Cost-Effectiveness of an Integrated Test to Accelerate the Triple Elimination of HIV, Syphilis and Hepatitis B in Nigeria

Donald S. Shepard, MPP, PhD, FASTMH[1*]; Abdulrahman Ahmed, MD, MS[1]; Isaiah Dzimbiri, Bpharm, MS[1]; Pacifique Dusabeyezu, PT, MS[1]; Missiani Ochwoto, PhD[2]; Michael Kingsley, MD[3]

[1]Brandeis University, Waltham, MA, USA; [2]Kenya Medical Research Institute, Kenya [3]Federal Ministry of Health and Social Welfare, Nigeria

*Email: shepard@brandeis.edu

Brandeis

EE334, Board 3007

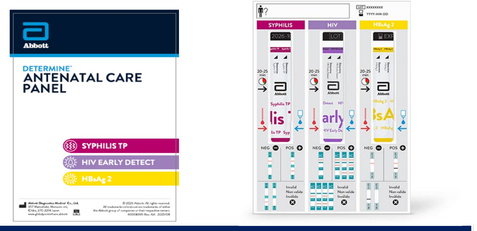
Objective

Evaluate the cost-effectiveness of a new, integrated test in antenatal care in Nigeria.

Introduction

- Following the World Health Organization's recommendations, Nigeria is working to eliminate three vertical (mother-to-newborn) infections: human immunodeficiency virus (HIV), syphilis and hepatitis B (HBV)
- National AIDS, Sexually Transmitted Infections Control and Hepatitis Programme (NASCP), Nigeria Federal Ministry of Health, approved the p24 laboratory performance **(Ex. 1)**
- Except for chronic HIV, current testing coverage in antenatal care (ANC) is low (**Ex. 2**). A recently pre-qualified integrated test detects all three infections, while also fulfilling the unmet need of testing for both chronic HIV and acute-phase HIV infections
- We modeled the health and economic impacts of introducing this integrated test for Nigeria's 6.4 million (M) women entering ANC annually

Exhibit 1. Rapid integrated test



Methods

- We developed a deterministic model with risks of infection and illness for both mother and infant and applied it to current and future (2028) conditions using a healthcare perspective
- We applied the post-exposure prophylaxis protocol to positive p24 results to initiate treatment promptly, as WHO recommends (no separate p24 guidelines currently available)
- We estimated prevalence rates, treatment rates, efficacy, health sector diagnostic and treatment costs by payer, and lifetime Disability Adjusted Life Years (DALYs) for each infection from program data, literature, and, where necessary, expert judgment **Ex. 2, 5)**

Conclusions

1 Highly cost-effective: The overall incremental cost-effectiveness ratio (ICER) is only $60 per DALY averted.

2 The ICER ($60/DALY) is substantially below both Nigeria's historical health opportunity cost threshold of $137 per DALY averted (Pichon-Riviere et al., 2023) and its GDP per capita of $807, making the screening highly cost-effective.

3 This integrated test and its associated expansion in the treatment of mothers and infants would be highly cost-effective and deserves serious consideration by stakeholders.

4 Nigeria currently experiences 253,936 vertical infections annually

5 The biggest advantage of the integrated test is its ability to detect acute HIV infections, generating 91% of the DALYs averted (422.1 of the 463.5 per 1,000 women) (Ex. 6, 8)

6 The process would avert 2,967,000 DALYs altogether annually (1,580,000 in infants and 1,386,000 in women) (Ex. 8).

7 The modeled process would avert 64,044 vertical transmissions annually from detections of HIV antibody (2,553), HIV p24 antigen (28,455), syphilis (5,774), and HBV (27,262) (Ex 3, 4)

8 Affordable: The net cost ($28/woman in ANC) appears affordable (Ex. 7, 9).

Results

Model Inputs for Each Infection, part 1, Exhibit 2

Input	HIV (P24)	Chronic HIV	Syphilis	Hepatitis B
Positivity rate*	1.84%	1.70%	1.57%	3.84%
Screening rate, current	0%	90.3%	58%	13%
Dual	0%	52.0%	52%	0%
Single	0%	38.3%	6%	13%
Screening rate, future	67%	95%	67%	67%
Triple	67%	67%	67%	67%
Dual	0%	0%	0%	0%
Single	0%	28%	0%	0%
Treatment rate, current	0%	92%	55%	7.5%
Treatment rate, future	95%	95.0%	60%	30%

*The positivity rate for p24 is the weighted average of the 2 studies found from sub-Saharan Africa using the rapid test in ANC, while the positivity rate for chronic HIV comes from a national survey in Nigeria. The higher rate for p24 compared to chronic HIV infection is consistent with a Nigerian survey of pregnant women with notable shares reporting recent HIV risky behaviors (multiple sexual partners and sex for money). See QR code for data sources.

EXHIBIT 3: NUMBER OF WOMEN SCREENED, FROM 6.4 MILLION ENTERING ANTENATAL CARE ANNUALLY

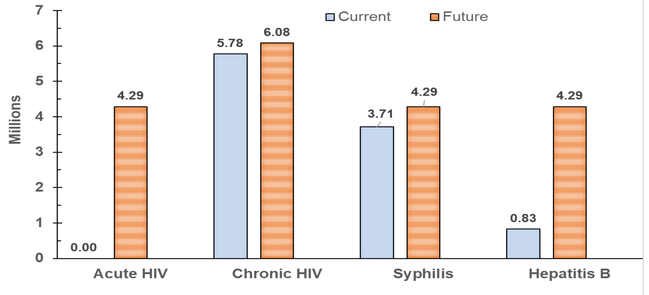
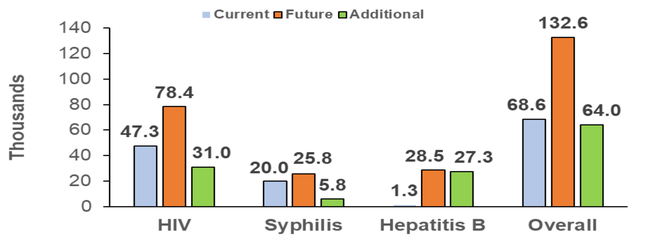


EXHIBIT 4: NUMBER OF VERTICAL TRANSMISSIONS PREVENTED ANNUALLY



Model Inputs for Each Infection, part 2 , Exhibit 5

Input	HIV (P24)	Chronic HIV	Syphilis	Hepatitis B
Single test: current cost of product by component	$0.00	$0.90	$0.90	$0.90
Dual test: Current cost of product by component	$0.00	$0.475	$0.48	n.a.
Confirmatory test costs	Uni-gold: $1.60	Uni-gold: $1.60	$0	$0
Treatment costs per infant	$31.89 over lifetime	$31.89 over lifetime	$10 once	$30 once
Treatment costs per mother (20.77 discounted years)	$2,783 over lifetime	$2,783 over lifetime	$10 once	$154 over lifetime

EXHIBIT 6: NET DALYS AVERTED PER 1000 WOMEN (MATERNAL AND INFANT)

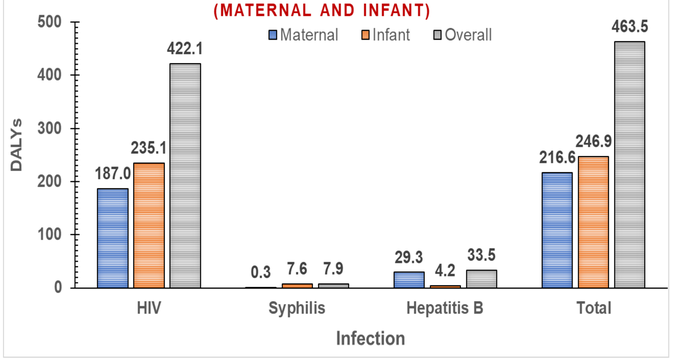
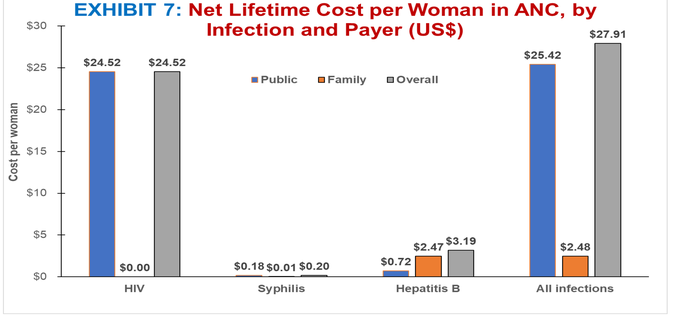


EXHIBIT 7: Net Lifetime Cost per Woman in ANC, by Infection and Payer (US$)



Key Results: Lifetime Health Impact in Annual Cohort* Exhibit 8

Infection	HIV (P24)	Chronic HIV	Syphilis	Hepatitis B	Total
Maternal DALYs averted	1,098,321	98,636	1,803	187,719	1,386,478
Infant DALYs averted	1,443,890	42,241	48,549	26,920	1,580,182
Total DALYs averted	2,542,211	159,459	50,352	214,639	**2,966,660**

Aggregate Annual Overall Net Costs (Public & Families, $million, Exhibit 9

Infection	Acute HIV	Chronic HIV	Syphilis	Hepatitis B	All infections
Aggregate net costs during pregnancy	$9.07	$4.36	$1.27	$9.65	$24.35
Aggregate net costs after pregnancy	$130.24	$13.26	$0.00	$10.76	$154.26
Aggregate overall net costs in cohort	$139.31	$17.62	$1.27	$20.41	$178.61

Limitations

1 As Nigeria has not yet promulgated guidelines specifically for acute HIV testing in ANC, this model applies the existing guidelines for post-exposure prophylaxis.

2 Higher treatment rates for syphilis and hepatitis B would improve outcomes for those infections

Support

Supported in part by an award from Abbott, Inc to Brandeis Univ.

Scan for Data Sources