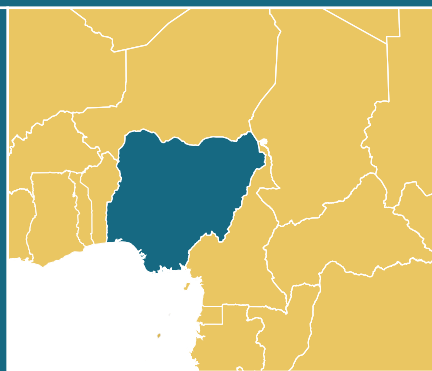


February 2015

THE COSTS AND IMPACTS OF SCALING UP PMTCT IN NIGERIA



*Summary of Findings
from 13 Nigerian States*

This publication was prepared by Adebisi Adesina and Sarah Alkenbrack of the Health Policy Project.

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The Costs and Impacts of Scaling Up PMTCT in Nigeria

Summary of Findings from 13 Nigerian States

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This publication was prepared by Adebisi Adesina¹ and Sarah Alkenbrack² of the Health Policy Project.

¹Avenir Health (formerly Futures Institute), ² Futures Group

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ABBREVIATIONS

AIDS	acquired immune deficiency syndrome
ART	antiretroviral therapy
ARV	antiretroviral drugs
CDC	Centers for Disease Control and Prevention
CTX	cotrimoxazole
eMTCT	elimination of mother-to-child transmission of HIV
FMOH	Federal Ministry of Health (Nigeria)
GON	government of Nigeria
HAART	highly active antiretroviral therapy
HIV	human immunodeficiency virus
HPP	Health Policy Project
HTC	HIV testing and counseling
MTCT	mother-to-child transmission of HIV
N	Nigerian naira
PCRPP	President's Comprehensive Resource Plan
PEPFAR	United States President's Emergency Plan for AIDS Relief
PMTCT	prevention of mother-to-child transmission of HIV
UNAIDS	Joint United Nations Programme on HIV/AIDS
USAID	United States Agency for International Development

EXECUTIVE SUMMARY

Nigeria is among the countries with the slowest decline in new HIV infections among children. To address this situation, the country is planning to scale up prevention of mother-to-child transmission (PMTCT) services and adopt new aggressive treatment guidelines recommended by the World Health Organization (WHO). Between 2009 and 2011, Nigeria's rate of HIV incidence among children declined by just 2 percent, compared with declines of 30 to 60 percent among other sub-Saharan countries (UNAIDS, 2013). Adopting the new WHO guidelines that recommend Option B+ for all pregnant women (antiretroviral therapy [ART] for life, regardless of CD4 count or clinical stage) will help accelerate Nigeria's progress toward elimination of new HIV infections among children by 2015 (elimination of mother to child transmission, or eMTCT).

This study by the USAID- and PEPFAR-funded Health Policy Project (HPP) assessed the costs and benefits of different treatment options (baseline treatment as currently offered, Option B, and Option B+) to scale up PMTCT in Nigeria's 13 high-burden states, which account for 70 percent of the MTCT burden. The analysis found that Option B+ is the more cost-effective option to achieve eMTCT in Nigeria, and provides policymakers with information on the resource requirements and benefits (in terms of new infections averted) of achieving state-level eMTCT targets for Option B and Option B+.

Table 1 highlights the costs, number of vertical infections averted, cost per vertical infection averted, total number of vertical and adult infections averted, and cost per infection averted (vertical and adult) by scenario and by state.

The total cost for the Baseline scenario (that assumed PMTCT coverage will remain at 2013 levels through 2018) for all the high-burden states was the lowest (approximately N3.4 trillion/US\$21 billion), followed by Option B (approximately N3.8 trillion/US\$24 billion), and Option B+ (N3.9 trillion/US\$24.5 billion). This translates to an incremental cost of N470 billion/US\$4 billion for the Option B scenario and N530 billion/US\$4.5 billion for the Option B+ scenario.

Comparisons of the impact and numbers of vertical infections averted for the Option B and Option B+ scale-up scenarios to the Baseline scenario showed that Option B+ averted an estimated 78,000 vertical infections, while Option B averted an estimated 65,000 vertical infections. The combination of the incremental cost and number of vertical infections averted shows that the average cost per vertical infection averted across the 13 states for the Option B+ scenario was N15 million/US\$83,000, compared to N11 million/US\$65,000 per vertical infection averted for the Option B scenario.

Table 1. Summary of Costs and Infections Averted

State	Cost (billions of naira)			Vertical infections averted		Cost per vertical infection averted (millions of naira)		Total (vertical and adult) infections averted		Cost per infection averted, vertical and adult (millions of naira)	
	Baseline	Option B	Option B+	Option B	Option B+	Option B	Option B+	Option B	Option B+	Option B	Option B+
Abia	458	483	483	4,469	5,872	5	4	4,668	6,069	5.2	4.0
Akwa Ibom	185	208	207	2,860	3,817	8	6	15,711	16,684	1.4	1.3
Anambra	474	496	498	764	1,704	29	14	782	1,735	28.1	13.7
Bayelsa	457	471	470	2,383	3,194	6	4	2,426	3,237	5.7	4.1
Benue	199	220	265	829	1,651	26	40	13,175	16,225	1.6	4.1
Cross River	167	181	181	3,474	4,225	4	3	16,134	16,931	0.9	0.8
FCT Abuja	207	217	217	200	382	51	27	230	411	44.5	24.9
Kaduna	195	233	233	7,950	7,950	5	5	37,470	37,470	1.0	1.0
Kano	239	404	404	29,420	34,412	6	5	109,789	115,141	1.5	1.4
Lagos	226	293	293	4,829	5,624	14	12	38,633	39,469	1.7	1.7
Nassarawa	161	177	167	542	950	29	7	7,190	7,619	2.2	0.9
Plateau	241	256	256	1,946	2,888	8	5	1,962	2,902	7.6	5.2
Rivers	177	216	242	5,030	5,798	8	11	38,016	38,111	1.0	1.7
Total cost/ Infections averted	3,385	3,854	3,917								
Incremental cost		468	531								
Infections averted				64,696	78,467			286,186	302,004		
Average cost per infection averted						15	11			7.9	5.0

While PMTCT's primary purpose is preventing vertical transmission of HIV, its benefits also accrue to the adult population. When the number of adult infections averted is added to the number of vertical infections averted, Option B+ averts more infections than Option B.

The cost per infection averted is a key factor in assessing cost-effectiveness, which is paramount for policymakers when deciding among various treatment options. HPP's analysis found that the Option B+ scenario is more cost-effective (N5 million/US\$31,000 per infection averted) than the Option B scenario (N7.9 million/US\$44,000 per infection averted). Therefore policymakers can expect Option B+ to have the greatest impact on reducing incidence rates.

An important caveat to this analysis is that it assumes the necessary infrastructure and human resource capacity are available to support the estimated volume of patients and achieve the level of scale-up needed to meet the eMTCT goals. It also assumes that investments have been made to expand access and service delivery, such as hiring new clinical providers, constructing new facilities, renovating existing clinical facilities to serve a larger patient volume, and refurbishing warehouses and distribution centers to handle the larger volume of medicines.

Comparing the total costs of implementing the various scenarios shows that Option B+ is more expensive. However, when the incremental costs are compared, Option B+ is only slightly more expensive than Option B. The results clearly indicate that Option B+ would be a more cost-effective way to achieve eMTCT in Nigeria. The benefits include a greater reduction in postpartum and infant infection via breastfeeding due to the greater probability of mothers' viral suppression, a reduced burden of treatment management and tracking because women will already be established in the ART program, a reduction in partner transmission, and a greater number of lives saved. As Nigeria moves toward scaling up adult HIV treatment, adopting Option B+ will be a critical component of achieving universal access to treatment by 2020.

INTRODUCTION

Nigeria carries the second-largest burden of HIV in the world, with more than 3.2 million people infected (UNAIDS, 2014). New HIV infections in Nigeria account for one-third of all infections in the 21 highest-burden countries in sub-Saharan Africa—the largest number in any country.² Despite its high HIV burden, prevention of mother-to-child transmission (PMTCT) services reach only 30 percent of eligible women in Nigeria (UNAIDS, 2014). In contrast, PMTCT coverage in South Africa and Botswana is approximately 80 and 100 percent, respectively (UNAIDS, 2014).

Nigeria is among the countries with the slowest decline in new pediatric HIV infections. Between 2009 and 2011, the country's HIV incidence among children declined by 2 percent, while eight other sub-Saharan African countries reduced incidence among children by 30 to 60 percent (UNAIDS, 2013).

In line with UNAIDS's Global Plan to eliminate new HIV infections among children by 2015 (eMTCT), Nigeria aims to scale up access to PMTCT services. To do this, the government of Nigeria (GON) has stated its intention to adopt the new PMTCT guidelines released by the World Health Organization (WHO) in 2013. These guidelines recommend that all pregnant women receive Option B+, a regimen that provides them with ART for life, regardless of their CD4 count or clinical stage (see Table 2). In 2013, President Goodluck Jonathan released the President's Comprehensive Resource Plan (PCRP) and, more recently, an updated National Operational Plan for the Mother to Child Transmission of Human Immunodeficiency Virus (HIV) in Nigeria, with the goal of ensuring that no Nigerian child dies from HIV.

Understanding the costs and impacts of scaling up PMTCT in Nigeria is complicated by the fact that PMTCT programs, like other health programs, are decentralized. Although all states would be required to follow national treatment guidelines, implementation, budgeting, and planning for PMTCT programs occurs at the state level, and targets for eliminating MTCT vary by state. It is therefore critical that PMTCT program managers and state government officials have the necessary information to plan for the scale-up of services. A team from the USAID- and PEPFAR-funded Health Policy Project (HPP) conducted this study to inform policymakers of the resource requirements and benefits, in terms of new infections averted, of achieving state-level eMTCT targets for both Option B and Option B+. The results indicate that when Option B and Option B+ are being considered as treatment options for HIV-positive pregnant women, the latter appears to be a more cost-effective means of reaching the target of eMTCT. These results provide a clear recommendation for the GON as it seeks the best way to effectively pursue the goal of eMTCT.

This report addresses the GON's expressed need to better understand the costs and impacts of scaling up PMTCT across the country's 12 high-burden states, as well as within the federal capital territory. These jurisdictions are collectively referred to as the 12+1 high-burden states and account for 70 percent of the MTCT burden in the country.

The objective of this study was twofold: 1) to generate analysis that would help the government of Nigeria determine if Option B+ is cost-effective relative to other options, including Option B, which is currently being offered in Nigeria; and 2) to train PMTCT program managers in the use of Spectrum-based tools, so they can update the analysis on a regular basis. As national policymakers consider the costs and impacts of implementing the most recent WHO treatment guidelines, cost projections can serve as useful planning tools for understanding the level of financial commitment needed from donors and the GON. Additionally, data about the impact of Option B+ on lives saved can inform evidence-based decision making and advocacy efforts.

Table 2. Three Options for PMTCT Programs

	Woman Receives		Infant Receives
	Treatment (for CD4 count ≤ 350 cells/mm ³)	Prophylaxis (for CD4 count ≥ 350 cells/mm ³)	
Option A^a	Triple ARVs starting as soon as diagnosed, <i>continued for life</i>	<i>Antepartum:</i> AZT starting as early as 14 weeks gestation <i>Intrapartum:</i> at onset of labour, SdNVP and first dose of AZT/3TC <i>Postpartum:</i> daily AZT/3TC through 7 days postpartum	Daily NVP from birth through 1 week beyond complete cessation of breastfeeding; or, if not breastfeeding or if mother is on treatment, through age 4–6 weeks
Option B^b	<i>Same initial ARVs for both^b</i>		Daily NVP or AZT from birth through age 4–6 weeks regardless of infant feeding method
	Triple ARVs starting as soon as diagnosed, <i>continued for life</i>	Triple ARVs starting as early as 14 weeks gestation and <i>continued intrapartum and through childbirth if not breastfeeding or until 1 week after cessation of all breastfeeding</i>	
Option B⁺	<i>Same for treatment and prophylaxis^b</i>		Daily NVP or AZT from birth through ages 4–6 weeks regardless of infant feeding method
	Regardless of CD4 count, triple ARVs starting as soon as diagnosed, ^c <i>continued for life</i>		

Source: WHO, 2012

Note: "Triple ARVs" refers to the use of one of the recommended 3-drug fully suppressive treatment options.

^a Recommended in WHO 2010 PMTCT guidelines

^b True only for EFV-based first-line ART; NVP-based ART not recommended for prophylaxis (CD4 > 350)

^c Formal recommendations for Option B+ have not been made, but presumably ART would start at diagnosis.

Approach

The activity focused on generating analysis that would be useful for policymakers while building the capacity of PMTCT program managers from the priority states. Work began in April 2014 and ended in July 2014. The approach involved the following steps:

- Engage major national stakeholders and gather data:** In April 2014, the HPP team conducted a stakeholder engagement meeting with approximately 30 program managers from the 12+1 priority states, the Federal Ministry of Health (FMOH), the Centers for Disease Control and Prevention (CDC), the United Nations Children's Fund (UNICEF), the Joint United Nations Programme on HIV/AIDS (UNAIDS), and the WHO to introduce the use of four Spectrum policy models: the AIDS Impact Model (AIM); the Family Planning (FamPlan) model; the Goals model; and the Resource Needs Model (RNM). The models were used to assess the costs and impacts of three PMTCT coverage scenarios. HPP staff guided program managers through each model and provided an overview of the data inputs necessary to conduct the analysis.
- Conduct a capacity-building workshop:** A three-day workshop was held between June 17 and 19, in which 40 federal and state PMTCT program managers were trained on the use of AIM, FamPlan, Goals, and RNM to estimate the impact and resource requirements of reaching Nigeria's PMTCT coverage targets for Option B or Option B+, as outlined in Nigeria's PCRP.

3. **Analyze the scenarios necessary to reach virtual elimination of mother-to-child-transmission (eMTCT):** HPP worked with the teams to develop three analysis scenarios: 1) a Baseline scenario that assumed PMTCT service/program coverage will remain at 2013 levels through 2018; 2) an Option B scenario that assumed universal coverage for Option B by 2018; and 3) an Option B+ scenario that assumed universal coverage for Option B+ by 2018.

Questions

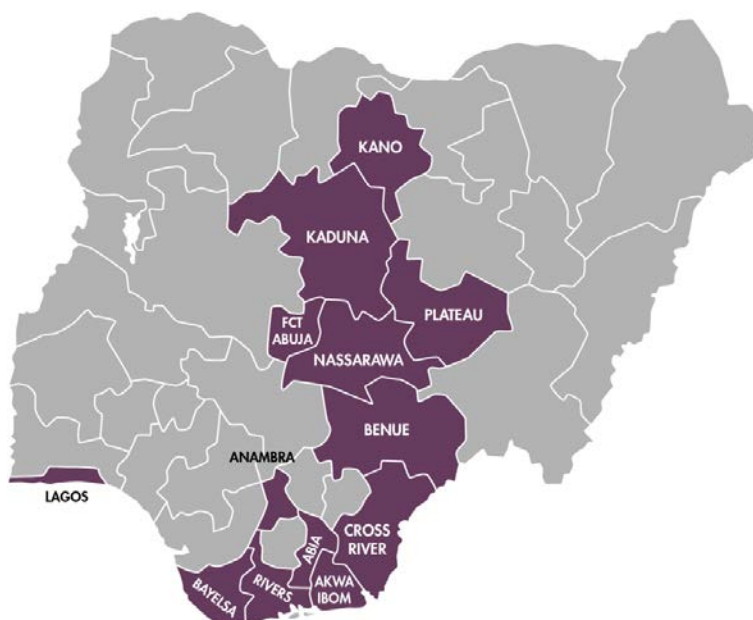
This activity provides policymakers and planners with insights into the following questions:

- How many infections are averted by each scale-up scenario, and how do Option B and Option B+ differ in this respect?
- What are the resource requirements to reach each of the 10 eMTCT targets¹ for each state?
- What would be the total cost and impact, in terms of infections averted, of reaching each state's eMTCT targets?

Overview of Priority States

The priority states for scaling up PMTCT are shown in Figure 1.

Figure 1: Nigeria's 12+1 Priority States for Scaling Up PMTCT



¹ “The EMTCT initiative has 10 targets—2 overall targets, 2 child health targets, and 6 targets related to the four prongs of PMTCT [described in the methodology section]. The two overall global targets are: reduce the number of new HIV infections among children by 90% by 2015; reduce the number of HIV-associated deaths among pregnant women by 50% by 2015” (WHO, 2014).

METHODOLOGY

The impact and resource requirements of scaling up PMTCT in Nigeria to achieve the goal of virtual eMTCT were calculated for the following program areas or prongs:

- **Prong 1:** HIV prevention in women of reproductive age
- **Prong 2:** Unwanted pregnancy prevention in HIV-infected women
- **Prong 3:** Prevention of HIV transmission from infected mother to child
- **Prong 4:** Care and support to HIV-infected women, children, and families

To estimate these costs and impacts, PMTCT-related programs were then mapped from these four prongs to Spectrum projection models and program areas as follows:

- **Prong 1:** HIV prevention activities were matched to the interventions in the Goals model, specifically community mobilization, mass media campaigns, testing and counseling condom provision, sexually transmitted infection (STI) management (males and females receiving STI treatment), and post-exposure prophylaxis (PEP).
- **Prong 2:** Family planning activities were matched to the inputs in FamPlan, specifically method mix and contraceptive prevalence rate (CPR).
- **Prong 3:** PMTCT interventions were mapped to AIM, specifically the PMTCT module.
- **Prong 4:** Care and support activities were mapped to AIM, specifically adult highly active antiretroviral therapy (HAART) treatment and pediatric HAART and cotrimoxazole treatment.

After mapping the various activities to the models, population (epidemic and demographic) and program data up to 2013 for each state were compiled by the surveillance team from the National Aids Control Agency (NACA), state surveillance officers, and UNAIDS. Family planning method mix² and CPR were obtained for each state from the Demographic and Health Surveys for 2008 and 2013. These data were used to run projections for each state using Spectrum (version 5.06 Beta 2).³

Overview of Coverage Inputs and Goals

To provide a range of costs and impacts for the 12+1 priority states, we produced three scenarios for each state. The timeframe for the scenarios was from 2013 to 2020 and each scenario assumed different rates of service scale-up based on state eMTCT strategy plans (see tables 4, 5, and 6 for coverage of Prongs by state).

Baseline: In this scenario it is assumed that the level of coverage for family planning services and PMTCT services remains constant at 2013 levels.

Option B: This scenario assumes the following:

² This refers to the percentage of women of reproductive age (ages 15–49) who are using each family planning method.

³ Spectrum is a suite of seven software models designed to support policymakers in making decisions related to health and demographics.

- Coverage rates for PMTCT, family planning, and HIV prevention and treatment services are scaled up in a linear trend starting in 2014 and the targets for each category of services are achieved by 2018.
- For PMTCT coverage, it is assumed that by 2015 SdNVP and Option A treatments are no longer offered. PMTCT coverage for the three remaining groups is increased to collectively reach the state coverage goal (see PMTCT goals by state in Table 5). These remaining groups include: HIV-positive women with a high CD4 count who need treatment during pregnancy (Option B); HIV-positive women who are pregnant, have a low CD4 count, are not currently on ART, and need to be put on ART for life (Option B+); and HIV-positive women who are already receiving ART and became pregnant while on ART. The scenario assumes that the state target coverage is reached by 2018 and stays constant until 2020.
- Family planning service coverage increases so that CPR increases by 1 point per year.
- HIV prevention programs are increased to reach 80 percent of the population in need of the services/programs, while HAART treatment (adult and pediatric) increases to the PCR target rate by 2018 (see coverage rate by state in tables 5 and 6).
- The supply of antiretroviral drugs (ARVs) for Option B is steady and there are no stockouts.

Option B+: As with the Option B scenario, PMTCT, FP, and HIV services for this scenario are scaled up in a linear trend from 2014 to 2018. Family planning service coverage increases CPR by 1 percentage point per year. PMTCT coverage for SdNVP, Option A, and Option B is no longer offered by 2015, so by 2018 all HIV-positive pregnant women are on HAART before becoming pregnant or start HAART during pregnancy (see PMTCT goals by state in Table 5). Additionally, HIV prevention programs are increased to reach 80 percent of the population of people in need of services/programs and HAART treatment is scaled up to attain PCR targets by 2018 (see coverage rate by state in tables 5 and 6). Note that the coverage rate for all these services remains constant at the target rate between 2018 and 2020.

Tables 4 through 6 outline the current coverage rates and targets that each state has outlined within its eMTCT plan. The coverage targets for HIV prevention interventions (Prong 1, Table 3) are the same for all states, while there is slight variation across states for the other coverage targets.

Table 3: Prong 1 – HIV Prevention Coverage⁴ (percentage of adults receiving services)

Prevention Program	Baseline (2013)	Target (2018)
Community mobilization	4	80
Mass media campaigns	30	80
Counseling and testing	12	20
Condom provision	18	80
STI management	56	80
Post-exposure prophylaxis	0.5	0.5

⁴ Coverage of prevention services is the proportion of people who both need and receive a service. For example, 12 percent of adults who need HIV testing and counseling are receiving it.

Table 4: Prong 2 – Contraceptive Prevalence Rate Among Women of Reproductive Age

State	Baseline CPR (2013)	Target CPR (2018)
Abia	33.4	40.4
Akwa Ibom	29.0	35
Anambra	35	42
Bayelsa	13.3	20.3
Benue	16.5	23.5
Cross River	24	31
FCT Abuja	25.2	32.2
Kaduna	20.2	27.2
Kano	0.6	8.6
Lagos	48	55
Nassarawa	18.1	25.1
Plateau	15.2	22.2
Rivers	34.5	41.5

Table 5: Prong 3 – Percentage of HIV-positive Pregnant Women Receiving PMTCT Services

State	Baseline (2013)						Target Option B (2018)				Target Option B+ (2018)		
	SdNVP	Option A	Option B	On HAART before pregnancy	Started HAART during pregnancy	Total PMTCT Coverage	Option B	On HAART before pregnancy	Started HAART during pregnancy	Total PMTCT Coverage	On HAART before pregnancy	Started HAART during pregnancy	Total PMTCT Coverage
Abia	4	1	11	13	4	33	35	25	40	100	25	75	100
Akwa Ibom	11	6	26	7	5	56	22	28	40	90	28	62	90
Anambra	1	2	20	25	23	71	40	10	40	90	10	80	90
Bayelsa	18	6	40	23	13	100	39	29	19	90	30	60	90
Benue	18	6	40	23	13	100	33	30	17	80	30	50	80
Cross River	11	8	12	7	7	44	30	20	40	90	19.84	70.16	90
FCT Abuja	10	10	58	16	5	100	30	20	40	90	20	70	90
Kaduna	3	6	14	13	3	39	15	35	40	90	35	55	90
Kano	1	0.5	2	1	1	5	40	10	40	90	10	80	90
Lagos	1	1	21	16	8	47	33	10	40	83	10	73	83
Nassarawa	0	0	80	19	1	100	40	10	40	90	10	80	90
Plateau	1	0.5	43	19	1	64.5	36	19	40	95	19	76	95
Rivers	1	0	20	4	11	36	40	10	40	90	10	80	90

Table 6: Prong 4 – Pediatric and Adult Treatment Coverage

State	Pediatric Cotrimoxazole		Pediatric Treatment		Adult Treatment (male and female)	
	Baseline (2013)	Target (2018)	Baseline (2013)	Target (2018)	Baseline (2013)	Target (2018)
Abia	3.61	80	5.66	80	27(m), 23(f)	80
Akwa Ibom	3.9	80	3.93	80	52(m), 60(f)	80
Anambra	10.29	90	65	90	77.5(m), 77.5(f)	90
Bayelsa	3.7	80	8.24	80	22(m), 32.6(f)	80
Benue	16.77	100	66.54	100	61.7(m), 90(f)	90
Cross River	10.72	90	22.29	90	37.5(m), 64.7(f)	80
FCT Abuja	52	100	92	100	40(m), 72.5(f)	80
Kaduna	3.25	100	19.53	100	47(m), 52(f)	80
Kano	0.19	80	4.9	80	18(m), 26(f)	80
Lagos	5.54	100	66.99	100	63(m), 68(f)	80
Nassarawa	19.72	80	85	90	61(m), 79(f)	80
Plateau	0.21	80	38.62	80	48(m), 67(f)	80
Rivers	0.84	80	8.77	80	51(m), 56(f)	80

Overview of Unit Cost Data

We used national-level data on the costs of services to build the scenarios. Unit costs of HIV services (prevention and treatment) were based on cost estimates generated by UNAIDS and NACA and were used to development state AIM files. Unit costs of family planning services (cost per family planning method) were based on global cost estimates (see Table A1 in the Annex). The costs of HAART components (including ARVs, care, etc.) are expected to decrease by 30 percent by 2030, so this analysis assumed that by 2020 the costs of care and treatment will reduce by approximately 11 percent. The cost estimates generated from this analysis only focus on the cost of delivering treatment and care services and do not include investments in infrastructure (construction or renovation of warehouses and facilities, hiring and training of additional healthcare providers, etc.).

The annual total cost of HIV and AIDS programs was categorized into Prong 1 (prevention programs), Prong 3 (PMTCT), and Prong 4 (pediatric and adult treatment). Annual total costs for Prong 1 were calculated by multiplying coverage (the proportion of the target population receiving services/program), the target population (adults between ages 15 and 49), and the unit cost (cost per person served per year) of the HIV prevention program (for example, counseling and testing, condom use, or community mobilization). Similarly, total costs for Prong 3 and Prong 4 services were calculated by multiplying the unit cost of PMTCT and treatment (cost per pediatric and adult patient served per year), respectively, by coverage (the proportion of people in the target group receiving treatment), and the target population (HIV-positive pregnant women, children, and adults living with HIV). The annual total cost of Prong 2 (family planning services) was calculated in Spectrum by multiplying the method mix (percent of women on each family planning method) by the total number of women of reproductive age and the cost per method per year.

The cumulative cost for each scenario was calculated by combining the annual total cost for all four prongs from 2013 to 2020. The incremental cost by scenario for each state was calculated by subtracting

the cumulative total cost of the baseline for each state from the cumulative cost for each scale-up scenario.

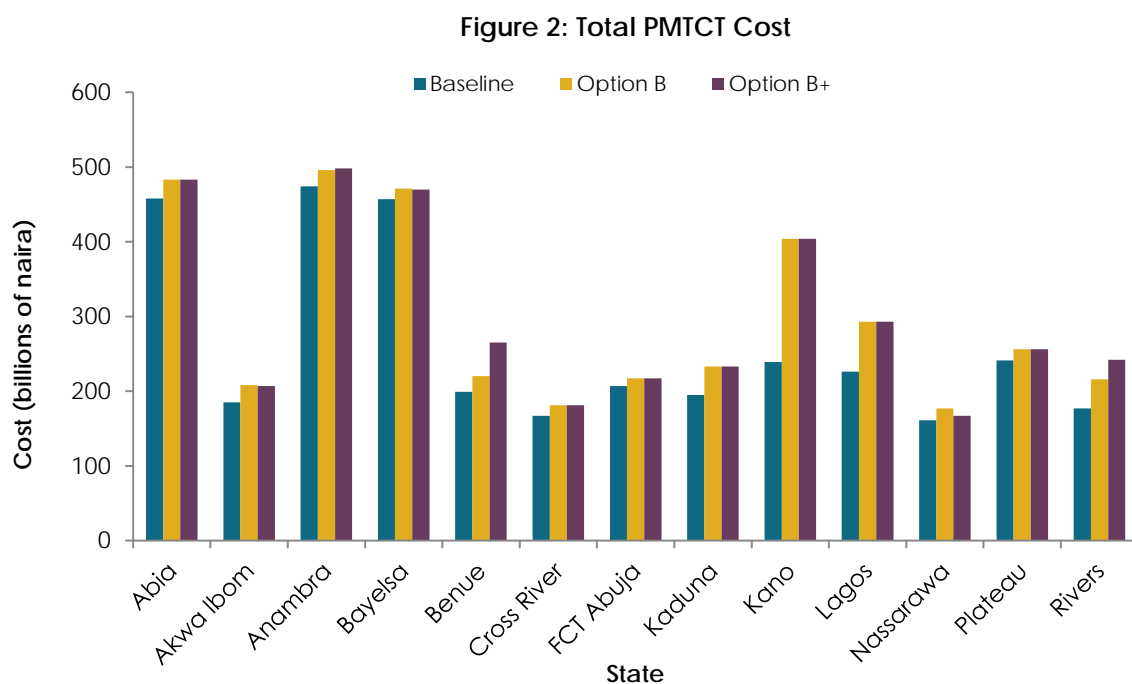
Mother-to-child infections averted for each of the four scenarios for each state were calculated by summing the cumulative infections in each scenario from 2014 to 2020 and subtracting this total from the total cumulative infections in the baseline scenario.

Cost per mother-to-child infection averted was calculated by dividing the incremental cost by the number of mother-to-child infections averted for each scenario.

RESULTS

Resource Requirements to Achieve eMTCT Targets for Each State

The results are summarized in figures 2 through 6, and costs are reported in billions of naira (see tables A1–A6 in Appendix for U.S. dollar conversion rates). The Baseline scenario for the 12+1 states had the lowest cost (approximately N3.4 trillion/US\$21 billion), followed by the Option B scenario (approximately N3.8 trillion/US\$24 billion), and the Option B+ scenario (N3.9 trillion/US\$24.5 billion). When the incremental costs are compared, implementing Option B+ is slightly more expensive than implementing Option B. Figure 2 shows the PMTCT cost by state and by scenario (the costs in U.S. dollars are presented in Table A2 in the Annex).

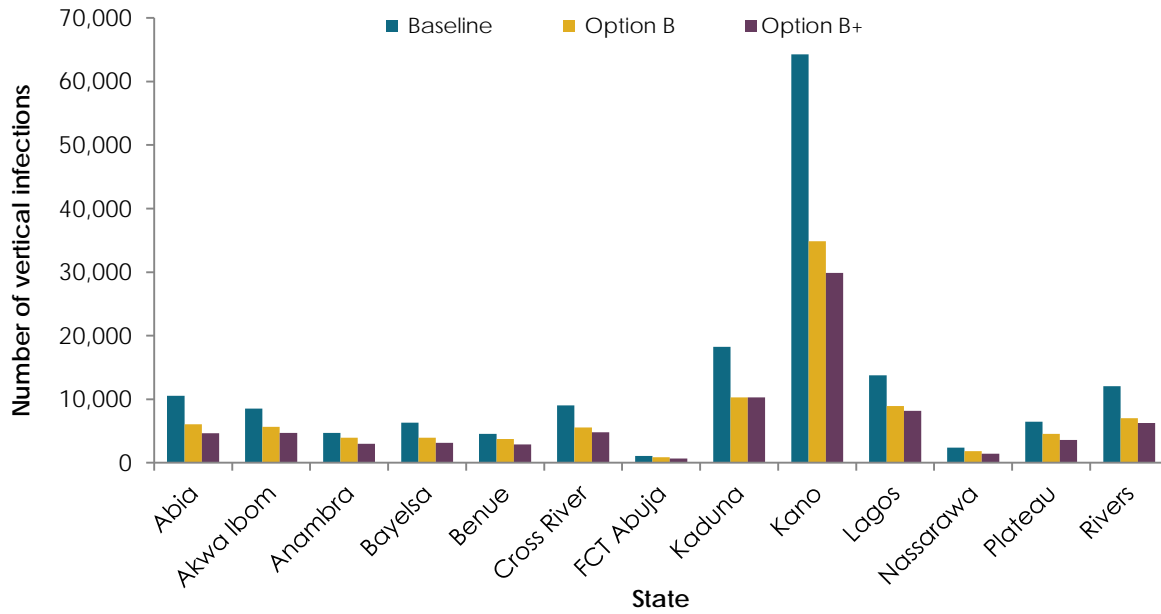


Vertical Infections Averted Under Each Scenario in Each State

For policymakers, it is important to compare the costs of different policy options, but they must also consider how the different treatment options fare with respect to averting infections. When the numbers of new infections in the two scale-up scenarios are compared to the Baseline, Option B+ averts approximately 78,000 vertical infections and Option B averts approximately 65,000 infections.

Figure 3 shows that Option B+ averts 14,000 more vertical infections than Option B.

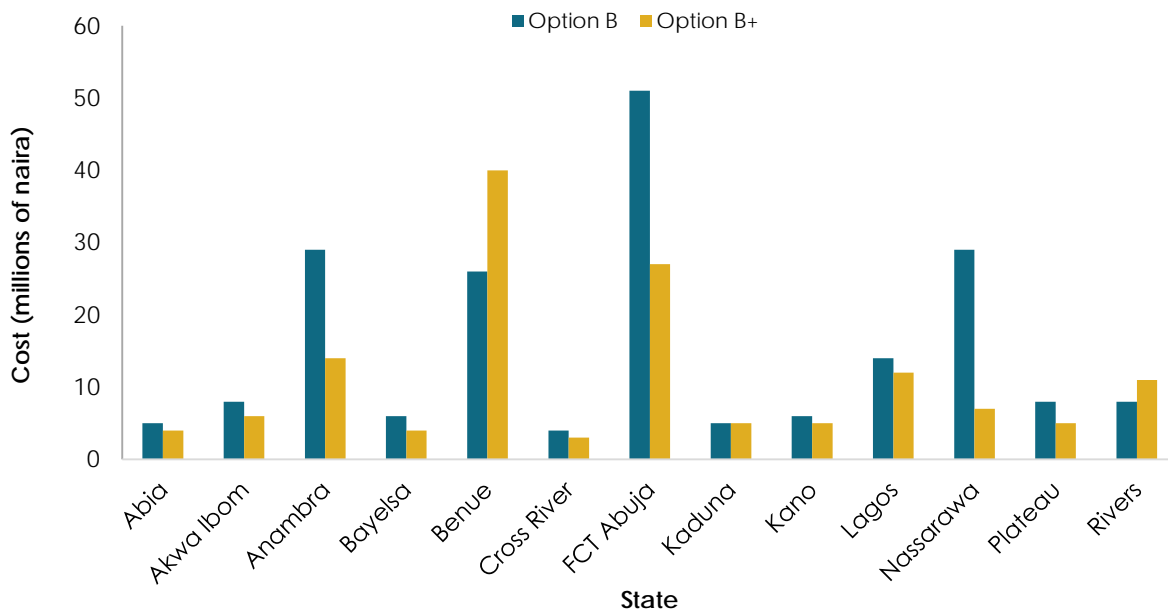
Figure 3: Estimated Number of New Vertical Infections



Cost per Vertical Infection Averted in Each State

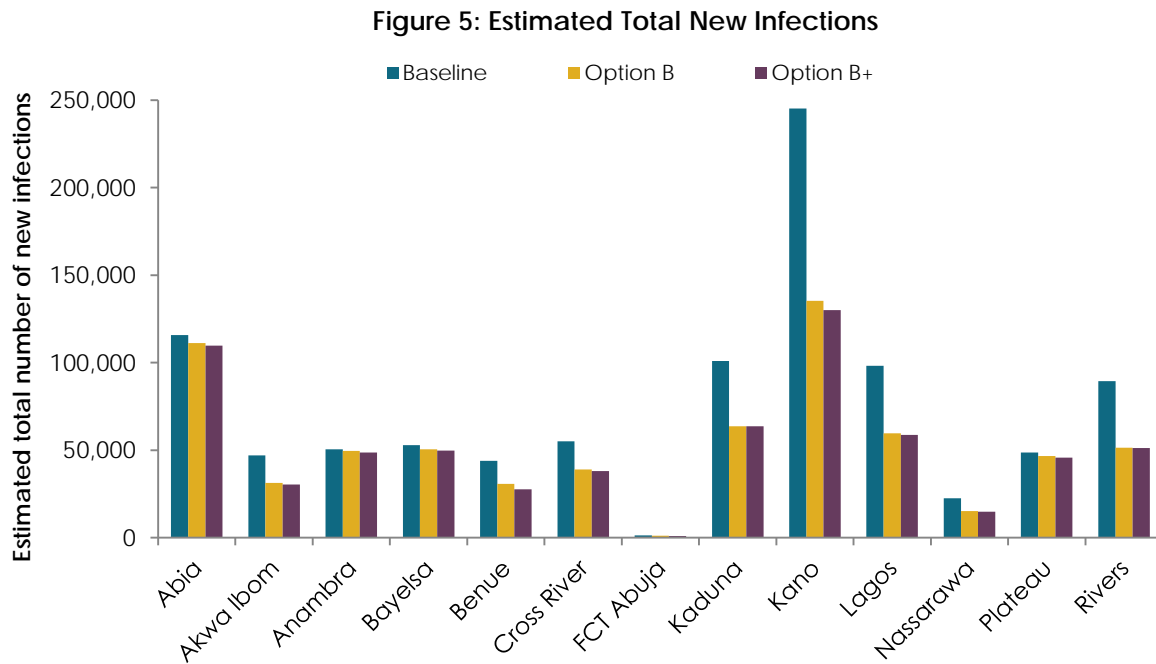
When the cost is compared to the number of new infections averted for each state, the average cost per infection averted is lower for Option B+ scenario (N10 million), relative to Option B (N15 million). Figure 4 shows the cost per vertical infection averted and the average cost per vertical infection averted across the 12+1 states (the cost per infection averted in U.S. dollars is shown in table A3 in the Annex).

Figure 4: Cost per Vertical Infection Averted



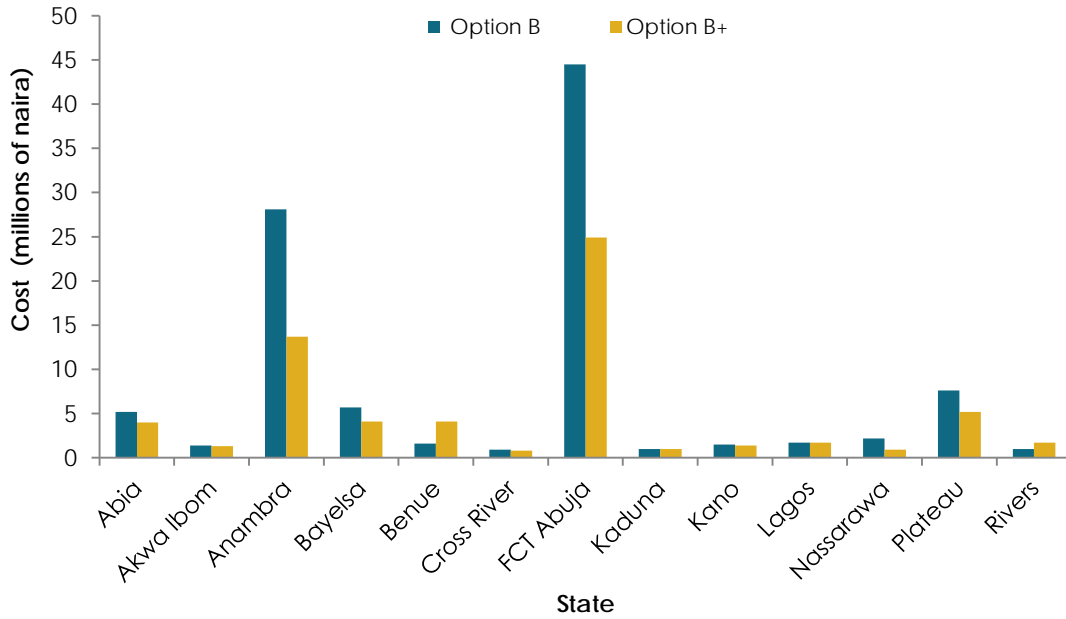
Total (vertical and adult) Infections Averted and Cost per Infection Averted, by Scenario for Each State

While the primary aim of PMTCT is to prevent vertical transmission, there are benefits to the non-infant population. This analysis considers vertical and adult infections and infections averted to estimate the overall impact of scaling up different treatment options for PMTCT. Figure 5 shows the impact in terms of total new infections. When compared to the Baseline scenario, Option B+ results in 302,000 fewer new infections and Option B results in 286,000 fewer new infections.



The cost per infection averted, regardless of mode of infection, is one of the most important factors in the decision-making process. Figure 6 shows the cost per infection averted when vertical and adult infections are considered (the costs in U.S. dollars are shown in Table A4 in the Annex).

Figure 6: Estimated Cost per Infection Averted



The inclusion of all new infections, regardless of infection mode, lowers the cost per infection averted considerably, and Option B+ is more cost-effective (N5 million/US\$31,000 per infection averted) than Option B (N7.9 million/US\$44,000 per infection averted).

DISCUSSION

Within the government of Nigeria, considerable dialogue has centered on whether or not to adopt Option B+ in Nigeria. As one of the countries with a significant MTCT burden, Nigeria's use of a comparative analysis to inform the decision-making process adds value. The estimates provided in these results are not a final step but one of many critical components of Nigeria's decision-making process. It is important to note that this analysis assumes the necessary infrastructure and human capacity are available to support the estimated volume of patients and achieve the level of scale-up necessary to meet the eMTCT goals. Therefore, it is assumed that investments have been made to expand service delivery—constructing new facilities, renovating existing clinical facilities to meet increasing patient demand, and refurbishing warehouses and distribution centers to handle the larger volume of medicines. We also assume that new clinical providers will be hired and trained so all the necessary components of program delivery are in place to meet the expanded needs for care and service delivery.

Despite these limitations, the results point to a clear recommendation that the government of Nigeria adopt Option B+ to effectively pursue the goal of eMTCT. The results indicate that when Option B and Option B+ are considered as treatment options for HIV-positive pregnant women, the latter is more cost-effective. The adoption of Option B+ will be integral to achieving Nigeria's goals of universal access to treatment by 2020 and ending the HIV epidemic by 2030. Additional cost savings may be realized when the treatment criteria for PMTCT expand to include all women and the cost of CD4 testing becomes redundant. Kripke et al. (2013) and Gopalappa et al. (2014) have also presented results on the benefits of adopting Option B+ which, in comparison to Option B, include: 1) greater reduction in postpartum and infant infection rates due to the greater probability of mothers' viral suppression as a result of "test and treat" (Option B+); 2) a decreased burden of treatment management and tracking because women will already be established in the ART program; and 3) a reduction in partner transmission.

The exercise also provides a useful model for other countries considering the implications of implementing Option B+. A crucial part of this approach is the focus on subnational/state-level projections, which allow planners and program managers to improve the accuracy of resource targeting. Conducting a workshop to build state-level capacity to support planning and monitoring of PMTCT target-setting with evidence from policy tools like Spectrum strengthens the decision-making process in the medium and long term. The more familiar state-level program managers become with using policy planning tools, the more likely they are to apply these tools to strengthen the development and monitoring of PMTCT implementation at the state level. Armed with data showing the impact and cost of different strategies, program managers are better able to advocate for resource allocation and ensure strategic implementation of PMTCT programs.

As state-level policy planners and program managers incorporate the use of planning tools like Spectrum into the decision-making process, the need to improve the quality and expand the breadth of the data needed to generate more accurate impact and cost estimates becomes clearer. Strengthening the capacity of national and subnational government staff to collect high-quality data on coverage levels and costs will become a priority. Nigeria's approach to PMTCT scale-up highlights this need and is an example for other countries as they consider adopting Option B+. Nigeria's experience also contributes to the broader discussion about building country ownership of planning and monitoring programs that focus on eliminating mother-to-child transmission of HIV.

ANNEX

Table A1: Unit Cost

Program Service	Cost in US\$ 2013	Cost in US\$ 2020
Community mobilization – cost per person reached	1.62	1.62
Mass media- cost per person reached	4.00	4.00
Voluntary counseling and testing per VCT client	17.00	17.00
Condom provision – cost per male condom distributed by the public sector	0.10	0.10
Youth		
Cost per teacher trained in primary school education	50.00	50.00
Cost per teacher trained in secondary school education	181.50	181.50
Cost of peer education for out-of-school youth	3.32	3.32
Workplace programs		
Cost per person in employment reached (peer education)	4.30	4.30
Cost per STI treated in the workplace	6.33	6.33
Female sex workers – Cost per sex worker targeted	29.28	29.28
Male sex workers – Cost per sex worker targeted	29.28	29.28
Men who have sex with men – Cost per man targeted	11.75	11.75
Injecting drug users		
Cost of harm reduction programs per person contacted	15.00	15.00
Cost of counseling and testing per IDU targeted	15.00	15.00
Cost of community outreach and peer education per IDU targeted	15.00	15.00
Cost per needle distributed and destroyed	0.26	0.26
Cost of drug substitution per IDU targeted	1008.53	1008.53
STI management – Cost per STI treated in clinics	4.69	4.69
Blood safety – Cost of screening one unit of blood for HIV	20.00	20.00
Post-exposure prophylaxis – Cost per PEP kit	100.00	100.00
Safe medical injection – Additional cost for auto-disable syringes	0.23	0.23
Universal precautions – Annual cost per hospital bed	300.00	300.00
Adults (costs per patient per year)		
First-line ART drugs	159.67	142
Second-line ART drugs	819.00	727
Additional ART drug costs for tuberculosis (TB) patients (male)	240.78	214
Additional ART drug costs for TB patients (female)	240.78	214
Lab costs for ART treatment	190.00	169
Drug and lab costs for opportunistic infections	11.10	10
Cotrimoxazole prophylaxis	7.40	7
TB prophylaxis	23.00	20
Nutrition supplements for infant's first six months	0.39	0.35
Children (costs per patient per year)		
ARV drugs	193.33	172

The Costs and Impacts of Scaling Up PMTCT in Nigeria

Program Service	Cost in US\$ 2013	Cost in US\$ 2020
Lab costs for ART treatment	86.54	77
Service delivery costs		
Cost per inpatient day	14.60	13
Cost per outpatient visit	6.40	6
Service delivery requirements (per patient per year)		
ART: inpatient days	1.60	1.42
ART: outpatient visit	6.20	5.50
Opportunistic infections treatment: inpatient days	1.60	1.42
Opportunistic infections treatment: outpatient days	6.20	5.50
Counseling (per mother)		
Pre-test	1.00	1.00
Post-test for HIV-positive mothers	15.00	15.00
Postnatal (including breastfeeding)	0	0.00
HIV testing (per test)		
Mother	5.00	5.00
PCR for infant after birth	30.00	30.00
Infant after cessation of breastfeeding	0	0
ARVs (cost per person per day)		
Nevirapine, 200mg for mother	0.05	0.04
Nevirapine, for infant	0.59	0.52
AZT	0.18	0.16
3TC	0.08	0.07
Triple treatment (AZT + 3TC + NVP/EVF)	0.25	0.22
Triple prophylaxis	0.25	0.22
Service delivery (per mother)	186.00	165.08
Formula (per child)	0	0

Table A2: Total PMTCT Cost

	In naira (billions)			In U.S. dollars (billions)		
	Baseline	Option B	Option B+	Baseline	Option B	Option B+
Abia	458	483	483	2.87	3.02	3.02
Akwa Ibom	185	208	207	1.16	1.30	1.29
Anambra	474	496	498	2.96	3.10	3.11
Bayelsa	457	471	470	2.86	2.94	2.94
Benue	199	220	265	1.24	1.38	1.65
Cross River	167	181	181	1.04	1.13	1.13
FCT Abuja	207	217	217	1.29	1.36	1.36
Kaduna	195	233	233	1.22	1.46	1.46
Kano	239	404	404	1.49	2.52	2.53
Lagos	226	293	293	1.42	1.83	1.83
Nassarawa	161	177	167	1.01	1.10	1.05

	In naira (billions)			In U.S. dollars (billions)		
	Baseline	Option B	Option B+	Baseline	Option B	Option B+
Plateau	241	256	256	1.50	1.60	1.60
Rivers	177	216	242	1.10	1.35	1.51
Total cost	3,385	3,854	3,917	21	24	24.5
Incremental cost		468	531		4	4.5

Table A3: Estimated Number of New Vertical Infections

	Baseline	Option B	Option B+
Abia	10,541	6,072	4,669
Akwa Ibom	8,503	5,643	4,686
Anambra	4,711	3,947	3,007
Bayelsa	6,308	3,925	3,114
Benue	4,553	3,724	2,902
Cross River	9,026	5,552	4,801
FCT Abuja	1,048	848	666
Kaduna	18,258	10,308	10,308
Kano	64,269	34,849	29,857
Lagos	13,778	8,949	8,154
Nassarawa	2,392	1,850	1,442
Plateau	6,481	4,535	3,593
Rivers	12,040	7,010	6,242
Total new infections	161,908	97,212	83,441
Infections averted	-	64,696	78,467

Table A4: Cost per Vertical Infection Averted

	In naira (millions)		In U.S. dollars	
	Option B	Option B+	Option B	Option B+
Abia	5	4	34,000	26,000
Akwa Ibom	8	6	49,000	36,000
Anambra	29	14	29,000	38,000
Bayelsa	6	4	36,000	26,000
Benue	26	40	160,000	250,000
Cross River	4	3	25,000	21,000
FCT Abuja	51	27	320,000	167,000
Kaduna	5	5	30,000	30,000
Kano	6	5	35,000	30,000
Lagos	14	12	86,000	74,000

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	In naira (millions)		In U.S. dollars	
	Option B	Option B+	Option B	Option B+
Nassarawa	29	7	180,000	43,000
Plateau	8	5	48,000	32,000
Rivers	8	11	49,000	71,000
Average cost per infection averted	15	11	83,000	65,000

Table A5: Estimated Total New Infections

	Baseline	Option B	Option B+
Abia	115,781	111,113	109,712
Akwa Ibom	47,041	31,330	30,357
Anambra	50,367	49,585	48,632
Bayelsa	52,922	50,496	49,685
Benue	43,916	30,741	27,691
Cross River	55,027	38,893	38,096
FCT Abuja	1,294	1,064	883
Kaduna	101,008	63,538	63,538
Kano	245,141	135,352	130,000
Lagos	98,227	59,594	58,758
Nassarawa	22,443	15,253	14,824
Plateau	48,607	46,645	45,705
Rivers	89,346	51,330	51,235
Total infections	971,120	684,934	669,116
Infections averted	-	286,186	302,004

Table A6: Estimated Cost per Infection Averted

	In naira (millions)		In U.S. dollars	
	Option B	Option B+	Option B	Option B+
Abia	5.2	4.0	33,000	25,000
Akwa Ibom	1.4	1.3	9,000	8,000
Anambra	28.1	13.7	176,000	86,000
Bayelsa	5.7	4.1	36,000	26,000
Benue	1.6	4.1	10,000	25,000
Cross River	0.9	0.8	5,000	5,000
FCT Abuja	44.5	24.9	278,000	155,000
Kaduna	1.0	1.0	6,000	6,000
Kano	1.5	1.4	9,000	9,000
Lagos	1.7	1.7	11,000	11,000
Nassarawa	2.2	0.9	14,000	5,000
Plateau	7.6	5.2	48,000	32,000

	In naira (millions)		In U.S. dollars	
	Option B	Option B+	Option B	Option B+
Rivers	1.0	1.7	6,000	11,000
Average cost per infection averted	7.9	5.0	49,000	31,000

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