

ECONOMIC EVALUATION OF HIV/AIDS INTERVENTIONS

Exercise: Costs and cost-effectiveness analysis of prevention strategies

The Objectives of this exercise are to provide participants with the practical experience of costing HIV/AIDS related programmes, and performing a cost-effectiveness analysis

HIV/AIDS is a major concern for policy makers in Southland¹ as it is for many other countries around the world. In 2006 it was estimated that 15% of the adult population (15-60 years) was HIV positive, whereas an average incidence of 2% of new infections per year has been estimated during the last 5 years. Although Southland is a poor country (considered a developing country with a GDP per capita of \$2,500) the government has decided to give a high priority to the HIV/ AIDS epidemic. In an inter-sector approach, with collaboration between the Ministry of Health, the Ministry of Education, and the Ministry of Social Development, the authorities have decided to embark in the implementation of three different strategies that target the adult population for prevention. Six months have already passed since the strategies were implemented, and although the authorities have kept records of the resources and expenditures involved, they do not have any idea of the unit costs of each approach. In order to obtain this valuable information, which would allow them to evaluate the strategies and decide on future modification of implementation issues, they have decided to hire you in a short term contract.

2. Aim of the exercise (part 1)

The aim of this exercise is to provide you with practical skills to analyse and determine average unit costs as well as incremental costs. And secondly, to improve your ability to use this information to inform policy decisions.

3. General questions for unit cost and incremental costs (Part 1 and 2):

- 1. How much does it cost to provide each programme per facility and per each adult covered?**
- 2. How much would it cost to increase the coverage of the programme by increasing the intensity of each strategy as described below?**

Please note the assumptions and hints you should use in the analysis before you start.

4. List of abbreviations used:

¹ Southland is a hypothetical country, whose data has been created only for illustrative purposes. However, most of the data presented here could well represent the situation of a real country

| | |
|----------|--|
| HIV/AIDS | Human Immunodeficiency Virus /Acquired Immunodeficiency Syndrome |
| GP | General Practitioner (medical doctor in PHC) |
| MoH | Ministry of Health |
| PHC | Primary Health Care |
| ARV | Antiretroviral |
| STDs | Sexually Transmitted Diseases |
| VCT | Voluntary Counselling and Testing |

5. Description of the strategies used²:

Strategy 1: Mass media campaign. The purpose of this strategy was to encourage behaviour change in order to minimise the risk of infection. The media messages encouraged condom use and encouraged a decrease in numbers of sexual partners. The message also informed people on the availability of further information. This strategy was carefully designed with the help of four experts: a psychologist, a sociologist, an advertising expert and a media coverage expert. TV and radio were chosen as the types of media for advertising. The campaign was broadcasted on the national TV channel NTVS, (owned by the government) and the main Southland radio station, Radio1 (privately owned). One advertisement was broadcasted per day on NTVS at around 8 pm (lasting 3 minutes), whereas 3 advertisements were transmitted by Radio1 (in the morning, at midday and in the evening - each lasting 1.5 minutes). More details of the resources used and populations reached are provided in table 1.

Table 1: parameters per Mass Media Campaign³

| <i>Mass Media Campaign (for HIV/AIDS prevention)</i> | <i>Unit cost \$</i> | <i>Other data</i> |
|--|---------------------|-------------------|
| Cost per minute for TV broadcast | 1,200 | |
| Cost per minute for radio transmission | 120 | |
| Cost per hour/ each professional in strategy design team | 60 | |
| Production cost of TV advertisement (incl. payments to actors and production team) | 4,000 | |
| Production cost of radio advertisement | 800 | |
| Number of hours per professional working in design | | 40 |
| % of people reached by NTVS | | 60% |
| % of people reached by Radio 1 | | 82% |

Strategy 2: Increasing STD treatment in public healthcare facilities. This approach comprises increasing detection and treatment of STDs. To launch this strategy the MoH distributed protocols for diagnoses and treatment of STDs to all

² Note that each strategy can be defined in many different ways from country to country. To simplify the analysis we have also simplified the implementation of each the strategy.

³ All numerical data has been also transferred into an excel sheet where you should carry out the analysis

PHC facilities. Most of the patients have been recruited by the medical staff after requesting services for other conditions (depending on risk profile). No additional human resources have been added to the facilities; however, GPs have been diverting some time from other activities to comply with this policy. It was also requested at the central level that one nurse per facility would be responsible for monitoring this policy (it was estimated that this would require, on average, one day per month). In order to evaluate this approach the authorities have been collecting data on costs and patients treated. An initial sample of 10 facilities was carefully selected. The sample accounts for variation between facilities and should therefore provide a good approximation of national unit costs. For simplicity, we are providing you with the average values across the 10 facilities⁴.

Table 2.1: Facility recurrent and capital costs (monthly average)

| <i>Average recurrent expenditure per facility</i> | <i>2004 \$</i> |
|--|-----------------------|
| Personnel (whole facility) | 38,000 |
| Drugs and medicines (incl. STDs) | 12,800 |
| Administration | 1,900 |
| Maintenance | 1,980 |
| Utilities (electricity, cleaning, water, etc) | 1,900 |
| Transport | 1,300 |
| Other | 800 |
| <i>STD related recurrent expenditure</i> | |
| Drugs (antibiotics) for treatment | 800 |
| Laboratory tests | 135 |
| Monthly Nurses salary | 1,200 |

Table 2.2: Description of capital costs

| <i>Average capital costs per facility (in 2004 \$)</i> | <i>Replacement cost</i> | <i>Expected Useful Life</i> |
|---|------------------------------------|--|
| Furniture and equipment | 120,000 | 5 years |
| Buildings | 280,000 | 30 years |
| Vehicles | 65,000 | 10 years |

Table 2.3: Average monthly activities per facility

| | |
|--|--------------------|
| <i>Visits headcounts (appointments) ⁵</i> | <i>4500</i> |
| STD patients treated | 120 |
| Average number of visits per treated STD patient | 2.5 |

⁴ A methodologically sound approach is to estimate unit cost per each facility separately and then to present general average costs across all facilities. This would capture variation between facilities. In costing a NSP, these differing costs must be accommodated.

⁵ This includes STDs appointments

Strategy 3: Providing Voluntary Counselling and Testing (VCT) in the facilities. Based on a well-designed protocol for VCT developed at the central level, this strategy was implemented in Southland PHC facilities which were relatively accessible to patients and that had a private room available for this activity. VCT was carried out by counsellors (psychologists) who were hired on a part time basis and who received a week of training in the DoH prior to programme initiation. VCT was planned in three standard appointments; pre-test counselling, testing and post-testing counselling. Pre and post-test counselling each lasted 30 minutes. A special leaflet with general information on HIV/AIDS prevention was provided to each client in the pre-testing counselling session. Although testing was completely voluntary, some of the clients tested did not return for post-test counselling. Condoms were also offered to all clients and provided on request. To evaluate the strategy data collection of activities, patients and resources involved was closely monitored in five clinics. In Table 3 we provide you with the average values observed in these facilities.

Table 3.1: Facility recurrent and capital costs (average per month)

| <i>Average recurrent expenditure per facility</i> | <i>2004 \$</i> | |
|---|-----------------|---------------------|
| Personnel (whole facility) | 48,000 | |
| Drugs and medicines (incl. condoms & HIV test kits) | 15,000 | |
| Administration | 2,800 | |
| Maintenance | 1,890 | |
| Utilities (electricity, cleaning, water, etc) | 2,000 | |
| Transport | 1,800 | |
| Other recurrent expenditure | 1,500 | |
| <i>VCT related recurrent expenditure</i> | <i>Quantity</i> | <i>Unit cost \$</i> |
| Condoms distributed | 1200 | 0.045 |
| HIV testing kits | 64 | 3 |
| HIV prevention leaflets | 95 | 1.5 |
| Monthly counsellor salary | | 1500 |

Table 3.2: Description of capital costs

| <i>Average capital costs per facility</i> | <i>Replacement cost in 2004 \$</i> | <i>Expected useful life</i> |
|---|--|-----------------------------|
| Furniture and Equipment | 120,000 | 5 years |
| Buildings | 350,000 | 30 years |
| Vehicles | 75,000 | 10 years |
| Training of VCT counsellors | To estimate | 3years |
| <i>VCT related capital expenditure (average for all facilities)</i> | | |
| Buildings | It was estimated that the area of the room used by the programme constituted 4 % of the entire facility area | |

Table 3.3: One week training on costs

| <i>VCT training programme costs</i> | <i>Cost in 2004 \$</i> | <i>quantity</i> |
|---|------------------------|-----------------|
| Trainers full salary cost/hour | 50 | 4 |
| Per diem per trainee | 30 | 20 |
| Material distributed per trainee | 10 | 20 |
| Mean travel cost per trainee | 15 | 20 |
| Room and equipment rent paid per training programme | 100 | 1 week |

Table 3.4: Average monthly activities per facility

| | |
|---|-------------|
| Total visits headcounts (appointments)⁶ | 6000 |
| Total pre-test counselling sessions | 95 |
| Total patients tested | 64 |
| Total post-test counselling sessions | 52 |

Practical question 1 - unit costs:

For strategy 1 please provide:

- 1) Total cost of implementing the strategy during the six month period, note that all costs here are considered recurrent costs (see assumptions).
- 2) The unit cost per person covered by each media used (you will need to use some demographic data from appendix 1) and used the relative weight of non-shared costs to allocate shared cost. *(For example, if radio costs constitute 20% of all non-shared costs then you should allocate 20% of shared costs to radio media).*
- 3) The unit cost per person covered by any media (see assumptions)

For strategy 2 please provide:

- 4) Total average monthly cost of implementing STD treatment per facility. For the allocation of shared costs you should use the weighting of STD visits on total facility visits headcounts.
- 5) The unit cost per person treated for STD

For strategy 3 please provide:

- 6) Total average monthly cost of implementing VCT per facility. For the allocation of shared costs you should use the weighting of VCT visits on total facility visits headcounts (check assumption on time per appointment).
- 7) The unit cost per person that attended at least one counselling session (i.e. pre-testing sessions)
- 8) The unit cost per person that completed the counselling process.

⁶ This includes pre and post –testing appointments. Note testing session are not included in total headcounts as this activity is done in the laboratory

Practical question 2 - incremental costs:⁷

For the estimation of incremental costs we are assuming that strategy 1, 2 and 3 would have been implemented slightly differently - basically using some extra resources in order to obtain a higher coverage. The modified versions of these strategies are explained below.

Modified Strategy 1 corresponds to Strategy 1 but includes a second, more rural oriented, radio station, radio2. Radio2 has the ability of reaching an additional 7% of the target population (not covered by other media). The number of broadcasts per day, duration of broadcasts and cost per minute remained the same as for radio1:

- 9) Calculate the total incremental cost of adding radio2 to **strategy 1**
- 10) Estimate the average incremental cost per additional person reached with radio2.

Modified Strategy 2. In the modified version each facility would have been provided with 22 extra hours of a GP to meet the increased demand for STD treatment (salary of \$2500 per month). This would have increased the number of people treated for STDs by 20%. Consequently the cost per drugs (antibiotics), as well as the cost per laboratory tests of these patients would have increased in 20%.

- 11) Calculate the total incremental cost per month of **modified strategy 2** (in relation to **strategy 2**)
- 12) Estimate the average incremental cost per additional person treated for STD in **modified strategy 2** (in relation to **strategy 2**).

Modified Strategy 3. It has been suggested that a more extensive counsellor training lasting two weeks would have allowed counsellors to develop more skills to compel clients to be tested and to come back for the post-testing counselling session. The modified strategy 3 includes a two weeks training, with cost of training increasing proportionally (doubling). This modification would have brought the number of clients choosing to be tested up to 86, those completing the post-testing session to 80 (average per month) and the condoms distribution up to 30%. Note that the number of HIV test kits and post-test sessions need to be increased accordingly.

- 13) Calculate the total incremental cost per month of **modified strategy 3** (in relation to **strategy 3**)

⁷ Before undertaking a new *study question*, participants will be provided with the model answer of the previous *study question*

- 14) Estimate the average incremental cost per additional person attending the post-test session in **modified strategy 3** (in relation to **strategy 3**).

Study question 3 - interpretation of results so far⁸.

- 15) What conclusions for policy decisions can be drawn from the unit cost of each original strategy?
- 16) Is unit cost information enough to guide policy decisions regarding which interventions should be implemented? How would one estimate the cost of a national programme with all 3 strategies? What additional information should be considered?
- 17) Based on the incremental analysis you performed for each strategy, what version of the strategy would you implement (original or modified)? What other factors might influence this decision?

8. Necessary assumptions

Economic evaluation normally requires the use of certain assumptions. This is because detailed data is scarce (especially in developing countries), and because available data does not always exactly meet your needs.

For this evaluation you will need to use the following assumptions:

1. Discount rate is 6% (for capital costs)
2. For strategy 1, 6 months is equivalent to 180 days
3. For strategy 1, the initial cost of planning and recording the messages is a sunken cost and does not constitute a capital cost. This is because the authorities have decided not to continue broadcasting the message after the six month period without a complete evaluation.
4. For strategy 1 (question 3) a person is counted only once, even if covered by more than one form of media
5. For strategy 1 (question 3), media coverage experts have suggested that 95% of people covered by NTVS are also covered by radio 1.
6. For strategy 3 (question 6) in the calculation of the allocation factor for shared costs assume that VCT visits (pre and post-testing) take, on average, twice as much time (30 minutes) as normal facility visits (15 minutes).
7. For the healthcare facilities assume that a full monthly salary corresponds to 176 working hours per month.

⁸ This study question can be discussed in groups of 4 and a summary of the issues /answers discussed per group should be presented by one participant per group

8. Assume that a month has 22 work days and a day has 8 work hours (one week has 40 hours).
9. For strategy 3, the personnel includes patient specific staff (such as GPs and counsellors) and non-patient specific staff. The latter constitutes 40% of all personnel, which you need to allocate using visit headcounts.
10. Inflation for 2004 = 0.06

Hints:

- To estimate the annual cost of capital use the excel function PMT, entering the 'present value' preceded by a negative sign. You can also use discount tables to identified the factor (denominator) that allow you to get the annual cost (based on discount rate and years of useful life)
- For the calculation of the incremental strategies in excel you can copy the sheet which contains the results of the original strategy and perform the changes on it.

Study question 4- cost-effectiveness ratios (CEA)

Based on some assumptions about the ability of each of the previous strategies at averting new infections for HIV/AIDS, you are required to estimate total costs and effects, using the outcome of infections averted, to calculate the cost per infection averted, and to plot your results in a cost-effectiveness plane.

Table 4 was constructed by a team of epidemiology and policy analysis experts from Southland, as well as policy makers from PHC. The team, which also reviewed literature and documents on effectiveness in similar settings, estimated the impact of these approaches in preventing HIV/AIDS infections in Southland. Given the uncertainty of these estimations they have provided ranges to perform sensitivity analysis.

Table 4: Effectiveness of strategies analysed

| <i>Strategy</i> | <i>Intermediate output unit</i> | <i>Effectiveness (cases averted per output unit)</i> | <i>(ranges for Sensitivity Analysis)</i> | <i>Coverage of strategy</i> |
|------------------------------|--|---|---|------------------------------------|
| Mass media campaign | People reached | 1 per 50000 | (40000-70000) | Entire country |
| Modified mass media campaign | People reached | 1 per 40000 | (30000-60000) | Entire country |

| | | | | |
|-------------------------------|--|-----------|-----------|-----------------|
| STD treatment in PHC | People treated | 1 per 100 | (100-200) | 1000 facilities |
| Modified STD treatment in PHC | People treated | 1 per 100 | (100-200) | 1000 facilities |
| VCT in PHC | People who attended entire counselling | 1 per 120 | (100-200) | 500 facilities |
| Modified VCT in PHC | People who attended entire counselling | 1 per 120 | | 500 facilities |

Please provide for the scale of activities described and for the six months of implementation:

- 18) Total costs and total effectiveness (intermediate outcomes) for each of the **six strategies**, for the six month period.
- 19) Cost per infection prevented with each of the six strategies
- 20) Plot your results in a cost-effectiveness plane
- 21) Considering that 'original' and 'modified' strategy are mutually exclusive for implementation, which 3 strategies should you recommend for implementation (based on CEA results)

Study question 5- Cost utility analysis (CUA)

The same group of experts that estimated the infections averted by each strategy has done an estimation of the average QALYs gained per infection averted with each strategy. The experts have suggested that different strategies allow preventing infection a different average each. For example, it was estimated that the Mass Media Campaign reaches a relatively younger population, therefore impacting greatly on the average number of QALYs gained when preventing an infection. Southland Life expectancy for individual alive at 17 was taken as 57 years, whereas life expectancy after infection was taken as 20 years (accounting for probability of ARV treatment), all QALYs were discounted at 6%.⁹

Using these data please provide:

- 22) Total QALYs gained per each strategy (for the whole evaluation period)
- 23) Cost per QALY gained with each approach
- 24) Considering that 'original' and 'modified' strategy are mutually exclusive for implementation, which 3 strategies should you recommend for

⁹ You will be provided with a complete detail of the calculation of QALYs in the spreadsheet of 'base data for CEA)

implementation (based on CUA results) How different are the strategies selected from those you selected using CEA results? Is there any change in the ranking for CEA/CUA result?

Study question 6: Incremental cost effectiveness ratios (ICER)

- 25) Use the three strategies you selected with CEA to estimate ICERs. (rank the strategies by effectiveness)
- 26) Interpret your results obtained. What policy changes would you recommend? How could you communicate these results to guide policy makers?

Appendix 1: Demographic and epidemiological data of Southland 2004

| | |
|------------------------------|------------------------------|
| Total population | 26,500,500 |
| Rural population | 45% of total population |
| Adult population (age 15-60) | 40% of total population |
| Adult population with HIV | 15% of adult population |
| Estimated annual incidence | 2% of susceptible population |
| STD prevalence | 5% of adult population |
| PHC facility coverage | 80% of adult population |