

C H A P T E R

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*Approaches to
Economic
Evaluation
of HIV/AIDS
Interventions*

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Approaches to Economic Evaluation of HIV/AIDS Interventions

INTRODUCTION

HIV/AIDS program planners and policy makers are often confronted with a wide range of worthy and effective interventions but severely limited resources for carrying them out. In the past it may have been acceptable simply to allocate resources to specific interventions based on the best judgment of those making the decisions—such as evenly dividing the prevention resources for condom distribution; information, education, and communication (IEC); and sexually transmitted disease (STD) interventions. But today there is a growing need to prove that resource allocation decisions are made strategically, based on sound principles, and represent good value.

The increased emphasis on accountability often necessitates accessing data that have never been collected before, and health economists are often asked to contribute to the decision making process.

This chapter is for HIV/AIDS program planners and decision makers who are thinking of using an economic evaluation to determine how to focus their financial resources and demonstrate that their interventions are producing good value. The chapter is designed to define and differentiate the various forms of economic analysis that can be used to evaluate HIV/AIDS interventions, as well as to identify the problems associated with each approach.

STRATEGIES OF ECONOMIC EVALUATION

The four types of economic evaluation are: cost analysis, cost-effectiveness analysis (CEA), cost-utility analysis (CUA) and cost-benefit analysis (CBA). All have a number of advantages and disadvantages when applied to HIV/AIDS issues. Each of the four types of economic evaluation is preferable under certain circumstances, depending on the type of information required and the resources available for performing the study, and each one has been used to address issues of HIV/AIDS.

COST ANALYSIS

A cost analysis is the simplest form of economic evaluation, as it involves evaluating the costs of HIV/AIDS interventions but does not require estimating the value of the output produced. It usually includes at least the following components:

- Methodology and assumptions
- Full cost
- Incremental cost
- Future cost
- Cost recovery

COST-EFFECTIVENESS ANALYSIS (CEA)

A CEA allows program planners and other decision makers to move beyond a simple evaluation of costs and attempt to assess the value (in non-monetary terms) of the outputs produced. In the field of HIV/AIDS, CEA has been the most frequently used approach for economic evaluations.

COST-UTILITY ANALYSIS (CUA)

CUA usually states the denominator of an economic evaluation in terms of Quality Adjusted Life Years (QALYs), Disability Adjusted Life Years (DALYs), or Healthy Years Equivalent (HYE), rather than illness averted or treated. CUA is useful for politicians and policy makers because it allows them to compare or rank different interventions in league tables.

COST-BENEFIT ANALYSIS (CBA)

A CBA puts a monetary value on both the cost of the program and its output. The greatest problem with this approach is that it is very difficult and controversial to assign a monetary value to changes in a person's health. There are two economic methods of measuring benefits within a CBA for HIV/AIDS interventions in developing countries:

- Cost of illness (COI) approach
- Willingness to pay (WTP) approach

LESSONS LEARNED

The application of economic techniques to evaluate HIV/AIDS interventions in developing countries has revealed a number of challenging obstacles. This section offers recommendations for pursuing the four approaches in a number of hypothetical scenarios that illustrate the immediate need of policy makers in evaluating their HIV/AIDS programs.

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I N T R O D U C T I O N

Program planners and policy makers in the field of HIV/AIDS often confront a wide range of worthy and effective interventions, but have severely limited resources for carrying them out. In the past it may have been acceptable simply to allocate resources to specific interventions based on the best judgment of those making the decisions—such as evenly dividing prevention resources for condom distribution; information, education, and communication (IEC); and sexually transmitted disease (STD) interventions. But today there is a growing need to prove that resource allocation decisions are made strategically, based on sound principles, and represent good value. For example, when new research shows there are effective prevention and care interventions—such as voluntary counseling and testing (VCT), nevirapine for limiting mother-to-child transmission (MTCT) and tuberculosis (TB) prophylaxis—decision makers must determine whether strained HIV/AIDS budgets should be stretched even further to pay for these new interventions.

The increased need for accountability also often necessitates accessing data that have never been collected before. In some cases it may be enough to make informal estimates for donors or the government about the money spent on each intervention and the amount of output produced. But it is increasingly necessary to make difficult decisions based on knowledge concerning each intervention’s “value for money.”

Health economists are often asked to contribute to this decision-making process. Health economists have a range of evaluation tools available to them, each with its own distinct advantages and disadvantages. When program planners and policy makers are confronted with this range of different approaches to economic evaluation, they often have a hard time understanding which one is appropriate for the given needs and audience.

When is a cost analysis of different HIV/AIDS interventions sufficient?

How theoretically sound are cost-effectiveness and cost-utility analyses?

What resources are required to conduct each type of analysis?

As a result of this confusion about the proper use of economic evaluation tools, some policy makers consent to research studies that are more complex than is actually necessary for answering their questions. In other cases, policy makers recommend certain types of economic evaluations that lack the rigor they need to be truly useful.

The most common economic analyses used with HIV/AIDS interventions are cost analysis, cost-effectiveness analysis (CEA), cost-utility analysis (CUA) and cost-benefit analysis (CBA). These can be seen as a continuum, with cost analysis being the simplest but least informative. On the other end of the scale, CBA is often the most difficult type of evaluation to conduct, though it often provides the most comprehensive picture of the intervention.

This chapter is intended for HIV/AIDS program planners and decision makers who are thinking of using an economic evaluation to determine how to focus their financial resources and demonstrate that their interventions are producing good value for money. The chapter is designed to define and differentiate the various forms of economic analysis that can be used to evaluate HIV/AIDS interventions and identify the problems associated with each approach. It is not intended to be a technical “how-to” manual but an introduction to the basics of economic evaluation, as applied to the field of HIV/AIDS.

Each of the four forms of economic analysis serves a different purpose. None of them is right for every situation or audience. But it is important for program planners and decision makers to know when to use each approach and to understand their pitfalls.

STRATEGIES OF ECONOMIC EVALUATION

Each of the four different types of economic evaluation is preferable under certain circumstances, depending on the type of information required and the resources available for performing the study, and each one has been used to address issues of HIV/AIDS. The four types of economic evaluation are described in greater detail below.

COST ANALYSIS

A cost analysis is the simplest form of economic evaluation, as it involves evaluating the costs of HIV/AIDS interventions but does not require estimating the value of the output produced. Cost analyses are particularly useful for evaluating budgetary requirements or determining if an intervention is affordable or sustainable. A cost analysis can also provide a breakdown of costs to describe current and future cost requirements, as well as to measure cost changes that are likely to occur as a result of changes in an intervention's scale.

If the program planners determine that a cost analysis is appropriate and sufficient, the analyst must fully understand how the particular intervention operates. This will require observing the intervention and interviewing staff involved in providing the service. It is also necessary to interview those who manage the finances of the intervention. The analyst must be able to disaggregate the intervention into the various services provided. To estimate the cost of voluntary counseling and testing (VCT) within a health center, for example, the analyst would need to allocate all costs according to the various services provided—such as family planning, antenatal care, VCT and maternal and child health. This will enable the analyst to identify both the total cost of providing VCT (including all direct and indirect costs) and the incremental cost of adding VCT services to an existing health center.

Cost analyses are most successful when they begin by calculating the value of all resources used in any way to carry out the intervention. This includes identifying recurrent and capital costs, direct and indirect costs, and fixed and variable costs.

Cost analyses are increasingly being used to address the issue of scale. As small pilot projects become national programs, it is necessary to fully understand

how costs are likely to change. For example, many countries are currently attempting to develop nationwide VCT, home-based care and MTCT programs. It is probably not going to be enough to project the costs of such national programs based solely on the costs of pilot projects. Program planners and policy makers need to consider whether economies of scale will result in substantial savings. For example, the scale-up of a home-based care program in Zimbabwe found that costs declined substantially as the size of the program increased.¹ Economists also need to consider whether the pilot projects were actually conducted under ideal circumstances. Pilot projects are often conducted in districts that are accessible and already have well-motivated staff. If this is the case, a national program might actually be much more expensive on a per-client basis than the costing of a pilot project might suggest.

There are guidelines available for program planners who wish to learn the technical aspects of evaluating the costs of HIV/AIDS interventions. Some of these guidelines are listed in the Recommended Reading section at the end of this chapter.

A cost analysis usually includes at least the following components:

- **Methodology and Assumptions.** This component describes the intervention and the approach used for evaluating costs, including the approach for assessing shadow prices. It also includes basic assumptions used in the cost analysis, including information regarding inflation, discount rates, land prices and taxes.
- **Full Cost.** This component identifies the full value of all resources used by an intervention, including donated items and resources shared with other interventions.
- **Incremental Cost.** This component assesses the additional resources required to conduct an intervention when different from a full cost analysis.
- **Future Cost.** This component assesses the future resources needed to carry out an HIV/AIDS intervention.

- **Cost Recovery.** A cost recovery component evaluates opportunities to sustain an intervention by assessing how much the consumer of the service can pay for it relative to the total cost of the intervention.

These five components form the basis of a cost analysis that may provide policy makers with sufficient information to address the necessary issues.

Follow-up issues may include addressing the ways in which costs can be minimized. Cost-minimization studies, for example, have attempted to determine such things as the least expensive way to distribute condoms, treat STDs and offer VCT services. But such cost-minimization studies are often criticized because they fail to take into consideration the quality and effectiveness of the intervention, the result of focusing only on the intervention's cost and to some extent output, but not on the actual outcomes. This is why it is often necessary to move beyond simply analyzing costs and include an outcomes evaluation. In this case, it is necessary to move to CEA, CUA or CBA.

COST-EFFECTIVENESS ANALYSIS (CEA)

A CEA allows program planners and other decision makers to progress beyond a simple evaluation of costs and try to assess the value (in non-monetary terms) of the outputs produced. An explanation of CEA should begin with a definition of the numerator and denominator used. The numerator is typically defined as the cost, and should include any cost savings expected as a result of the intervention. An analysis of the cost of cotrimoxazole, for example, should include not only the cost of the medication, but also the cost savings expected from a reduced number of future hospital visits. The denominator, or the measure of effectiveness, can be any measure that accurately reflects the main output. In the field of HIV/AIDS prevention, the most frequently used measure of effectiveness has been the number of HIV infections averted.

At this point it is important to note that cost-effectiveness is a relative term that reflects a comparison of interventions with similar goals. An intervention cannot be deemed inherently "cost-effective," but can only be cost-effective relative to other interventions.

In other words, an intervention with an incremental cost per HIV infection averted of US\$2,000 cannot be assumed to be cost-effective unless data are available indicating that other interventions have a higher incremental cost per HIV infection averted.

One advantage of the CEA approach is that it can be relatively easy for policy makers to comprehend. For example, for every US\$1,000 invested in HIV/AIDS prevention, an average of 20 infections can be averted. Another advantage to this approach is that the denominator (effectiveness) does not have to be converted into monetary terms (in other words, the 20 infections averted do not need to be assigned a specific dollar value). An economist can therefore avoid the political pitfalls of making any direct judgment regarding the controversial issue of valuing the life that has been saved.

CEA also is particularly useful when there is a limited budget to achieve a particular goal. For example, if a project has US\$1 million to spend on HIV/AIDS prevention, CEA can be useful in identifying the cost per infection averted for a number of approaches. While it is not perfect, CEA can provide policy makers with an idea of which priorities to pursue. In this case, we might assume that the intervention with the lowest cost per averted HIV infection should be the first to be pursued.

CEA is also useful when comparing two interventions with similar objectives. For example, a study in Kenya and Tanzania determined that VCT is less cost-effective than the use of NVP to limit MTCT.²

If a program planner determines that a CEA is necessary, the analyst must be able to develop cost estimates as well as a model that can provide estimates of the number of infections that can be averted as a result of the intervention. Some macro models have been used (e.g., iwgAIDS*) to estimate how an intervention can influence behavior within a population, which in turn can be used to estimate infections

Table 1

COST-EFFECTIVENESS OF HIV/AIDS INTERVENTIONS IN AFRICA

Country	Intervention	CEA	Source
Kenya	VCT	\$241 per HIV infection averted	ref. 3
Kenya	STD treatment and condom distribution	\$8-\$12 per HIV infection averted	ref. 26
South Africa	Reduced MTCT	\$1,484 per HIV infection averted	ref. 27
South Africa	Directly observed therapy for TB	\$879 per case of TB treated	ref. 28
Sub-Saharan Africa	Female condoms	\$38 per HIV infection averted	ref. 29
Sub-Saharan Africa	Use of nevirapine to reduce MTCT	\$138 per HIV infection averted	ref. 30
Sub-Saharan Africa	Use of AZT to reduce MTCT	\$3,748 per HIV infection averted	ref. 31
Tanzania	VCT	\$243 per HIV infection averted	ref. 32
Tanzania	Improved treatment of STDs	\$218 per HIV infection averted	ref. 33
Zambia	Blood screening	\$31.62 per HIV infection averted	ref. 34
Zimbabwe	Blood donor deferral	\$127-\$773 per HIV infection averted	ref. 35

averted. Such macro-models require an extensive amount of data and significant amounts of time to conduct modeling. Others have used micro models (e.g., AVERT[†]) that focus on the direct infections averted that can be attributed to the intervention within certain subpopulations (e.g., commercial sex workers [CSWs] and their clients). Such micro models tend to be simpler to use, but generally produce more conservative estimates of impact, since they fail to capture any “downstream” infections averted.

In the field of HIV/AIDS, CEA has been the most frequently used approach for economic evaluations. Table 1 illustrates some of the CEA studies that have been performed on HIV/AIDS interventions in Africa. The wide variation in estimates is due in part to the interventions’ differing levels of effectiveness, but they also vary with the HIV prevalence in the selected country and the method pursued for measuring costs and effectiveness. The methodological differences in analyzing costs and effectiveness make a comparison of these interventions very difficult.

Although the CEA approach is popular, it is also problematic for several reasons.³ First, to compare interventions requires that all services have the same

measure of effectiveness. But all HIV/AIDS services do not necessarily produce one common output. The effectiveness of a condom distribution program may be measured in terms of infections averted. The measure of effectiveness for antiretroviral therapy may be the number of patients successfully treated. The effectiveness of VCT is likely to be composed of some combination of treatment and prevention gains. This is why these three interventions, designed to address the same illness, cannot be compared using CEA.

Next, prevention programs are often extremely difficult to associate with a specific number of illnesses averted.⁴ In the case of HIV/AIDS, this is due in part to a lack of knowledge about such basic inputs as the probability of transmission for any particular sex act. This problem is confounded by the lack of data regarding the impact of interventions on “downstream infections.” An intervention may prevent an HIV infection within the target audience, but it also is

* *iwgAIDS* is a comprehensive prediction and analysis tool used to understand the spread of HIV/AIDS around the world by public health officials and academics. It uses nonlinear partial differential equations to model the demographic, behavioral and epidemiological components of the HIV/AIDS epidemic. It includes partial factorial sensitivity routines to assess the impact of “sort” data in the model and an intervention facility to allow the user to perform “thought experiments.”

† AVERT is a computer model developed by FHI, which uses information that is readily available to many programs to derive estimates of the reductions in HIV infections achieved through interventions. This model enables users with little experience in modeling to develop estimates of program impact.

likely to prevent many more subsequent HIV infections among the people that a targeted person might have infected. As a result, most static models designed to measure the effectiveness of preventing infectious diseases have been unable to reliably estimate the number of infections averted as a result of any particular intervention.

Another problem arises when trying to develop one measure of effectiveness for any particular service. Unless the measure of effectiveness truly reflects all the benefits of a particular service, it will inevitably underestimate its value. A good example of this would be VCT, which has been evaluated using CEA.² The problem is that the benefits of VCT are much broader than simply the number of averted infections. VCT has value not only because it prevents new infections, but also because it: 1) informs clients; 2) opens up access to treatment for those who are infected; and 3) increases discussion and “normalization” of the epidemic. Thus narrowly defining the gains of VCT in terms of only HIV infections averted underestimates the true value of the service, and CEA will not reflect the real value for money invested in the provision of this service.

CEA is also problematic in that it assumes that an intervention has succeeded in preventing or treating an illness for an indefinite period of time. But “model estimates on HIV infections averted should be interpreted cautiously, especially in populations with high-risk behaviors where the observed behavior changes suggest that the interventions may only postpone the timing of infections rather than prevent infections indefinitely.”⁵ Thus a CEA may exaggerate the benefits of an intervention if it really only postpones, rather than prevents, new infections.

A CEA can also provide results that contradict the recommendations of epidemiologic evaluations. For example, an epidemiologist might recommend that

interventions be pursued in countries that are at an early stage of the epidemic, so as to limit the possibility of future spread. But a health economist using CEA over a short time span might recommend investing in HIV/AIDS prevention in countries where the epidemic is already well established (and where the cost per HIV infection averted would presumably be lower).

Finally, a CEA does not necessarily reflect the utility of the service from the community’s perspective. In CEAs, each HIV infection averted is of equal value. But in reality society may not view all lives in equal terms. For example, the health economist performing a CEA on an intervention that prevents a healthy adult from becoming infected might deem it to be of equal value as NVP in preventing the transmission of HIV from an infected mother to her child. The society, however, may put a very different value on preventing the infection of a child who will be orphaned relative to the prevention of an adult infection. Thus the health economist is making a value judgment that the society itself may not hold. This is contrary to one of the basic tenets of welfare economics, which states that people themselves are the best judges of their own utility.

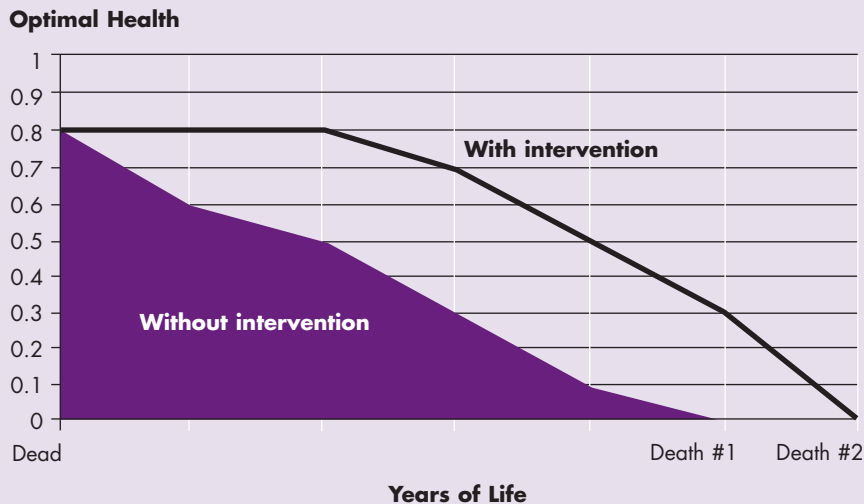
COST-UTILITY ANALYSIS (CUA)

CUA* usually states the denominator of an economic evaluation in terms of Quality Adjusted Life Years (QALYs) Disability Adjusted Life Years (DALYs) or Healthy Years Equivalent (HYEs), rather than illness averted or treated. The CUA approach has been shown to reflect the effectiveness of the intervention in more comprehensive terms than CEA since it combines both changes in quality of life and mortality in one measure.

CUA is useful for politicians and policy makers because it allows them to compare or rank different interventions in league tables, such as showing the impact of investing in directly observed therapy (DOTS) for TB versus more traditional forms of TB care. Policy makers who have a fixed AIDS budget to achieve a particular output are able to use CUA by

** Some economists categorize CUA as a subset of CEA, while others identify CUA as a separate form of evaluation.*

Figure 1
IMPACT OF INTERVENTION



funding the intervention with the lowest CUA first, then funding the next lowest CUA intervention, etc., until all available funds have been allocated to achieve the greatest utility.

CUA also has the advantage of being a technique with which economists, donors and policy makers are increasingly familiar. Many donors, including the World Bank, ask that projects demonstrate a sufficiently low cost/DALY to receive funding. The advantages and disadvantages of the CUA technique are also increasingly understood, which makes the tool more useful for policy makers.

CUA also is preferable to CEA because it places interventions in a context of healthy years of life saved, rather than simply counting the number of lives saved. As noted, a CEA cannot distinguish between a permanently prevented infection and one that is sim-

ply postponed. For example, a project may convince a CSW to use a condom today and she thereby avoids infection. But next week she may not use a condom and become infected. A CEA would only indicate that the intervention prevented the CSW from becoming infected, while a CUA would provide a more realistic assessment by revealing that there was only one week's delay in the woman's infection and illness.

As illustrated in Figure 1, an individual's health can be measured on a scale from 1 (perfectly healthy) to 0 (dead). Tools for measuring quality of life include Euroqol, SF36, and SF12. **

These tools have been developed

by various European and U.S. groups to develop quantitative estimates of health. They involve asking respondents to evaluate their own health in a limited number of questions about the person's physical and emotional well-being. In Figure 1, the average person without an intervention—such as antiretroviral therapy (ART) or cotrimoxazole—will decline and die quickly (death 1). This person's QALYs are equal to the area under the curve without any intervention. With the introduction of an intervention, though, the person's quality of life may improve and their death be postponed for a number of years (death 2). The difference between the areas under the two curves (with and without the intervention) is the number of QALYs saved as a result of the intervention. Programs that save the greatest number of QALYs for the smallest amount of money are considered to be cost-effective.

In its 1993 World Development Report, the World Bank developed a list of diseases and estimated the average number of DALYs incurred by each disease. The diseases with the largest health impact were: 1) respiratory disease, 2) diarrhea, 3) perinatal causes, 4) neuropsychiatric diseases, and 5) cancer.

** Table 2 provides a list of questions that are asked in the SF-12 to measure a person's quality of life.

Table 2

SF-12 Health Survey Scoring

1. In general, would you say your health is:

- Excellent
 Very Good
 Good
 Fair
 Poor

The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

2. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf.

- Yes, limited a lot
 Yes, limited a little
 No, not limited at all

3. Climbing several flights of stairs.

- Yes, limited a lot
 Yes, limited a little
 No, not limited at all

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

4. Accomplished less than you would like.

- Yes
 No

5. Were limited in the kind of work or other activities.

- Yes
 No

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

6. Accomplished less than you would like.

- Yes
 No

7. Didn't do work or other activities as carefully as usual.

- Yes
 No

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

- Not at all
 A little bit
 Moderately
 Quite a bit
 Extremely

These questions are about how you feel and how things have been with you during the past four weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past four weeks...

9. Have you felt calm and peaceful?

- All of the time
 Most of the time
 A good bit of the time
 Some of the time
 A little of the time
 None of the time

10. Did you have a lot of energy?

- All of the time
 Most of the time
 A good bit of the time
 Some of the time
 A little of the time
 None of the time

11. Have you felt downhearted and blue?

- All of the time
 Most of the time
 A good bit of the time
 Some of the time
 A little of the time
 None of the time

12. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

- All of the time
 Most of the time
 Some of the time
 A little of the time
 None of the time

Table 3
COST-UTILITY OF HIV/AIDS INTERVENTIONS IN AFRICA

Country	Intervention	CUA	Source
South Africa	Reduced MTCT	\$47 per DALY gained	ref. 27
South Africa	HAART for people living with HIV/AIDS	\$10,000 per DALY gained	ref. 36
Sub-Saharan Africa	Female condoms	\$29 per DALY gained	ref. 29
Sub-Saharan Africa	Use of nevirapine to reduce MTCT of HIV	\$5.25 per DALY saved	ref. 30
Tanzania	Improved STD treatment services	\$10.33 per DALY saved	ref. 33
Zambia	Blood screening	\$1.32 per year of life saved	ref. 34

Table 3 lists some of the CUA studies that have been carried out for HIV/AIDS interventions in Africa. Most recent studies have used DALYs as a measure of utility, which has made these studies more comparable. Given that most interventions are viewed as cost-effective if they cost less than US\$50/DALY, these HIV/AIDS interventions generally appear to produce good “value for money,” with the exception of highly active antiretroviral therapy (HAART) in South Africa, which had a cost/DALY of US\$10,000.

When a program planner determines that a CUA is warranted, the analyst must determine an appropriate way to measure changes in the quality of a person’s life. The easiest way to do this is to use published figures that attempt to associate infections averted with some measure of utility gained. A more complex approach is to conduct a study that attempts to measure changes in utility.

CUA is most often performed using either the standard gamble (SG) or the time-trade-off (TTO) approach. Both of these tools are designed to evaluate the utility of an intervention from the perspective of the individual. In the case of SG, the probability of death is varied and compared to the value of the intervention by using such questions as, “Would you choose to receive HAART if there were a five percent

chance of immediate death?” In the case of TTO, the change in life expectancy is varied and compared to the intervention in a question such as, “Would you choose to take HAART if it would make you fully healthy, but would reduce your life expectancy by two years?” Asking such questions of people living with HIV/AIDS, particularly in a developing country, is obviously very challenging and sensitive.

Like CEA, CUA requires a comparison among interventions.^{***} An intervention should ideally be compared to a “league table” of health interventions measured in terms of their cost/QALY (or DALY or HYE) saved. One problem with this approach is that few countries have such league tables, which means policy makers have a hard time determining whether an intervention is truly a good investment of limited resources. Policy makers are left wondering whether a CUA represents a comparatively good or poor investment, since they lack the data necessary to compare interventions.

Another problem with this approach is that CUAs do not have much meaning to most policy makers or their constituents. A policy maker who is presented with the “good news” that their wise investment in health has produced 10,000 QALYS is usually either unimpressed or unable to translate this accomplishment for their constituents. As a result, CUAs are often unsuccessful in convincing policy makers on the best way to invest their limited health resources or the wisdom of already taken public investments.

^{***} Unlike CEAs, CUAs can be used to compare interventions that deal with different diseases.

CUA is also problematic because people place value on health outcomes and because of the information conveyed. As shown in various studies,⁶⁻⁸ information has value even if it does not change the treatment eventually proposed. This may be particularly true of VCT when knowledge of one's HIV status is likely to have significant value even in the absence of treatment. Thus CUA, like CEA, may seriously underestimate the value of VCT.

Finally, CUAs, like CEAs, do not necessarily reflect the utility of the services to the community. Using the example of MTCT, a CUA might conclude that saving the life of a newborn would have greater value than saving the life of the mother, since the uninfected newborn may have a greater number of future healthy years than the mother. But as already indicated, the community may place a much greater value on the life of the mother**** CUAs therefore do not necessarily reflect the judgment of society regarding the value of different lives saved and therefore may not produce a welfare-maximizing recommendation.

COST-BENEFIT ANALYSIS (CBA)

A cost-effectiveness analysis gives the narrowest options for comparison. It may only facilitate comparisons between different ways to treat a specific disease. Cost-utility analysis has been developed to facilitate comparisons between different medical specialties. Cost-benefit analysis offers a direct comparison between costs and outcomes, since both are expressed in monetary terms.⁹

A CBA puts a monetary value on both the cost of the program and its output. This produces information that is often more appealing to policy makers, especially those concerned about assuring value for money. CBA gains from the fact that any intervention

can be evaluated on its own merit, rather than requiring a comparison of interventions. CBA also allows programs that have very different objectives to be compared (e.g., should the government focus its limited resources on new roads or new malaria control projects?).

One weakness of cost-effectiveness analysis is that its foundation in welfare economic theory is unclear. The classical tool of economic evaluation based on welfare economic theory is cost-benefit analysis, where both costs and health effects are measured in the same units.⁹

While CBA is a theoretically and politically appealing tool, it also faces tremendous obstacles in implementation. The greatest problem with this approach is that it is very difficult and controversial to assign a monetary value to changes in a person's health. This is further confused when making comparisons across countries. For example, should the value of someone's life in a developing country be worth less than the life of someone in a developed country, simply because people in developed countries are, on average, wealthier?*****

There are two economic methods for measuring benefits within a CBA for HIV/AIDS interventions in developing countries: 1) the cost of illness (COI) approach, and 2) the willingness to pay (WTP) approach. Both of these methods are described below.

Cost of illness (COI)

The COI approach uses two components in measuring benefits. The first values the benefit of treating or preventing HIV/AIDS by the change in the net cost of health care associated with treatment. The second is the aversion of indirect costs, which are equated to the value of lost earnings attributable to that illness.¹⁰ Thus, the total benefit from, for example, pre-

**** Although it is possible to adjust the discount rate to reflect the value of life to the community, most CUAs instead use a standard discount rate that does not necessarily reflect a community's value.

***** In fact, CEA, CUA and CBA all make certain assumptions about the value of life. But CBA studies usually require that these assumptions be made explicit.

venting an HIV/AIDS infection is equal to the amount the infected person (or the government) would have had to pay for treatment plus the amount of income that would have been foregone because of the HIV/AIDS-related illness and death.

When it is determined that a CBA using a COI technique is warranted, the analyst must choose a way to calculate the direct and indirect value of a person's life. The direct cost analysis may include assessing the cost of the labor, materials, medication and overhead required to treat hospitalized patients living with HIV/AIDS. More extensive analyses may also include an assessment of such other costs as outpatient and home-based care, and investments in traditional medicine.

Indirect cost estimates are often performed simply by multiplying the discounted per capita income by the years of life expected to be lost as a result of HIV/AIDS. More extensive analyses actually attempt to evaluate whether the income of people living with HIV/AIDS differs from those in the general community. It is still debatable whether the value of an individual's consumption should be deducted from the income lost to illness.

Assume, for example, that a case of AIDS costs US\$1,000 to treat and that the patient loses US\$5,000 in lifetime discounted earnings due to the illness and premature death. The benefit of averting that illness would be equated to US\$6,000. A public program to prevent HIV/AIDS would be recommended if it cost less than US\$6,000 per case averted, but would be considered too expensive if it cost more than US\$6,000.

One of the first studies on the economic impact of HIV/AIDS on developing countries was published using this COI methodology in Tanzania and Zaire.¹¹ COI was subsequently used in a variety of other developing countries, including Kenya,^{12,13} Malawi,¹⁴ Mexico,¹⁵ Honduras¹⁶ and Thailand.¹³ The COI approach has the advantage of being relatively simple for economists to calculate and for policy makers to understand. *****

***** Most of these studies were actually designed to illustrate impact, and therefore did not go so far as to use the COI approach to determine which interventions were cost-beneficial.

But for a number of reasons, the COI approach has been viewed as a theoretically inadequate methodology for evaluating the benefits of preventing or treating diseases and has been widely rejected by most economists.¹⁷ The COI approach has problems, among them:

- Direct cost analyses generally ignore the fact that the cost of care does not reflect the full benefits of care to the patient. For example, patients may put a high value on a life-saving drug, but its price would not necessarily reflect that value. In this case, the cost of the treatment does not reflect its benefit to the patient.
- Because COIs are so strongly influenced by direct costs, they may inaccurately recommend that life-prolonging treatment should never be pursued, since allowing a patient to die is frequently the least expensive treatment alternative. Thus, even when society places a high value on treatment strategies, COI will frequently suggest that such treatment is not cost beneficial.
- Indirect costs are a poor measure of a human being's value, especially in terms of work that is not compensated such as education, homemaking and child rearing. This means the value of saving or extending a woman's life, particularly when she is not formally employed, is often underestimated or completely ignored.
- A methodology for determining indirect costs has never been clearly defined, so it remains unclear if the indirect costs should reflect the fact that individuals consume as well as earn. If so, should an elderly person who consumes but has no potential earnings then be considered of negative value?
- By assigning a monetary value to an individual's life, the COI makes some implicit assumptions about the different values associated with different people's lives. It has typically been assumed in CBA that a wealthier individual's life has greater value than a poor person's, because the loss of a

wealthy person would result in greater monetary losses in terms of productivity. Human life is likewise assumed to have more value in developed countries than in developing countries when performing COI studies.

- COI does not permit an adequate comparison between diseases. The fact that one disease creates a greater impact than another does not necessarily mean that public funds should be invested in the disease with the greater impact. Instead, society may favor equity in health care over reducing the overall impact of disease.
- COI lacks any basis in welfare economic theory. The COI technique does not necessarily reflect the value associated with a change in health since any measure of benefits should be capable of satisfying the Pareto criterion. An allocation of resources is only “Pareto efficient” if it is impossible to make one person better off without making someone else worse off. Future earnings are not necessarily related to such an improvement.¹⁸

[V]aluing benefits in terms of rates of pay neglects the health benefits that accrue to people who are not employed—for example, non-working wives and retired people. It also ignores the non-financial costs of pain, suffering and grief that are often associated with illness. But from an economist’s perspective, the main criticism of the approach is that it is not based on an individual person’s valuations of benefits. Indeed, a third party view is taken about people’s “worth” to society in terms of their productive potential. This viewpoint is inconsistent with the prevailing view among economists that the individual person is the best judge of his or her own welfare.¹⁹

Because of these and other significant problems with the COI approach, economists have begun to use alternative methodologies to evaluate benefits as part of a CBA.

Willingness to pay (WTP)

WTP is the approach most often preferred by economists for measuring benefits because it has a sound theoretical basis in welfare economics. WTP is the most commonly used approach for evaluating benefits in the environmental field, and is rapidly becoming more popular in the field of health economics.

The advantage of WTP over QALYs stems from the fact that the latter permits the valuation of health gains only. It could be argued that, although health gain is the main attribute of health care, there are other important attributes which QALYs and other health indices do not take into account. Such attributes include the “process of care,” which often means more to the patient than do clinical outcomes.²⁰

There are two ways to determine willingness to pay:

- **The indirect approach** determines someone’s WTP by observing his or her market behavior and identifying how much he or she is apparently willing to pay to avoid a disease. For example, it may be possible to determine someone’s benefit from averting an HIV/AIDS infection by observing how much he or she spends on condoms, STD treatment or blood screening, if such a private market exists. But because there are so many confounding factors associated with people’s behavior, the indirect approach has never been used in evaluating the benefits of HIV/AIDS prevention, to the author’s knowledge.
- **The direct approach**, known as contingent valuation (CV), is generally conducted by interviewing people and determining their WTP through one of a variety of techniques. CV allows the user of the service—and in some cases the community as a whole—to indicate how they value a particular health service by asking about their willingness to pay to obtain that service or, less commonly, their willingness to accept its unavailability. The approach resolves some, though not all, of the problems associated with the COI.

CV was originally developed as a tool for measuring the benefits that people obtain from the environment. The technique was subsequently refined to address other public goods, including health care. (For a review of the CV technique as applied to health, see the Recommended Reading section.) The CV approach involves creating a hypothetical market for goods or services that could not otherwise be readily exchanged.

The use of CV to evaluate HIV/AIDS interventions in developing countries is a very new concept. But it is being used to assess VCT, chronic care services, antiretroviral (ARV) therapy and a hypothetical AIDS vaccine in Kenya.²¹ Studies also have been designed to determine the possible value of an AIDS vaccine in developing countries.²²⁻²⁴

If a program planner believes it is appropriate to determine CBA using the CV approach, it will be necessary to interview all of the intervention's potential beneficiaries. In the case of care that has no aspect of a public good, interviews would need to be conducted only with those who are infected. But most HIV/AIDS interventions do contain some public good components, so it is also necessary to interview people in the general community. By asking people how much they would give up to have access to an HIV/AIDS service—or to assure access for other people in the community—it should be possible to develop a more comprehensive assessment of the intervention's benefits.

Some criticize the CV approach on philosophical grounds, arguing that the desires of individuals should not be the major determining factor in choosing to publicly subsidize a good or service. In other words, policy makers may prefer to finance public goods based on grounds of paternalism rather than economic demand.²⁵

Another criticism of the CV technique concerns its hypothetical nature. It is easy to say you would be willing to pay a substantial sum to obtain a service until you are actually asked to pay for it. CV is also criticized on logistical grounds, since carrying out surveys of sufficient size is also expensive and extremely complicated.

LESSONS LEARNED

Using economic techniques to evaluate HIV/AIDS interventions in developing countries has revealed a number of challenging obstacles. Although cost analyses can provide a simple assessment of the resources needed to introduce or sustain an intervention, they are not particularly useful for actually comparing interventions.

Health economists have attempted to use measures such as “HIV infections averted” in CEAs. These studies have particular appeal because of their clear message to policy makers and usefulness for advocacy purposes. But they can also be criticized because of their lack of rigor and inability to consider the wider benefits that can be obtained using interventions such as VCT.

The World Bank has continued to promote CUA as a more rigorous way to evaluate HIV/AIDS interventions. But CUA appears to have less appeal in developing countries, where results are more difficult to use for advocacy purposes and comparable figures are often not available.

CV as a tool for performing CBA has an appeal to economists and those who are looking to use economic evaluations for advocacy purposes. But this technique is still somewhat experimental and further research is required before using it on a wide scale.

Given the advantages and disadvantages of each of the four approaches, it is now useful to provide a few illustrative scenarios, along with recommendations, about which approach to pursue. Table 4 provides a number of hypothetical scenarios that illustrate the immediate need of policy makers in terms of evaluating their HIV/AIDS program.

Table 4 illustrates that in some circumstances it may be adequate to focus on a simple cost analysis. This is particularly useful when the program planner

Table 4

DETERMINING THE APPROPRIATE FORM OF ECONOMIC EVALUATION

Scenario	Recommended form of economic evaluation
"I only need to know how much my program costs."	Cost Analysis
"I want to know my future resource needs to reach scale for my interventions."	Cost Analysis
"I am not concerned with theory, only clearly illustrating the significant impact that will be incurred if we don't intervene."	Cost-of-Illness Approach
"I want a form of economic evaluation that simply and clearly illustrates the advantages of my intervention."	Cost-Effectiveness Analysis Contingent Valuation
"I want the approach that is the most theoretically sound."	Cost-Utility Analysis Contingent Valuation
"I want to compare different HIV/AIDS interventions and/or prevention vs. care"	Cost-Effectiveness Analysis Cost-Utility Analysis
"I want to know how much cost-recovery is feasible, so that I can financially sustain my intervention."	Cost Analysis Contingent Valuation
"The benefits of my intervention are much wider than simply infections averted or health improved."	Contingent Valuation
"I want an economic evaluation that is simple and requires the fewest resources possible."	Cost Analysis
"My primary audience is my constituency."	Cost-Effectiveness Analysis
"My primary audience is the National AIDS Control Program."	Cost Analysis Cost-Effectiveness Analysis
"My primary audience is the Minister of Health."	Cost-Utility Analysis
"My primary audience is the Minister of Finance."	Contingent Valuation

needs to collect budgetary information, but does not actually need to compare various interventions. It is also useful when attempting to assess the resources required for scaling-up interventions.

CEA can be a simple but powerful policy tool for program planners presenting an evaluation of their intervention to policy makers. Making policy makers aware of the number of HIV infections the intervention can avert is often enough to demonstrate value for money. CEA is particularly useful as an advocacy tool, as it can be used to present simple messages about infections averted per dollar invested in the intervention.

CUA is most frequently used when it is necessary to compare interventions. Donors are increasingly requiring that program managers and national policy makers demonstrate that their interventions produce good value for money by estimating cost/DALY.

Finally, CBA using the COI approach can be useful when demonstrating impact for advocacy purposes. CBA using the CV approach can be useful when a more theoretically sound approach is needed and resources are available for carrying out surveys.

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