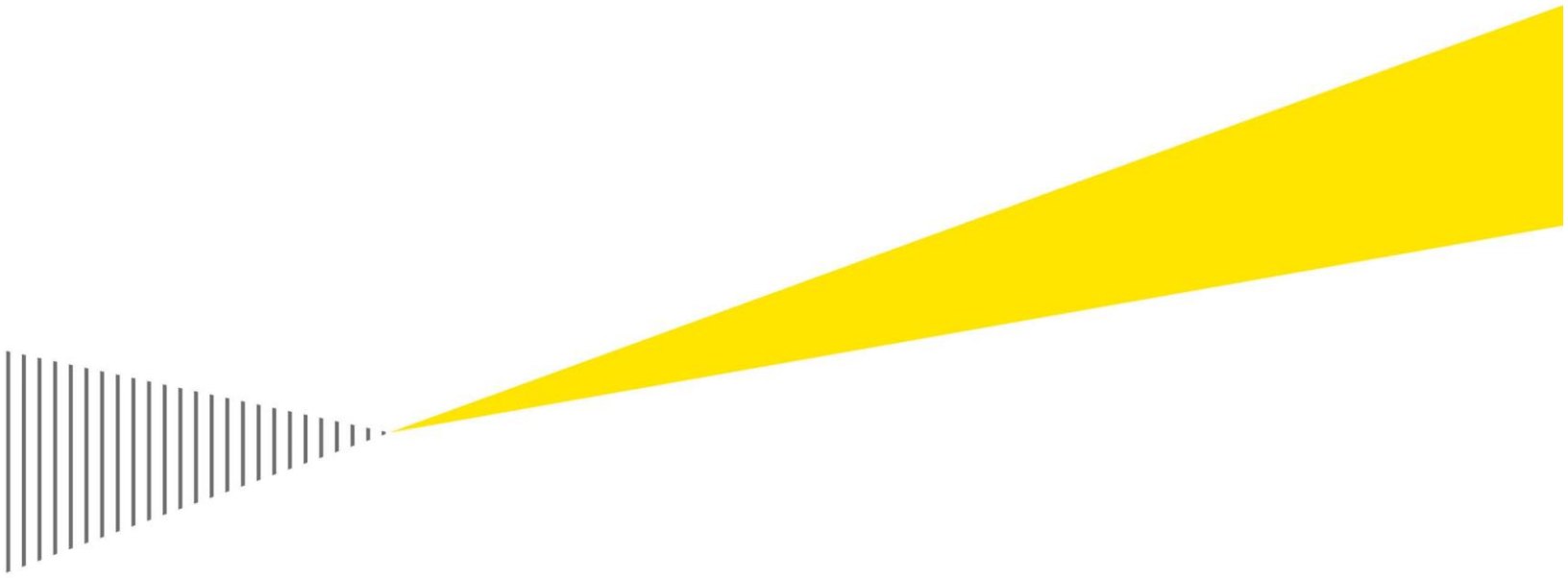
LAGOS STATE HEALTH SCHEME

Supplementary Actuarial Analysis of Tuberculosis (TB) cover.



Building a better working world

EXECUTIVE SUMMARY

Our focus in this report is to actuarially estimate the medical cost of including tuberculosis (TB) in the total benefit structure.

We have considered modular pricing under 3 different regimens:

Regimen I - Drug susceptible TB cases of Kids (pediatrics)
Regimen II - Drug susceptible TB cases of adults
Regimen III - Shorter Regimen (DRTB)

The pure premium estimate under the three regimens above are presented in the table below:

Table 1: Modular pricing for three (3) TB regimens

Additional Risk premium for TB cover	Projected amount in Naira
GeneXpert Test	92.64
Sputum Test I	9.97
Sputum Test II	9.97
Sputum Test III	9.97
Regimen I - DSTB for (Kids - Pediatrics)	10.92
Regimen II - DSTB for others	78.59
Regimen III - DRTB for All	276.74
Total Cost for additional TB Cover	**488.79**

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.

Table of Contents

1. Introduction

USAID's Health Finance and Governance Project contracted Ernst & Young, to carry out an actuarial study of the medical cost of Tuberculosis (TB) as a benefit in an insurance scheme. This analysis also forms part of the main actuarial study being conducted on the proposed benefit package for the Lagos State Health Scheme (LSHS).

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 TB to the Lagos State Health Scheme benefit package, i.e. advise on the additional risk premium to cover TB.

- Modular pricing for TB cover structured along;

    - Testing
    - Treatment, which is further segmented into costs for;
        - Drug Susceptible (DS) – paediatrics
        - Drug Susceptible (DS) – adults
        - Drug Resistant (DR)

1.2 Target Market

The Lagos State Health Scheme is intended to be a mandatory insurance scheme to cover the entire population of the state. Our understanding is that, at inception, the program may commence with the enrolment of Lagos State government workers as well as pregnant women and children under 5 years of age.

We have assumed a take-up rate of 10% of the entire population takes up the insurance in this analysis and also demonstrate the impact of a 100% take-up.

1.3 Actuarial Data and Limitations

The State's TB co-ordination office provided us with statistics from the National TB and Leprosy Control Program reports on case finding. The report is specific to Lagos State and covers all 20 LGA's. The same office also provided us with the cost of treatment per patient for each regimen.

There are limitations within the data, some of which include;

- DS and DR cases have not been explicitly specified in the total number of cases registered in the year. We have estimated the number of DR cases as 4.3% of new TB cases, and 25% of previously treated *[World Health Organisation. Global Tuberculosis Control: WHO report 2016. Geneva, Switzerland: World Health Organisation, 2016].*
- The data format for years 2013 through to 2015 is not consistent with the format of the most recent review

year (2016).

- The TB prevalence rate in Nigeria is 322 out of 100 000 lives in Nigeria according to the World Health Organisation (WHO). *[World Health Organisation. Global Tuberculosis Control: WHO report 2016. Geneva, Switzerland: World Health Organisation, 2016].*

- The data provided suggests Lagos State has a prevalence rate of **38 out of 100 000 lives,** lower than the national average. Further information such as; stage of infection, stage of treatment, geographic location of the patient, occupation/socio-economic status, etc., which could serve as relevant information of other risk factors to be considered are not available.

2. Pricing and Methodology Assumptions Data

The pricing method adopted entails estimating the number of TB cases likely to be notified and treated in any particular year over the next 3 years. This involves deriving the average number of TB cases (both DS and DR) over the past 3 years from the service data and use this experience to project the number of cases likely to emerge in the next 3 years and then computing the rate of utilization as the number of cases spread over the number of residents exposed (Lagos State population). The medical cost is then determined as the product of the utilization rate and the cost of treatment.

Similarly, we have utilized the experience analysed from the historical dataset to estimate the number of tests that are likely to be performed and projected the number of tests likely to be performed over the next 3 years. The risk premium for testing TB is then determined as the product of the number of tests and the costs incurred in performing the test.

2.1 Encounter Data

The TB service data was provided by the LSMoH and the State's TB co-ordination office and has been collated across all the Local Government Areas (LGA's) in the State. The records have been provided from years 2013 through to 2016.

The information in the dataset provided includes;

- Total number of TB cases notified and further splits this into;
  - Bacteriologically diagnosed cases
  - Clinically diagnosed TB cases
  - Cases with known HIV status
  - HIV positive cases, etc.

The data can be further broken down into gender and age cohorts. In our analysis, we have utilized the age cohort to separately determine the medical costs for drug susceptible variant of the ailment for both children (pediatrics) and adults.

Table 2: Summary of number of DS –TB encounters from year 2013 to 2016

					Projected Years		
Age Band	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
0 -14	641	636	530	509	848	1,188	1,697
15-19	629	595	623	717	1,041	1,457	2,081
20-24	910	784	792	718	1,327	1,858	2,655
25-49	5,212	5,001	4,814	4,781	7,915	11,080	15,829
50+	1,444	1,387	1,446	1,469	2,475	3,466	4,951
Total	**8,836**	**8,403**	**8,205**	**8,193**	**13,606**	**19,049**	**27,212**

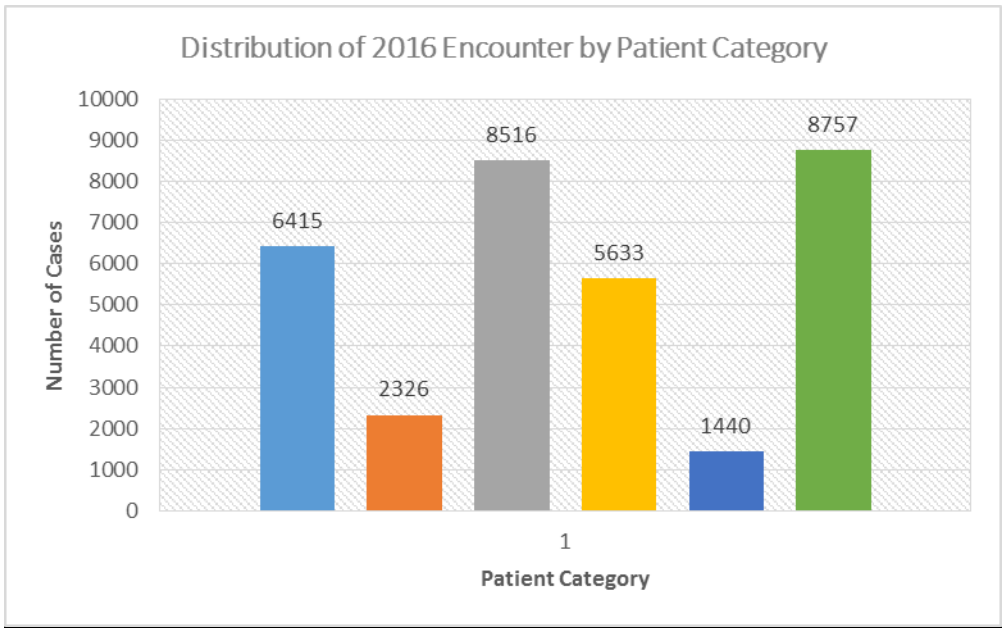
Table 3: Summary of number of DR –TB encounters from year 2013 to 2016

					Projected Years		
Age Band	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
0 -14	44	44	36	35	58	82	117
15-19	43	41	43	49	72	100	143
20-24	63	54	55	49	91	128	183
25-49	359	344	331	329	545	763	1,090
50+	99	96	100	101	170	239	341
Total	**608**	**579**	**565**	**564**	**937**	**1,312**	**1,874**

Table 4.1: Summary of TB cases in 2016

Patient Category	**2016**
Bacteriologically diagnosed PTB cases	6,415
Clinically diagnosed PTB Cases	2,326
Known HIV Status	8,516
TB Cases managed by TS	5,633
HIV positive TB Cases	1,440
Total TB notified	8,757

Graph 1: presentation of 2016 encounter distribution by patient category



2.2 Projected Costs

We have used the costing information provided by the National and Lagos State TB officers for cost per patient per

regimen for the drugs utilized in Lagos State. The costs have been supplied for drug susceptible treatment for adults, drug susceptible treatment for kids (paediatrics), as well as the costs for drug resistant treatment.

2.3 Assumptions

The unit costs provided in the reference data are denominated in US dollars - we have assumed the medical cost inflation 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 the Central Bank of Nigeria dollar to naira exchange rate of $1:N306 at the time of preparing this report.

We have assumed a pediatric age band to be 0 – 14 years of age

To arrive at the number of TB cases notified and under treatment in the future projection years, we have assumed the proxy experience of 2017 will continue over the next 3 years. On average, we do not expect the impact of variable decreases, including successful treatments and the rate of new incidences, to materially alter the average experience going into the future.

The WHO in its 2016 report *[World Health Organisation. Global Tuberculosis Control: WHO report 2016 Geneva, Switzerland: World Health Organisation, 2016]* indicated that only 15% of the total burden of the disease had been notified in 2015. We are assuming the LSHS will intensify its efforts to capture all infected people and the roll-out of an insurance scheme will also create a strong awareness that will enable more infected people to be captured hence, we have assumed 25%, 35%, and 50% of the total burden of the disease will be notified in the projection years 2017, 2018 and 2019

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

Table 5: The input assumptions adopted in the model

Modular pricing of TB cover	Category	Assumption on Utilisation	Assumtion on Average Unit Cost	Unit Cost in Naira	Sources of Data
GeneXpert Test	All	0.028388	$ 11	3,600	Lagos State Ministry of Health/ TB Coordination Office
Sputum Tests					
Test I	All	0.006231		1,500	
Test II	All	0.006231		1,500	
Test III	All	0.006231		1,500	
Regimen I - Drug Susceptible TB Cases	Kids - Pediatrics	0.001673	$ 21	7,200	
Regimen II - Drug Susceptible TB Cases	Others	0.012042	$ 21	7,200	
Regimen III - Drug Resistant TB Cases	All	0.000598	$ 1,512	510,480	

3. Results

The results from the analysis performed for the separate modules as well as the overall cost are presented in the following tables. These results are on the basis that only 10% of the entire State population will take up the insurance policy;

*Table 6: Modular pricing for **Testing TB***

Breakdown of TB Tests modular cost	Projected amount in Naira
GeneXpert Test	92.64
Sputum Test I	9.97
Sputum Test II	9.97
Sputum Test III	9.97
Total Cost for the tests	**122.54**

The 1st General Test was computed assuming that a GeneXpert test will be performed. Subsequent tests at the end of months 2, 4 and 6 have been estimated assuming the use of the Sputum test.

*Table 7: Modular pricing for **DS-TB Cases***

Breakdown of DSTB modular cost	Category	Projected amount in Naira
Regimen I - Drug Susceptible TB Cases	Kids - Pediatrics	10.92
Regimen II - Drug Susceptible TB Cases	Others	78.59
Total Cost for the tests		**89.51**

The DS-TB cases for pediatrics have been estimated based on the assumption of children are defined as being in the age band 0 – 14 years.

*Table 8: Modular pricing for **DR-TB Cases***

Breakdown of DRTB modular cost	Category	Projected amount in Naira
Regimen III - Drug Resistant TB Cases	All	**276.74**

This pricing encompasses all individuals tested, and progressed from the DS state to the DR state, and it is regarded in this report as the 3rd Regimen.

3.1 Medical Cost for additional tuberculosis (TB) cover

The overall total additional cost to the scheme is ₦488.79 per year, illustrated in the breakdown of costs below;

Table 9: Additional risk premium for TB cover

Additional Risk premium for TB cover	Projected amount in Naira
GeneXpert Test	92.64
Sputum Test I	9.97
Sputum Test II	9.97
Sputum Test III	9.97
Regimen I - DSTB for (Kids - Pediatrics)	10.92
Regimen II - DSTB for others	78.59
Regimen III - DRTB for All	276.74
Total Cost for additional TB Cover	**488.79**

As mentioned in section 2, the key drivers of the above estimated costs are examined in a sensitivity analysis in Section 4.

4. Sensitivity Analysis

In this report, we have examined changes in assumptions of the risk factors used in the actuarial analysis such as the medical inflation rate, exchange rate, utilisation of TB services and the incidence rate. However, socio-economic risk factors such as orientation on TB, occupation, geographical location, etc were not examined.

Table 10: Risk factors and impact on premium

Risk factor	Shock	Impact on additional risk premium for TB cover
Medical Inflation	22.0%	15.9%
Exchange Rate	N360: $1 instead N306:$1	16.0%

A 22% increase in the cost of treatments/drugs or exchange rate of N360:$1 instead of the assumed N306:$1 will lead to an increase in the risk premium by about 16%.

Table 11: Additional risk premium for TB assuming a medical inflation of 22%

Additional Risk premium for TB cover	Projected amount in Naira
GeneXpert Test	107.38
Sputum Test I	11.55
Sputum Test II	11.55
Sputum Test III	11.55
Regimen I - DSTB for (Kids - Pediatrics)	12.65
Regimen II - DSTB for others	91.10
Regimen III - DRTB for All	320.79
Total Cost for additional TB Cover	**566.58**

5. Further Sensitivity and Scenario Analysis

We have considered the impact on the medical cost assuming the take-up rate of the scheme is 20% or 50% of the entire population of the State.

Table 12: Additional risk premium for TB assuming 20% Of Lagos populace is enrolled

Additional Risk premium for TB cover	Projected amount in Naira
GeneXpert Test	46.34
Sputum Test I	4.99
Sputum Test II	4.99
Sputum Test III	4.99
Regimen I - DSTB for (Kids - Pediatrics)	5.46
Regimen II - DSTB for others	39.32
Regimen III - DRTB for All	138.43
Total Cost for additional TB Cover	**244.51**

This result indicates that if 20% of Lagos populace is enrolled in this scheme, there's about a 50% drop in the risk premium calculated.

Table 13: Additional risk premium for TB assuming 50% Of Lagos populace is enrolled

Additional Risk premium for TB cover	Projected amount in Naira
GeneXpert Test	18.54
Sputum Test I	1.99
Sputum Test II	1.99
Sputum Test III	1.99
Regimen I - DSTB for (Kids - Pediatrics)	2.18
Regimen II - DSTB for others	15.73
Regimen III - DRTB for All	55.39
Total Cost for additional TB Cover	**97.83**

This result also indicates 80% drop in the risk premium calculated assuming 50% of State population are enrolled on the scheme.

6. Conclusions

6.1 We have estimated in this supplementary analysis that an additional risk premium of N488.79 is sufficient to cover the additional costs as the scheme kicks off. **We strongly recommend that a review of this exercise is conducted a year after the scheme kicks off and some actual experience data has been gathered.**

6.2 On behalf of Ernst & Young, we thank you for the opportunity to conduct this exercise, and we look forward to partnering with you on other similar engagements.

7. Appendix

Table 14: Encounter data for Testing

Test Category	2016	2017	2018	2019	Average
GeneXpert Test	26,683	44,472	62,260	88,943	65,225
Sputum Test	5,857	9,762	13,666	19,523	14,317

Graph 3 – Growth curve for the projected Testing

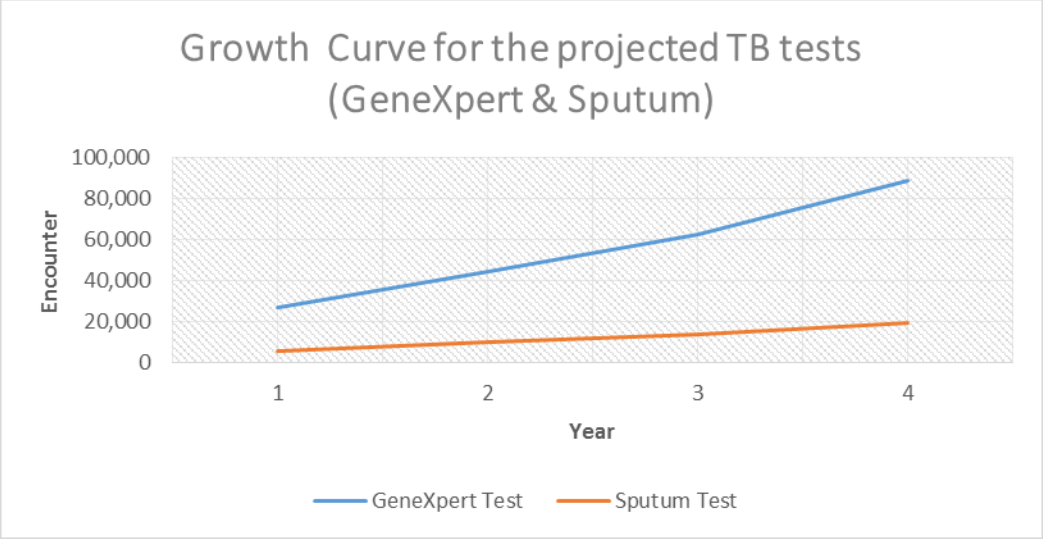
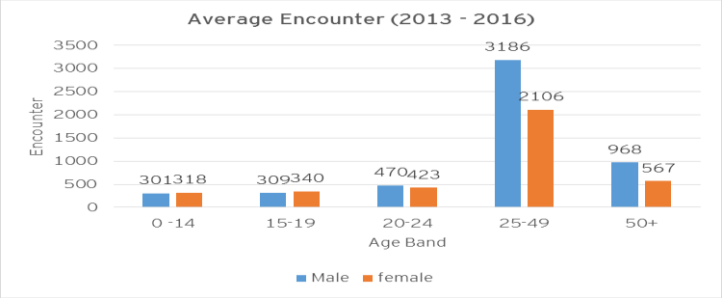


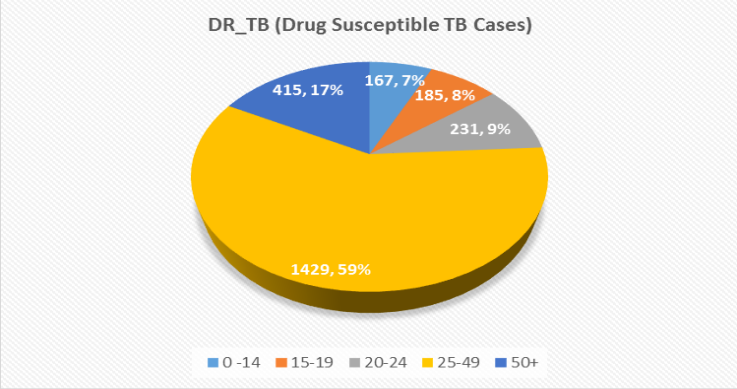
Table 15: Costing for the Testing & three Regimens TB cases

Modular pricing of TB cover	Category	Utilisation Rate	Assumed Average Unit Cost	Assumed Average Unit Cost in Naira
GeneXpert Test	All	0.0284	$ 10.66	3,263.21
Sputum Tests				
Test I	Confirmed positive only	0.0062	$ 5.23	1,599.61
Test II	Confirmed positive only	0.0062	$ 5.23	1,599.61
Test III	Confirmed positive only	0.0062	$ 5.23	1,599.61
Regimen I	Drug Susceptible Pediatrics TB cases	0.0017	$ 21.33	6,526.42
Regimen II	Drug Susceptible Others TB cases	0.0120	$ 21.33	6,526.42
Regimen III	Drug Resistant TB Cases	0.0006	$ 1,512.17	462,723.11

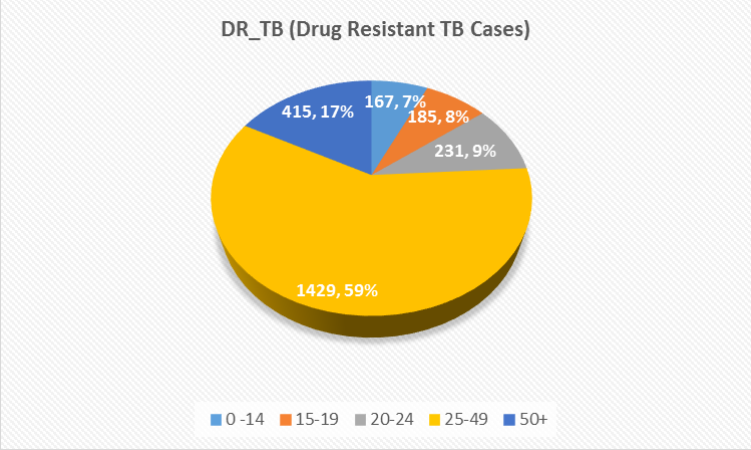
Graph 4 – Average encounter by gender



Graph 5 – Distribution of Drug Susceptible TB cases



Graph 6 – Distribution of Drug Resistant TB cases



EY | Assurance | Tax | Transactions | Advisory

About EY

EY is a global leader in assurance, tax, transaction and advisory services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. We develop outstanding leaders who team to deliver on our promises to all of our stakeholders. In so doing, we play a critical role in building a better working world for our people, for our clients and for our communities.

EY refers to the global organization and/or one or more of the member firms of Ernst & Young Global Limited, each of which is a separate legal entity. Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients. For more information about our organization, please visit ey.com.