if they were not helping at the new clinic. Another example is if the new clinic required a part-time pharmacist and a currently employed pharmacist was asked to fill in at the clinic as part of his or her duties (instead of hiring a new part-time pharmacist for the clinic).

 The “price” or the amount that is charged to a payer is not necessarily synonymous with the **cost** of the product or service. For example, if a hospital system wanted to calculate how much it cost to treat a patient with a specific diagnosis, there may be a substantial difference in what the total cost is to the hospital when compared with the amount the hospital charges the payer and what is actually collected from the payer after allowable amounts are factored in. Think of these differences as similar to the new car market. There is a cost to the car manufacturer to produce a car, a “sticker price,” which is the suggested price of the car (higher than the cost to produce the car), and the amount paid by the average car buyer (usually lower than the sticker price, which is good news for the buyer, but is hopefully higher than the cost to produce the car, which is good news for the manufacturer). These, in turn, are similar to the actual cost of a hospital to provide a service, the charge billed to the payer (third-party insurance payer, patient payer, or a combination), and the **allowable charge** or **reimbursed** amount paid by the payer(s).

**Cost categorization**

In the 1980s and 1990s, most textbooks categorized pharmacoeconomic (PE)-related costs into four types: **direct medical costs**, **direct nonmedical costs**, **indirect costs**, and **intangible costs** (Table 1.2). These terms are not used consistently in the literature, and it has been noted that the economic term indirect costs, which refers to a loss of productivity, might be confused with the accounting definition of indirect costs, which is used to assign overhead. An alternative method of categorization has been recently proposed by Drummond *et al*. that includes the following four categories: **health care sector costs**, **costs to other sectors**, **patient and family costs**, and **productivity costs**.

Table 1.2 Examples of types of costs



**Direct medical costs**

Direct medical costs are the most obvious costs to measure. These are the medically related inputs used directly to provide the treatment. Examples of direct medical costs include the costs associated with the pharmaceuticals, diagnostic tests, physician visits, pharmacist visits, emergency department visits, and hospitalizations.

 For chemotherapy treatment, for example, direct medical costs may include the chemotherapy products themselves, other medications given to reduce side effects of the chemotherapy, intravenous supplies, laboratory tests, clinic costs, and physician visits.

**Direct nonmedical costs**

Direct nonmedical costs are costs to patients and their families that are directly associated with treatment but are not medical in nature. Examples of direct nonmedical costs include the cost of traveling to and from the physician’s office, clinic, or the hospital; child care services for the children of a patient; and food and lodging required for the patients and their families during out-of-town treatment.

 For the chemotherapy treatment, patients may have increased travel costs related to traveling to the clinic or hospital. They may also have to hire a babysitter for the time they are undergoing treatment.

**Indirect costs**

Indirect costs involve the costs that result from the loss of productivity because of illness or death. **Indirect benefits**, which are savings from avoiding indirect costs, are the increased earnings or productivity gains that occur because of the medical product or intervention.

 In the chemotherapy example, some indirect costs result from time the patient takes off from work to receive treatment or reduced productivity because of the effects of the disease or its treatment.

**Intangible costs**

Intangible costs include the costs of pain, suffering, anxiety, or fatigue that occur because of an illness or the treatment of an illness. Intangible benefits, which are avoidance or alleviation of intangible costs, are benefits that result from a reduction in pain and suffering related to a product or intervention. It is difficult to measure or place a monetary value on these types of costs.

 In the example of chemotherapy, nausea and fatigue are common intangible costs of treatment.

**Alternative method of categorization**

As mentioned, an alternative method of categorizing costs has recently been proposed by Drummond *et al*. The first category is **health care sector costs**, which include medical resources consumed by health care entities. These types of costs are similar to the definition of direct medical costs but do not include direct medical costs paid for by the patient (e.g., deductibles, co-payments) or other non–health care entities.

 The second category is **other sector costs**. Some diseases and their treatment impact other non–health care sectors, such as housing, homemaker services, and educational services. One example often noted is that when measuring resources used and savings incurred by the treatment of patients with schizophrenia, researchers should consider the impact on other sectors, including public assistance and the prison system.

 The third category is **patient and family costs**. This categorization includes costs to the patient and his or her family without regard to whether the costs are medical or nonmedical in nature.

 The fourth category is termed **productivity costs** and is analogous to the economic term indirect costs but has the advantage of not being confused with the accounting term with the same name. Drummond *et al*. advise against using the term intangible costs because they are “not costs (i.e., resources denied other uses)” and they are “not strictly intangible as they are often measured and valued, through the utility or willingness-to-pay approach.”



**Conclusions:**Across Europe there was a significant reduction in the cost of maintaining patients at their appropriate LDL-C levels with simvastatin versus atorvastatin. The results of this analysis, along with the proven clinical benefits of simvastatin, support the use of this drug as the treatment of choice in the secondary prevention of CHD.