

Cost effectiveness of facility and home based HIV voluntary counseling and testing strategies in rural Uganda

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Abstract

Background: In Uganda, the main stay for provision of human immunodeficiency virus (HIV) voluntary counseling and testing (VCT) has been at health facilities. Home based VCT on the other hand, was initiated in the country to improve service coverage.

Objective: To evaluate the cost effectiveness of facility- and home-based HIV VCT strategies in rural southwestern Uganda.

Methods: Data on costs and effectiveness of facility- and home-based HIV VCT intervention strategies was collected in two sub-Counties in rural southwestern Uganda. Costing was performed using the ingredients approach. Effectiveness was measured as the number of HIV sero-positive clients identified. Incremental Cost-Effectiveness Ratios (ICERs) were calculated from the provider perspective.

Results: The cost per client tested were US\$6.4 for facility based VCT and US\$5.0 for home based VCT. The corresponding costs per positive case identified were US\$86.5 and US\$54.7 respectively. The incremental cost to providers per additional positive case identified by facility based VCT was US\$3.5.

Conclusion: Home based VCT was the least costly strategy per client tested and was also cost effective in identifying HIV sero-positive clients in rural areas. This strategy should therefore be promoted to improve service coverage and thereby facilitate early and extensive detection of clients eligible for treatment.

Key words: cost effectiveness; facility and home based VCT; positive cases identified; Uganda

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Introduction

HIV VCT that relies mostly on individuals presenting themselves and giving voluntary informed consent^{1, 2} is a key component of national AIDS programs in sub-Saharan Africa³, especially in prevention and treatment^{4, 5}. Individuals or couples undergo pre-test counseling, risk assessment, a same-day rapid HIV test, post-test HIV prevention counseling, and referral for medical and support services by trained counselors⁶. Through post-test counseling, high-risk

HIV-uninfected individuals are able to re-think about their lives and change their risk sexual behavior while those who are positive can be linked to care and treatment. The timely identification of HIV sero-positive clients through VCT and their subsequent enrollment on treatment enables them to be healthier and live longer, reduces the incidence of AIDS-related opportunistic infections and has broader population benefits by reducing onward transmission of the virus⁷. HIV infected clients are also able to access prevention of mother-to-child transmission services, cotrimoxazole and isoniazid prophylaxis⁸.

Different strategies have been used to offer VCT services, including at the work place, through mobile clinics and home-based models⁹. However, the main stay for provision of VCT in Uganda has been at health facilities (facility-based) supplemented

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by stand-alone clinics (such as the AIDS Information Centre) and mobile outreach programs. Facility-based VCT is located preferably at a County level health centre (level IV) and above, where capacity and associated HIV/AIDS services are available. However, Sub-county level health centres (level III) with adequate capacity (personnel, supplies and laboratory facilities) also provide VCT. The health facility may be either public or non-government aided such as faith-based health units. VCT services at such sites are integrated into existing health services on a daily basis or if a facility is inadequately staffed, specialized VCT clinic days are established¹⁰. However, for various reasons particular groups of clients such as the young and men may not be willing to visit health facilities for VCT. Further, with inadequate staffing at health facilities, occurrence of emergencies may interrupt the provision of VCT services². The home based model was therefore initiated as an alternative to improve equity in access to VCT. In this model, counseling and testing is offered within the home. It involves the use of counselors or community health workers who offer and provide counseling and testing to family members¹¹.

In Uganda, the estimated number of testing and counseling health facilities per 100,000 of the adult population was 13 in 2010, up from 8.5 in 2009¹². While the number of people 15 years and older who had received HIV VCT was 18.1% in 2010 slightly up from 16.5% in 2009¹². The Government of Uganda has set a target of increasing the proportion of people who know their HIV status from currently 38% to 70% by the year 2015¹³. However following the global recession, financial resources for the response appear to have peaked and flattened^{7, 13}. UNAIDS reports that the future of AIDS resourcing depends on smart investing: spending now to curtail the need to 'spend more – forever'⁷. It therefore becomes critical that decision makers are guided to allocate the available resources to the most cost effective strategies¹⁴.

Studies conducted on cost effectiveness of HIV counseling and testing interventions have predominantly examined particular service provision models¹⁵⁻¹⁷. Further, these studies have used cost per HIV infection averted or cost per quality-adjusted life-year or disability adjusted life year saved as outcomes¹⁵⁻²². This article evaluates the cost effectiveness of facility-and home-based VCT models with the primary outcome measure of "extra cost per HIV sero-positive case identified." The use of an intermediate outcome measure makes the

study findings more readily interpretable²³ for health service managers at primary care level in making decisions on suitable alternatives for VCT provision in rural communities in Uganda based on operational efficiency^{20, 24}.

Methods

Study setting

A pre-post VCT intervention study was conducted in Rugando sub-County (Mbarara district) and Kabingo sub-County (Isingiro district) of Uganda from November 2007 to March 2008. Mbarara and Isingiro districts have estimated populations of 418,300 and 385,500 respectively²⁵. Prior to providing the VCT intervention in both sub-Counties, the services were promoted through the local community leaders. During the study, facility-based VCT was offered to clients at a health centre level IV in Rugando while home based VCT was offered at the household level in Kabingo sub-county. A detailed description of the study setting and the intervention is given elsewhere²⁶. The facility-based and home-based strategies are briefly described below.

Facility based VCT

At the Rugando health centre, clients willing to receive VCT were registered by a nursing assistant in the outpatient department and then referred to the counselor. Pre-and post test counseling was provided by a trained counselor (a midwife). HIV testing was performed by a laboratory assistant in the health centre laboratory. The nationally recommended three test algorithm was used²⁷. The first test (HIV Determine I/II) is very sensitive, the second (HIV Unigold I/II) is a confirmatory test run on only positive samples and a third test (HIV Statpak) breaks the tie when necessary.

Home based VCT

Kabingo parish was randomly selected in Kabingo sub-county, and home-based VCT offered in its nine villages. The households to be visited were randomly selected from household lists generated by the village leaders. An adult aged between 18 and 59 years was offered VCT in each of the households. Pre- and post- counseling and testing was provided by integrated trained counselors (ITCs). The ITCs had previously been trained by an Integrated Community Based Initiatives project that provided district-wide door-door counseling and testing in the neighboring district of Bushenyi from January 2005 to December 2006²⁸. Both the counselor at the health facility and

the ITCs were re-oriented using the national counselor training manual prior to commencement of the study²⁹. As with the facility-based strategy, the three HIV test algorithm was used. The two ITCs who provided home based VCT collected test kits and sundries from Rugando health centre at the beginning of every week throughout the one month study period. The ITCs also provided weekly reports to the health facility on the number of clients counseled and tested and supplies used.

Data collection and analysis

A questionnaire was administered to the study participants. Information on socio-demographic profile and HIV risk reduction behavior was collected. Ethical approval for the study was sought and obtained from the Institutional Review Board at Mbarara University of Science and Technology.

Costs

A cost analysis using the “ingredients” approach²³ and based on a programmatic perspective considering economic costs was performed. The resources used (type, quantity and unit price) for each of the strategies were documented prospectively during the study implementation. However financial accounts and reports were also analyzed where necessary. Costs of the research exercise such as data collection by the study team were excluded. The cost for each resource was calculated by multiplying quantity by unit cost and total cost was derived by adding up all the individual costs²³. All costs were expressed in 2008 US Dollars at an exchange rate of 1700.94 per US Dollar (US\$)³⁰.

Capital costs

Capital costs that included buildings, furniture, and training (home based VCT) were annualized using a discount rate of 3% with an assumed lifespan of 30 (buildings) and 10 (furniture) years²³. Capital costs for facility based VCT included; buildings (out-patient department and laboratory) as well as the furniture used by clients in these two areas. Training of the counselor (midwife) was not included as a capital cost because counseling is part of the pre-service training curriculum for midwives. Capital costs for the home based approach included; building costs (for record keeping) and the initial cost of training the ITCs that was met by the Integrated Community Based Initiatives project.

Personnel costs

Personnel costs were calculated based on monthly salaries or allowances and percent hours spent on

VCT activities. The mean time spent on counseling for facility based VCT was 12 minutes (95%CI: 11-13) and 16 minutes (95%CI: 15-17) for home based VCT. The personnel for the facility based approach included; counselor (midwife), laboratory assistant, nursing assistant (who registered VCT clients in the out-patient department), records assistant (who managed health records) and two community mobilizers at the parish level. Personnel costs for home based VCT included; ITCs, the record assistant (responsible for health records returned to the health facility) and nine community mobilizers at the village level. The personnel costs for the two ITCs were calculated based on the outreach allowance for health facility staff who conduct weekly home visits as part of the facility primary health care outreach activities.

Other recurrent costs

The cost of supplies such as test kit and sundries were based on the Joint Medical Stores price catalogue. On-going training costs were incurred for the re-orientation of the counselor and ITCs. While, transport costs were computed as the reimbursement provided to the ITCs during provision of home based VCT.

Effectiveness

The number of HIV sero-positive clients identified following the VCT intervention was used as the measure of effectiveness. In the era of antiretroviral treatment (ART) and cotrimoxazole preventive therapy, identification of HIV-infected persons through VCT remains pertinent³¹.

Cost effectiveness

Costs effectiveness analysis using a decision model was performed in TreeAge Pro 2009³². A cost effectiveness ratio was calculated for each of the VCT approaches, by dividing its cost by the numerical value of the effect (number of HIV sero-positive clients identified). To evaluate the additional cost per HIV sero-positive client identified by the least cost-effective strategy an incremental cost effectiveness ratio (ICER) is reported.

Sensitivity analysis

One way sensitivity analysis was conducted taking into consideration that HIV prevalence was likely to change over time. It has been reported that as prevalence rises, the costs of testing increase, although economies of scale may be observed as well²⁴.

Additional sensitivity analysis was conducted by using an alternative discount rate of 5%³³.

Results

Background characteristics of clients

Nine hundred ninety four (500 for facility- and 494 home-based VCT) clients, were enrolled and tested. The characteristics of the clients by type of VCT strategy are shown in table 1.

Both strategies attracted more; women than men, clients who had ever attended school, clients who

were ever married, and those who had sex in the 12 months prior to the study. The median monthly income of clients in both groups was similar and the majority tested HIV sero-negative.

Costs

The total cost for provision of facility-based VCT was US\$ 3114, while it was US\$ 2462 for home-based VCT over the study period. The cost by category and strategy is shown in table 2.

Table 1: A comparison of the background characteristics by VCT strategy

Characteristic	N=994		p-value
	n (%)		
	FB-VCT n (%)	HB-VCT n (%)	
Gender			
Male	139 (28)	156 (33)	0.16¥
Female	351 (72)	326 (67)	
Age: Mean (sd)	31.8 (11.3)	32.7 (10.7)	0.15*
Ever attended school			
Yes	385 (79)	374 (77)	0.36¥
No	100 (21)	112 (23)	
Ever married			
Yes	287 (62)	336 (75)	<0.001
No	179 (38)	112 (25)	
Monthly income median (US\$)	17.64	17.64	Na
Had sex in the past 12 months			
Yes	379(79)	353(82)	0.36¥
No	93(21)	79(18)	
HIV status			
Positive	36 (7)	45 (9)	0.29¥
Negative	454 (93)	444 (91)	

*t-test, Na=not applicable, ¥ Chi Square test, sd =standard deviation, FB= facility-based, HB= home-based

Cost effectiveness and incremental cost effectiveness ratio (ICER)

The number of HIV sero-positive clients identified was 36 (7%) and 45 (9%) for the facility- and home-based strategies respectively. The calculated unit cost per HIV sero-positive client identified for both strategies is shown in table 3.

The unit cost per HIV positive client identified was US\$ 86.5 and US\$ 54.7 for the facility- and home-based strategies respectively. Based on these costs and effectiveness measures the home-based dominates the facility-based strategy with an ICER of US\$ 3.5.

Sensitivity analysis

An increase or decrease in HIV prevalence and change in the discount rate did not influence the cost effectiveness of home-based strategy in identifying HIV sero-positive clients. The home-based strategy remained less costly and more effective.

Table 2: Cost by category and VCT strategy

Cost Category	VCT Strategy	
	FB-VCT (US\$)	HB-VCT (US\$)
Capital		
Building	435	54
Furniture	7	0
Training	0	353
Sub-total capital costs	443	407
Recurrent		
Personnel	525	579
Supplies	1261	1247
Building operation and maintenance	767	0
On-going training	118	220
Transport	0	9
Sub-total recurrent costs	2671	2055
Total cost	3114	2462
Unit cost per client tested	6.4	5.0

VCT= voluntary counseling and testing, FB= facility-based, HB= home-based
 The unit cost per client tested was US\$6.4 and US\$ 5.0 for the facility-based and home-based VCT strategies respectively.

Table 3: Incremental cost effectiveness ratios

Strategy	Cost (US\$)	Incremental cost (US\$)	Effectiveness (+ve clients)	Incremental effectiveness (+ve clients)	Cost/ Effectiveness (US\$/+ve client)	ICER*
HB-VCT	54.7	-	45	-	1	-
FB-VCT	86.5	31.8	36	9	2	3.5 (Dominated)

*Incremental cost effectiveness ratio, VCT= voluntary counseling and testing, FB= facility-based, HB= home-based

Discussion

This study reports that the home-based VCT strategy is more effective at identifying HIV sero-positive individuals and at a lower cost to health service providers, than the facility-based strategy. The HIV prevalence for facility- (7%) and home-based VCT (9%) to a large extent reflects the prevalence among the 30-34 year olds reported at the time in Uganda³⁴. The cost per client tested for the home-based strategy was comparable to that (US\$ 5.88 – 8.29) reported in other studies³⁵⁻³⁷. Although the cost per client tested in the facility-based strategy reported here was higher than that of home-based VCT, it was lower than that reported elsewhere^{31, 36, 38, 39}. The level of care and range of services provided by a facility affects

the costs and therefore contributes to the variation in costs observed.

The lower cost per client tested using the home based approach suggests that the home based VCT would be the more suitable approach for improving service coverage when compared to the facility based approach. Another study undertaken in Uganda has also shown that compared to HIV counseling and testing models such as stand alone and hospital based, the home based approach was the least expensive per client tested³⁶.

The additional cost per HIV sero-positive case identified by the facility-based strategy was US\$ 3.5 which is considered reasonable given that this

cost is lower than the estimated expenditure on health per capita for 2007/08 in Uganda of US\$ 8.4¹³. However, the current study findings show that the home-based strategy is the most cost effective in identifying those HIV sero-positive individuals in rural areas. It has been suggested that, HIV testing must become simple and ubiquitous as home-based pregnancy test kits⁷. This will ensure that the costs of maintaining dedicated HIV testing and counseling centres are lowered and individuals are empowered to access HIV treatment and care services in a timely and confidential manner⁷. VCT provided in the home environment can be convenient and conducive for counseling and testing and eases the workload on the existing health infrastructure²⁷. Further, provision of VCT through a home-based strategy is at no cost to the clients and physical accessibility is ensured by reaching people in their homes³⁷ and therefore greatly improves service coverage.

Study limitations

The facility-based group was self selected which may have probably been determined by their risk taking behavior. The study findings however show that the HIV prevalence was not significantly different among study participants in the two groups.

Conclusion

Home based VCT was the least costly strategy per client tested and is a cost effective strategy for enabling the early identification and subsequent referral of HIV sero-positive individuals that is critical for Uganda's HIV prevention approach. This strategy will ensure an improvement in HIV counseling and testing service coverage and effectiveness among rural communities.

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References

1. UNAIDS: UNAIDS Terminology Guidelines. 2008.
2. Bateganya MH, Abdulwadud OA, Kiene SM: Home-based HIV voluntary counseling and testing in developing countries. *Cobrane Database of Systematic Review* 2007. 2007.

3. Wringe A, Isingo R, Urassa M, Maiseli G, Manyalla R, Chagalucha J, Mngara J, Kalluvya S, Zaba B: Uptake of HIV voluntary counselling and testing services in rural Tanzania: implications for effective HIV prevention and equitable access to treatment. *Tropical Medicine and International Health* 2008;13(3):319-327.
4. Matovu JK, Gray RH, Kiwanuka N, Kigozi G, Wabwire-Mangen F, Nalugoda F, Serwadda D, Sewankambo NK, Wawer MJ: Repeat Voluntary HIV Counseling and Testing (VCT), Sexual Risk Behavior and HIV Incidence in Rakai, Uganda. *AIDS Behav* 2007; (11):71-78.
5. UNAIDS: UNAIDS/WHO Policy Statement on HIV Testing. Geneva: UNAIDS; 2004.
6. Irungu TK, Varkey P, Cha S, Patterson JM: HIV voluntary counseling and testing in Nakuru, Kenya: findings from a community survey. *HIV Medicine* 2008; 9:111-117.
7. UNAIDS: UNAIDS World AIDS Day Report 2011. Geneva: UNAIDS; 2011.
8. Tumwesigye E, Wana G, Kasasa S, Muganzi E, Nuwaha F: High Uptake of Home-Based, District-Wide, HIV Counseling and Testing in Uganda. *AIDS Patient Care and STDs* 2012; 24(11).
9. WHO: Guidance on provider-initiated HIV testing and counseling in health facilities. Geneva: World Health Organization; 2007.
10. Ministry of Health: Uganda National Policy Guidelines for HIV Counseling and Testing. Edited by Programme SAC: Ministry of Health; 2003.
11. Service delivery models for HIV counseling and testing [http://www.fhi.org/NR/rdonlyres/enjg3dojredmsbucesa6ey2i2wbz3erszczmhj16pz62ogzln4guycff_b4kk2egibf6p5oafwg3k/ModelsofCT2pager122706.pdf]
12. UNAIDS: Global HIV/AIDS Reponse: Epidemic update and health sector progress towards Universal Access, Progress Report 2011. Geneva: UNAIDS; 2011.
13. Ministry of Health: Health Sector Strategic and Investment Plan 2010/11 - 2014/15 Ministry of Health; 2010.
14. Singer ME, Applegate KE: Cost-Effectiveness Analysis in Radiology. *Radiology* 2001, 219:611-620.
15. Varghese B, Peterman TA: Cost-Effectiveness of HIV Counseling and Testing in US Prisons. *Journal of Urban Health: Bulletin of the New York Academy of Medicine* 2001; 78(2):304-312.

16. Sweat M, Gregorich S, Sangiwa G, Furlonge C, Balmer D, Kamenga C, Grinstead O, Coates T: Cost-effectiveness of voluntary HIV-1 counselling and testing in reducing sexual transmission of HIV-1 in Kenya and Tanzania. *Lancet* 2000; 356(9224):113-121.
17. Creese A, Floyd K, Alban A, Guinness L: Cost-effectiveness of HIV/AIDS interventions in Africa: a systematic review of the evidence. *Lancet* 2002, 359:1635-1642.
18. Hogan RD, Baltussen R, Hayashi C, Lauer AJ, Salomon AJ. Cost effectiveness analysis of strategies to combat HIV/AIDS in developing countries. *BMJ* November 2005; doi:10.1136/bmj.38643.368692.68
19. Thielman N, Chu H, Ostermann J, Itemba DK, Mgonja A, Mtwewe S, Bartlett JA, Shao JF, Crump JA: Cost-Effectiveness of Free HIV Voluntary Counseling and Testing Through a Community-Based AIDS Service Organization in Northern Tanzania. *American Journal of Public Health* 2006; 96(114-119).
20. UNAIDS: Cost-effectiveness analysis and HIV/AIDS. Geneva; 1998.
21. Farnham PG, Pinkerton SD, Holtgrave DR, Johnson-Masotti AP: Cost-Effectiveness of Counseling and Testing to Prevent Sexual Transmission of HIV in the United States. *AIDS and Behavior* 2002; 6(1):33-43.
22. FHI: Evaluating Programs for HIV/AIDS Prevention and Care in Developing Countries. Edited by Rehle T, Saidel T, Mills S, Magnani R, Rodgers BA: Family Health International; 2006.
23. WHO (Ed.): *Cost analysis in primary health care: a training manual for programme managers*. Geneva: WHO; 1999.
24. UNAIDS: Costing Guidelines for HIV Prevention Strategies. Geneva: UNAIDS; 2000.
25. UBOS: Statistical Abstract 2009. Kampala: Uganda Bureau of Statistics; 2009.
26. Mulogo EM, Abdulaziz AS, Guerra R, Baine SO: Facility and home based HIV Counseling and Testing: a comparative analysis of uptake of services by rural communities in southwestern Uganda. *BMC Health Services Research* 2011; 11(54).
27. Ministry of Health: Uganda National Policy Guidelines for HIV Counselling and Testing. Edited by Programme SAC: Ministry of Health; 2005.
28. Asiimwe S, Muganzi E, Tumwesigye E, Achom M, J. T: Door-door home-based VCT reveals high HIV incidence among HIV-discordant couple members, Uganda. In *4th IAS Conference on Pathogenesis, Treatment and Prevention (IAS 2007): July 2007 2007; Sydney, Australia*. International AIDS Society; 2007.
29. Ministry of Health: HIV Counselling and Testing: A National Counsellor Training Manual. Government of Uganda; 2005.
30. Interbank Average Exchange Rates [http://www.bou.or.ug/bou/collateral/interbank_forms/2008/Mar/major_28mar08.html]
31. Hausler PM, Sinanovic E, Kumaranayake L, Naidoo P, Schoeman H, Karpakis B, Godfrey-Faussett G: Cost of measures to control tuberculosis/HIV in public primary care facilities in Cape Town, South Africa. *Bulletin of the World Health Organization* 2006; 84(7):528-536.
32. TreeAge Software Inc.: TreeAge Pro 2009. 2009 edition. Williamstown, MA: TreeAge Software, Inc; 2009.
33. Fox-Rushby J, Cairns J (Eds.): *Economic Evaluation*. New York: Open University Press; 2005.
34. Uganda AIDS Commission: UNGASS Country Progress Report Uganda: January 2006 to December 2007. Edited by Commission UA: Government of Uganda; 2008.
35. Negin J, Wariero J, Mutuo P, Jan S, Pronyk P: Feasibility, acceptability and cost of home-based HIV testing in rural Kenya. *Tropical Medicine and International Health* 2009; 14(8):1-7.
36. Menzies N, Abang B, Wanyenze R, Nuwaha F, Mugisha B, Coutinho A, Bunnell R, Mermin J, Blandford JM: The costs and effectiveness of four HIV counseling and testing strategies in Uganda. *AIDS* 2009; 23:395-401.
37. Tumwesigye E, Wana G, Kasasa S, Muganzi E, Nuwaha F. High Uptake of Home-Based, District-Wide, HIV Counseling and Testing in Uganda. *AIDS PATIENT CARE and STDs* 2010, 24(11): 735-41
38. Terris-Prestholt F, Kumaranayake L, Ginwalla R, Ayles H, Kayawe I, Hillery M, Godfrey-Faussett P. Integrating tuberculosis and HIV services for people living with HIV:Costs of the Zambian ProTEST Initiative. *Cost Effectiveness and Resource Allocation* 2008, 6(2) [http://www.resource-allocation.com/content/6/1/2]
39. Forsythe S, Arthur G, Ngatia G, Mutemi R, Odhiambo J, Gilks C: Assessing the cost and willingness to pay for voluntary HIV counselling and testing in Kenya. *Health Policy and Planning* 2002;17(2):187-195.