

1. Introduction to health care evaluation

1.1 INTRODUCTION

The aim of this book is to explain how the theory and practice of cost–benefit analysis apply in the context of making health care expenditure decisions. We start by explaining why evaluation is necessary, defining an evaluation and identifying the main ingredients. Then we show how the ingredients are put together to form four alternative types of economic evaluation. Cost–benefit analysis will be demonstrated to be the primary evaluation technique, so the basic concepts behind this approach will be outlined. We proceed to supply applications (case studies) which illustrate some of the main evaluation principles and provide an overview of the health evaluation field. We close with sections that include problems, a summary, and a look forward that provides a guide to the book.

1.1.1 Why One Needs to Evaluate Programs

To many non-economists working in the health care field, the idea of taking the trouble formally to evaluate treatment programs seems a total waste of time and effort. Surely, they would ask, health care is absolutely necessary, so we know in advance that one must spend on what is necessary?

However, an economist would counter that it is doubtful that every item of health care expenditure was really indispensable. Moreover, even if it were true that every health expenditure were necessary, it is a fact of life that there are not enough resources to meet every health care demand. It is probable that, in the present state of knowledge, all the world's resources would not eliminate cancer. Even if this cancer goal were feasible, what about resources for other deadly diseases, such as AIDS? Also, what about resources for non-health necessities, such as food? Very soon one reaches the conclusion that some necessities are more necessary than others and so we must choose amongst the necessary items to decide which ones to finance from our limited resources.

Economic evaluation as a subject has been developed to provide a framework for helping to make the choices with which we are faced in the health care field. Only by making an economic evaluation can one be sure that all the other ways of making people better off have been considered and resources allocated to the areas that give the highest satisfaction.

If anyone needs to be convinced that one ever needs to carry out an economic evaluation in the health care field, consider this case. The American Cancer Society endorsed the protocol of having six sequential stool tests for detecting cancer of the bowel. Five sequential tests were previously the standard practice. 'Hey', you can imagine doctors saying, 'one can never be too careful when it comes to matters of health'. However, it was found that for every extra case detected by the sixth test, the cost was \$47 million! One may not know exactly what is the value of detecting the one case of colon cancer. But one can suspect that it is not as high as \$47 million, given that for the same amount society can instead feed over 12 000 people for a year (at \$10 a day). Only by subjecting health care expenditures to an economic evaluation can we uncover the basis for making worthwhile decisions.

1.1.2 Definition of an Economic Evaluation

An economic evaluation tries to assess the social desirability of a program relative to some other alternative. If no other alternative is being considered, then the program is being described, but not evaluated. A good example of an analysis in health care that does not include alternatives explicitly is that contained in estimating the 'cost of a disease'. Consider the \$65 billion estimate of the cost of schizophrenia in the US in 1991 by Wyatt et al. (1995). This estimate seems to be implying that, if schizophrenia were eliminated, then \$65 billion would be saved. But, although such a figure is interesting in an abstract sense, involved with making a 'thought experiment' whereby one would like to know what would happen if the world were different than it actually was, the figure has little relevance for public policy purposes. There is no set of programs that exist today that can actually eradicate completely this mental illness. So no current choices are clarified by knowing the total cost of a disease.

The existence of alternatives is at the heart of an economic evaluation because making choices is central to economics. In fact, economics can be called the 'science of choice'. When there are no alternatives to consider, there is no need to make a choice, and there is no need to make an evaluation. It is important to understand from the outset the need to make choices, as much confusion over the nature of economic evaluations can then be avoided.

In the first place, it explains why economists carry out evaluations. Economists try to value a life in monetary terms not because they want to 'play God', but because one needs to choose how much of the world's resources should be devoted to saving lives. To claim that a life is infinitely valuable is not helpful (no matter how true it is in a spiritual sense). Devoting all the world's resources to save one life does not leave any for the rest of the 6 billion on the planet who would also desire to survive. The existence of finite resources forces us to make choices and undertake evaluations based on finite valuations.

Secondly, the need to make choices explains why an approach to evaluation can be adopted as 'best' even though one may have major reservations with the approach. Some approach must be adopted or else choices cannot be made. A flawed approach may be better as a guide to choice than one that is incomplete because difficult measurement issues have been avoided. Refusing to make difficult estimation decisions does not make the problem of having to make difficult choices disappear.

Prior to an evaluation, one must always check the effectiveness of the programs. That is, one has to establish whether a treatment does actually have an effect on the complaint. As Drummond et al. (1987) point out, 'There is no point in carrying out an ineffective program efficiently'. Nonetheless, having a controlled clinical trial, where one tries to control for all major influences (such as age, sex and severity of illness) when comparing the effectiveness of alternative treatments, may not be a good basis for collecting data for economic evaluations. There are very few health care interventions that work identically for all individuals. Recognizing individual differences is a very important part of conducting an economic evaluation because individual preferences greatly determine outcomes. For example, a medication that is more effective than another may not be better if people choose not to take it (because they do not like the side-effects).

1.1.3 Components of an Economic Evaluation

Health care programs take inputs (labor, capital, etc.) and transform them into outputs. In order to aggregate the inputs, one usually values the labor and capital using market prices to produce a measure of all the resources taken up in the health care intervention. This aggregate input measure is called 'costs' and is in monetary units. The outputs of the evaluation can come in different forms and these are the consequences of the intervention. The most obvious output to consider is what the health care industry immediately works with, such as a diagnostic test outcome or an operation successfully completed. These outputs are called 'effects' and expressed in natural units (such as a percentage detection or completion ratio). A

broader measure of effects relies on 'utilities' (i.e., estimates of the satisfaction of the effects) and the output unit is called a 'quality adjusted life year' (the satisfaction of the time that a person has left to live). Lastly, the output can be expressed in the same monetary units as the costs, in which case the consequences are now called 'benefits'.

In the health care field (see Drummond et al. (1987)) the costs and benefits are disaggregated into three categories: direct, indirect and intangible. 'Direct' means directly related to the health care industry (the doctors, the hospitals and the patients). So physician and nursing expenses, and any hospital cost savings, are called direct costs and direct benefits respectively. 'Indirect' refers to inputs and outputs that pass outside the health care industry. The main measure of these indirect effects is via earnings forgone or enhanced due to treatment, as the earnings reflect the value of production lost to, or gained by, the rest of society. 'Intangible' refers to the pain and suffering that are caused or alleviated by a health care intervention.

Corresponding to the costs and consequences just identified, there are four types of economic evaluation that incorporate some or all of the components. All four evaluation types make use of costs. The type that only uses costs is called a cost minimization study. The other three differ according to what kind of consequence they incorporate along with the costs. A cost-effectiveness analysis uses the effects, a cost-utility analysis uses the utilities, and a cost-benefit analysis uses the benefits. This book is devoted to explaining, analyzing and developing these four types of evaluation, a process that we begin in the next section.

1.2 TYPES OF ECONOMIC EVALUATION

As we have just seen, there are four main types of economic evaluation that exist in the health care literature as recognized and understood by economists. The four methods are: cost-benefit analysis (CBA), cost-effectiveness analysis (CEA), cost-utility analysis (CEA) and cost minimization (CM). However, most of those who carry out the health care evaluations are non-economists. They actually do use one of the four types of evaluation, but they label their work differently. We need to be aware that many studies are called CBAs when in fact they correspond to a different evaluation category.

The distinguishing characteristic of a CBA is that it places a monetary value on the consequences. Forming 'benefits' means that the consequences are in the same units as 'costs'. One can tell whether the benefits are greater than the costs and thus know whether the expenditure is worthwhile. The

main organization principle of this book is that the three other types of economic evaluation can be best understood as special cases of CBA. We are now going to give a brief summary of the four evaluation types using this principle. We start with an outline of CBA and then introduce the other three methods in terms that make their relationship to CBA clear from the outset.

1.2.1 Cost–Benefit Analysis

Consider the simplest type of health care intervention (or treatment), that is, taking an aspirin, which we designate by the subscript 1. This medication leads to advantages and disadvantages. When the advantages and disadvantages are measured in monetary terms, we will call them benefits B_1 and costs C_1 . The aspirin would be worth buying (make a person better off) if the amount of the benefits exceeded that of the costs:

$$B_1 > C_1 \quad (1.1)$$

Equation (1.1) presents the basic cost–benefit criterion. It is this relation that determines whether a health care expenditure should be approved or not.

The CBA approach can be thought of as dealing with the final result of a health care intervention (consumer or patient satisfaction). In the process of arriving at the end result, there is an intermediate stage, which involves transforming the treatment from an input into an output that can be represented as E_1 . Here E is called the effect of the intervention. In the aspirin example the effect might be pain (headache) relief. Benefit estimation can then be thought to have occurred in two steps: first there was an effect of an intervention, and then a monetary value was assigned to it. Let the second step be interpreted to be ‘pricing’ the effect and denoted by P_1 . The two steps combine to construct the benefit measure in the form of a product of the effect times the price, that is: $B_1 \equiv P_1 \cdot E_1$. In which case, equation (1.1) can be rewritten as:

$$P_1 \cdot E_1 > C_1 \quad (1.2)$$

This criterion can be expressed in an equivalent way by dividing both sides of equation (1.2) by C_1 . We then obtain the requirement that the benefit–cost ratio must exceed unity:

$$\frac{P_1 \cdot E_1}{C_1} > 1 \quad (1.3)$$

The CBA criterion has an alternative formulation when there is a financial budget constraint, which limits how much costs can be expended. The logic is that if there is a budget constraint, then using funds for one purpose precludes their use for another. Let the alternative health care intervention, which could be something unrelated to providing headache relief, such as a diagnostic test for cancer, involve benefits B_2 (equal to $P_2 \cdot E_2$) and costs C_2 . Then it is not sufficient that the benefit–cost ratio for intervention 1 exceeds unity; it must also exceed the benefit–cost ratio of the alternative intervention:

$$\frac{P_1 \cdot E_1}{C_1} > \frac{P_2 \cdot E_2}{C_2} \quad (1.4)$$

Criterion (1.4) ensures that if one spends on intervention 1, then one receives more benefit per dollar spent on costs than with the alternative use of the funds.

1.2.2 Cost-Effectiveness Analysis

In the health care evaluation field there has been a general unease with the step in CBA which entails the pricing of the effects, that is, with setting P_1 and P_2 . The most popular approach is CEA, which tries to continue without the prices and work on the consequences side only with effects E_1 and E_2 . In the classical version of CEA, there is envisaged to be a budget constraint, which means that treatments cannot be considered in isolation. However, treatment effects must be the same kind across alternatives. For example, one can compare either different ways of providing headache relief, or different ways of diagnosing cancer, but one cannot consider both effects at the same time. This means that the only difference between E_1 and E_2 is that E_1 (the effect coming from intervention 1) is at a different level of the same effect as E_2 (the effect coming from intervention 2). The aim now is to choose the intervention that supplies a unit of effect at lowest cost. Under a CEA, treatment 1 would be more cost-effective than treatment 2 if:

$$\frac{C_1}{E_1} < \frac{C_2}{E_2} \quad (1.5)$$

Rather than requiring the lowest cost for a given effect, one can instead try to achieve the most effect per dollar of cost. By inverting equation (1.5), we can see that the CEA is equivalent to requiring that:

$$\frac{E_1}{C_1} > \frac{E_2}{C_2} \quad (1.6)$$

Now compare equation (1.6) with (1.4). The only difference involves the inclusion of prices in the CBA criterion. Thus, if the prices of the effects are considered the same, which is valid in a CEA since it is a common effect that one is comparing with the two treatments, we can set $P_1 = P_2 = P$ in equation (1.4). Dividing both sides of this equation by P , we obtain the CEA criterion (1.6).

Clearly, in principle, CEA can be regarded as a special case of a CBA. The requirements, however, are very stringent. The effect must be *exactly* the same for the treatments being compared. This means that not only must there be a single effect that is common to the treatments; the quality of the effect also must be identical across treatments in order for the value, or price, of the effect to be the same.

1.2.3 Cost–Utility Analysis

Note that, in a CEA, the only difference between E_1 and E_2 is that the quantity of the effect is different in the two treatments. It is not the effect itself that is different. If we want to compare entirely different effects (as with headache pain relief and the precision of a diagnostic test) and we do not want to use prices explicitly, then one needs to have a process that enables all effects to be converted to a common unit.

In a CUA, the common unit is a quality adjusted life year (a QALY). The idea is that any health care intervention either enables one to live longer (that is, have more life years) or to live healthier (that is, have a better-quality life). Thus, the aspirin by relieving pain adds to the quality of life, and the more accurate diagnostic test would (if it leads to preventative action that reduces the chances of dying) add to the quantity of life. The essence of a QALY then is entailed in finding out how much quantity of life someone is willing to give up in order to live a higher quality of life (as is the case when deciding whether to have life-threatening surgery that would remove an obstacle to living normally).

With the QALY as the common effect, the evaluation exercise returns to the CEA framework. A CUA is therefore the special case of a CEA where the effect E is measured by a QALY, and the following criterion is used to replace equation (1.6):

$$\frac{QALY_1}{C_1} > \frac{QALY_2}{C_2} \quad (1.7)$$

Since a CEA is a special case of a CBA, and a CUA is a special kind of CEA, it means that a CUA is a restricted CBA, where the restrictions are that to result in (1.7) from equation (1.4) we have $E = QALY$ for each

treatment, in addition to $P_1 = P_2 = P$ (where P now relates to the price of a QALY).

Just as with a CEA, a CUA differs from a CBA in practice, not in principle. A CBA relies on the fact that individuals are used to purchasing goods on a market at a price. Individuals are familiar with the process of trading off valuations in terms of how much money they are willing to give up to receive more of a good. On the other hand, individuals are not used to buying a QALY and are therefore unfamiliar with the process of trying to obtain a QALY at lowest cost. Deriving meaningful estimates of QALYs is therefore at the heart of the CUA evaluation exercise.

1.2.4 Cost Minimization

In a CM, consequences play no part in the evaluation. The ‘trick’ therefore is to make disappear both parts of the benefit term, P and E . This does *not* mean setting $P.E=0$, for then criterion (1.4) would be totally undefined. Rather it means that ‘somehow’ $P.E=1$. With this specification of benefits for all treatments, equation (1.4) becomes:

$$\frac{1}{C_1} > \frac{1}{C_2} \quad (1.8)$$

Equation (1.8) is equivalent to requiring:

$$C_1 < C_2 \quad (1.9)$$

There is no unique way to satisfy the condition $P.E=1$. For example, one could assume $P=1/E$ (though I know of no one who actually does employ this assumption). What would be logical is that one treat a CM as a special case of a CEA. The restriction then would be that all effects are the same, $E_1 = E_2 = E$, and that the common effect would be standardized as a single unit, i.e., $E=1$. This restriction, together with the assumption of an equal valuation per unit of effect ($P_1 = P_2 = P$), would be sufficient to reduce equation (1.4) to (1.8) and ensure that a CM is also a special case of a CBA.

If it is difficult in practice to justify the requirements of a CEA, it is going to be even more difficult to justify a CM. The quantity of an effect must be exactly the same for all treatments; but also the quality of an effect must be the same. Unless consequences are identical across treatments, a CM would not constitute a valid evaluation of treatments.

1.3 THE BASICS OF COST–BENEFIT ANALYSIS

Since CBA is the primary evaluation method, that the other types of evaluation only approximate, it is necessary to outline some of the fundamentals of the approach before we see it in action throughout the book. As we shall see in the applications section, there is a widespread (and increasing) reluctance to use CBA for health care evaluations. Outlining the fundamentals of CBA is especially important in order to dispel false perceptions of the weaknesses of CBA.

1.3.1 Why Cost–Benefit Analysis?

There are two parts to the answer to the question ‘why CBA?’. The first involves explaining why, in general, CBA should be used rather than some other method of allocating resources. The second part involves explaining why, in the health care context, one should use CBA rather than the other types of economic evaluation. We consider each part in turn.

CBA is the core of a public policy course. Roughly, half of economics is trying to explain how the economy operates, and the other half is concerned with trying to *alter* how the economy operates. It is this second half that constitutes the public policy domain. Very few people would be interested in economics as a subject if there were not perceived some need to intervene in the economy. Policies to eliminate inflation, unemployment and poverty are all driven by this perceived need.

It is in this context of government intervention that CBA is most useful, for it provides a consistent framework for deciding when interventions are desirable or not. Considering whether to introduce a tariff reduction, a labor subsidy, an agricultural price support scheme, an environmental regulation, an interest rate change, or supply new funds for AIDS research are all matters for a CBA. When areas of economics, both within and outside the field of health care, do not employ the principles of CBA they engage in ‘bad’ public policy, in that their findings are based on incomplete analyses of what is socially desirable.

What, then, are the alternatives to using CBA? One could allow the market mechanism to allocate resources without any government intervention. But markets do have their imperfections and fairness/equity is not a market objective, even though in the health care field fairness is probably considered as important as efficiency. On the other hand, one could leave it to the political system to allocate resources. This has the drawback of government imperfections, in that voter preferences may be made secondary to political agent preferences. Even without government imperfections, it is not feasible to have a national vote every time a government intervention is to take place.

A CBA is designed to be a better reflection of what is socially desirable than market forces or direct government determination. As we shall see, CBA incorporates the efficiency rationale behind markets and makes adjustments for situations where market failure exists. It is efficiency that non-economists often ignore when in the health care field evaluators violate fundamental CBA principles. In addition, CBA *can* incorporate distributional considerations, which markets ignore and the health care field considers an essential ingredient in an evaluation.

In the health care context, CBA should be used rather than the other types of economic evaluation because it is the only method that can tell whether an intervention is worthwhile. Even the most cost-effective intervention may not actually be socially desirable, especially when we compare it with alternative uses of funds. It is not sufficient that we concentrate only on the health care sector. Our evaluation framework must ensure that health care programs are evaluated on a consistent basis with those in education, nutrition, the environment and social security. The objective is that all of public funds be spent wisely, not just those allocated (perhaps arbitrarily) to the health care sector.

The logic of this need to keep our perspective as general as possible comes out clearly even if health is the only social priority. For there are many different ways of achieving good health from areas not considered a part of the traditional health care sector. For example, the high rate of female literacy in Kerala in India is a main reason why that state (with only average levels of income per head) has one of the lowest rates of infant mortality and one of the highest rates of life expectancy.

1.3.2 The Social Perspective in Cost–Benefit Analysis

The perspective in CBA is a very broad one as it embraces the effects on everyone in society. A social evaluation does not consider just the parties directly involved with an intervention, that is, the firms (the hospitals and the physicians) and the consumers (the patients as clients). It also covers those indirectly affected, including the family members of the patients and even the general taxpayer. Strictly, then, CBA should be called ‘social’ CBA to recognize the all-inclusive nature of the evaluation. However, this usage is not widespread either within or outside the health care field. So we shall just refer to the analysis as CBA, leaving the social connotation implicit.

It is interesting that in the health care field it is considered good practice to make the perspective explicit at the outset of a study. That is, it is thought necessary to specify whose perspective the study is from. Is it from the perspective of the hospital, the client, the government taxpayer or whatever? Although it is true that an economic evaluation has usefulness from each

and every one of these perspectives, it is only the social perspective that is important for social decision-making. A study that ignores the costs for the families of patients with psychiatric problems is not very useful for making choices about the best place to house the seriously mentally ill. Consequently, one should always adopt the social perspective in an economic evaluation if one wishes to try to influence social decisions.

Even though the social perspective is primary, other perspectives are not irrelevant. In a mixed economy, where the government makes decisions recognizing its interaction with the private sector, it is important to know whether the social outcome is in accord with outcomes from a more narrow perspective. If it is socially worthwhile for people to be inoculated for TB, but it is not worthwhile from an individual's point of view (as the benefits to the non-inoculated population who have a lower chance of contracting TB are ignored), then there could be an 'incentive compatibility problem'. Which is to say that the socially desirable outcome will not in this case be chosen by the individual. Therefore some government incentive must be given to induce individuals to adopt the socially optimal outcome if they do not think it is in their best interests. (Chapter 4 explains this further.)

1.3.3 Efficiency Costs and Benefits

Whether an effect of a health care service is a 'benefit' or a 'cost' depends on what is the purpose of the expenditure. For example, a reduction in the number of persons born stemming from a population control program may be considered an advantage if one is trying to ensure that existing food supplies enable the most people to survive; but it would constitute a disadvantage if one were trying to build a large (human) army for defense purposes.

In welfare economics (the theoretical base for all policy economics) the objective is usually assumed to be to maximize (aggregate) consumer satisfaction (also called utility). It is this sense of maximizing satisfaction (something to be made more precise in later chapters) that is meant by saying that programs are efficient. People get satisfaction if they are willing to pay for something. With resources (income) limited, purchasing health care precludes the purchase of other goods and services, which also give satisfaction. There would be no point in people purchasing the health care if it did not make them better off. Because it is the individuals themselves who are to decide how to spend their income, and in the process make themselves better off, the basic value judgment behind the welfare economic approach to valuation entails the assumption of 'consumer sovereignty'. That is, the individual is assumed to be the best judge of his/her own welfare.

If one does accept the assumption of consumer sovereignty, there is no good reason not to accept willingness to pay (WTP) as a measure of benefits, and therefore no good reason not to use CBA to evaluate health care expenditures. This has to be borne in mind when one considers the criticism of CBA that it is based on the questionable use of earnings to measure health benefits. The use of earnings (what was labeled 'indirect benefits' in section 1.1.3) is a part of 'traditional' CBA. The economic philosophy behind this valuation method is embodied in the 'human capital' approach. A person's earnings are meant to reflect a person's productivity. A health intervention by restoring a person's productivity thereby provides a benefit to society.

The complaint has been that the inclusion of earnings biases programs in favor of those who work and earn, against those that affect children, housewives and the elderly. The traditional CBA approach thus is thought to be inequitable. However, the main criticism of the human capital approach by economists is that this approach ignores the preferences of the individual him/herself, and clearly does not fit in with the usual welfare economic base behind CBA, which is based on an individual's WTP. Thus, one can be an opponent of the human capital approach, yet still be an advocate of modern (efficiency based) CBA.

The equity issue is also something that is not outside CBA, even though it may not be a part of traditional CBA. When one uses WTP, one can weight effects according to their social significance. Thus, if one person is in poverty, their WTP can be given a premium so that their lack of 'ability to pay' can be allowed for. The real problems of CBA are therefore: (a) dealing with cases when consumer sovereignty does not apply (as with programs geared to the severely mentally ill); (b) trying to measure WTP when market valuations of WTP do not exist or are greatly distorted (which is often the case in the health care field); and (c) trying to obtain meaningful measures of the equity weights. The human capital approach is the 'fall-back position' that one should rely on only when other approaches cannot be applied. Traditional CBA is not necessarily 'best practice'.

1.4 APPLICATIONS

We begin our applications with two studies typical of those in the health care evaluation field. In the first we consider an evaluation of gallstones procedures using a CUA, and in the second we present a CEA of alternative sites for hypertension treatment. The emphasis in both of these studies will be on allowing for the side-effects of health care interventions. We also use both these studies to reinforce the point that only a CBA can tell

whether a treatment or intervention can be accepted or not. Despite the apparent superiority of CBA, CBA is not the method of choice in the health care evaluation field. The third application reports on a recent survey that finds that non-CBA evaluations predominate and that their share is increasing over time. We use this survey to give an overview of health care evaluations in practice. We close the applications section with an account of exactly how the \$47 million estimated cost for the sixth stool guaiac protocol was obtained.

1.4.1 Evaluating Gallstone Treatments

Whether to include indirect costs (forgone earnings due to the patient's time being taken up by treatment) is a controversial issue. As we remarked earlier, there are those who consider its inclusion as inequitable. Other opponents stress its conflict with WTP principles. Even if one does endorse the inclusion of indirect costs, there are a whole host of measurement issues involved with estimating the extent to which society's output will actually fall when a person cannot show up for work. In a CUA of gallstone treatments by Cook et al. (1994), they focus on establishing the quantitative importance of including indirect costs.

Indirect costs impact the choice of gallstone treatment in the following way. The standard treatment for gallstones was removing the gallbladder itself (called a cholecystectomy). This causes considerable post-operative sickness (pain, diarrhea and nausea) and a lengthy recovery period (hence a lengthy period away from work). As an alternative to this 'open' surgery, one could have the gallstone removed by a laparoscopic cholecystectomy (a laparotomy is a surgical incision into any part of the abdominal wall), which is a minimal access surgery where the post-operative morbidity (sickness) is greatly reduced and patients can resume normal duties within two to three days. Finally, there is now available a way of fragmenting the gallstones by external shock waves, called an extracorporeal shock wave lithotripsy or ESWL (lithotripter is Greek for 'stone crusher'). With an ESWL being non-invasive, post-treatment sickness is minor and the patient can leave the hospital on the same day as treatment. The work disruption is thus least with an ESWL.

A CUA was a more appropriate evaluation technique than a CEA because there did not exist a single outcome to use as 'the' effect. A QALY covers the post-treatment sickness as a quality of life (QoL) issue, and the chance of dying from the operation as a quantity of life dimension. In the gallstone case, the chance of dying from surgery was thought to be 1 in 1000. The QALY outcomes therefore depended mainly on the QoL component (with life expectancies from gallstone patients set at 25 years, 0.001

times 25 produces a QALY amount of 0.025, that is, the *quantity* of life years element was about nine days).

Living (having time) with severe pain was judged by the patients to be worth 89% of time without pain. So an 11% reduction in QoL was assigned to any life years spent in pain. Having severe diarrhea had a QoL loss of 19%. For the three symptoms combined that were associated with time after open cholecystectomy, the QoL loss was 56%.

Table 1.1 (based on Tables 3 and 4 of Cook et al.) presents the results for the three kinds of gallstone treatment. Cook et al. used two different perspectives for estimating the QALYs. To simplify matters, we record only the approach that had the higher QALY magnitudes.

Table 1.1: Costs and effects for alternative gallstone treatments

Cost variables and QALYs	Open cholecystectomy	Laparoscopic cholecystectomy	ESWL
Hospital cost	\$3366	\$2581	\$4007
Patient cost	\$992	\$395	\$254
Cost of conversion	\$4358	\$3154	\$4962
Indirect cost	\$2564	\$1268	\$574
Total cost	\$6922	\$4422	\$5536
Effect (QALY loss)	0.1650	0.1200	0.1205

Source: Cook et al. (1994)

Open cholecystectomy has higher costs and lower outcomes (a larger QALY loss) than laparoscopic cholecystectomy and so it cannot ever be more cost-effective than the non-open form of surgery, no matter how one values a QALY. The additional total cost (\$1114) of ESWL over laparoscopic cholecystectomy (that is, \$5536 – \$4422) divided by the additional effect of 0.005 QALYs (or 0.1210 – 0.1205) produces an estimated incremental cost of \$2228000 per QALY gained from ESWL. If one omits the indirect costs, the incremental cost per QALY from ESWL would be 62% higher at \$3616000. Cook et al. therefore found that omitting or including indirect costs makes a big difference to the gallstone treatment outcomes.

There are two aspects of the gallstone treatment study that we wish to highlight. On one hand, we see the strength of a CUA in that it quite naturally includes treatment side-effects in the determination of outcomes. As we shall see in the next case study, trying to measure side-effects in monetary terms for use in a CBA is very difficult. On the other hand, we see the inherent weakness of any CUA study. Cook et al. found that the cost per

QALY gained from ESWL was \$2228000 when indirect costs were included (and as high as \$3616000 when indirect costs were omitted). The authors state, 'it is doubtful that any authority would consider buying QALYs at the costs reported here'. While this judgment is undoubtedly correct, with a CUA we need to know exactly what cut-off point would make a QALY worth buying. The authors suggest that a cost per QALY of \$13573 might be worthwhile (which would be obtained if we omit laparoscopic cholecystectomy from consideration and look at ESWL over open surgery). But how can one know this for sure? Only a CBA can tell whether a treatment is worth undertaking.

Whether to include indirect costs can be resolved as follows. In a traditional CBA, restoring one's earnings ability is included as a benefit (indirect) and forgoing earnings in order to undergo treatment is included as a cost (indirect). So, clearly, ignoring indirect costs would not be valid in a traditional CBA because negative earnings are as important to record as positive earnings. Would it be valid to omit such costs from a CUA where the consequence is not measured in earnings?

Relative to a traditional CBA, a CUA can be interpreted to be omitting indirect benefits from the denominator of the cost-effectiveness ratio, but including indirect costs in the numerator. Omitting indirect benefits would be valid in a CUA because the consequence side has an all-inclusive outcome measure in a QALY. Quality-adjusted time can be used for any purpose one likes, including earning income. Using time for work is not an additional consequence. There would then be no question of trying to add earnings measured in dollars to the QALYs. Indirect costs, on the other hand, are not subsumed in the input side by some non-monetary index and so should be included on the denominator of a CUA.

1.4.2 A Worksite Hypertension Program

One of the intangible effects of taking medication is that there are side-effects to the treatment. The medications for hypertension (high blood pressure) particularly had this drawback as people were refusing to take the required medication. Low compliance and high treatment dropout rates were mainly responsible for the fact that, in the 1980s, only 30% of the US population had their blood pressure under good control. If one were going to conduct a CBA of hypertension treatments, an important part of the analysis would then involve putting monetary valuations on the side-effects of the medications. But little work actually has been done in this direction.

As an alternative to trying to find precise estimates of these intangible costs of treatment, one could try to side-step the issue by focusing on compliance as a separate treatment program and trying to achieve greater

compliance at least cost. This in effect has been the approach adopted by Logan et al. (1981) who examined whether the greater convenience of worksite treatment programs would increase compliance. The relevance of Logan et al.'s CEA study for CBA is that if one can find a way to make the side-effects issue 'go away', a standard CBA that ignored compliance effects would be more valid. In effect, by providing a worksite location for treatment that is more convenient, one is lowering the disutility of the side-effects (in the sense that the side-effects occur in a more comfortable setting and hence become more tolerable) and thereby increasing compliance with the medication regime.

Table 1.2: Cost and effect per patient for worksite care and regular care

Variable	Worksite care (WS)	Regular care (RC)	WS – RC
Health system costs	\$197.36	\$129.33	\$68.03
Patient costs	\$45.50	\$82.00	(\$36.50)
Total costs	\$242.86	\$211.33	\$31.53
Effect (mm Hg)	12.10	6.50	5.60

Source: Logan et al. (1981)

Table 1.2 (based on Tables 3 and 4 of Logan et al.) shows the costs and effects of worksite care (WS), where a person is treated by a nurse at a person's worksite, compared to regular care (RC), where a person has to make an office visit to a physician. The effect of the treatment is recorded as a mm Hg reduction in the diastolic blood pressure (BP) of the patient. The direct costs are called here the 'health system costs'. As we can see in the table, the direct costs are higher for the worksite program, but the patient costs are lower. When we add the two categories of cost we find that total costs are \$31.53 higher for the WS program. For this additional cost, the WS program obtains a 5.6 mm Hg additional reduction in blood pressure (which means that a 1 mm Hg reduction in BP can be purchased for \$5.63).

The hypertension study highlights a number of principles concerning how to carry out an incremental analysis for a CEA (and these principles will be presented in Part III). However, we are more concerned here with discussing the study's relevance to the CBA principles established in this chapter.

The most important point to note with a CEA is that it does not establish whether *any* procedure is worthwhile. As Logan et al. acknowledge with their conditional statement: 'If conventional treatment of hyperten-

sion (RC) is considered worthwhile, it is clearly more cost-effective to replace RC with WS treatment.' We know that a 1 mm Hg reduction in BP can be purchased for \$5.63 in the WS program. But we do not know whether this is a price that individuals (or society) are willing to pay. Moreover, even though the RC program is less cost-effective than the WS program (the C/E ratio is lower), the RC program could still be worthwhile if it is thought that \$32.51 ($\$211.33/6.5$) is worth paying for a 1 mm Hg reduction in BP.

Worth mentioning are the different results from alternative perspectives shown in the study. Logan et al. were careful to distinguish the total costs that are incurred by society as a whole from those related to the persons being treated for hypertension. In this case, costs for society moved in the opposite direction from those for the patients. The total cost increase of \$31.53 from having the WS program consisted of a \$68.03 increase in health system costs and a \$36.50 reduction in patient costs. Clearly, patients will be more enthusiastic supporters of WS programs than the rest of society.

The fact that patients had the \$36.50 saving from the WS program is vital information in understanding how a CEA can supplement a CBA. Recall that the problem was how to incorporate into an evaluation the side-effects of the hypertension medication. The CEA comparison of WS with RC can be interpreted as a way of minimizing the costs for overcoming the side-effects. Patients in the WS program received greater convenience. Not having to make an office visit translated into a cash equivalent saving of \$36.50. One could argue that patients' behavior revealed their preferences over side-effects and so produced an estimate of what the side-effects were worth. That is, \$36.50 was sufficient to overcome the adverse side-effects of the medication, or else the patients would not have taken the medication, and there would not have been the BP reduction observed.

The result is that we are suggesting the use of a two-stage evaluation process. First we employ a CBA to evaluate treatment ignoring the side-effects. Then we add to the cost side a sum of money to minimize the side-effects, which entails finding the most cost-effective way to overcome those side-effects. For the hypertension case, the most cost-effective way was to use the WS program, and the total amount of money to add to the costs was the \$68.03 increase in health system costs for the program. The most informative way to view the \$68.03 figure is to consider the second stage to be taking the \$31.53 amount, reflecting the total additional resources required by the rest of society to set up the nurses at the worksite, and add to this the \$36.50 to compensate the patients for taking the medication and putting up with the side-effects.

1.4.3 A Survey of Health Care Evaluation Practice

In this case study we provide an overview of the health care evaluation field using the survey by Elixhauser et al. (1993). Specifically, we report which type of economic evaluation is most used in practice and what kinds of treatment or service are being evaluated. In this way the reader can get a feel for the scope of the health care evaluation field and obtain an idea of what applications to expect later in this book.

Elixhauser et al. compiled a list of 1897 reports of health evaluation studies and 1309 other articles (reviews, editorials, methods and comments) for the period 1979–90. We will concentrate on the results for the study reports. To be included in the list the study must cover both the inputs (the costs) and the outputs (the consequences). As a consequence they exclude all cost minimization studies. Because authors called their studies CEAs even when they used QALYs as the effect, CEAs and CUAs were combined and all called CEAs. What then took place was a comparison of CBAs and CEAs. Most (66%) of the studies were for the US. Studies originated in the US that used foreign data were classed as non-US. There was a large growth in the number of economic evaluations over time (the annual number of studies grew from five in 1966 to 251 in 1990).

Prior to this study period, from 1966 to 1978, Elixhauser et al. claimed that CBAs and CEAs were roughly in equal numbers in the literature. This parity then changed and CEAs became the evaluation technique of choice. During 1979–85, the share of CEAs rose to 58.9%, and increased even further to 64.5% for the most recent period, 1985–90. The authors of the survey suggested that the controversy involved with putting a monetary value on life and limb that takes place in a CBA contributed to the relative appeal of CEA.

Table 1.3 (based on Tables 1 and 3 of Elixhauser et al.) summarizes the health care evaluation field for the 1979–90 period as it relates to CBA and CEA and to the two combined (called ‘all’). From the outset we need to be aware that components do not sum to the correct totals (because the classification scheme used does not have categories that are mutually exclusive and collectively exhaustive).

The 1897 studies are split into three categories according to their medical function: (1) preventative (334 studies); (2) diagnostic (612 studies); and (3) therapeutic (761 studies). The first entry in Table 1.3 (listed as the ‘medical function’) presents the aggregate figures for the three categories, and the other headings deal with the detailed breakdown for these categories. We now cover the details for each category in turn.

Table 1.3: Comparison of CBA and CEA study reports from 1979 to 1990

Dimension	All reports	CBA	CEA
<i>Medical function</i>			
Prevention	333.7 (20.0%)	134.5 (23.1%)	171.5 (16.5%)
Diagnosis	612.2 (35.9%)	160.5 (27.6%)	421.5 (40.4%)
Treatment	761.2 (44.6%)	287.5 (49.4%)	449.5 (43.1%)
<i>Prevention function</i>			
Medically oriented	272.5 (80.4%)	106.5 (76.3%)	140.5 (74.5%)
Education / behavior	66.5 (19.6%)	33.0 (23.7%)	48.0 (25.5%)
<i>Diagnosis function</i>			
Symptomatic	353.5 (55.6%)	81.0 (46.6%)	254.0 (58.0%)
Screening	282.5 (44.4%)	93.0 (53.4%)	184.0 (42.0%)
<i>Treatment function</i>			
Cure	319.0 (44.6%)	103.0 (39.3%)	205.0 (48.4%)
Rehabilitation	58.0 (8.1%)	24.0 (9.2%)	29.0 (6.8%)
Maintenance	339.0 (47.3%)	135.0 (51.5%)	190.0 (44.8%)
<i>Treatment modality</i>			
Medication	233.0 (38.3%)	100.0 (44.8%)	128.0 (35.3%)
Device / procedure	152.0 (25.0%)	43.0 (19.3%)	99.0 (27.3%)
Surgery	133.0 (21.9%)	47.0 (21.1%)	83.0 (22.9%)
Education / behavior	58.0 (9.5%)	22.0 (9.9%)	33.0 (9.1%)
Other	30.0 (5.3%)	11.0 (4.9%)	20.0 (5.5%)

Source: Elixhauser et al. (1993)

1. *Preventative*: There are two types of preventative intervention, namely, medically oriented (consisting of traditional clinical interventions, such as physical check-ups, vaccinations and providing antibiotics) and education/behavior interventions (such as smoking cessation classes and community heart disease programs). The medically oriented prevention programs greatly predominated, with a share of around 80% for both CBAs and CEAs.
2. *Diagnostic*: This category comprises symptomatic (diagnosing patients with the symptoms of a disease by such devices as laboratory tests) and screening (diagnosing illness in asymptomatic patients, which includes tests for such things as cervical cancer). Symptomatic testing outnumbered screening testing overall and for CEAs, but not for CBAs.
3. *Therapeutic*: This type of intervention (listed under the heading 'treatment' in Table 1.3) is subdivided using two different classification schemes. First, treatments are classified by their function, whether cure (as with treating infectious diseases), rehabilitation (for example,

providing physical therapy after a stroke), maintenance interventions which do not eliminate the underlying conditions (as with hypertension treatment in the case study we have just covered) and multiple functions (for example, interventions in an intensive care unit). There are more maintenance studies than those related to cure for CEAs, but the reverse holds for CBAs. There were very few studies of rehabilitation whether it be CBA or CEA. Secondly, treatments were classified by treatment modality. For both CBAs and CEAs, roughly 40% of the modalities concern medications (pharmaceutical interventions), 20% are for procedures (such as venous compression stockings), 20% for surgery (invasive procedures) and the remaining 20% are for education (exercise regimens) and 'other' (nutritional interventions).

A useful way of providing some perspective about the Elixhauser et al. survey is to use as a reference point Drummond's (1981) observations comparing and contrasting economic evaluations in the health care field with those in other sectors. Drummond made his points in the context of evaluations prior to 1980, but they seem to be just as valid today.

In some respects, evaluations in the health care field are most suitable for the standard type of economic appraisal. Economic evaluations rely on 'partial equilibrium analysis', assuming that income and all other prices are held constant. Strictly, then, only 'small' projects are appropriately evaluated by economic appraisals. In the health care field this has definitely been the case. Evaluations have been applied to limited and tightly defined problems, such as whether hernias should be treated by inpatient or outpatient surgery, or whether one should screen for a particular disease.

A major difference between health applications and those elsewhere is over the selection of alternatives chosen for evaluation. In other fields, evaluations have been of large capital projects (e.g., airports). In the health care field the applications are of procedures (treatments) and not capital expenditures, such as hospitals. This has advantages and disadvantages.

The advantages are that:

- (a) Decisions over procedures are at the heart of resource allocation in the medical field and so it makes sense to focus on activities that are of most concern to those involved in the field.
- (b) Consequently, the health care field has an edge over other areas that have neglected to evaluate procedures, for example in the transportation field, where there is a need to evaluate whether standby flights are worthwhile.

The disadvantages of concentrating evaluations on procedures are:

- (a) Health evaluators have had to deal with the difficult issues of measuring outputs.
- (b) Important issues have been missed, for example, decisions over where to site hospitals.
- (c) There is no direct link between the evaluation and the making of expenditure decisions. For example, it has been shown that kidney transplants are more cost-effective than any form of dialysis. The issue is: who is the client for this information? The question of transplants and kidney treatment as a whole is dealt with by health planners (hospital administrators, insurance companies, health maintenance organizations, and public officials) who take a broad view, and would need a lot wider evaluation than just knowing about a particular set of procedures.
- (d) The narrow focus has led to the neglect of other health producing measures, such as changes in lifestyles and government agricultural policy, which may affect health just as much as the medical procedures.

1.4.4 The Sixth Stool Guaiac Protocol

The sixth stool guaiac protocol is a classic in the health care field as a case study in showing what happens when apparently sensible health regulations or procedures are imposed without first undertaking a thorough economic evaluation of the costs and effects of those procedures. Neuhauser and Lewicki published their work in 1975. More recently, there has been a re-evaluation of the case study (see Brown (1990), Neuhauser (1990) and Gatsonis (1990)). Our view is that a lot can be learned from this study even if everything was not as assumed by Neuhauser and Lewicki. We first explain exactly how such a large figure of \$47 million per case detected was obtained. Then we explore some of the wider implications following from the case study.

In earlier work, D.H. Greigor had studied asymptomatic colonic cancer, which involved testing the stool for occult blood. Unfortunately, some of those with cancer were not detected by a single test. Greigor therefore recommended, and the American Cancer Society endorsed, a protocol of six sequential tests. If a positive outcome for a test were found, the existence of cancer would be confirmed by a subsequent barium-enema examination.

The cost of an individual test was very small. The first stool test was assumed to cost \$4, and each subsequent test cost \$1. The barium-enema procedure was considered to cost \$100. Clearly, so it seemed in a CM-type

framework, it would be cheaper to use the stool tests than to use the barium-enema procedure on everyone. The issue was, though, how many extra cases would be detected by the sixth test.

Neuhauser and Lewicki used Gregor's results, which were based on a screening of 278 people, and extrapolated them for a hypothetical study of 10000 people. Thus, because two cases were confirmed out of the 278 cases, there would be 72 cases in a population of 10000. They treated each one of Gregor's tests as an independent event with a 91.67% chance of detecting cancer. After one test, with 91.67% of the cases detected, there would be 8.33% of the cases undetected. Test two would have a 91.67% chance of detecting the remaining cases, which means there would be an additional 7.64% cases detected (i.e., 0.9167 times 8.33% equals 7.64%). And so on. What this means is that of 72 cases of colonic cancer, 66 cases would be detected after one test, and 71 cases after two tests. Clearly, there were very few cases left undetected (precisely one) after two tests. By undertaking test six, only 0.0003 extra cases were detected. The cases detected and the corresponding costs are indicated below in Table 1.4 (see their Table 2). (The 'incremental' cost is the cost of one more test, while 'marginal' cost is the cost per case detected from one more test.)

Table 1.4: *Detection rates for successive stool guaiac tests*

Number of tests	Cancer detection			Screening costs (\$)		
	Number of cases	Incremental gain	Total	Incremental	Marginal	Average
1	65.9469	65.9469	77511	77511	1175	1175
2	71.4424	5.4956	107690	30179	5492	1507
3	71.9004	0.4580	130199	22509	49150	1810
4	71.9385	0.0382	148116	17917	469534	2059
5	71.9417	0.0032	163141	15024	4724695	2268
6	71.9420	0.0003	176331	13190	47107214	2451

Source: Neuhauser and Lewicki (1975)

The final line is what interests us. It shows that for an extra 0.0003 of a case detected, the extra cost involved with the sixth test was \$13190. In other words, an extra case detected by the sixth test was \$47 million (\$13190/0.0003). Note that if the occult blood testing were bypassed and the barium used as the screening procedure for 10000 persons, the total cost would be \$1 million (10000 times \$100). The (marginal and average)

cost would have been \$13900 per cancer case detected. Thus, the sixth stool guaiac protocol was not even cost minimizing.

One general issue concerning the guaiac protocol that is often found in health care evaluations is the importance of assuming that treatments are divisible and that a proportional relationship concerning outputs and costs applies. One needs to be aware that \$47 million was not actually at stake and could have been devoted elsewhere. The extra cost of the sixth test was only \$13 190. The point was that for this \$13 190 very little was obtained (0.0003 of a case detected). *If* one purchases cases at this rate, and *if* there were this proportional relation between cost and cases, then one would end up paying \$47 million if one stopped when one purchased exactly one case. But, actually, only \$13 190 would have been saved if the protocol had not been introduced. CEAs and CUAs are especially vulnerable to relying on this proportionality assumption because their outcome measures are always expressed in ratio form.

In terms of the specifics of the case study, the main message (emphasized by Gatsonis) is the need to obtain precise estimates of clinical and economic outcomes when making economic evaluations. The Neuhauser and Lewicki study was based on working with the assumption that only two cases of colonic cancer were found in the study population. However, these were just the *proven* cases. Some of the people who had negative test results could have had the disease (Gatsonis writes: 'the possibility that further cancers may have existed among them is not negligible'). If instead of two cases there were three cases, all the numbers would change dramatically and the sixth test would not have been nearly so costly. One of the real problems therefore was in the Gregor data (concerning the prevalence of the disease), which Neuhauser and Lewicki used to carry out their evaluation.

The evaluation of the sixth stool guaiac protocol had a widespread impact. Not only did the study greatly affect the whole field of clinical decision-making, but it also changed actual policy. As pointed out by Getzen (1997), the study (and its aftermath) caused the American Cancer Society to amend its recommendations: 'Now, routine stool guaiac screening is recommended only for individuals over age 50, or whose family history makes them at high risk for colorectal cancer'.

1.5 FINAL SECTION

All chapters will contain a problems section, a chapter summary, and a section indicating where some of the unresolved issues will be covered in later chapters.

1.5.1 Problems

The four main methods for making an economic evaluation in health care have been introduced in this chapter. The problems that follow require the reader to select and assemble from a set of categories of costs and outcomes the necessary ingredients to conduct each of the four kinds of evaluation.

Table 1.5: Evaluation of neo-natal intensive care treatment

Cost or consequence	Before intensive care	With intensive care	Incremental effect
1. Cost per additional survivor (to hospital discharge)	\$5400	\$14200	\$8800
2. Cost per additional survivor (to death)	\$92500	\$100100	\$7600
3. Survival rate (to hospital discharge)	62.4%	77.2%	14.8%
4. Survival time (per live birth):			
a. Life-years	38.8	47.7	8.9
b. QALYs	27.4	36.0	8.6
5. Earnings	\$122200	\$154000	\$32000

Source: Boyle et al. (1983)

The evaluation being considered in Table 1.5 is Boyle et al.'s (1983) study of neo-natal intensive care in Canada. (All monetary figures cited are in Canadian dollars.) The provision of neo-natal intensive care involves increased current capital expenditures (to control the respiratory, nutritional and environmental circumstances of the baby) in order to increase a baby's future survival chances. The costs and consequences for babies with birth weight 1000–1499 g are listed in Table 1.5 (all figures are undiscounted).

1. Undertake a cost minimization comparison of neo-natal intensive care (before versus with intensive care) from: (a) the hospital's perspective and (b) society's perspective.
2. Undertake a CEA comparison of neo-natal intensive care from society's perspective. (Hint: more than one category of consequence could be used to form the CEA comparison.)
3. Undertake a CUA comparison of neo-natal intensive care from society's perspective. (Hint: only one category of consequence can be used to form the CUA comparison.)

4. Undertake a traditional CBA comparison (that is, use the human capital approach) to evaluate neo-natal intensive care from society's perspective. (Hint: only one category of consequence can be used to form the CBA comparison.)

1.5.2 Summary

This chapter started with a definition of a health care evaluation that stressed the need to consider alternatives. It was argued that one needed to carry out evaluations in order to ensure that funds were put to their best use. We then introduced the four main types of economic evaluation that comprise the health care evaluation field. In explaining the logic of each type of evaluation, we first set up CBA as the primary evaluation method, and then showed that the other types of evaluation could be considered to be special cases of a CBA. It was the fact that CBA measured both inputs and outputs in common, monetary terms that made CBA the only method that can actually tell whether a health care intervention should, or should not, be undertaken.

Although there is this unity from a theoretical point of view, the focus in all cases was on identifying the practical circumstances necessary to validate a particular method. This focus will be the defining characteristic of the book. That is, we are trying to develop an understanding of the strengths and weaknesses of trying to apply each of the evaluation types.

In the outline of the basics of CBA, we identified consumer sovereignty as the main value judgment. Whenever it is sensible to assume that the individual is the best judge of his/her welfare, modern CBA based on WTP is the appropriate evaluation framework. How practical WTP is as an approach to estimating benefits is a separate issue and one that will be explored in depth in this book. The modern approach has to be contrasted with the traditional approach to CBA based on the concept of human capital. Traditional CBA, which uses earnings to measure the benefits, has the merit that data on production are readily available. This largely accounts for its popularity in the health care field. But it is not based on firm welfare economic principles that depend on individual preferences for their validity. Also the human capital approach has its critics on equity grounds.

The applications section revealed the strong preference in the practice of health care evaluations for non-CBA types of evaluation. Thus the applications covered the three main alternatives to CBA, that is, CUA, CEA and CM. The CUA study of gallstone treatments highlighted the strength of CUA to be able to include routinely in its evaluations quality of life issues, such as pain and suffering; something which CBA often fails to incorporate.

In the CEA of hypertension treatment locations, we showed how a CEA could be used in a back-up role to a CBA to help it include treatment of side-effects. However, with both applications, we emphasized the inherent weakness of using any non-CBA type of evaluation. One could not say whether any of the treatment alternatives were worthwhile. The final application, which was conducted in a CM-type framework, returned to the theme introduced at the beginning of the chapter. That is, why it is necessary to explicitly carry out a health care evaluation. Without a formal evaluation, one could be wasting dollars that could be used elsewhere to save lives or otherwise make society much better off.

1.5.3 Looking Ahead

With only the introductory chapter (Part I) covered at this stage, looking ahead involves providing a guide to the rest of the book. Each of the four evaluation types will be analyzed in depth. Part II deals with CM; CEA forms Part III; CUA is in Part IV, and the final Part V is on CBA.

Since all four evaluation types depend on costs, and this is all there is in a CM, we start with Chapter 2 defining costs from an economic perspective and examining the rationale of CM as a type of economic evaluation. Chapter 3 explains some of the problems of measuring costs and examines whether hospital and physician charges can be used. The concept of costs is then broadened in Chapters 4 and 5 to include the costs on the rest of society, whether they are people not directly involved with treatment (generating so called 'external costs') or general taxpayers.

Chapters 6 and 7 are on CEA. They analyze its relationship to CBA and cover the controversial issues involved with discounting effects. Chapter 8 starts the part on CUA and examines its link to CBA. Chapter 9 describes the main instruments used to estimate the utilities, and Chapter 10 examines other alternatives to a QALY in an equity context. The two different kinds of CBA, traditional and modern, are discussed in Chapters 11 and 12. The final chapter explores how to include equity considerations in CBA.