The Role of Community Acceptance Over Time for Costs of HIV and STI Prevention Interventions: Analysis of the Masaka Intervention Trial, Uganda, 1996–1999

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Objective: The objective of this study is to estimate the annual costs of information, education, and communication (IEC), both community- and school-based; strengthened public and private sexually transmitted infections treatment; condom social marketing (CSM); and voluntary counseling and testing (VCT) implemented in Masaka, Uganda, over 4 years, and to explore how unit costs change with varying population use/uptake.

Study: Total economic provider’s costs and intervention outputs were collected annually to estimate annual unit costs between 1996 and 1999. In early intervention years, uptake of all activities grew dramatically and continued to grow for public STI treatment, CSM, and VCT. Attendance at IEC performances started to drop in year 4. Unit costs dropped rapidly with increasing uptake of and participation in interventions.

Conclusions: When implementing long-term community-based interventions, it is important to take into account that it takes time for communities to scale up their participation, since this can lead to large variations in unit costs.

INTERVENTIONS TO PREVENT human immunodeficiency virus (HIV) and sexually transmitted infections (STI) are being implemented and scaled up in many countries without detailed information on their resource requirements, communities’ demand for interventions, and how these change over time and program maturity. It is recommended that costings of community intervention capture both the startup period and be continued long enough for the intervention to have been accepted by communities, when its outputs will have reached a steady state. However, because multiyear economic evaluations are rare, many estimates of the costs of scaling up interventions have had to rely on costs from a single point in time as model inputs. Estimates from a single point in time cannot incorporate the impact of increases of acceptance or uptake over time on unit costs. Interventions with low marginal costs such as information, education, and communication (IEC) can expect changes in uptake to have a greater impact on their unit costs, leading potentially to incorrect conclusions about intervention efficiency and resource requirements for expanding programs.

This is the first study to explore the impact of community acceptance/uptake on the costs of HIV-prevention interventions. Costs and outputs of IEC, both community- and school-based; strengthened STI services; condom social marketing (CSM); and voluntary counseling and testing (VCT) in Masaka, Uganda, were collected over 6 years. Although costs have been estimated for similar interventions in developing countries, unit costs over time and scale of output are available in the literature only for CSM and school-based programs; these showed declining unit costs over time. We estimate annual unit costs for the interventions implemented in the context of the Masaka Intervention Trial (MIT) between 1996 and 1999.

Methods

Setting and Interventions

The HIV epidemic in Uganda peaked in 1989, with an estimated national prevalence of 13.3%, with a subsequent decline to approximately 4.4% in 2001. Between 1994 and mid-2000, a range of HIV-prevention interventions was evaluated as part of the MIT,
a 3-armed randomized controlled trial in 18 parishes in Masaka, Uganda. The aim of the trial was to measure the impact of (i) IEC alone and (ii) IEC with syndromic STI management on reducing HIV incidence and other STI at community level. In arms A and B, a standardized behavior change/IEC intervention was introduced. In arm B, STI treatment services were strengthened in government and private health facilities. The control arm, C, received community development activities with home-based care for house- or bed-bound patients regardless of their underlying condition. All arms received VCT and CSM. The trial was conducted by staff employed by the Medical Research Council (MRC). The interventions were sequentially introduced by parish between 1994 and 1996. Each parish had a population of approximately 5000 to 6000 adults; thus, approximately 32,000 adults were targeted per arm.

IEC was implemented at the community level. The main intervention components were general community meetings in conjunction with dramas, video shows, education via community-based volunteers, and a shorter schools program, described in detail elsewhere. For this analysis, we distinguish between performance activities (drama and video performances led by the central MRC-based IEC team) and community-led activities (meetings ranging in size from 2 to several hundred and led by a local resident such as the parish coordinator or the community educators). The field-based staff was supervised monthly by the central IEC team, which consisted of a coordinator, 3 health educators, and a part-time drama consultant. Within the IEC component, a comprehensive acquired immunodeficiency syndrome education program was implemented in 66 schools staggered over the 12 parishes between 1996 and 1998. In total, 148 teachers were trained. The curriculum consisted of 19 program activities for students aged 12 to 16 to be covered during scheduled classroom time or as an extracurricular activity. Despite intensive supervision, the school program was incompletely implemented and had little impact on knowledge, overall attitude, intended condom use, or intended assertive behavior.

The STI intervention entailed training all public (n = 49) and private (n = 40) health care providers within 6 parishes in syndromic management of STI. Government health clinics were provided with some basic equipment and supplies such as an examination couch, a screen, a drug cupboard, and drugs. The private practitioners were only supplied with a water filter and STI drugs (ciprofloxacin, doxycycline, and erythromycin) that were newly introduced specifically for the management of STI at cost. Providers were supervised every 2 weeks and given any additional training needed, and supplies were replenished. During consultations free condoms were offered to patients.

CSM and VCT were provided in all 18 parishes. The condom promoter distributed condoms monthly to established commercial outlets in all 18 parishes for resale. Twice monthly, 2 trained counselors visited communities in order to provide VCT services. Initially, HIV testing was done centrally, and clients were required to return for results after 2 weeks. In 1999, rapid tests were introduced, and results were provided to clients at the same visit. CSM and VCT interventions could not be formally evaluated for HIV infections or STI averted. The trial results were analyzed at 2 levels. The first analysis was at the community level comparing the intervention arms A and B with the control arm C; analysis at community level did not show an impact on HIV incidence. The individual level analysis of these data looked specifically at the impact of the IEC-only intervention on those who attended at least 1 activity and were sexually active. This analysis found a significant reduction in HIV incidence for women.

Costs

Costs are presented by intervention, input type, and year of project activity. Economic costs were collected retrospectively by year from the provider’s perspective (MRC) between 1994 and 1999 using a step-down costing methodology. This method allocates total program costs to the different interventions (IEC, STI, etc.) to obtain intervention costs. Economic costs represent the value of all resources used in the intervention, including project expenditures and an estimated value for donated goods and time. Inputs donated to the intervention were government health worker and private practitioner time. Full costs are presented for the IEC, CSM, and VCT interventions. For the STI and the school intervention, costs presented are incremental to the existing health and education infrastructure and should thus be considered as incremental costs. Data were collected from existing financial data, interviews with key project staff, and observation of activities. Costs for startup and implementation of MIT activities were included. Because of the sequential implementation, introduction of activities in parishes occurred between 1995 and 1996. By the end of 1995 about half the parishes were in the implementation stage, with all running by the end of 1996. As it is difficult to disentangle startup from implementation during 1995 and 1996, we consider the startup period as 1994 and 1995 and all of 1996 as implementation. Startup costs were treated as a capital cost and were spread over the 5-year life of the project (the full program ended during 2000). Capital costs were annualized using a 3% discount rate, as is commonly recommended by costing guidelines. Expenditures in Ugandan shillings (USh) were converted to US dollars ($) at the average exchange rate during the year of the expenditure (1000–1472 USh per $). All costs were converted to 2001 $ using an average inflation rate of 3.2%. All costs associated with research-related activities were excluded from the analysis.

Average Costs

Annual intervention costs were divided by annual intervention outputs to obtain annual unit costs. Outputs used were the number of IEC activities held (performance and community led); attendance at IEC activities, syndromes treated at public and private clinics; condoms distributed through CSM; people collecting their HIV test results from the counseling service.

Sensitivity Analysis

During this analysis, a number of assumptions were made. We estimated the impact of these assumptions on unit costs in a sensitivity analysis. A univariate analysis varied 1-by-1: the allocation of central support costs up and down by 15% about the baseline allocation; the discount rate between 0% and 10%; and because the introduction of the intervention was spread over 2 years, we looked at the impact of defining the start-up period as 1994 only, rather than 1994 and 1995. The multivariate sensitivity analysis considered the most favorable options (discount rate 0%, support costs reduced by 15%, and only 1994 as start-up period) and the least favorable assumptions (discount rate 10%, support costs increased by 15%, and start-up period as 1994 and 1995).

Total Costs

Table 1 shows the total 4-year economic costs of IEC, STI, CSM, and VCT. The total cost of the community-based IEC intervention in the 2 arms was $616,298, of which 46% was spent on the performance activities. The school intervention was only implemented for a
year in each school and cost $165,584. The other major intervention was the strengthening of STI services in the public and private sectors. The public-sector STI management came to $278,708, and the private sector came to $123,468. The cost of CSM was $142,881; and of VCT, $114,761. Labor was the largest single expenditure, covering over 40% of all expenditures for the IEC, school, and STI interventions. Startup ranged from 9% to 23% of total costs. Supplies, including condoms and HIV-test kits, made up a larger portion of the CSM and VCT interventions than the other interventions (39% and 53% versus 2% to 10%, respectively).

**Community Participation and Uptake**

The activities and attendance of the IEC intervention grew during the first 3 years (Fig. 1). During 1999, video and drama performances were starting to be scaled down and occurred less frequently. Attendance rates for performances were highest in 1997, attracting on average 113 people per show. Community-led IEC activities, led by parish coordinators and community educators, continued to rise. The number of people presenting for an STI continued to grow over time, with the exception of private treatment in 1999. This is consistent with the trial results that showed increased recognition (reporting) of STI syndromes with intervention maturity but no serological evidence of an increase in STI.17 Additionally, improved services may have provided an incentive to actually present for treatment at the clinic. The VCT uptake and the number of condoms sold in commercial outlets went from 713 people receiving their HIV test results and 202,940 condoms distributed in 1996 to 1526 and 567,180, respectively, in 1999.

**Average Costs**

Annual average costs can be found, along with annual total costs and annual outputs, in Figure 1. Although total costs grew each year, the number of IEC activities remained steady, while the number of people treated for STI rose quickly, which led to decreasing unit costs. This was most pronounced between 1996 and 1997. Averaging over the interventions, between 1996 and 1997, total costs increased by 12%, and uptake increased by 76%. This led to a strong drop in average costs between the first and second year of implementation, ranging from 11% for public sector STI treatment to 58% for community-led activities. From 1997 to 1998, there was an average increase in uptake of 42%, and from 1998 to 1999, the average increase was 14%; average costs dropped by 14% and 4% in 1998 and 1999, respectively. In the last year, there was a drop in STI treated in the private sector and performance activities and attendance. This was reflected in their average costs: with a 12% increase in the cost per STI treated in the private sector and a 17% and 25% increase for performance activities and attendance, respectively. There was no clear pattern for the changes in unit costs of performance activities. Unit costs per attendance at performance activities in 1996 were $3.66, $2.05 in 1997, increasing again to $2.65 in 1999. The cost per syndrome treated in the public sector in 1996 was $3.66, dropping to $2.1 in 1999. In the 66 schools participating in the schools-based HIV-prevention program, 3500 students were exposed to the intervention, giving a unit cost of $47 per student.

The sensitivity analysis explored a number of assumptions (Table 2). The costs were fairly robust to changes in discount rate (0% and 10%) and variations in the amount of central support received (up and down 15%). Defining the startup period as “1994 only” would have led to a 13.0% drop in the 4-year cost of the intervention. Using the most favorable assumptions would give a cost of 15.1% lower than the current central costs, and all the least favorable assumptions would lead to 5.9% higher costs.

**Discussion**

This study estimated the total and unit costs over 4 years of HIV-prevention interventions in Uganda and explored the impact of increased community acceptance and uptake on measures of relative efficiency, such as unit costs. There was a strong increase (74%) in the uptake of interventions between the first and second year, accompanied by a 34% drop in unit costs. Although uptake continued to grow in the third year, by the fourth year some of the interventions experienced saturation and even a drop in uptake. For example, there was a 17% drop in activities and a 25% drop in attendance for the performance activities. Individuals may find it interesting to attend an activity once, twice, or even thrice but become less interested by the fourth drama, video show, or community meeting. This saturation effect was not seen in the other interventions within our time frame (STI, CSM, VCT).

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**TABLE 1. Total Economic 4-y Intervention Costs by Inputs (1996–1999)**

<table>
<thead>
<tr>
<th></th>
<th>IEC %</th>
<th>School* %</th>
<th>STI %</th>
<th>Condom %</th>
<th>VCT %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capital costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buildings</td>
<td>2,727</td>
<td>0.4</td>
<td>1,087</td>
<td>0.7</td>
<td>1,613</td>
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<td>Equipment</td>
<td>3,088</td>
<td>0.5</td>
<td>471</td>
<td>0.3</td>
<td>1,986</td>
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<tr>
<td>Vehicles</td>
<td>27,940</td>
<td>4.5</td>
<td>13,927</td>
<td>8.4</td>
<td>8,534</td>
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<tr>
<td>Start-up</td>
<td>129,511</td>
<td>21.0</td>
<td>38,216</td>
<td>23.1</td>
<td>85,506</td>
</tr>
<tr>
<td><strong>Total capital costs</strong></td>
<td>162,266</td>
<td>26.5</td>
<td>53,701</td>
<td>32.4</td>
<td>97,659</td>
</tr>
<tr>
<td><strong>Recurrent costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personnel</td>
<td>303,156</td>
<td>49.2</td>
<td>73,005</td>
<td>44.1</td>
<td>210,781</td>
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<tr>
<td>Supplies</td>
<td>19,349</td>
<td>3.1</td>
<td>2,878</td>
<td>1.7</td>
<td>40,270</td>
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<tr>
<td>Vehicles O&amp;M</td>
<td>58,484</td>
<td>9.5</td>
<td>18,635</td>
<td>11.3</td>
<td>10,872</td>
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<tr>
<td>Building O&amp;M</td>
<td>4,763</td>
<td>0.8</td>
<td>1,411</td>
<td>0.9</td>
<td>2,818</td>
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<td>Central support costs</td>
<td>62,846</td>
<td>10.2</td>
<td>14,087</td>
<td>8.5</td>
<td>37,174</td>
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<tr>
<td>Other</td>
<td>4,434</td>
<td>0.7</td>
<td>1,866</td>
<td>1.1</td>
<td>2,623</td>
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<tr>
<td><strong>Total recurrent costs</strong></td>
<td>453,032</td>
<td>73.5</td>
<td>111,883</td>
<td>67.6</td>
<td>304,538</td>
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<tr>
<td>Total (1,441,700)</td>
<td>616,298</td>
<td>100</td>
<td>165,584</td>
<td>100.0</td>
<td>402,176</td>
</tr>
</tbody>
</table>

| Target area, approximate population | 12 Parishes (arms A and B), 64,000 | 6 Parishes (arm B), 32,000 | 18 Parishes (arms A, B, and C), 96,000 |

Q&M = operating and maintenance. All costs presented in 2001 dollars.

*The school costing is for 3 y.
Fig. 1. Intervention outputs, total costs and unit costs by year.
Although costs over time were explored, due to the nature of the costing by year rather than parish, it was impossible to precisely disentangle startup from implementation in 1995 and 1996. The consequence is that maturity of the intervention cannot be defined as precisely as we would have liked and that implementation in some of the parishes will be more mature than in others throughout the study.

Economic analyses that rely only on a single year time frame, or which report costs over a limited period of time, may miss the extent to which costs change over time. If projects are considered only in their first year of operation, before they have reached their optimal scale of output, it is unlikely that their average costs are representative of long-term unit costs. Similarly, costs of mature programs may underestimate the costs of interventions in their early implementation years.

Existing costs of services providing syndromic management of STI show a wide range of unit costs. These range from $0.01–$0.06, depending on the media type. Clearly, these are 2 very different types of IEC interventions, and comparison of unit costs is not justified.

This study highlights that program managers and funders need to be aware of the importance of community uptake on measures of relative program efficiency when comparing the unit costs of different interventions at different stages of maturity. When modeling the cost of scaling up community interventions, it is crucial to take project maturity into account.

References