Introduction to Economic Evaluation for Global Health

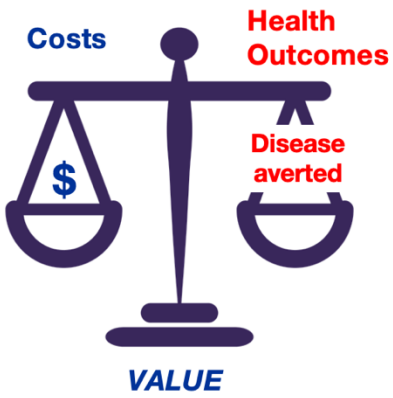
Definition and Overview of Economic Evaluations

Week 1 lecture

Hello, everyone. Welcome to the first week of this course, *Economic Evaluation for Global Health*. I'll start off by defining some concepts and providing an overview of economic evaluations. First, I want to define economics. It's the study of how societies distribute their scarce resources to satisfy the demands of their citizens. These resources can be for defense, education, or infrastructure. And health economics is a branch of economics that focuses on how these scarce resources are used to produce health.

Economic evaluation is a branch of health economics focused on **identifying, measuring and comparing the costs and outcomes** of alternative strategies to produce health. So, it's a technique used to evaluate and compare different health interventions. And this goes beyond clinical trials, which provide data on efficacy and safety of health interventions. clinical trials are run under ideal conditions, like highly paid staff and targeted patient populations. And they usually provide an upper limit of an intervention's effectiveness. Economic evaluations focus on the effectiveness of the intervention under real world conditions. And they also assess the "**value for money"** or the cost effectiveness of health interventions. They can also assess the overall budget impact, or the affordability of a health intervention.

Specifically, an economic evaluation is an analysis that considers both the comparative costs associated with two or more health interventions, and also the comparative clinical effects. So, you're comparing both the costs and the health outcomes of different interventions to assess their value.

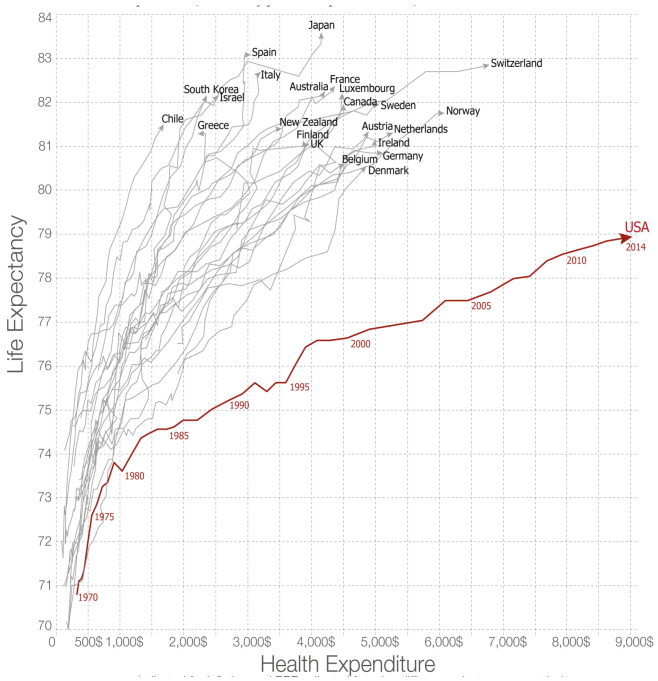


And the overall goal of health economics is to **distribute limited resources in a way that optimizes population level health outcomes**, so to **use scarce resources to produce health**.

And why are economic evaluations important?

Well, the main reason is that we have **a limited budget for health interventions**, and we have an infinite number of possible health interventions that we can implement. So, there's lots of things that we can do to improve population health. But because we have a limited budget, we need some way of prioritizing these interventions to **maximize health benefits**. And we need a framework to compare the costs and the health benefits of each different intervention. We can use this framework in a standardized way to compare health interventions to assist in policy decisions. For example, we can **compare different ways to address the same health problem**.

Like we can answer a question like what's the most efficient way to identify HIV positive persons in the community. Or we can **compare different health interventions to determine which one maximizes health within a given budget**. For example, should the Kenyan government fund rotavirus vaccination or HPV vaccination?



So, this graph here on the right shows life expectancy on the Y axis and health expenditure on the X axis, and it's mainly high income countries, but you can see that the US is an outlier there in red. It spends a lot of money on health care, but life expectancy in the US is much lower than other high-income countries. So, this really highlights the fact that more expensive does not equal better health outcomes. The US spends more but doesn't prioritize it in a way that maximizes health gains. So many countries in Europe will not implement a health intervention unless they've conducted an economic evaluation and have determined that it's a cost-effective intervention. In the US policymakers are explicitly prohibited from using cost effectiveness to choose which interventions to implement. So, implementing interventions that are cost effective is important in both high and low resource settings.

The attributes of public health decisions include complexity, and uncertainty. So, we're not always sure what the consequences of health intervention will be. And we make a lot of assumptions. We have multiple alternatives and risks associated with different interventions, for example, side effects or adverse events. There are competing objectives and unavoidable tradeoffs, because you can only implement one intervention for the given money that you have. And there are also different perspectives.

Economic evaluations are a way to synthesize all of the available evidence. And this includes costs intervention effectiveness, disease, burden, etc., to provide an estimate of value for money for the intervention. And this provides information to policymakers who are then deciding which interventions to implement.

This table lists the types of economic evaluations that we'll talk about in this class. In all these evaluations, the costs are measured in dollars.

	Cost measurement	Benefit measurement	Summary measure
Cost-Effectiveness Analysis (CEA)	$	"natural" units: Life-year gained, HIV infections averted, cancer cases detected	Incremental cost-effectiveness ratio (incremental costs per cases averted)
Cost-Utility Analysis (CUA)	$	Life-years adjusted for quality-of-life (QALYs or DALYs)	Incremental utility ratio (incremental costs per cases DALY averted)
Cost-Benefit Analysis (CBA)	$	Benefits valued in monetary terms ($)	Net Benefits (Benefits – Costs)

In a **cost effectiveness analysis or CEA**, the benefits are measured in what we call natural units, like life years gained HIV infections averted, or cervical cancer cases detected. The summary measure that you would calculate in a CEA is the incremental cost effectiveness ratio. So that's the cost per HIV infection averted or cancer case or cancer death averted. A **cost utility analysis** is often considered a subtype of a CEA and it's one of the most popular types of economic evaluations. Health Benefits are measured in life years adjusted for quality of life. So, QALYs or DALYs, which we'll discuss more in detail later on. And the summary measure is the incremental cost per DALY averted or per quality gained. And then a **cost benefit analysis**, you analyze the costs and the health benefits in monetary terms. So, you can estimate the health benefits and then convert them into money. So, how much you value that health outcome. The summary measure is net benefits, which is the benefits of the intervention minus the costs of the intervention. **And all of these are ways to assess value for money for health interventions.**

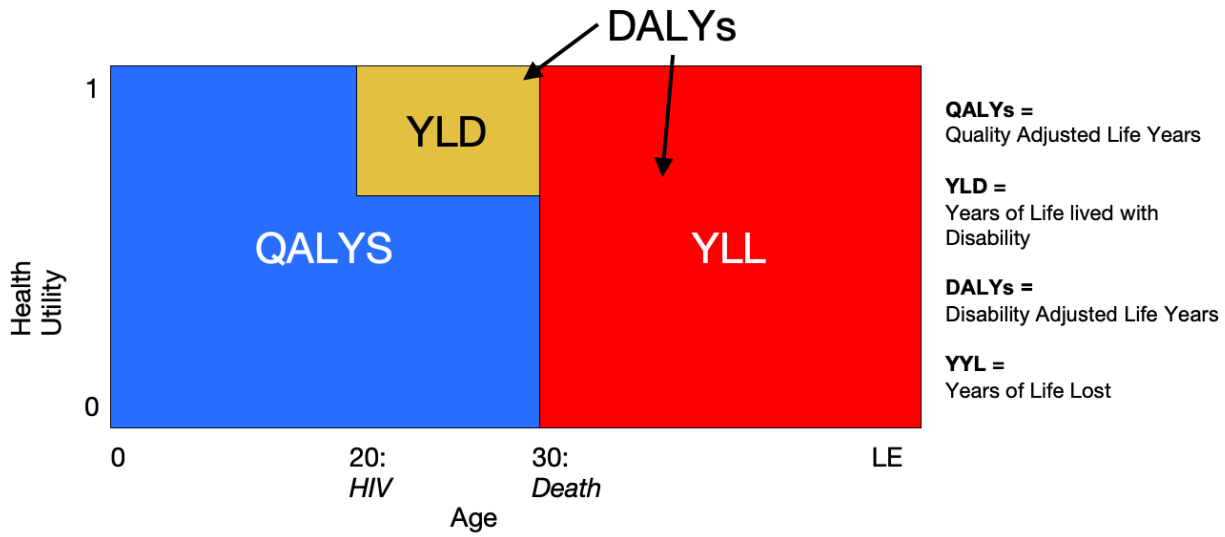
So, in terms of valuing health benefits, you can use natural units like health outcomes. So, life years gained, cancer cases averted or HIV infections averted. And then your summary unit would be a cost per that health outcome. But in general, economists prefer to use Disability Adjusted Life Years or DALYs, or Quality Adjusted Life Years or QALYs.

And the advantages of using DALYs and QALYs are that they combine morbidity and mortality into a single measure. So, most interventions have more than one health consequence. For example, an HIV testing intervention can avert HIV related deaths by identifying persons with HIV and linking them to care, which prevents their disease progression. But it also prevents onward HIV transmission. So that person is no longer transmitting to their partner. So, if you use cost per death averted as your outcome, you're not incorporating these infections averted. And if you use costs per infections averted as your outcome, you're not taking into account deaths. So, one way to combine all of these health benefits from an intervention is to use DALYs

or QALYs. Another reason to use DALYs and QALYs is that some interventions don't increase life years, but they improve quality of life, like preventing blindness or treating STI eyes. These are conditions that have a large impact on an individual's quality of life. For example, an intervention that treats cataracts to prevent blindness doesn't increase the length of life. So, if you're using life years to measure health benefits, it might not look like a worthwhile intervention. But if you incorporate the utility estimates for people living with blindness, and how it affects them every day, the quality adjusted life years that you save by averting blindness is fairly high. Another major advantage of using DALYs and QALYs is that you can compare across health interventions. So, if you have a Tuberculosis intervention that costs $1,000 per case of TB averted, and a cervical cancer intervention that costs $2,000 per case of cervical cancer averted, you can't really directly compare these interventions because the denominators are different. And it's hard to compare the value of averting a TB case versus a cervical cancer case. But if you convert these conditions into DALYs, or QALYs, you can then get a cost per disability adjusted life year averted, which you can compare across interventions. And you can also incorporate tradeoffs, like survival versus quality of life. Some interventions can extend your life but at a lower quality, such as chemotherapy. You can also incorporate that the risks of an intervention or side effects, like drug therapy for depression can alleviate depression, but has a potential side effect, which is dry mouth. So, looking at the quality adjustment of not living with depression, but then living with the side effect of dry mouth is something that we can incorporate using DALYs or QALYs.

DALYs and QALYs

So, in order to visualize how we conceptualize qualities and valleys, we can imagine that a person who was born healthy and remained healthy up until age 20, when they were diagnosed with HIV. So, for the first 20 years of their life, they had a health utility of one, which you can see on the Y axis.



And then after age 20, they continue to live their life, but they're at a lower utility because they're living with an illness. And then at age 30, they die of HIV. So, the blue area is the quality adjusted life years lived by that individual. And the yellow is the years of life lived with disability. So, they were alive from age 20 to age 30. But they had a lower quality of life because they were living with an illness. And if this person hadn't gotten HIV, they would have died after a certain time based on the life expectancy of the country in which they're living. If this person hadn't gotten HIV, they would have died at a certain age which corresponds to the life expectancy of the country that they're living in. So, in this case, the years between age 30, and their expected date of death is the years of life lost. And the years of life lost plus the years of life lived with disability are the DALYs. So, the QALYs are the amount of time they lived either healthy or with an illness. So, DALYs and QALYs are kind of the inverse of each other. Although mathematically they're not completely calculated this way, conceptually, that's how you can think of them.

So, we hope that this course will provide you the tools that you need to evaluate the published literature on global health, economic evaluation, and also to design your own analyses. Thanks.