Types of Economic Evaluation in Healthcare

Joseph B. Babigumira
Global Medicines Program
Department of Global Health
# Healthcare Evaluation

Are both costs and outcomes of alternatives assessed?

<table>
<thead>
<tr>
<th>Is the comparison of two or more alternatives</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exames only outcomes</td>
<td>Exames only costs</td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partial evaluation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Outcome description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Partial evaluation</td>
<td>Full economic evaluation</td>
</tr>
<tr>
<td>• Efficacy (Outcomes) analysis</td>
<td>Partial evaluation</td>
<td>Cost-Consequences Analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cost-Minimization Analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cost-Effectiveness Analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cost-Utility Analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cost-benefit Analysis</td>
</tr>
</tbody>
</table>

Adapted from Drummond et al. Methods of Economic Evaluation in Healthcare (2006)
## Types of (Full) Economic Evaluations

<table>
<thead>
<tr>
<th>Method of Analysis</th>
<th>Cost Measurement</th>
<th>Outcome Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost-Consequences Analysis</td>
<td>$</td>
<td>Multi-dimensional listing of outcomes</td>
</tr>
<tr>
<td>Cost-Minimization Analysis</td>
<td>$</td>
<td>Equivalence demonstrated or assumed in comparative groups</td>
</tr>
<tr>
<td>Cost-Effectiveness Analysis</td>
<td>$</td>
<td>Single “natural” unit outcome measure</td>
</tr>
<tr>
<td>Cost-Utility Analysis</td>
<td>$</td>
<td>Multiple outcomes—life-years adjusted for quality-of-life</td>
</tr>
<tr>
<td>Cost-benefit Analysis</td>
<td>$</td>
<td>$</td>
</tr>
</tbody>
</table>
# Application of Economic Evaluation Methods

<table>
<thead>
<tr>
<th>Method of Analysis</th>
<th>Applicability for assessing</th>
<th>Options to achieve a specific objective</th>
<th>Options across health sector</th>
<th>Options inside and outside health sector</th>
<th>Intrinsic value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost-Consequences Analysis</td>
<td>Yes</td>
<td>?</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Cost-Minimisation Analysis</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Cost-Effectiveness Analysis</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Cost-Utility Analysis</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Cost-Benefit Analysis</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Cost-Consequences Analysis (CCA)

- Systematic description and measurement of a set of intervention attributes that should be considered when making a decision
- Does not prescribe a decision rule
- Provides information to decision maker in a simple disaggregated format and decision maker must make their own choice
  - Akin to everyday attribute-specific decision making
- Disadvantage is that weighting of different attributes is left to individual decision makers
  - Increases welfare of decision maker
  - But decision by individual might not be in the best interest of patients or society
Cost-Consequences Analysis—Example

A Prospective Cost-Consequence Analysis of Adding Lamivudine to Zidovudine-Containing Antiretroviral Treatment Regimens for HIV Infection in the US

L. Lacey,1 J. Mauskopf,2 R. Lindrooth,3 S. Pham,4 M. Saag5 and W. Sawyer6

1 Global Health Outcomes, Glaxo Wellcome, Greenford, Middlesex, England
2 Center for Economics Research, Research Triangle Institute, Research Triangle Park, North Carolina, USA
3 Institute for Health Services Research & Policy Studies, North Western University, Evanston, Illinois, USA
4 US Medical Affairs, Glaxo Wellcome Inc., Research Triangle Park, North Carolina, USA
5 University of Alabama, Birmingham, Alabama, USA
6 HIV Health-Economics Collaboration, Royal Free Hospital, Hampstead, Middlesex, England
Lacey et al. (Results)

Additional costs and consequences of managing 100 patients (time horizon = trial period)

<table>
<thead>
<tr>
<th>Costs</th>
<th>Placebo</th>
<th>Lamivudine</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total costs ($US * 100)</td>
<td>$531,200—$630,700</td>
<td>$568,300—$595,400</td>
<td>-$35,300—+$37,100</td>
</tr>
<tr>
<td>In-patient costs</td>
<td>$457,200—$556,600</td>
<td>$270,300—$297,500</td>
<td>-$186,900—-$259,100</td>
</tr>
<tr>
<td>Outpatient costs</td>
<td>$5,600</td>
<td>$4,200</td>
<td>-$1,400</td>
</tr>
<tr>
<td>Medications costs</td>
<td>$56,400</td>
<td>$52,500</td>
<td>-$3,900</td>
</tr>
<tr>
<td>Lamivudine costs</td>
<td>$12,000</td>
<td>$241,300</td>
<td>+$229,300</td>
</tr>
</tbody>
</table>

**Progression**

| Disease progression       | 20                       | 9                        | -11                      |
| No. of HIV-related events | 68                       | 41                       | -27                      |
| Deaths                    | 6                        | 3                        | -3                       |

**Resource use**

| Patient admissions        | 11                       | 6                        | -5                       |
| Additional OP visits      | 15                       | 10                       | -5                       |
| Prescribed medication     | 43                       | 30                       | -13                      |
Cost-Minimization Analysis (CMA)

- Cost-minimization analysis is used when outcomes are equal or assumed to be equal (owing to outcomes being roughly identical)
- Historically recommended for economic evaluations of trials showing no statistical significance in effectiveness
- Conduct separate and sequential hypothesis tests on costs and effects to determine whether incremental cost-effectiveness is necessary
- Advantage
  - Simple and easy to interpret
- Disadvantages
  - No longer considered by many to be “valid” (2001 paper by Briggs and O’Brien—Death of CMA) and omitted from seminal text (Drummond et al. (2006)) as a type of economic evaluation
  - Argument is that researchers should do CEA and estimate joint density of costs and effects and examine uncertainty regardless of whether there is a statistically significant difference in effectiveness
Cost-Minimization Analysis—Example

BMC Health Services Research

Research article
**Potential impact of task-shifting on costs of antiretroviral therapy and physician supply in Uganda**
Joseph B Babigumira*1, Barbara Castelnuovo2, Mohammed Lamorde2, Andrew Kambugu2, Andy Stergachis3, Philippa Easterbrook2 and Louis P Garrison1

Address: 1Pharmaceutical Outcomes Research and Policy Program, School of Pharmacy, University of Washington, Seattle, WA, USA, 2Infectious Diseases Institute, Makerere University, Kampala, Uganda and 3Departments of Epidemiology and Global Health, School of Public Health & Community Pharmacy, University of Washington, Seattle, WA, USA
Email: Joseph B Babigumira* - babijo@u.washington.edu; Barbara Castelnuovo - bcastelnuovo@idi.co.ug; Mohammed Lamorde - mlamorde@idi.co.ug; Andrew Kambugu - akambugu@idi.co.ug; Andy Stergachis - stergach@u.washington.edu; Philippa Easterbrook - philippa.easterbrook@kcl.ac.uk; Louis P Garrison - lgarrison@u.washington.edu
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Impact of Task Shifting

### Table 3: Per visit and annual costs of antiretroviral therapy follow-up for different types of health workers at the Infectious Diseases Institute clinic, Kampala, Uganda from a societal perspective

<table>
<thead>
<tr>
<th>Health worker type</th>
<th>Cost per visit ($)</th>
<th>Number of visits per year</th>
<th>Annual societal cost of follow-up ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PF</td>
<td>NF</td>
<td>PWF</td>
</tr>
<tr>
<td>Physician</td>
<td>2.51</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Triage</td>
<td>1.68</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Nurse</td>
<td>0.98</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Regular PW</td>
<td>0.80</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Refill PW</td>
<td>0.22</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

PW--Pharmacy Worker, PF--Physician Intensive Follow-up, NF--Nurse Intensive Follow-up, PWF--PW-intensive follow-up

### Table 4: Per visit and annual costs of antiretroviral therapy follow-up for different types of health workers at the Infectious Diseases Institute clinic, Kampala, Uganda from a ministry of health perspective

<table>
<thead>
<tr>
<th>Health worker type</th>
<th>Cost per visit ($)</th>
<th>Number of visits per year</th>
<th>Annual payer cost of follow-up ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PF</td>
<td>NF</td>
<td>PWF</td>
</tr>
<tr>
<td>Physician</td>
<td>1.18</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Triage</td>
<td>1.12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Nurse</td>
<td>0.74</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Regular PW</td>
<td>0.34</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Refill PW</td>
<td>0.17</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

PW--Pharmacy Worker, PF--Physician Intensive Follow-up, NF--Nurse Intensive Follow-up, PWF--PW-intensive follow-up
Cost Effectiveness Analysis

• Outcomes are measured in “natural units”
  ▫ The outcomes are usually clinically relevant e.g. life-years, mm Hg for BP, HbA1c for diabetes, etc.

• Examines the costs of alternative approaches to achieving a specific (health) objective.
  ▫ Can be used to compare interventions to achieve the same outcomes e.g. the same clinical indication

• Identifies the least cost way of achieving the objective to see how both cost and choice of technique vary as the magnitude of the objective varies.

• Advantages are ease of communication and specificity.

• Disadvantage is lack of ability to compare interventions across the health sector i.e., costs can be compared but outcomes cannot.
Cost-Effectiveness Analysis—Example

Cost Effectiveness of a Pharmacy-Only Refill Program in a Large Urban HIV/AIDS Clinic in Uganda

Joseph B. Babigumira, Barbara Castelnuovo, Andy Stergachis, Agnes Kiragga, Petra Shafer, Mohammed Lamorde, Andrew Kambugu, Alice Muwanga, Louis P. Garrison

1. Pharmaceutical Outcomes Research and Policy Program, School of Pharmacy, University of Washington, Seattle, Washington, United States of America, 2 Infectious Diseases Institute, Makerere University, Kampala, Uganda, 3 Departments of Epidemiology and Global Health, School of Public Health, University of Washington, Seattle, Washington, United States of America

Abstract

Background: HIV/AIDS clinics in Uganda and other low-income countries face increasing numbers of patients and workforce shortages. We performed a cost-effectiveness analysis comparing a Pharmacy-only Refill Program (PRP), a form of task-shifting, to the Standard of Care (SOC) at a large HIV/AIDS clinic in Uganda, the Infectious Diseases Institute (IDI). The PRP was started to reduce workforce shortages and optimize patient care by substituting pharmacy visits for SOC involving multiple physician visits for accessing antiretroviral medicines.

Methodology/Principal Findings: We used a retrospective cohort analysis to compare the effectiveness of the PRP compared to SOC. Effectiveness was defined as Favorable Immune Response (FIR), measured as having a CD4 lymphocyte count of over 500 cells/μl at follow-up. We used multivariate logistic regression to assess the difference in FIR between patients in the PRP and SOC. We incorporated estimates of effectiveness into an incremental cost-effectiveness analysis performed from a limited societal perspective. We estimated costs from previous studies at IDI and conducted univariate and probabilistic sensitivity analyses. We identified 829 patients, 578 in the PRP and 251 in SOC. After 12.8 months (PRP) and 15.1 months (SOC) of follow-up, 18.9% of patients had a FIR, 18.6% in the PRP and 19.6% in SOC. There was a non-significant 9% decrease in the odds of having a FIR for PRP compared to SOC after adjusting for other variables (OR 0.93, 95% CI 0.35–1.38). The PRP was less costly than the SOC (US$ 320 vs. 655 annually, respectively). The incremental cost-effectiveness ratio comparing PRP to SOC was US$ 13,500 per FIR. PRP remained cost-effective at univariate and probabilistic sensitivity analysis.

Conclusion/Significance: The PRP is more cost-effective than the standard of care. Similar task-shifting programs might help large HIV/AIDS clinics in Uganda and other low-income countries cope with increasing numbers of patients seeking care.


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Competing Interests: The authors have declared that no competing interests exist.

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Interpretation
The PRP results in one less FIR for an additional saving of $13,500 from the societal perspective or $11,400 from the MoH (Governmental) perspective.
Cost-Utility Analysis (CUA)

- Uses a non-financial common metric that allows comparisons across the health sector i.e., can compare different drugs or technologies
- Metric is a combination of length of life and quality of life
  - Quality-adjusted life-year (QALY)
  - Disability-adjusted life-year (DALY)
- CUAs may not capture inter-health sector comparisons completely
  - Some health interventions have other outcomes which must be explicitly listed as inputs to the decision-making process
- CUAs require studies to estimate utility (for QALY measurement) or disability weights (for DALY measurement)
- There are many theoretical controversies and measurement issues in this field, but QALYs are generally seen as a reasonable, practical measure of utility to the patient.
QALYs Gained by Health Intervention

QUALITY OF LIFE (Weights)

QUANTITY OF LIFE (Years)

Death
Death
QALYs gained vs. DALYs averted
Cost-Utility Analysis Example

Cost Effectiveness of Facility-Based Care, Home-Based Care and Mobile Clinics for Provision of Antiretroviral Therapy in Uganda

Joseph B. Babigumira,1 Ajay K. Sethi,2 Kathleen A. Smyth3,4 and Mendel E. Singer3

1 Pharmaceutical Outcomes Research & Policy Program, Department of Pharmacy, University of Washington, Seattle, Washington, USA
2 Department of Population Health Sciences, School of Medicine and Public Health, University of Wisconsin, Madison, Wisconsin, USA
3 Department of Epidemiology & Biostatistics, School of Medicine, Case Western Reserve University, Cleveland, Ohio, USA
4 Neurological Outcomes Center, University Hospitals Case Medical Center, Cleveland, Ohio, USA

Abstract

Background: Stakeholders in HIV/AIDS care currently use different programmes for provision of antiretroviral therapy (ART) in Uganda. It is not known which of these represents the best value for money.

Objective: To compare the cost effectiveness of home-based care (HBC), facility-based care (FBC) and mobile clinic care (MCC) for provision of ART in Uganda.

Methods: Incremental cost-effectiveness analysis was performed using decision and Markov modeling of adult AIDS patients in WHO Clinical Stage 3 and 4 from the perspective of the Ugandan healthcare system. The main outcome measures were cost (year 2008 values), life expectancy in life-years (LY) and the incremental cost-effectiveness ratio (ICER) measured as cost per QALY or LY gained over 10 years.
Results

- FBC appears to be the most cost-effective program for provision of ART in Uganda.
- The analysis supports the implementation of FBC for scale-up and sustainability of ART in Uganda.
- HBC and MCC would be competitive only if there is increased access, increased adherence or reduced cost.
Cost-Utility Analysis Example

Evaluating the cost-effectiveness of combination antiretroviral therapy for the prevention of mother-to-child transmission of HIV in Uganda

Andreas Kuznik, a Mohammed Lamorde, b Sabine Hermans, c Barbara Castelnuovo, b Brandon Auerbach, d Aggrey Semeere, b Joseph Sempa, b Mark Ssennono, b Fred Ssewankambo b & Yukari C Manabe b

**Objective** To model the cost-effectiveness in Uganda of combination antiretroviral therapy (ART) to prevent mother-to-child transmission of human immunodeficiency virus (HIV).

**Methods** The cost-effectiveness of ART was evaluated on the assumption that ART reduces the risk of an HIV-positive pregnant woman transmitting HIV to her baby from 40% (when the woman is left untreated) to 25.8%, 17.4% and 3.8%, respectively, when the woman is given: (i) single-dose nevirapine (at an estimated total drug cost of 0.06 United States dollars [US$]); (ii) dual therapy with zidovudine and lamivudine for 7 weeks (at a total drug cost of US$ 15.63); or (iii) ART for 18 months (at a total annual cost of US$ 469.77). Lifetime ART (US$ 6883), recommended for pregnant women with < 350 CD4+ T lymphocytes per mm³, was assumed to give the same reduction in transmission risk in each subsequent pregnancy.

**Findings** Compared with single-dose nevirapine, dual therapy and no therapy, 18 months of ART averted 5.21, 3.22 and 8.58 disability-adjusted life years (DALYs), respectively, at a cost of US$ 46, US$ 99 and US$ 34 per DALY averted. The corresponding figures for lifetime ART are, respectively, 19.20, 11.87 and 31.60 DALYs averted, at a cost of US$ 205, US$ 354 and US$ 172 per DALY averted.

**Conclusion** In Uganda, ART appears highly cost-effective for the prevention of mother-to-child HIV transmission, even if continued over the patients’ lifetimes. Given the additional public health benefits of ART, efforts to ensure that all HIV-positive pregnant women have access to lifelong ART should be intensified.

Abstracts in العربية, 中文, Français, Русский and Español at the end of each article.
Results

- In Uganda, ART appears highly cost-effective for the prevention of mother-to-child HIV transmission, even if continued over the patients’ lifetimes.
- Given the additional public health benefits of ART, efforts to ensure that all HIV-positive pregnant women have access to lifelong ART should be intensified.

Table 2. Results from four models used to evaluate the incremental cost-effectiveness of combination antiretroviral therapy (ART) in Uganda relative to other treatment regimens or none, 2011

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1a: 18-month ART, relative to SDNVP</th>
<th>Model 1b: lifetime ART, relative to SDNVP</th>
<th>Model 2a: 18-month ART, relative to NT</th>
<th>Model 2b: lifetime ART, relative to NT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost difference per patient (US$)</td>
<td>482</td>
<td>4817</td>
<td>689</td>
<td>6883</td>
</tr>
<tr>
<td>Cost offset per patient (US$)</td>
<td>240</td>
<td>884</td>
<td>395</td>
<td>1455</td>
</tr>
<tr>
<td>Incremental cost per patient (US$)*</td>
<td>242</td>
<td>3933</td>
<td>294</td>
<td>5428</td>
</tr>
<tr>
<td>DALYs averted per patient</td>
<td>5.21</td>
<td>19.20</td>
<td>8.58</td>
<td>30.60</td>
</tr>
<tr>
<td>Incremental cost per DALY averted (US$)</td>
<td>46</td>
<td>199</td>
<td>34</td>
<td>172</td>
</tr>
</tbody>
</table>

DALY, disability-adjusted life year; DT, dual therapy; NT, no treatment; SDNVP, single-dose nevirapine; USS, United States dollar.
* Calculated by subtracting the cost offset from the cost difference.
Cost-Benefit Analysis (CBA)

- Places monetary values on inputs (costs) and outcomes thereby allowing comparison of projects (or interventions or investments) across the entire economy.
- The practical difficulty of monetary valuation of benefits and the fundamental problem in health of placing a dollar value on human life (or other health outcomes) limit the use of CBA.
- CBA allows the assessment of intrinsic value i.e., if benefits exceed costs the intervention is worth doing (ignoring deadweight loss from taxation and fiscal constraints).
- CBA results can indicate intervention desirability independently of a comparison to alternatives (other economic evaluation methods cannot).
Monetary Valuation of Health Benefits

- Given good markets for products or labor, benefits and costs can be assessed in monetary terms using market prices.
- In health sector, market prices are often lacking so questions in surveys can be used to estimate hypothetical willingness-to-pay (contingent valuation).
- Two problems of contingent valuation in healthcare suggest caution: tendency for individuals to systematically underestimate risks and ignorance about intervention effectiveness.
- Alternative human capital approach estimates the effect of a health intervention on productivity.
- Other method is value of a statistical life (VSL) — from the applied welfare economist’s perspective, valuing a saved life means finding the amount of money that someone is willing to accept for the extra risk involved with an activity that might, with a specified probability, lead to death.
A SOCIAL COST–BENEFIT CRITERION FOR EVALUATING VOLUNTARY COUNSELING AND TESTING WITH AN APPLICATION TO TANZANIA

ROBERT J. BRENT
Department of Economics, Fordham University, Bronx, NY, USA

SUMMARY

Rationale: There are many interventions for HIV/AIDS that require that people know their status and hence require a HIV test. Testing that is driven by a desire to prevent the spread of the disease often has an indirect effect on others. These external effects need to be identified, quantified and included as part of the benefits and costs of testing. Pioneering analyses of HIV testing by Philipson and Posner have introduced the economic calculus of individual expected benefits and costs of activities into an understanding of the HIV epidemic. What is required for social evaluations is an extension of the analysis to ensure that external effects are included.

Objectives: The objective of this paper is two-fold. First we seek to formulate cost–benefit criteria that incorporate fully the external effects in the evaluation of Voluntary Counseling and Testing (VCT). We achieve this by recasting the individual calculus of benefits and costs to a couple setting. We can then compute an individual’s cost–benefit analysis of being tested with social criteria that look at outcomes from a couple’s perspective for both separate and dual joint testing. Second we aim to apply our social criteria to VCT programs as they currently operate in Tanzania and how these programs might operate in the future when they are scaled up to relate to the general population.

Methodology: We develop social criteria for evaluating separate and dual VCT using a couple’s perspective with and without altruism. Therefore, the welfare function is based on two individual expected utility functions viewed as a couple, either married or regular partners. The benefits are the averted lives lost whenever discordant couples are revealed. The costs of VCT are the benefits of unprotected sex that the couple forgoes and the costs of the testing and counseling. The cost–benefit criteria are applied to VCT programs in Tanzania. The four main ingredients estimated are the foregone benefit of unprotected sex (measured by the compensated wage differentials charged by commercial sex workers); the probability of infection; the cost of an infection (measured by both the value of a statistical life and the human capital approaches) and the cost of a single test (which includes behavior-modifying counseling).

Conclusions: We find separate testing in existing VCT programs to be only marginally worthwhile. However, in scaled-up programs the benefit–cost ratio is over three. Dual testing is always more beneficial than separate testing. However, this advantage is reduced in scaled-up programs. VCT should be greatly expanded throughout Tanzania as future returns would be even higher for both separate and joint counseling and HIV testing. Copyright © 2009 John Wiley & Sons, Ltd.

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KEY WORDS: cost–benefit analysis; social welfare and externalities; Voluntary Counseling and Testing; HIV policy; Tanzania
Methods

- **Interventions**
  - Current VCT and Scaled-Up VCT
  - Separate testing vs. couple testing

- **Costs**
  - Benefits of unprotected sex (measured by the compensated wage differentials charged by commercial sex workers)
  - Costs of VCT (including behavior modification counselling)

- **Monetized benefits**
  - Averted lives lost whenever discordant couples are revealed (product of the probability of infection and cost of infection measured as the VSL and human capital approaches)
Results

- Separate testing in existing VCT programs is only marginally worthwhile
- Scaled-up programs are cost-beneficial (have benefit–cost ratio of over three)
- Dual testing is always more beneficial than separate testing but this advantage is reduced in scaled-up programs
- VCT should be greatly expanded throughout Tanzania as future returns would be even higher for both separate and joint counseling and HIV testing
Thanks Very Much

babijo@uw.edu