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Determinants of Technical Efficiency of HIV Prevention Interventions in four African Countries.

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Background

Limited evidence on the efficiency of HIV prevention-interventions is a barrier for creating effective policy. ORPHEA project aimed to estimate average costs and to analyze the determinants of efficiency using micro-costing and stochastic-cost-frontier methods for three HIV-prevention interventions: prevention of mother-to-child transmission (PMTCT), voluntary medical male-circumcision (VMMC), and HIV testing and counseling (HTC) in Kenya, Zambia, Rwanda and South Africa.

The scarce body of literature addressing how efficient are health systems to provide HIV/AIDS services has shown that substantial heterogeneity remains in terms of the average cost per service among facilities within the same region, and that the difference between the best performing facilities and the least efficient units reaches several orders of magnitude. The production scale — the number of services provided within a given period — is strongly correlated with lower average costs, however, increasing service utilization is not always feasible or even economically desirable, specially in contexts of low prevalence or concentrated epidemics.

ORPHEA produced new empirical evidence on the unit costs of HIV interventions in Africa and which facility's characteristics were more likely to have an influence on them. During 2011-2012, information on costs, output indicators and determinants of efficiency were collected across more than 240 sites providing HTC, PMTCT and VMMC services in Kenya, Rwanda, South Africa and Zambia.

ORPHEA revealed that while scale remains a strong determinant of costs efficiency, there is huge variation in facility average costs not only among countries but also within units of the same country. Staff is the main cost driver, around 70% of the average cost per HTC client tested and 80% in the case of PMTCT client tested.

Objectives

This paper reports the association between the average cost of each prevention intervention (HTC and PMTCT) and two determinants (scale and quality) widely discussed in the literature (Kumaranayake, 2008) and the average cost of HIV prevention interventions (HTC and PMTCT) and additional determinants that measure the management of the facility (supervision, accountability, monitoring, incentives and governance). For each intervention, we first report the association between the average cost and a variable that approximates the scale at which HIV prevention services are being supplied. Secondly, we present correlations of the average cost with quality based on indicators of process quality for services measured through exit interviews and vignettes. Thirdly, we show the association between the average cost and some management indicators at facility level.

Methods

The study applied a robust methodological design to collect comparable information to estimate the cost of HTC, PMTCT, VMMC, and sex worker prevention services in Kenya, Rwanda, South Africa, and Zambia, the level of efficiency in the current delivery of these services, and the key determinants of efficiency. We applied micro-costing techniques. This required the collection information on input costs and intervention output retrospectively by month for 2011/2012. Staff's time allocation was measured using time-motion methods. Quality was captured by measuring the facility's attrition rate at each stage of the service delivery, using clinical vignettes and client's exit interviews. We analyze the relation between the cost of production of HIV prevention services (HTC and PMTCT) with simple regression methods. We included determinants of efficiency such as: facility type, quality, scale, HIV prevalence, country and management (supervision, accountability, monitoring, incentives and governance).

Results

Mean average costs for HTC were US$31.9 (IQR: 6.0-35.2) and US$136.8 (IQR: 21.8-146.9) for PMTCT. Figure 1 present the relationship between the scale of HIV detection services (HTC and PMTCT) and the unit costs. Tables 1-4 depict multivariate regressions of HTC and PMTCT unit costs and quality indicators and other determinants (management determinants (supervision, accountability, monitoring, incentives and governance).

Figure 1. Average cost vs scale for HTC and PMTCT at two stages in the cascade of the service provision

Scale (i.e., volume or quantity of services provided) is an important factor in regards to determining the efficiency of HTC and PMTCT services. Figure 1 first row displays the correlation between the average cost of HTC client tested and the total number of HTC clients tested (on a log scale) and HTC client tested and HIV positive, organized by country and size of the facilities. Greater volume of HTC and PMTCT clients per facility increases the efficiency of the service (because it reduces the cost of production). That is because as the number of clients

increases, there is a reduction in the average cost per client tested in the production of HTC and PMTCT services. Slightly more than 20% of the variability of the average costs – all positively correlated with lower average costs – was explained by the scale of the production of HTC services.

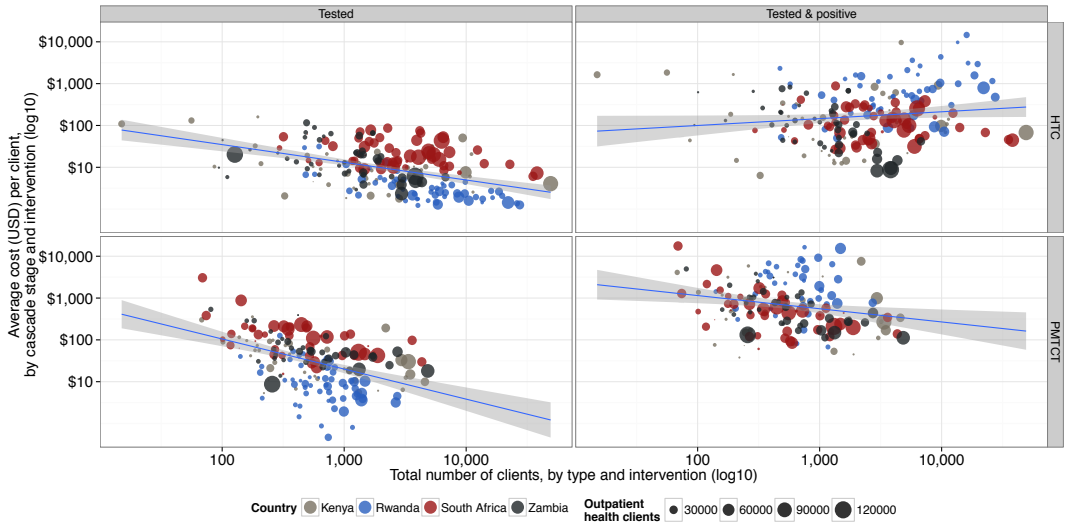

Figure 1.

Scale of production is important in HIV detection to increase levels of efficiency. Variability in unit costs across facilities and countries is found across all levels of output.

Tables 1 and 2. Multivariate relation between HTC unit costs, quality indicators and management determinants (supervision, accountability, monitoring, incentives and governance).

Y=Log of cost per HTC client tested	I	II	III	IV
SCALE				
Log of number of HTC clients	**-0.430*** **	**-0.392*** **	**-0.382*** **	**-0.405*** **
PROCESS QUALITY				
HTC Patient Exit Interview		**-1.089** **	-0.636	-0.243
HTC Vignettes		-0.107	-0.0341	-0.0215
COUNTRY				
Rwanda			**-0.404** *	**-0.570** **
South Africa			**1.246*** **	**1.171*** **
Zambia			**0.309** **	**0.312** **
OTHER DETERMINANTS				
Supervision				**0.628** **
Accountability				-0.160
Monitoring				**-0.486** **
Governance				**-0.435*** **
Funding linked to performance				**0.311** **
Constant	5.518***	5.678***	5.096***	5.294***
Observations	218	218	218	218
Adjusted R-squared	0.236	0.250	0.530	0.579

*** p<0.01, ** p<0.05, * p<0.1
Country reference: Kenya

Table 1. Determinants of efficiency of cost per client tested.

Scale of production is an important determinant of efficiency. An increase of 1% in the production of HTC services reduces costs of production in 0.44%.

Management aspects that correlates negatively with cost per client of HTC are: accountability and monitoring.

Y=Log of cost per HTC client tested and positive	I	II	III	IV	V
SCALE					
Log of number of HTC clients	**0.154** **	-0.0192	-0.0859	**-0.165** **	**-0.183*** **
PROCESS QUALITY					
HIV positivity rate		**-5.861*** **	**-5.625*** **	**-4.693*** **	**-4.668*** **
HTC Patient Exit Interview			**2.094*** **	0.154	0.569
HTC Vignettes			0.184	0.243	0.309
COUNTRY					
Rwanda				**1.209*** **	**0.986*** **
South Africa				0.418*	0.345
Zambia				-0.105	-0.127
OTHER DETERMINANTS					
Supervision					0.653
Accountability					-0.0780
Monitoring					**-0.680** **
Governance					**-0.419** *
Funding linked to performance					**0.368** **
Constant	3.852***	6.041***	5.656***	6.414***	6.558***
Observations	214	214	214	214	214
Adjusted R-squared	0.013	0.382	0.424	0.466	0.500

*** p<0.01, ** p<0.05, * p<0.1
Country reference: Kenya

Table 2. Determinants of efficiency of cost per client tested and positive.

Scale of production is less important determining the efficiency of HIV detection among HIV positive clients.

HIV positivity rate at facility level is negatively associated with the cost of the detection of HIV positive clients.

Management aspects that correlates negatively with costs: monitoring and governance and positively with costs: funding link to performance.

Tables 3 and 4. Multivariate relation between PMTCT unit costs, quality indicators and management determinants (supervision, accountability, monitoring, incentives and governance).

Y=Log of cost per PMTCT client tested	I	II	III	IV	V
SCALE					
Log of number of PMTCT clients	**-0.662*** **	**-0.606*** **	**-0.604*** **	**-0.491*** **	**-0.492*** **
PROCESS QUALITY					
PMTCT Vignettes		**-2.027*** **	**-1.987*** **	-0.476	-0.0513
PMTCT Patient Exit Interview			-0.233	-0.185	-0.109
COUNTRY					
Rwanda				**-1.150*** **	**-1.501*** **
South Africa				**0.898*** **	**0.919*** **
Zambia				0.115	0.223
OTHER DETERMINANTS					
Supervision					**0.774***
Accountability					0.182
Monitoring					-0.196
Governance					0.268
Funding linked to performance					**0.366** **
Constant	7.632***	8.254***	8.315***	6.955***	6.313***
Observations	186	185	185	185	185
Adjusted R-squared	0.205	0.250	0.247	0.542	0.573

*** p<0.01, ** p<0.05, * p<0.1
Country reference: Kenya

Table 3.

Scale of production is an important determinant of efficiency. An increase of 1% in the production of PMTCT services for HIV detection reduces costs of production in 0.49%.

Management aspects that correlates positively with cost per PMTCT client tested are: supervision and funding linked to performance.

Y=Log of cost per PMTCT client tested and positive	I	II	III	IV	V
SCALE					
Log of number of PMTCT clients	**-0.308*** **	**-0.443*** **	**-0.436*** **	**-0.419*** **	**-0.410*** **
PREVALENCE					
HIV positivity rate		**-5.746*** **	**-5.849*** **	**-4.773*** **	**-4.692*** **
PROCESS QUALITY					
PMTCT Patient Exit Interview			0.568	-0.475	-0.386
PMTCT Vignettes			-0.627	**-1.198***	-0.702
COUNTRY					
Rwanda				**1.029*** **	**0.730*** **
South Africa				0.290	0.341
Zambia				-0.300	-0.199
OTHER DETERMINANTS					
Supervision					0.757
Accountability					0.255
Monitoring					-0.419
Governance					0.222
Funding linked to performance					**0.343***
Constant	8.417***	9.957***	10.00***	10.21***	9.550***
Observations	166	166	166	166	166
Adjusted R-squared	0.042	0.328	0.328	0.428	0.452

*** p<0.01, ** p<0.05, * p<0.1
Country reference: Kenya

Table 4.

Both scale of production and HIV positivity rate are important determining the efficiency of HIV detection among pregnant women in PMTCT services.

HIV positivity rate at facility level is negatively associated with the cost of the detection of HIV positive clients.

Management aspects that correlates positively with costs of are: funding link to performance.

Discussion

Greater volume of either HTC or PMTCT clients per facility for HIV testing increases the efficiency of the service (because it reduces the cost of production). That is because as the number of clients increases, there is a reduction in the average cost per client tested.

Several other factors were examined for their effect on the costs and efficiency of HTC and PMTCT services. These other efficiency determinants include specific facility management aspects such as governance, supervision and monitoring, incentives provided to health staff, and performance accountability. Collectively, these factors were found to have a huge influence on the costs of HTC and PMTCT services for HIV detection, accounting for 57% of the variability in average costs (considerably greater than scale alone). The effect differed among them, however. On the one hand, analysis indicates that aspects such as monitoring and governance contribute to reduce costs of HTC services. In contrast, supervision activities (e.g., supervision conducted by the national and local health ministries and by donors) increased the HTC costs; so too did the use of rewards for performance for HTC and PMTCT costs (in the category of incentives). On the other hand, the presence of a governing board and the participation of the community in the governing board reduced the cost of the HTC services.

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