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# Supplementary Actuarial Analysis of HIV/AIDS Cover Lagos State

*Prepared for USAID - HFG by*



18th August 2017



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# Supplementary Actuarial Analysis of HIV/AIDS Cover Lagos State



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- Version 0 - Initial draft report issued on 11<sup>th</sup> May 2017  
Version 1 - Final draft report issued on 18<sup>th</sup> August 2017 (incorporates peer review comments)  
Version 2 - Update report incorporating costs of Dolutegravir (DTG)

This work was funded with support from the U.S. Agency for International Development (USAID) as part of the Health Finance and Governance (HFG) project led by Abt Associates under USAID cooperative agreement AID-OAA-A-12-00080. The contents are the responsibility of Abt Associates and do not necessarily reflect the views of USAID or the United States Government.



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## Executive Summary

Lagos State Government signed into Law a bill that establishes a Lagos State Health Management Agency and the Lagos State Health Scheme in 2015 to ensure residents of the State have access to quality and affordable health care services and financial protection. Further to this, the State Government has had an actuarial study conducted and designed and priced a healthcare insurance package to meet this need.

The healthcare package as currently priced does not include cover for HIV/AIDS and this report – can be considered as a supplementary but independent analyses to the previous work – discusses an appropriate additional risk premium to include in the main healthcare package to cover this element (HIV/AIDS) as the State, and perhaps the country as a whole, needs to take ownership of HIV/AIDS response and ensure its sustainability. Similar to the healthcare package and analysis already developed by PharmAccess, this report analyses only the medical costs (drugs and testing where applicable) and excludes any associated service delivery costs, profit margin or taxes.

The financial impact of adding HIV/AIDS cover has been analysed under the 3 modules – HIV Test and Counselling (HTC), Anti-Retroviral Therapy (ART) and Prevention of Mother to Child Transmission (PMTCT). **In this revised/updated report, we show the costs of HIV assuming the new ARV drug, Dolutegravir (DTG), is used. The unit costs are referenced from the 2017 Antiretroviral (ARV) CHAI Reference Price List.**

We have estimated the total medical cost for including HIV/AIDS cover as **₦209.40** per person per year and in Table 1 below, have demonstrated the modular costs under HTC, ART and PMTCT.

Table 1: Modular pricing for HIV/AIDS cover

Modular pricing of HIV/AIDS cost of cover	Amount in Naira (₦)
---HTC	13.60
---ART	133.05
---PMTCT	15.96
---Contingency Margin	46.78
<b>Total cost for additional HIV/AIDS cover</b>	<b>209.40</b>
<b>With Dolutegravir</b>	<b>175.10</b>

The module, HTC, includes the cost of testing and counselling for the general population. ART covers the anti-retroviral medications for HIV+ patients in both 1<sup>st</sup> and 2<sup>nd</sup> lines of defense as well as the viral load test. Under PMTCT, the study has considered anti-retroviral medications for infected mothers, Nevirapine drugs for babies born to infected mothers as well as the EID test for infants after 6 weeks. Testing and counselling for pregnant mothers has been excluded under PMTCT under this study as it has already been covered under the PharmAccess analysis. Opportunistic infections have not been considered under this study.

We have relied on the service data of HIV patients collated and validated by the Lagos State Ministry of Health (LSMoH) to serve as the encounter data, Lagos State population projections as well as the projected costs of drugs and testing supplied by the LSMoH.

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# 1. Introduction

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USAID and Health Finance Governance subcontracted me to carry out this supplementary actuarial analysis for the Lagos State Health Scheme benefit package to include the additional medical cost for covering HIV/AIDS services.

## 1.1 Scope of Works

By the terms of reference, the works cover;

- Carrying out an actuarial analysis to determine the financial impact of adding HIV/AIDS services to the Lagos State Health Scheme benefit package, i.e. advise on the additional risk premium to cover HIV/AIDS.
- Providing an actuarial analysis model to enable the State conduct sensitivity analysis where required.
- Modular pricing for the HIV/AIDS cover structured along;
  - HTC – HIV testing and counselling for the general population
  - PMTCT – Medication for both mother and infant to prevent mother to child transmission as well as the ‘EID’ test for infants
  - ART – Medication for infected patients on anti-retroviral therapy (1<sup>st</sup> and 2<sup>nd</sup> Lines of Defence) as well as the viral load test.

## 1.2 Target Market

The package is an add-on to the Lagos State Health Scheme benefit package which has, as a long term goal, mandatory enrolment for the entire population of Lagos State.

The entire population of Lagos State is currently 24.05 million people, and our understanding is that in the inception phase the healthcare package may commence with the enrolment of Lagos State Government workers as well as pregnant women and children under 5 years of age.

We have used the entire population in this analysis and assumed that the characteristics of a mix of people taking-up the contract is a reflection of the entire population.

Further characteristics of the population are described in the Pharm Access report.

## 1.3 Actuarial Data and Limitations

The HIV service data provided is only segmented into 2 cohorts – ‘Age Bands’ and ‘Gender.’ There is no further information to help to estimate trends over the years. Other such risk factors that may have been relevant include;

- Stage of infection
- Geographic location of the patient
- Duration on drugs
- Occupation/socio-economic status
- Latent period

Historical unit costs for drugs and testing, which are denominated in US dollars, under the various modules were not available to assess the actual price inflation over the years.

in the tables below, we have summarised the service data provided according to age Bands for the 3 modules under investigation;

*Table 2: Summary of number of HTC encounters from years 2012 - 2016*

Age Band	2012	2013	2014	2015	2016
<b>0 -14</b>	8,185	15,726	21,964	34,246	100,729
<b>15-19</b>	4,370	6,037	9,264	23,347	79,943
<b>20-24</b>	10,089	19,749	15,241	43,738	172,232
<b>25-49</b>	85,250	99,059	79,619	229,823	667,615
<b>50+</b>	7,116	16,480	13,918	41,323	128,816
<b>TOTAL</b>	<b>115,010</b>	<b>157,051</b>	<b>140,006</b>	<b>372,477</b>	<b>1,149,335</b>

*Table 3: Summary of number of ART encounters from years 2012 - 2016*

ART (1 <sup>st</sup> line of defense)					
Age Band	2012	2013	2014	2015	2016
<b>Infants</b>	9	337	276	150	43
<b>Ages 1-14</b>	1,545	4,230	3,724	2,146	2,785
<b>15 years and above</b>	31,074	43,952	45,024	41,998	53,411
<b>TOTAL</b>	<b>32,628</b>	<b>48,519</b>	<b>49,024</b>	<b>44,294</b>	<b>56,239</b>

ART (2 <sup>nd</sup> line of defense)					
Age Band	2012	2013	2014	2015	2016
<b>Infants</b>	-	1	5	13	7
<b>Ages 1-14</b>	121	2,283	209	211	300
<b>15 years and above</b>	2,291	2,660	2,790	2,883	3,400
<b>TOTAL</b>	<b>2,412</b>	<b>4,944</b>	<b>3,004</b>	<b>3,107</b>	<b>3,707</b>

*Table 4: Summary of number of mothers on PMTCT medication from years 2012 - 2016*

Age Band	2012	2013	2014	2015	2016
<b>15 - 49</b>	1,250	1,379	4,018	1,564	1,720

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## 2. Pricing Methodology and Assumptions

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The pricing method adopted involves estimating the number of HIV/AIDS cases including new incidence cases over the next 3 years from the service data, derive the corresponding utilisation rates and multiply this by the cost of drugs. The number of estimated cases in each of the projection years also considers the number of lives that may be lost through death (AIDS mortality) as well the number of persons that stopped accessing treatment.

To determine the appropriate dataset for costing HIV testing, we have utilized the historical data and the least squares method to determine a trend in the number of tests that will be carried out in the next 3 years relative to the entire population (the projected population statistics are as provided by LSMoH budget allocation office) and multiplied it by the cost of carrying out the test.

### 2.1 Encounter Data

The HIV service data provided by the LSMoH has been collated from service providers across all the Local Government Areas (LGA's) in the State. The records have been provided for years 2012 through to 2016.

It captures, for instance, numbers of infected patients receiving anti-retroviral drugs for both 1<sup>st</sup> and 2<sup>nd</sup> lines of defense, number of HIV tests performed in a year, number of pregnant women receiving medication to prevent transmission to a child, etc.

We have not adjusted for encounters, especially for HIV testing that may have been conducted in facilities not included among the facilities covered in the service data, and have assumed the records reflect the experience within the entire population.

We have assumed ART continuation and conversion rates of 90/90/90. This compares with past experience of conversion and continuation rates between 85% and 90%.

### 2.2 Projected Costs

The unit costs utilized in this study are based on LSMoH Global Fund Quantification document prepared in 2016 with budget costs for the 1<sup>st</sup> quarter of 2017. There is no differentiation in price between public and private providers.

For any particular module, e.g., ART – 1<sup>st</sup> line of defense, the unit cost adopted is the weighted average cost of the different drugs that can be used where the weights are the proportion of people likely to be on each particular drug.

In this revised/updated report, we show the costs of HIV assuming the new ARV drug, Dolutegravir (DTG), is used. The unit costs are referenced from the 2017 Antiretroviral (ARV) CHAI Reference Price List.

### 2.3 Assumptions

The projected costs provided in the reference data are denominated in US dollars – we have assumed the medical cost trend to be 6.5% in the future projection years (PwC's Health Research Institute – Medical cost trend in 2017).

In the base calculations, we have adopted a dollar to naira exchange rate of \$1:N306, the official rate quoted by the Central Bank of Nigeria at the time of preparing this report.

We have assumed women of child-bearing age fall within the age band 15 years – 49 years.

Further assumptions in respect of utilization rates, cost of drugs and testing and the data sources are detailed in the table below;

*Table 5: Input assumptions adopted in the model*

Module	Assumption on utilisation	Assumption on cost per annum	Source of data	Source of projected costs
ART (1 <sup>st</sup> line)	0.00283	N31,704	LSMoH HIV service data for encounters, projected population from LSMoH budget allocation office	LSMoH Global Fund Quantification - 2016
ART (2 <sup>nd</sup> line)	0.00017	N89,799	LSMoH HIV service data for encounters, projected population from LSMoH budget allocation office	LSMoH Global Fund Quantification - 2016
PMTCT (for mother)	0.000333	N32,056	LSMoH HIV service data for encounters, projected population from LSMoH budget allocation office	LSMoH Global Fund Quantification - 2016
PMTCT (for child)	0.000333	N10,690 for six weeks	LSMoH HIV service data for encounters, projected population from LSMoH budget allocation office	LSMoH Global Fund Quantification - 2016
HTC (test for general population)	1 test	N261	LSMoH HIV service data for encounters, projected population from LSMoH budget allocation office	LSMoH Global Fund Quantification - 2016
HTC (confirmatory test)	1 test	N614	LSMoH HIV service data for encounters, projected population from LSMoH budget allocation office	LSMoH Global Fund Quantification - 2016
Viral load test for HIV positive patients	1 test	N4,079	LSMoH HIV service data for encounters, projected population from LSMoH budget allocation office	LSMoH Global Fund Quantification - 2016

New ARV drug - Dolutegravir (DTG)	Similar to ART 1 <sup>st</sup> & 2 <sup>nd</sup> Lines above	N22,950	LSMoH HIV service data for encounters, projected population from LSMoH budget allocation office	2017 Antiretroviral (ARV) CHAI Reference Price List
EID test for infant at 6 weeks	1 test	N5,091	LSMoH HIV service data for encounters, projected population from LSMoH budget allocation office	LSMoH Global Fund Quantification - 2016
Contingency margin	Assumed an additional contingency margin to cover utilization of +50% and currency exchange rate at N360:\$1 (adopted 30% of impact)			

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## 3. Results

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### 3.1 Modular Pricing

As requested in the scope of works, we have determined the additional costs to include HIV/AIDS on aggregate as well as by modules. A breakdown of the modular pricing per person per year is as shown below;

*Table 6: Modular pricing for HTC for the general population*

<i>Breakdown of HTC modular cost</i>	<i>Amount in Naira (₦)</i>
----HTC (General population test)	13.20
----HTC (Confirmatory test)	0.40
<b>Total cost for module - HTC</b>	<b>13.60</b>

Our understanding is that the cost of counselling the general population that gets tested has been allowed for under the Pharm Access actuarial study.

*Table 7: Modular pricing for ART including cost of performing a viral load test*

<i>Breakdown of ART modular cost</i>	<i>Amount in Naira (₦)</i>
----ART (1st Line of Defense)	102.93
----ART (2nd Line of Defense)	16.19
----ART (Viral Load Test)	13.93
<b>Total cost for module - ART</b>	<b>133.05</b>

The viral load test costs has been computed on the basis that all infected patients will get tested once in the year.

In this updated report, we show the modular costs for ART assuming the New ARV drug, DTG, is used instead of the traditionally available drugs previously indicated. On average, the cost of DTG is about 40% lower than the costs utilized originally for ART (1<sup>st</sup> and 2<sup>nd</sup> Lines of Defense). This is reflected in ART modular cost of N98.76 compared to the N133.05 shown above.

<i>Breakdown of ART modular cost</i>	<i>Amount in Naira (₦)</i>
----ART (1st Line of Defense) [New ARV drug – DTG]	80.38
----ART (2nd Line of Defense) [New ARV drug – DTG]	4.45
----ART (Viral Load Test)	13.93
<b>Total cost for module - ART</b>	<b>98.76</b>

Table 8: Modular pricing for PMTCT including drugs for both mother and infant as well as EID test for infant

Breakdown of PMTCT modular cost	Amount in Naira (₦)
----PMTCT (Drugs for mother)	10.69
---- PMTCT (Drugs for infant)	3.57
----PMTCT (EID test for infant)	1.70
Total cost for module - PMTCT	<b>15.96</b>

Testing for HIV for pregnant mothers has been excluded from this study as we understand this has been previously captured in the main actuarial study.

### 3.2 Medical cost for additional HIV/AIDS cover

The financial impact on the Lagos State Health Scheme benefit package of including HIV/AIDS cover is an additional risk premium of **₦162.61** per person per year.

Table 9a: Additional risk premium for HIV/AIDS cover

Additional risk premium for HIV/AIDS cost of cover	Amount in Naira (₦)
----HTC	13.60
----ART	133.05
----PMTCT	15.96
Total cost for additional HIV/AIDS cover	<b>162.61</b>

The comparative risk premium assuming DTG is used is **N128.32**.

We have considered the impact on medical cost of uptake of the scheme being only 50% of the target and currency exchange being N360:\$1 and adopted 30% of this as a contingency margin.

Table 9b: Additional risk premium for HIV/AIDS cover including contingency margin

Additional risk premium for HIV/AIDS cost of cover	Amount in Naira (₦)
----HTC	13.60
----ART	133.05
----PMTCT	15.96
----Contingency Margin	46.78
Total cost for additional HIV/AIDS cover	<b>209.40</b>

The comparative risk premium including the contingency margin assuming DTG is used is **N175.10**.

The main drivers of this price are as described in Section 2 and in the next section, we have conducted sensitivity tests to demonstrate the impact of actual experience deviating from the expected assumptions.

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## 4. Sensitivity Analysis

In this section we describe the impact of the input assumptions being different from actual future experience. We haven't considered risk factors such as the socio-economic status of the infected persons, sexual orientation, geographic location, occupation, stage of infection etc. to determine the additional risk premium as the information is not available.

We have assessed the impact of the change in each assumption separately in the sensitivity analysis and illustrated this in the table below;

*Table 10: Risk factors and the corresponding impact when stressed*

Risk factor	Shock	Pure risk premium (N)	Impact on additional risk premium for HIV/AIDS cover
<b>Incidence rate</b>	Incidence of new infections as recorded in UNAIDS report for Nigeria - about 30% shock	183.83	12.8%
<b>Utilisation of HIV/AIDS services</b>	+25%	215.23	32.4%
<b>Utilisation of HIV/AIDS services</b>	+33%	227.43	39.9%
<b>Medical inflation</b>	22% (similar to price inflation in main actuarial study) instead of 6.5%p.a.	N191.02	17.5%
<b>Exchange rate</b>	N360:\$1 instead of N306:\$1	N204.48	25.7%

From the sensitivity test results above, the most important risk factors are the utilisation of HIV/AIDS services as well as foreign exchange risk.

The utilisation is very important and can lead to significant increase in cost. Similar to the observations made in the main actuarial study, it is important the entire Lagos State population are enrolled on the scheme. The impact when this is not achieved is demonstrated in the next section.

In the last couple of years, the country has experienced significant volatility in the value of the local currency and assuming the official dollar exchange rate reaches N360:\$1 instead of the current level of N306:\$1, the base medical costs will increase by 25.7%.

## 5. Further Sensitivity and Scenario Analysis

Considering the scheme is new and the uptake rates may not be as expected, we demonstrate in the table below the impact on the medical cost only if only 10%, 20% or 50% of the target population enroll on the scheme.

Table 11: Impact on medical cost only of different population take up rates

Sensitivity	Pure risk premium (N)	Impact on additional risk premium for HIV/AIDS cover
Base	162.61	-
Uptake rate of 10% of target population	1,360.07	736%
Uptake rate of 20% of target population	694.81	327%
Uptake rate of 50% of target population	295.66	82%

We have also considered a **scenario** where the different sensitivities considered in section 4 above happen in tandem and illustrate the results in the table below;

Table 12: Impact on medical cost only of scenario of sensitivities described in previous section happening in tandem

Risk factor	Shock	Additional risk premium when shock occurs (N)	Impact on additional risk premium for HIV/AIDS cover
Incidence rate	Incidence of new infections as recorded in UNAIDS report for Nigeria - about 30% shock	326.81	100.98%
Utilisation of HIV/AIDS services	+33%		
Medical inflation	22% (similar to price inflation in main actuarial study) instead of 6.5%p.a.		
Exchange rate	N360:\$1 instead of N306:\$1		

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## 6. Conclusions

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- 5.1 Based on the available data provided we have in this actuarial study investigated HIV/AIDS incidence rates, utilisation or prevalence rates, and the likely number of investigations and testing that would be carried out in the future projection years – 3 years.
- 5.2 We have estimated in this supplementary actuarial analysis that an additional risk premium including a contingency margin of ~~₦209.40~~ added on to the Lagos State Health Scheme benefit package will cover HIV/AIDS services. Modular pricing for HTC, ART, and PMTCT has also been provided which can serve as a guide to which of the modules may be included in the benefit package. This margin fall to N175.10 if it assumed that the new ARV Dolutegravir (DTG) is used.
- 5.3 It is important to note that the analysis has been carried out on the assumption that the entire Lagos State population will be enrolled on to the scheme and the impact of lower than expected uptake could result in significant increase in the additional risk premium recommended.
- 5.4 We thank you for the opportunity of carrying out this analysis and will be delighted to make presentations as required.

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## Appendix - further data analysis

### Number of HIV Positive Pregnant Mothers

Age Band	2012	2013	2014	2015	2016
15 - 49	1,250	1,379	4,018	1,564	1,720

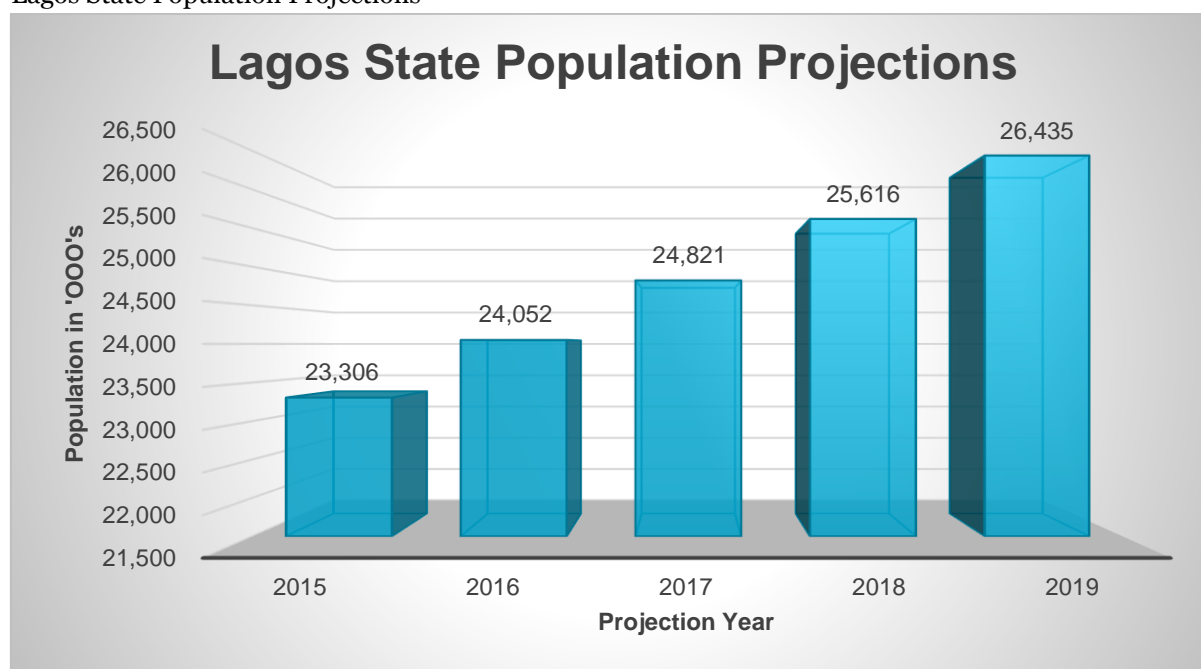
Age Band	2012	2013	2014	2015	2016
15 - 49	1,556	2,660	3,416	2,781	3,856

### Number of HIV Positive Patients on ARV's

ART (1 <sup>st</sup> line of defence)					
Age Band/Year	2012	2013	2014	2015	2016
Infants	9	337	276	150	43
Ages 1-14	1,545	4,230	3,724	2,146	2,785
15 years and above	31,074	43,952	45,024	41,998	53,411
<b>TOTAL</b>	<b>32,628</b>	<b>48,519</b>	<b>49,024</b>	<b>44,294</b>	<b>56,239</b>

ART (2 <sup>nd</sup> line of defence)					
Age Band/Year	2012	2013	2014	2015	2016
Infants	-	1	5	13	7
Ages 1-14	121	2,283	209	211	300
15 years and above	2,291	2,660	2,790	2,883	3,400
<b>TOTAL</b>	<b>2,412</b>	<b>4,944</b>	<b>3,004</b>	<b>3,107</b>	<b>3,707</b>

## Lagos State Population Projections



## Weighted Average Cost of Drugs

Module	Weighted average cost per annum
ART (1 <sup>st</sup> line of defense)	N31,704
ART (2 <sup>nd</sup> line of defense)	N89,799
PMTCT (drugs for mother)	N32,056
PMTCT (drugs for child)	N10,690 for six weeks
HTC (test for general population)	N261
HTC (confirmatory test)	N614
Viral load test for HIV positive patients	N4,079
EID test for infant at 6 weeks	N5,091

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