

## ANNEX 6. Case example: Cost-effectiveness analysis for assessing different HTS strategies for PMTCT.

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Four illustrative country scenarios were developed based on data from Namibia, Kenya, Haiti and Viet Nam, with national HIV prevalences among females ages 15-49 years of 17%, 7%, 3% and 0.1% respectively. Sub-national HIV prevalence estimates were used to divide each country into high, medium and low burden areas (Table 6.1A). Different levels of coverage for pregnant women including coverage of ANC, HTS and ARV services were then assigned to each sub-area for the following four strategies:

- Highly focused HTS (very high coverage for high burden areas and low coverage for medium and low burden areas),
- Focused HTS (very high coverage for high and medium burden areas, low coverage for low burden areas),
- Current coverage (current coverage levels from national surveys),
- Universal HTS (very high coverage for all pregnant women).

**Very high coverage** was defined as antenatal clinic (ANC) coverage of 95%, HIV testing among ANC attendees of 95%, and ARV coverage among mothers who tested HIV positive of 95%.

**Low coverage**: was defined as the country current level of ANC coverage, 20% HIV testing among ANC attendees, and 95% ARV coverage among mothers who tested HIV positive.

**Table 6.1A. Epidemiologic parameters for country-specific scenarios.**

Country	Epidemiological data			
	Burden	HIV prevalence	Estimated proportion of women aged 15-49	Estimated proportion of HIV+ women
Namibia	High	>20%	37%	49%
	Intermediate	10-20%	52%	46%
	Low	<10%	11%	5%
Kenya	High	>10%	14%	37%
	Intermediate	5-10%	60%	48%
	Low	<5%	26%	16%
Haiti	High	≥3%	26%	34%
	Intermediate	2-3%	51%	40%
	Low	<2%	22%	15%
Viet Nam	High	≥ 0.20%	17%	36%
	Intermediate	0.10-0.19%	41%	48%
	Low	< 0.10%	41%	16%

Standardized unit costs were applied for all scenarios except health services costs which varied by country and were obtained from the WHO CHOICE database (2010). Unit costs for HIV rapid tests, CD4 count, viral load testing, early

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infant diagnosis, and laboratory monitoring (CD4 testing every six months and viral load every 12 months), were obtained from WHO Central Procurement Service, UNICEF and the Supply Chain Management System (SCMS). Paediatric treatment costs for all scenarios were estimated for a 20 year period (US\$ 258 per year for ages 0 to 2 years, US\$ 182 for ages 3-9 years and US\$ 136 for children over 10 years). Costs used in analyses included HIV testing (HIV test kits and counselling services), PMTCT costs (HIV testing, maternal and infant ARVs and health services) and total costs (PMTCT costs and paediatric treatment costs for 20 years).

Health outcomes, costs and cost-effectiveness from this analysis can be examined in different ways. The narrowest approach is to assess the number of HIV-positive cases identified under the different scenarios, the cost of HIV testing, and thus the cost per HIV case detected. In this case study, the average HIV testing cost per HIV positive mother identified across approaches in Namibia were US\$17.00-18.40, in Kenya US\$15.70-23.80, in Haiti US\$29.80-35.60, and in Viet Nam US\$400-570. Considering this narrow definition of health benefits and costs associated with these programmes, in all four scenarios, highly focused HTS was the most efficient way to detect new cases within a given country. However, it also results in the fewest number of HIV-positive mothers being identified, as less focused approaches provide coverage to more women.

The main limitation to considering only HIV testing costs and HIV-positive cases detected is that this approach does not account for paediatric infections averted and downstream health effects of infections, nor for the costs for providing PMTCT or for treating infected infants whose mothers did not receive PMTCT. These are important health outcomes and costs that decision-makers should consider.

Based on a broader analysis that considers PMTCT costs (which includes HIV testing costs) and infections averted by the different programmes, the current coverage HTS approach was the least efficient in each country scenario, indicating that resources are not currently being distributed as efficiently as they could be (Table 6.2A). When considering infections averted and PMTCT costs, in all four country scenarios, highly focused HTS was again the most efficient strategy, followed by focused HTS and then universal HTS. Any three of these scenarios could be considered cost effective based on a decision makers willingness to pay for infections averted, with the most expensive program, universal HTS, averting the greatest number of infections. In the three countries with generalized epidemics, the incremental cost per infection averted were fairly similar across HTS approaches within a country. For example in Namibia, the incremental cost per infection averted was US\$ 1,146 for highly focused HTS compared to US\$ 1,183 for universal HTS, which implies limited efficiency gains for a highly focused compared to a universal approach. Although the differences in efficiency were fairly modest when considering this broader definition of costs and health impacts, the cost of implementing a universal HTS approach was approximately two-fold higher in each scenario than that of highly focused HTS, while averting twice the number of paediatric infections. This budgetary reality may have bearing on decision making for HTS implementation in the context of limited resources.

In the Viet Nam-based scenario, a country with very low prevalence in the general population, the pattern when considering testing and PMTCT costs across alternative HTS approaches is similar. However, the efficiency gain when employing focused as compared to universal approaches is greater than in the three generalized epidemic scenarios. Despite this, universal testing could still be considered very cost-effective. For example, if we assume approximately 20 quality-adjusted life years QALYs gained for each infection averted(1, 2), universal HTS would have an incremental cost effectiveness ratio of around \$230 per QALY gained in the Viet Nam-based scenario. Conventionally, interventions are deemed cost-effective if their incremental cost-effectiveness ratio is less than three times the gross domestic product (GDP) per capita. As the GDP per capita for Viet Nam is approximately \$2000, by the conventional thresholds, universal HTS would be considered highly cost-effective.

Finally, the above analyses are still somewhat incomplete, in that they ignore the downstream costs required to provide ART to infected newborns. When the cost of 20 years' worth of future treatment for paediatric infections was considered in addition to HIV testing and PMTCT costs, universal HTS for all pregnant women saved the most in terms of total costs in the three generalized epidemic country scenarios (that is, Haiti, Kenya and Namibia). This means that universal HTS both saves money and improves health outcomes compared with focused approaches.

**Table 6.2A Cost-effectiveness of different HIV testing service approaches in four country-based scenarios.**

Country Scenario per 1,000,000 pregnant women (HIV prevalence)	HTS Approach	HIV+ mothers Identified	Pediatric infections averted	HIV testing cost <sup>1</sup> (thousands)	PMTCT cost <sup>2</sup> (thousands)	Total cost <sup>3</sup> (thousands)	Incremental cost <sup>4</sup> per infection averted	Costs Saved <sup>5</sup> (thousands)
Namibia-based case (17%)	Highly focused	89,710	24,824	\$1,527	\$28,446	\$98,768	\$1,146	\$107,106
	Current coverage	138,221	34,221	\$2,541	\$39,651	\$88,035	\$ (1,192)*	\$117,838
	Focused	148,803	41,175	\$2,673	\$47,324	\$79,476	\$1,154	\$126,398
	Universal	155,765	43,102	\$2,863	\$49,604	\$77,258	\$1,183	\$128,616
Kenya-based case (7%)	Highly focused	32,175	10,635	\$504	\$8,096	\$39,952	\$761	\$46,671
	Current coverage	63,584	16,860	\$1,513	\$13,610	\$32,501	\$ (886)*	\$54,122
	Focused	57,366	18,848	\$1,249	\$14,785	\$29,536	\$814	\$57,087
	Universal	65,658	21,551	\$1,562	\$17,055	\$26,175	\$840	\$60,448
Haiti-based case (3%)	Highly focused	10,923	3,247	\$326	\$2,921	\$13,444	\$900	\$14,310
	Current coverage	14,635	4,259	\$522	\$3,926	\$12,334	\$ (993)*	\$15,420
	Focused	18,731	5,568	\$638	\$5,089	\$10,763	\$934	\$16,992
	Universal	21,646	6,434	\$771	\$5,915	\$9,778	\$953	\$17,976
Viet Nam-based case (0.1%)	Highly focused	577	214	\$231	\$370	\$1,008	\$1,728	\$738
	Focused	1,020	378	\$448	\$694	\$987	\$1,977	\$759
	Current coverage	932	328	\$531	\$744	\$1,141	... **	\$605
	Universal	1,168	433	\$665	\$947	\$1,123	\$4,601	\$622

Notes: <sup>1</sup>HIV testing cost includes HIV test kit and counseling services; <sup>2</sup>PMTCT cost includes HIV testing costs + maternal and infant antiretrovirals and health services; <sup>3</sup>Total cost includes HIV testing costs + PMTCT cost + pediatric treatment costs for 20 years; <sup>4</sup>Based on PMTCT cost column, does not include paediatric treatment cost; <sup>5</sup>Costs Saved = (total costs of no PMTCT intervention) – (total costs of selected approach) where total cost includes HIV testing costs + PMTCT cost + pediatric treatment costs for 20 years; \* Weakly dominated approach; \*\* Dominated approach: where an intervention costs more and yields fewer health benefits than an alternative approach.

This is because failing to prevent new infections among infants due to a lack of HTS, and the subsequent need to treat infected infants for life, have significant long-term cost implications. In the Viet Nam-based scenario, which has a concentrated HIV epidemic, all approaches were cost saving compared with having no PMTCT programme, although the amount saved was slightly higher in focused than in universal approaches. However, the number of HIV positive mothers identified and paediatric infections averted was twice as high in universal compared with highly focused approaches.

Therefore, if a decision maker is concerned about all current and future costs and health outcomes associated with a PMTCT programme, the most efficient approach for the generalized epidemic scenarios would be universal HTS for all pregnant women. This approach identifies the most HIV positive mothers, minimizes the number of infections among infants and actually saves money compared with other approaches. In the Viet Nam-based scenario of a concentrated epidemic, either the highly focused, focused or the universal approaches could be considered highly cost-effective and all three have lower costs relative to no intervention.

Another consideration in addition to cost-effectiveness is a country's current coverage of both ANC and PMTCT services. In a situation where there is poor ANC and/or PMTCT coverage, and programmes are planning their scale-up, a phased approach in which high prevalence areas are targeted first, followed by areas of lower prevalence, would likely be the most rational use of resources. However, in reality, achieving the highly focused testing and retention goals defined in this case study is likely to be difficult, and costs for reaching the final 5-10% of pregnant women are likely to be higher than for reaching women who access programmes on their own.

Ultimately, programme managers need to make difficult decisions based on available resources for HTS while considering long-term programmatic implications. Conducting cost-effectiveness analyses such as in this case study will provide information on the most efficient approach to reach the maximum number of people who need testing, care and treatment with given resources. Other non-economic reasons, such as the programmatic logistics of either initiating or withdrawing HTS, should be thought through when evaluating whether incremental gains in cost efficiency are worthwhile.

## References

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