Introduction to Economic Evaluation for Global Health

Conducting and Interpreting Economic Evaluation

Week 1 lecture

Hi everyone. In this session we'll be talking about conducting and interpreting economic evaluations. So, we'll start by talking about how we conduct an economic evaluation. And we'll use the example of Voluntary Medical Male Circumcision (or VMMC). In Kenya, male circumcision can reduce the risk of getting HIV by over 50%. And this is a very effective strategy and regions with high HIV burden, such as many countries in Sub Saharan Africa. But implementing a circumcision strategy can be costly. You have to train medical staff buy supplies, and then advertise the intervention to increase demand and encouragement to get circumcised. And it can also be associated with adverse events. So, there can be complications from circumcision that are experienced by small number of men. Also, Kenya has other competing health priorities and unlimited budget. So, if we want to answer the question is implementing VMMC in Kenya, an efficient use of resources?

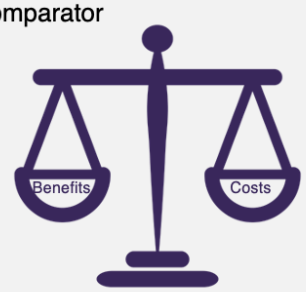
So, we want to answer the question*, is implementing VMMC in Kenya and efficient use of resources? And how would we go about doing this?*

We can assess this by comparing two scenarios. One, HIV prevention in Kenya without male circumcision (VMMC), standard of care. And a second scenario, which is standard of care, plus VMMC. And we would add up the costs for each of these scenarios. And this includes not only the cost of the intervention, but also the healthcare costs for people living with HIV, which can be substantial. And this lets us capture the costs averted by implementing VMMC. Since circumcision reduces HIV incidence, so fewer people are getting HIV, and then they're not incurring treatment and hospitalization costs. And this can represent a cost saving to the health system. We would then add up the benefits of each scenario. And that's usually measured in QALYs or DALYs. And then we would calculate the incremental cost effectiveness.

And how do we calculate the incremental cost effectiveness? We assess cost effectiveness by calculating the incremental cost effectiveness ratio, or ICER. And the ICER is a ratio between the difference in the costs of an intervention minus the cost of the competitor over the difference in the effectiveness of the intervention minus the effectiveness of the competitor. So in this example, our intervention would be male circumcision in Kenya, and we would subtract the cost of standard of care with no male circumcision from this scenario. And that would be over the relative difference in effectiveness of male circumcision versus a strategy with no male circumcision.

Calculate the **incremental cost-effectiveness ratio** (ICER)

$$\text{ICER} = \frac{\text{Cost}_{\text{Intervention}} - \text{Cost}_{\text{Comparator}}}{\text{Effectiveness}_{\text{Intervention}} - \text{Effectiveness}_{\text{Comparator}}}$$



Helps determine whether an intervention provides good 'value for money'

So, what we have is the difference in costs over the difference in effectiveness. And if the ICER is less than the cost effectiveness threshold, which is the amount that you're willing to pay per unit of health benefit, then the intervention is considered cost effective.

What is a cost-effectiveness threshold?

So, what is a cost-effectiveness threshold? This is the amount of money that a country is willing to pay for an intervention per QALY gained or per DALY averted. So, how much they're willing to pay to gain an additional unit of health in that country. There's no consensus on which threshold we should use below which an ICER is considered cost effective. And this is something that's currently under a lot of debate in the field. And this threshold varies by country. A commonly cited threshold that's been used for a long time and is recommended by the who is the country's gross domestic product or GDP per capita. And this is mainly used for low- and middle-income countries. For high-income countries, the threshold is usually between 50,000 to $100,000 per QALY gained.

VMMC interventions

So as an example, if we were to look at VMMC interventions in Kenya, and we use the willingness to pay threshold of Kenya's GDP per capita, which for this example, we'll assume is $5,200, so our threshold is $5,200 per DALY averted.

Program	Cost ($)	Effectiveness (QALYs)
VMMC promotion at time of HIV test	200,000	50
VMMC promotion + SMS reminder	400,500	45
VMMC promotion + 2 home visits	300,000	60

And then we have three interventions. So, say we have the standard of care, which is male circumcision and promotion at the time that somebody comes in and gets an HIV test. And then a second scenario, which is VMMC promotion at the time of a test, plus an SMS reminder to that participant that says, *"please come in and get circumcised"*. And then a third possible intervention is male circumcision promotion at the time of the HIV test, plus to home visits, so going to someone's house and encouraging them to uptake male circumcision, if they haven't already.

So, just looking at these scenarios, and you have their costs and their effectiveness and qualities, is there one intervention that you would definitely not implement. And I'll give you a moment to think about it. So, we would not want to implement the second intervention, VMMC promotion plus SMS reminder, because it costs more than the first intervention VMMC promotion at the time of HIV test, and it has lower health benefits. So, without doing any calculations, you can eliminate this strategy from consideration.

Program	Cost ($)	Effectiveness (QALYs)
VMMC promotion at time of HIV test	200,000	50
~~VMMC promotion + SMS reminder~~	~~400,500~~	~~45~~
VMMC promotion + 2 home visits	300,000	60

And it's ruled out by strong dominance, which is what it's called when an intervention is more costly and less effective than a competitor intervention.

So, then you're left with two interventions, the standard of care, and then the standard of care, plus two home visits.

Program	Cost ($)	Effectiveness (QALYs)	ICER
VMMC promotion at time of HIV test	200,000	50	$200,000/50= $4,000 per QALY gained
VMMC promotion + 2 home visits	300,000	60	$300,000/60= $5,000 per QALY gained

And it's a little bit harder to decide which intervention you should implement. So, we would need to do a calculation. And here we would try to calculate the ICER for the standard of care. So, we have a cost of $200,000, and an effectiveness of 50 QALYs. So, 200,000 divided by 50 is 4000 per QALY gained. And if we look at the next strategy, it's 300,000. And it gains 60 QALY. So, 300,000 divided by 60 is $5,000 per QALY gained. And so, $5,000 per QALY gained is less than our threshold, our willingness to pay a $5,200 per quality gain. So, it looks like we would implement this intervention.

~~VMMC promotion + 2 home visits~~	~~300,000~~	~~60~~	~~$300,000/60= $5,000 per QALY gained~~

So no, we do not want to do this. We want to look incrementally. So, if you just take the average cost effectiveness, the total cost divided by the total effectiveness of each intervention. You're not comparing the interventions incrementally to each other, what we really want to know is what's the added benefit of the second intervention compared to the first one.

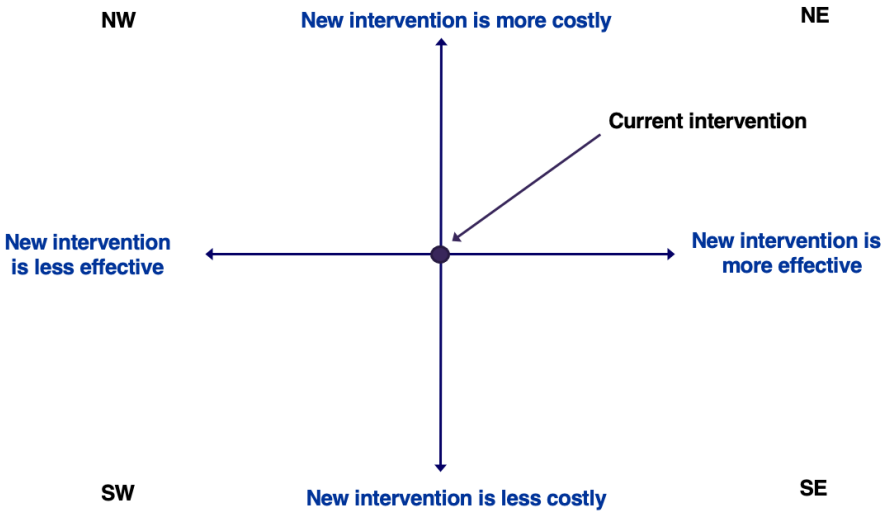
So instead, we'd like to calculate the incremental costs and the incremental effectiveness. So, for the first intervention, we're assuming that this is standard of care. So, we would assume that we are comparing this to a scenario of doing nothing, which would cost $0. So, if you compare VMMC promotion at the time of HIV test to doing nothing, you would get $200,000 minus zero, which is $200,000. And that is the incremental cost of the intervention. For the incremental effectiveness, it's 50 QALYs compared to doing nothing, which would give you zero QALYs. So, you have 50 minus zero, or 50 QALYs. And the ICER is $200,000 divided by 50, or $4,000 per QALY gained, which is actually the same as what we had calculated earlier.

Program	Cost ($)	Effectiveness (QALYs)	Incremental cost	Incremental effectiveness	ICER
VMMC promotion at time of HIV test	200,000	50	$200,000-0= 200,000	50-0= 50 QALYs	$200,0000/50= $4,000 per QALY gained
VMMC promotion + 2 home visits	300,000	60	$300,000-$200,000= $100,000	60-50= 10 QALYs	$100,000/10= $10,000 per QALY gained

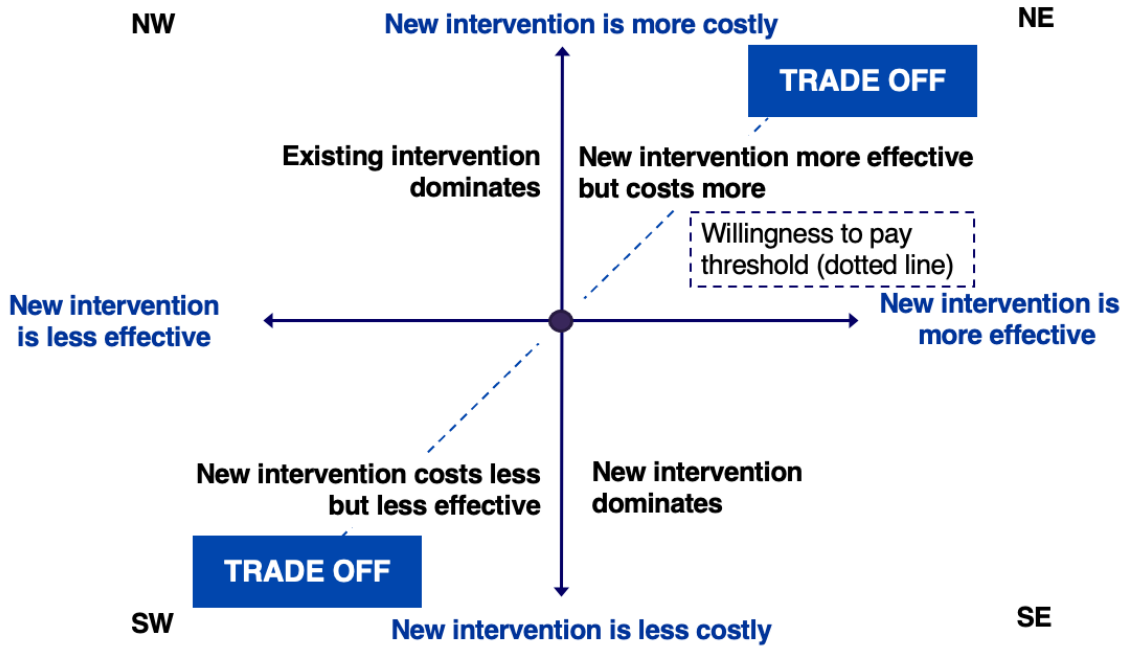
But for the second intervention of VMMC promotion plus 2 home visits, it's associated with a cost of $300,000. So, instead of taking this average cost effectiveness, we want to say how much better is this than something else we could be doing. So, $300,000 minus comparateur, which is $200,000. So, you get a $100,000 incremental cost. And similarly, with the effectiveness, we would like to compare the effectiveness compared to the next best option, so instead of the average effectiveness, so that's 60 QALYs minus 50, which is the QALYs associated with the previous intervention. And that's 10 additional QALYs for the additional cost that you pay. And therefore, the ICER is $100,000 divided by 10 QALY, or $10,000 per QALY gained. And this is a lot higher than our willingness to pay threshold of $5,200 per QALY gained. And so, this really highlights the importance of our choice of comparator. Anything can look cost effective if you compare it to something that's really inefficient, or if it's compared to doing nothing. But if you compare it to something else that you could be doing with the money that you have available, that's a pretty good and cheap intervention, then implementing a new intervention that costs a lot more relative to that other intervention and only produces a little more health benefit does not look cost effective.

The Cost-Effectiveness Plane

So, this is a cost effectiveness plane, which is a way to visualize the icers that we just calculated, if we were to graph them on a plane. The middle shows the current intervention. So the new intervention can either be less effective or more effective than the current intervention that we have.



And this is shown on the X axis. And the new intervention can either be more costly or less costly than the current intervention, which is shown on the Y axis. So, in the northwest quadrant here, if the intervention is less effective and more costly, we would consider this to be dominated. And this is what we saw in the VMMC example. So generally, we would not want to implement an intervention that is more costly and less effective than something else that we're already doing, because it would not be a good use of resources.

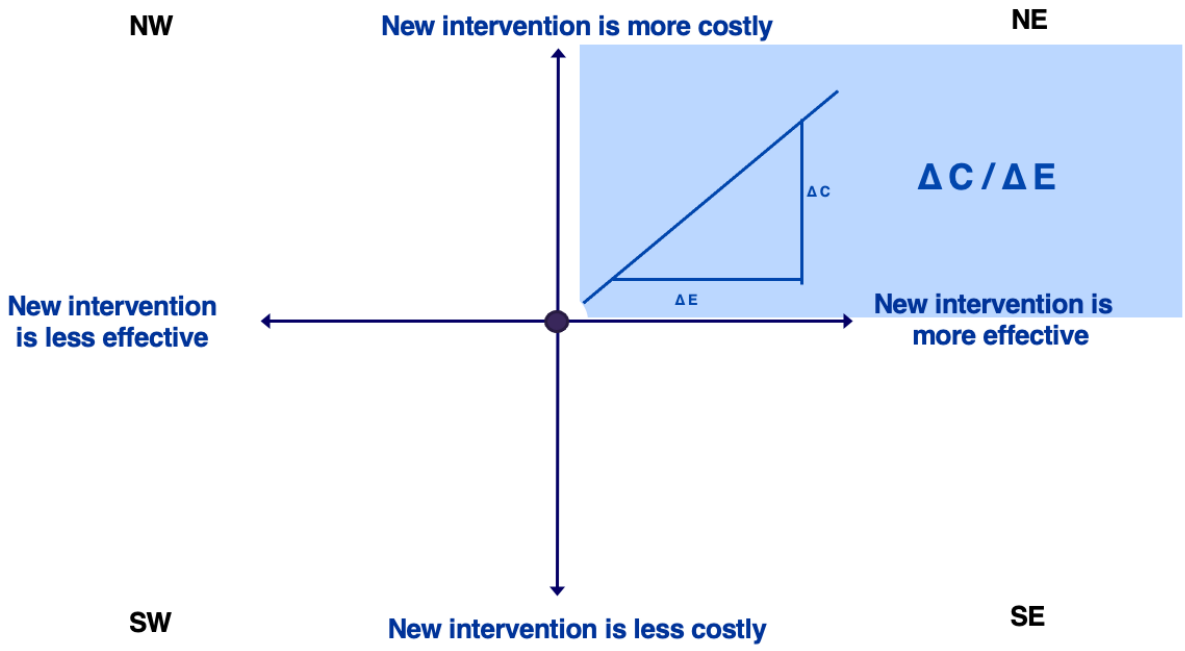


If we were to look at the Southeast quadrant, in this case, the new intervention is less costly, and more effective than the current intervention. So, in this case, the new intervention dominates. And we would likely want to implement this intervention, because it's more effective, and it costs less than what we're already doing.

If we look at the Northeast quadrant, the new intervention is more effective, but also more costly. And this is where the bulk of our cost effectiveness research lies, we're generally looking at interventions that cost more than something that we're already doing, but also provide more benefit. And we wanted to look at for that additional cost, how much more benefit are we getting, and is that an efficient use of resources. And therefore, we need to make a trade off and somehow quantify that trade off.

So, in the Southwest quadrant, the new intervention costs less, but it's also less effective. And we don't normally work in this sphere in high income countries, but occasionally in low-income countries will consider a tradeoff where an intervention is less effective, but much less costly. So, you could take that money that you save and spend it in another way, which can overall increase the health impact in a budget constraint health system. So, this is another trade off.

And the dotted line here that's running diagonally is the willingness to pay threshold. So, this changes depending on the country that we're looking at, but generally the willingness to pay threshold is the increase in costs over the increase in effectiveness. And that can be graphed visually.



Limitations of Economic Analyses

So, I want to end by covering some of the limitations of economic analyses. economic analyses do not address feasibility. So, there can be an intervention that's highly cost effective but really strategically difficult to implement. They also don't address affordability. So, some interventions are very cost effective, but the cost needed to implement the intervention is high and exceeds the country's healthcare budget. So that's usually why we need some other kind of assessment like a budget impact analysis, particularly in resource limited settings. And they also don't address equity. So, we can just look generally at what the health benefits are that are produced by a health intervention, we aren't able to look at the heterogeneous impact. So, it could be that most of the health is going to one portion of the population and not another. And this is not explicitly incorporated into the ICER. And they also don't inform ethics or provide information about why we would want to ethically implement one intervention over another. So economic evaluations don't provide definitive answers about how resources should be allocated. They're decision oriented and not truth oriented. And policy decisions should never be made solely on cost effectiveness criteria. Thank you.