

Assessing Service Delivery in Public and Private Hospitals in Nigeria: Lagos State Perspective

Joseph Afolabi Ibikunle

Abstract

This study assesses the service delivery of public and private hospitals in Lagos State, Nigeria for the period of 2008 to 2017. Convenience sampling method was employed to select 10 public and 10 private hospitals. The input variables are the number of Doctors, Nurses, and hospital beds, unit cost of operation, equipment and cost of drugs while the output variables were inpatient, outpatient, deliveries and revenue. Data Envelopment Analysis and the Malmquist Productivity Index (MPI) was used to calculate the efficiency and productivity growth of the hospitals. Findings revealed that the public hospitals were more efficient in terms of technical, allocative and cost with the mean score of (0.899, 0.886 and 0.805) than the private hospital (0.848, 0.829 and 0.714), but both are deteriorating in productivity growth pattern due to the technical efficiency change and technological changes. The study recommends that government should reduce the health budget gap so as to bring the public hospitals into healthy competition with their foreign counterpart in order to reduce medical tourism and invariably reduce capital flight from Nigeria. Also, for private hospitals with inefficiency related to allocation and cost, government may need to intervene in the spatial location to warrant fair distribution of the facilities. This will reduce unnecessary competition among them and improve proper utilization of available resources.

Introduction

Efficiency analysis in health care sector has attracted significant interest in recent decades due to escalating health care costs. Better understanding of health facility efficiency is important for ensuring effective use of health

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resources, especially in countries where public involvement in health care provision is high (Kitaki, 2018; Camila, Lenka & Jana, 2019). This is because the health system is widely considered as an important institution in the health improvement agenda of any country (Hakkinen & Joumard, 2007; Novignon & Lawanson, 2014). Health system according to the World Health Organisation (WHO, 2000) is the activities whose primary purpose is to promote, restore or maintain health. In Nigeria, the federal structure has shaped health delivery as all the three tiers of government are involved in health care delivery system, management and financing. The prevailing situation is such that the tertiary health care is provided by the federal government, secondary health care by the State governments while Local Government Areas (LGAs) are in charge of the primary level (Khunbhaka & Lovell, 2001; Olaniyan & Lawanson, 2010).

Every country both developed and developing makes provision for healthcare delivery system for its members. This is with a view to providing medical and related services for the maintenance of good health, particularly through the prevention and treatment of diseases. This is in recognition of the pervasive importance of good health upon which life is contingent. In Nigeria, health care can be provided through public and private providers. Public health care is usually provided by the government through public funds. Private health care on the other hand can be provided through (for profit) hospitals and (not for profit ones) non-government providers, including faith-based organizations (Horwitz, 2015; Ssenyonjo et al, 2018). Nigeria as a developing country with an estimated annual population growth rate of 2.60 percent is currently in 2019 having over 200 million people with Lagos State having about over 17.5 million of its population and is projected to be the world's third most populous country by the year 2050 (NBS, 2018; UN Report, 2017). It is therefore evident that the nation's demand for healthcare is huge and would continue to increase in proportion to the huge, growing and ageing population, level of health care, environmental problem, lifestyle within the loose of the policy loop and traditions. In the sub-set, urban population is equally growing as a result of rural-urban migration; while resources for healthcare provision are limited. This is due to a combination of factors related to the supply, such as the misplaced construction of facilities without prior need-assessment, and poor quality of services; it is also caused by demand-related factors such as financial, geographical and cultural barriers to people's access. One of the main concerns of policy makers and health system managers in lower middle-income countries such as Nigeria, Philippines, Pakistan and so on is to improve the efficiency and performance of hospitals, given the need to

ensure the best use of scarce resources to produce maximum outputs (Bello, 2000; Hakkinen&Joumard, 2007;Nistor, Stefanescu, Sintejudeanu&Crisan, 2017;Novignon&Lawanson, 2014).

In Nigeria, when it comes to matters of health, Lagos is listed among States in the “high end” class both in the public and the private hospitals because of the high number and variety of general and specialist health facilities on offer. Statistics from the Healthcare Facilities Monitoring and Accreditation Agency, HEFAMAA, shows that in Lagos, there are 26 registered General Hospitals, 256 public healthcare centers, 2, 886 private hospitals or specialist clinics and laboratories or diagnostic centers in addition to an estimated 160 tradomedical centers. Despite the high number of the health facilities, the talk about crowded emergency wards, lack of empathy from health workers and having to wait endlessly before getting a shared room in hospitals were common complaints. Those are problems that can be explained from the perspective of Lagos being a victim of its success as in adding to the State’s status as a mega city of more than 23 million people, it daily receives influx of people across the Federation seeking qualitative health care services (Oyekale, 2017; Musbau, 2019).

This longstanding and particularly heated debate about the efficiency of the private and public sectors in meeting the healthcare needs of the poor people in Nigeria, especially in the South west, is increasingly important because governments are faced with the challenge of providing more and better-quality healthcare to growing populations, all with increasingly squeezed budgets. Therefore, finding the most efficient and cost-effective means of delivery is crucial for achieving this goal. For example Oliver et al. 2011; Pia, Karen, Alabi and Imoh, 2011 sees no difference in the performance of both private and public hospitals in terms of their health care delivery while (Andrew, 2012; Chang, Cheng and Das 2004, Hollingsworth, 2008and Ogoh, 2001) argues that the private sectors provisions of healthcare are more efficient than the public sectors. In contrast, Jacob (2012); Lee, Yang and Mchoi (2009) found that Public provision were more efficient than the Private sector provision of health care facilities. The above findings have put policy makers in a crossroad in the area of setting an effective policy that can help to put State in a better position.

The question that comes to mind therefore, are: Which sector (Private or Public) is more efficient in the provision of healthcare services in terms of technicality, allocation and cost?What is the role of technical efficiency change and technological change in driving productivity changes? and; finally, what is the pattern of efficiency growth in total factor productivity (TFP) of public and private hospitals in Lagos State? This paper therefore is set

to address the several questions raised so as to assist policy makers in the Health sector. This study sets out to estimate the efficiency of health care providers, both public and private hospitals in Lagos State, Nigeria. Apart from the introduction, the paper develops as follows. Section 2 presents the review of literature. Section 3 focuses on the methodology. The analysis of result is presented in section 4. Section 5 concludes and recommends while section 6 focuses on the limitations of the study and section 7 provides guides for further research.

Literature Review

A hospital is an institution that provides medical services. In Nigeria, the major providers of healthcare are the private and the public sectors, giving birth to both private and public hospitals. A private hospital is one which is owned and governed by a person or many people who are managing the whole finances on their own. Not just finances, even the funding process and the administration, staff, all the doctors, everything is under the control of that private body. A public hospital is completely and entirely run by the government's funding and money. Everything from the construction to the fees of the doctors to the equipment, medicines are based on the government budget (Osain, 2011).

Efficiency can simply be defined as the ratio of output to input. According to Farrell (1957), efficiency of any decision-making units (DMU) means the success of the unit to produce the largest possible outputs from inputs available. Efficiency can be measured in three ways; First is the Technical efficiency, which is a concept that aims to evaluate whether a productive unit is using the minimum possible quantity of resources. Evaluation is achieved through the relationship between input (e.g., hospital beds and hours of work by physicians) and output (e.g., number of ordinary admissions and medical outpatients). Second is Allocative (or price) efficiency refers to the ability to combine inputs and outputs in optimal proportions in the light of prevailing prices and available technology and is measured in terms of behavioural goal of the production unit (Hollingsworth, 2012) and the third is Economic efficiency, also called productive or cost efficiency, is simply a combination of the technical and allocative efficiency. It is the maximum use of resources at a minimum average cost and a state in which every resource is optimally allocated to serve each person in the best way while minimizing waste and inefficiency. A number of studies exist on efficiency in the provision of health care services in the literature; however, some of the studies are largely beyond the shore of Africa. Most of the studies are carried out in the developed

countries, some in Africa and few in Nigeria. However, they all found different result based on different methodologies adopted and political will of the countries.

Empirically, a number of studies have been carried out in both developed, emerging economies and developing economy. For example, Majid, Azadeh, Haleh, Mehdi and Mohsen (2014) examined the technical efficiency of Specialty Ophthalmology hospital in Iran between 2009 and 2011 using DEA and SFA methodologies. The results of a comprehensive data analysis method from their study shows that the capacity of improving technical efficiency in the studied sector is 34% (average technical efficiency is 0.663 parts); and some of the sectors met the excess inputs (factors of production). Technical efficiency using stochastic frontier analysis was 0.937. In fact, the stochastic frontier analysis showed that the inefficiency is less than the actual value. They conclude that reducing excess capacity factors (factors of production) should be conducted in the form of a comprehensive plan and by considering the major role in the hospital and health sector costs reduction. However, the study fails to differentiate between the non-for-profit hospital and for-profit hospital which would have determined the more efficient among health care providers.

In addition, Gu, Song and Zhang (2013) examined the experimental measure of output and productivity in the Canadian Hospital sector from 2002 to 2010. The volume index of the output of the hospital sector was estimated by aggregating the number of inpatient cases and outpatient cases using their cost share as weight. The analysis revealed a large substitution bias in the volume index when inpatient treatment and outpatient treatment of the same medical disease condition are aggregated using their respective unit cost as weight. It was also found that the volume index of the hospital sector output corrected for substitution bias increased by 4.3% annually during the 2002 to 2010 period. The result however may be interesting, but the author did not investigate the efficiency of the hospital in the area of their input and output which may leave most decision making at a crossroad.

More so, Frohloff (2007) estimated the cost and technical efficiency of German Hospital using a stochastic frontier analysis. The study is the first to investigate both technical and cost efficiency of more than 1500 German general hospitals. The empirical results for the years from 2000 to 2003 indicate that private and non-profit hospitals are less costly and technically efficient than publicly owned hospitals. According to him, the explanation for the result may be that German private and non-profit hospitals produce at a longer average length of stay and, thereby a higher cost per case than

public institution due to the incentives provided by reimbursement schemes until 2004. However, the study neglects the aspect of the data envelopment analysis which would have been used to confirm which of the health care providers, private or public is more efficient. In terms of allocative efficiency and cost efficiency the study failed to determine which of the sector is more efficient in the aspect of cost and allocation.

In another study Dash (2009) applied Malmquist DEA to examine productivity of 29 district headquarters hospitals in India during the years 2002 to 2007. The inputs were number of beds, number of nursing staff, and number of physicians (Surgeon). The outputs were number of inpatients, number of outpatients, number of surgeries undertaken, emergency cases handled, medico legal cases, and deliveries. The hospitals have a MTFP value of 1.2358, EFFCH of 1.15, and TECH of 1.07. Therefore, the 23.6% hospital productivity growth is explained by a 15% improvement in efficiency combined with a 7% increase in innovation. Similarly, Barros, Antonio, Jose, Nicolas and Bernardim (2007) explored productivity change of 51 hospitals in Portugal using both the Luenberger indicators and the Malmquist index during the years 1997 to 2004. The inputs include number of beds, number of full-time equivalent personnel, and total variable costs. The outputs are cash flows (number of persons that leave the hospital), length of stay, number of consultations, and number of emergency cases. The Luenberger indicator is 0.008, EFFCH is -0.001 and TECH is 0.009. On the other hand, the MTFP is 1.042, EFFCH is 1.036 and TECH is 0.995. The Malmquist DEA results imply that on average productivity of the hospitals under consideration grew mainly due to improvement in efficiency.

Corroborating the above, Mathiyazhgan (2006) highlighted the cost efficiency of public and private hospitals in Karnataka state in India. Efficiency is estimated through parametric as well as nonparametric DEA method. The findings indicated that the choice of econometric approach did not make any significant difference in the results and they are robust. The analysis infers that hospitals (both public and private together in the analysis) are cost inefficient in the state, which is due to technical and allocative system of resources of the hospitals. The private hospitals appear relatively less inefficient than the public hospitals and that the main determinants of the technical and allocative inefficiencies of the public hospitals are due to inappropriate interventions of inpatient days care, share of medical personnel, bed capacity, quality indices and choice of the location, while in the case of private hospitals, it relates only to bed capacity and quality indices. However, the study failed to compare the result with

the aspect of growth in their productivity for both the private and public hospital.

Andrew (2012) examined whether for-profit hospitals are more efficient than non-profit hospitals in Zimbabwe using data envelopment analysis and the Tobit model. DEA findings revealed that there is a marked deviation of efficiency scores from the best practice frontier with for-profit hospitals having the highest mean overall technical efficiency (OTE) score of 61.4%. The mean OTE scores for mission and public hospitals are 35% and 50.3% respectively. Evidence from the second stage, Tobit model suggests that while both for-profit hospitals and government hospitals are both important in influencing efficiency, for-profit hospitals had a higher marginal mean efficiency score than government hospitals. The study however made use of only one methodology which may be biased. Hence, comparing the result with SFA would have shown the reliability of the outcome of the study.

Theoretical Framework for the Model

In the health context, efficiency is concerned with the relation between resource inputs (labour, capital, material, or equipment) and health outcomes (inpatient, outpatient, lives saved, deliveries and so on). Existence of inefficiency is indicated by possible reallocation of resources in a manner that results in increase in health outcomes (Lawanson, 2015). The purpose of DEA is to construct a non – parametric envelopment frontier over the data points such that all observed points are on the frontier and those under the frontier are not optimal. In other words, to estimate efficiency of the hospitals and to explain the inefficiencies.

Therefore, to illustrate the DEA model mathematically, assume that each decision - making units (DMUs) use m inputs for the production of n outputs in a given technology level. Denotes the amount of input i ($i=1,2,\dots,m$) produced by j_{th} DMU ($j=1,2,3,\dots,k$), whereas y_{sj} represents the quantity of output s ($s=1,2,3,\dots,n$) produced by j_{th} DMU ($j=1,2,3,\dots,k$). The variables u'_r ($r=1,2,\dots,n$) and w'_i ($i=1,2,\dots,m$) are weights of each output and input respectively. The technical efficiency of DMU can be written as;

This mathematical representation can be clarified as finding the appropriate values for u and w that maximise efficiency level of the observed firm subject to all efficiency scores and are less than or equal to 1. To avoid infinite solutions (Coelli et al.,2005) and obtain a linear programming model, Charnes – Cooper (1978) transformed the model as follows:

$$Max = \frac{\sum_{r=1}^n u_r Y_{ro}}{\sum_{i=1}^m w_i X_{io}} \quad (2.1)$$

Subject to:

$$\frac{\sum_{r=1}^n u_r Y_{rj}}{\sum_{i=1}^m w_i X_{ij}} \leq 1 \quad \text{for } j=1,2,\dots,k \quad (2.2)$$

$$u_r \text{ and } w_i \geq 0 \quad (r=1,2,\dots,n) \text{ and } (i=1,2,\dots,m) \quad (2.3)$$

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$$Max\theta = \sum_{r=1}^n u_r y_{ro} \quad (2.4)$$

Subject to:

$$\sum_{i=1}^m w_i x_{io} = 1, \quad (2.5)$$

$$\sum_{r=1}^n u_r y_{rj} - \sum_{i=1}^m w_i x_{ij} \leq 0, \quad (2.6)$$

$$u_r \text{ and } w_i \geq 0 \quad (r=1,2,\dots,n) \text{ and } (i=1,2,\dots,m) \quad (2.7)$$

Where θ is the efficiency rating of the service unit been evaluated by DEA, y_{rj} is the amount of output r generated by service unit j . x_{ij} is the amount of input used by service unit j . i is the number of inputs used by the service units. r is the number of outputs generated by the service units. u_r is the coefficient of weight assigned by DEA to output r and w_i coefficient of weight assigned by DEA to output i .

The dual of the above linear programming called the envelopment form is constructed by minimizing the quantity of the m inputs required to

meet the stated output.

$$\text{Min } \theta \quad (2.8)$$

Subject to:

$$\sum_{j=1}^k \lambda_j x_{ij} \leq \theta x_{io} \quad (i= 1,2,\dots,m) \quad (2.9)$$

$$\sum_{j=1}^k \lambda_j y_{rj} \geq \theta y_{ro} \quad (r= 1,2,\dots,n) \quad (2.10)$$

$$\lambda_j \geq 0 \text{ for } j = 1,2,\dots,k \quad (2.11)$$

Where θ is a scalar and λ is a $k \times 1$ vector of constant. The solution of this linear system will end up with finding θ corresponding to the efficiency level of each DMU. Therefore, θ should be less than or equal to 1. A hospital with $\theta = 1$ is technically efficient and means that it is operating on the frontier according to Farrell's (1957) proposition while a firm with θ less than 1 is inefficient. Farrell's (1957) and Koopman;s (1951) highlighted that there is a precise need to integrate slack variables into the linear programming model through which efficiency scores will be gauged concerning the slack usage of any input. The model then becomes as follows:

$$\text{Min } \theta_0 - \varepsilon \left(\sum_{i=1}^m s_i^- + \sum_{r=1}^n s_r^+ \right) \quad (2.12)$$

Subject to:

$$\sum_{j=1}^k \lambda_j x_{ij} + s_i^- = \theta x_{io} \quad (i= 1,2,\dots,m) \quad (2.13)$$

$$\sum_{j=1}^k \lambda_j y_{rj} - s_r^+ = \theta y_{ro} \quad (r= 1,2,\dots,n) \quad (2.14)$$

$$s_r^+, s_i^-, \lambda_j \geq 0 \text{ for } j = 1,2,\dots,k \quad (2.15)$$

Where s_r^+ and s_i^- is constraint to become non – negative and transformed inequalities into equations? s_r^+ means that must be satisfied by every single solution, whereas denotes that must be sustained for each input used by DMU₀.

Input-oriented constant returns to scale (CRS) model was used to measure the states' hospitals technical efficiency, allocative efficiency and cost efficiency. Furthermore, the same CRS was used in the Malmquist model to measure productivity changes. The choice of the model is based on the assumption that both public and private hospitals have more control over their inputs than outputs. As a result, they can minimize their inputs and still maintain the same level of output. Also, a Malmquist TFP index may not correctly measure total factor productivity changes when variable return to scale (VRS) methodology is used. In order to measure effectively technical changes and technological changes Grifell – Tatje and Lowell, (1995) suggests that the CRS be implemented to estimate distance functions. Otherwise, the resulting measures may not properly reflect the TFP gains or losses resulting from scale effects.

Methodology

In the economics literature, there are two broad categories of analytic approaches to estimate the cost or production frontiers and associated efficiencies: parametric and non-parametric methods. The former uses econometric approaches to estimate the functional forms and the latter uses observed data to estimate the frontier without placing conditions on the functional form. The Stochastic Frontier Analysis (SFA) and DEA are the most prominent forms of the parametric and non-parametric approaches, respectively. In this study, we are adopting the DEA approach to address the research objectives and also provide comparative basis for studies utilizing alternative approaches. On this basis, two different models were estimated to achieve the objectives. The first being the DEA model with the inclusion of the input prices, the second was based on the DEA Malmquist productivity index (MPI) to measure the pattern of productivity growth of the hospitals.

Model I

In order to achieve the second objective of the paper, the DEA model by Coeli, Prasada, Rao and George (2005) was employed. Here, the input prices were used and the model is specified as

$$\begin{aligned}
 & \text{Min}_{\lambda, x_{it}^*} w_{it}' x_{it}^* \\
 & \text{Subject to:} \\
 & -y_{it} + Y\lambda \geq 0 \\
 & x_{it}^* - X\lambda \geq 0 \\
 & N1' \lambda_i = 1 \\
 & \lambda_i \geq 0
 \end{aligned} \tag{3.1}$$

Where:

w_{it} is a vector of unit price of inputs (unit cost of equipment, unit cost of drugs and unit cost of operating expenses) utilized by hospital i in time t . x_{it}^* (which is calculated by the Linear Programming) is the cost minimization vector of input quantities for the i -th hospital in period t , given the input price w_{it} and the output level y_{it} . y_{it} is the amount of output (revenue) generated by hospital i in period t . $N1$ is an $N \times 1$ vector of 1 and λ_i is a dual variable. The total cost efficiency (CE) or economic efficiency (EE) of the i -th hospital in period t is measured by the ratio of minimum cost to observed cost is calculated thus

$$CE = \frac{w_{it}' x_{it}^*}{w_{it}' x_{it}} \tag{3.2}$$

A hospital is said to have realized allocative efficiency if it is operating with the optimal combination of inputs, given their respective prices. When a hospital has $\theta = 1$, then the hospital is at a point on production frontier. It is relatively overall efficient to other hospitals and as such properly using their inputs resources to produce output and choosing the correct mix of inputs given the input prices in the comparative DMU. But for < 1 implies that the hospital is relatively inefficient and as such not properly using their inputs resources to produce output and choosing the correct mix of inputs given the input prices. The amount by which the score of the inefficient hospital differs from 1 indicates the extent the hospital could reduce inputs without reducing its output. The allocative efficiency is calculated residually by using the following relationship between cost efficiency (CE) and technical efficiency (TE) as:

$$AE = CE/TE \tag{3.3}$$

When a hospital has $\theta = 1$, then the hospital is at a point on production frontier. It is allocatively efficient to other hospitals and as such properly choosing the correct mix of inputs given the input prices in the comparative group. But for $\theta < 1$ implies that the hospital is allocatively inefficient.

Model II

To determine the productivity growth pattern arising from the technical efficiency change and technological change, the Malmquist productivity index was employed in order to determine the growth pattern of the hospitals. In line with Fare, Grosskopf, Lindgren and Bjorn (1957), the Malmquist index which measures the total efficiency change of production unit between successive periods t and $t+1$ is specified as:

$$M_{ic}(x_{t+1}, y_{t+1}, x_t, y_t) = \left[\frac{\theta_i^t(x_{t+1}, y_{t+1})}{\theta_i^{t+1}(x_{t+1}, y_{t+1})} \times \frac{\theta_i^t(x_{t+1}, y_{t+1})}{\theta_i^{t+1}(x_t, y_t)} \right]^{1/2} \quad (3.4)$$

Where the notation D represents the distance function and the value of M is the Malmquist productivity index. The first index relates the input - output combinations observed in the two time periods (t and $t + 1$) to the period t technology frontier, and the second index relates the same input - output combinations to the period ($t + 1$) technology frontier. The terms in the numerator are the inputs used and outputs generated by firms in period $t + 1$, and those in the denominator represent the corresponding quantities observed for period t . Following Fare, Grosskopf, Lindgren and Jean-Pierre (1957), manipulation of the Malmquist index makes it possible to distinguish between efficiency changes and productivity changes and is specified as

$$m_{ic}(x_t, y_t, x_{t+1}, y_{t+1}) = \frac{\theta_i^{t+1}(x_{t+1}, y_{t+1})}{\theta_i^t(x_t, y_t)} \left[\frac{\theta_i^t(x_{t+1}, y_{t+1})}{\theta_i^{t+1}(x_{t+1}, y_{t+1})} \times \frac{\theta_i^t(x_{t+1}, y_{t+1})}{\theta_i^{t+1}(x_t, y_t)} \right]^{1/2} \quad (3.5)$$

Where: $\frac{\theta_i^{t+1}(x_{t+1}, y_{t+1})}{\theta_i^t(x_t, y_t)}$ is the technical efficiency change which refers to the change in the relative efficiency of a hospital in relation to other hospitals (i.e. due to the production possibility frontier) between time periods t and $t+1$.

$\left[\frac{\theta_i^t(x_{t+1}, y_{t+1})}{\theta_i^{t+1}(x_{t+1}, y_{t+1})} \times \frac{\theta_i^t(x_{t+1}, y_{t+1})}{\theta_i^{t+1}(x_t, y_t)} \right]$ is the technical change or the change in technology efficiency which describes

the change in the production possibility frontier as a result of the technology development between time periods t and $t+1$. $M_{ic}(y_t, x_t, y_{t+1}, x_{t+1})$

can attain a value greater than, equal to, or less than one depending on whether a hospital in question is experiencing productivity growth, stagnation, or productivity decline. A value greater than one signaled progression in productivity growth, value less than one signaled deterioration while a value of one indicate that the hospital is stagnant.

Input and Output Data

The data used for this study are the number of Doctors, number of Nurses, number of hospital beds, unit operating cost of hospitals, unit cost of equipment and unit cost of drugs as indicator of accumulated capital; these variables were used as input variables. The output variables were the inpatient, outpatient, deliveries and revenue generated by each hospital sampled. The data for the research were obtained for the period 2008 to 2017. Information required for the analysis were extracted from all the hospitals both private and public through the use of a well-structured questionnaire. The questionnaire was open ended type so as to ensure that information received is meaningful for generalization.

Results and Discussion

Presentation of the DEA Efficiency Results.

Table 1: Technical Efficiency (TE), Allocative Efficiency (AE) and Cost Efficiency (CE) of Public and Private Hospitals

Years	Private TE	Public TE	Private AE	Public AE	Private CE	Public CE
2008	0.883	0.925	0.428	0.921	0.383	0.851
2009	0.917	0.899	0.825	0.935	0.755	0.841
2010	0.920	0.904	0.841	0.866	0.770	0.784
2011	0.894	0.894	0.832	0.683	0.739	0.790
2012	0.935	0.912	0.880	0.834	0.822	0.763
2013	0.898	0.875	0.495	0.967	0.450	0.845
2014	0.223	0.744	0.813	0.948	0.195	0.701
2015	0.935	0.911	0.891	0.853	0.831	0.777
2016	0.947	0.870	0.908	0.924	0.859	0.803
2017	0.935	0.965	0.924	0.924	0.881	0.891
Total	8.487	8.899	8.287	8.855	7.135	8.046
Mean	0.848	0.899	0.829	0.886	0.714	0.805
Percentage	84.8%	89.9%	82.9%	88.6%	71.4%	80.5%

Source: Author's computation, 2019.

NOTE: TE mean Technical Efficiency, AE mean Allocative Efficiency and CE mean Cost Efficiency

Table 1 displayed the trend of technical, allocative and cost efficiency for both the public and private hospitals in terms of their percentage performance in Lagos State. However, the behavior of efficiency outcome in the State cannot be explained away from the recourse to history which involves finance, policy and political issues. For instance, in 2008 Lagos State public hospitals, cost efficiency was very low due to technical, allocative efficiency. This period was due to structural changes in the economy and as a result there were policy redirection in terms of accountability and proper monitoring in the allocation and expenditure of the government reduces leading to low employment of the health workers. Between 2007 and 2011, the technical efficiency of the hospitals was high, indicating that for those periods there were enough resources in terms of equipment, hospitals beds, drugs and so on in the various hospitals but no available health workers in the right proportion to make use of the resources leading to waste of

most resources in the public hospitals. In 2013, there was a fall in technical, allocative and cost efficiency in the public hospitals, the poor performances of the public hospitals in these periods were not surprising since the period was blurred with the Tinubu and Obasanjo crisis that led the State to use their internally generated revenue (IGR) to run the affairs of the State which affected the hospitals as a result of no federal government allocation which reduces their finance and hence led to cost inefficiency of the hospitals.

The improvement in the period of 2015 to 2017 showed a period of change in government and policies this was the regime of Goodluck Jonathan in which more money was allocated to the health sector which led the States to improve in their efficiency performance in form of available equipment, drugs, hospital beds and so on with regular employment of health workers that led to more revenue in the State and reduction in strike by the health personnel. This period brings efficiency in the health sector. Looking at the trend of the private hospitals, during 2007 to 2008, the technical, allocative and cost efficiency were higher than that of the public hospitals. The private hospitals thrived in Lagos State during these periods since the government were not really settled as a result of changes in policies and poor allocation to the public-sector health finance. The private sector took the advantage of the transition as most patient tends to visit the private hospitals more than the public hospitals. Majorly because they have medical personnel that are ready to provide treatments to them since the public hospitals were not functioning efficiently.

In general, technical efficiency of the hospitals were higher in the public hospitals from 2015 to 2017 while for private hospitals the allocative efficiency was higher in 2015 and 2016 but in 2017, the technical efficiency outplayed the allocative and cost efficiency. This shows that both in the public and private hospitals, there were more input in the hospitals but were not utilized efficiently.

The summary of the mean for the technical, allocative and cost efficiency indicate that the public hospital has relative efficiency than the private hospitals due to technical, allocative and cost efficiency with value of 0.899, 0.886 and 0.805 while private hospitals were 0.848, 0.829 and 0.714 respectively. However, for the different years, the table shows that in terms of allocative and cost efficiency, both public and private hospitals also displayed inconsistency. For some periods, the public hospitals were efficient than the private hospitals while the private were more efficient than the public in other instances.

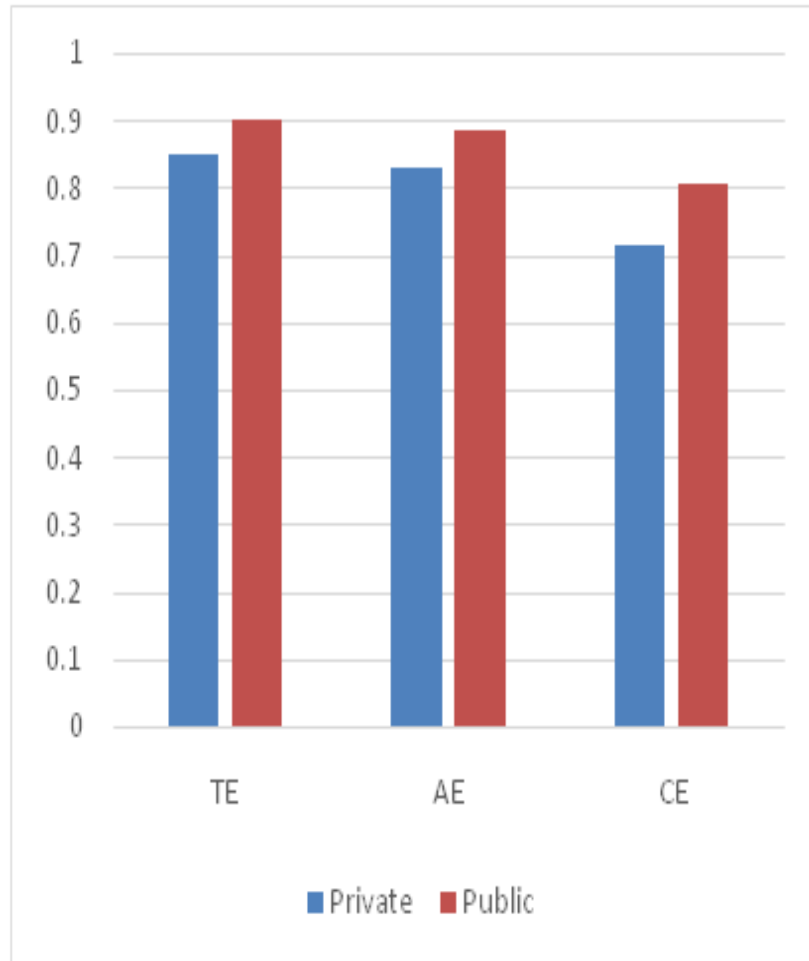


Figure1: Technical Efficiency (TE), Allocative Efficiency (AE) and Cost Efficiency (CE) of public and private hospitals in Oyo State.

Figure 1 above displayed the bar chart for both the public and private hospitals in Lagos State. The chart shows that for the three efficiency measurements, the public hospitals are higher than the private hospitals. The reported allocative efficiency scores of the hospitals generally indicate that the hospitals are not utilizing the perfect mix of their inputs given the input prices to commensurate with their output, meaning they are not annexing maximal output from their quantum of inputs given the input

prices. In other words, allocative efficiency of the hospitals can be increased by better use of available production resources (equipment, drugs and operating expenses) given the current state of technology. However, based on the results, the public hospitals are allocatively efficient than the private hospitals if monetary inputs are used in generating monetary outputs. Although, for the whole periods, both the public and private hospitals were not cost efficient as their efficiency score level lies below 1.000 but the public hospitals are a bit preferable in terms of cost.

Table 2: Technical Efficiency Change, Technological Change and Total Factor Productivity Change of Public Hospitals in Lagos State

Year	Δ EFF	Δ TECH	Δ TFP	Dec Δ EFF	Dec. Δ EFF	Dec. Δ TFP
2008/2009	0.601	0.785	0.471	Deteriorating	Deteriorating	Deteriorating
2009/2010	0.814	0.697	0.567	Deteriorating	Deteriorating	Deteriorating
2010/2011	0.778	1.003	0.780	Deteriorating	Progressing	Deteriorating
2011/2012	1.001	0.763	0.763	Progressing	Deteriorating	Deteriorating
2012/2013	0.754	0.790	0.596	Deteriorating	Deteriorating	Deteriorating
2013/2014	0.865	0.830	0.718	Deteriorating	Deteriorating	Deteriorating
2014/2015	0.908	1.233	1.120	Deteriorating	Progressing	Progressing
2015/2016	1.099	0.413	0.454	Progressing	Deteriorating	Deteriorating
2016/2017	0.964	0.738	0.711	Deteriorating	Deteriorating	Deteriorating
Mean	0.973	0.907	0.773	Deteriorating	Deteriorating	Deteriorating

Source: Author's computation, 2019.

Note: Δ EFF mean Technical Efficiency Change, Δ TECH Technological Change and Δ TFP mean Total Factor Productivity Change

Table 2 above shows that productivity growth displayed inconsistency for the period under study. For some years in the Lagos State public hospitals, the hospitals were progressing (2011/2012 and 2015/2016); (2010/2011 and 2014/2015); (2014/2015) in terms of technical efficiency change, technological efficiency change and total factor productivity change. However, for the rest periods, the hospitals were deteriorating based on the pattern of the technical efficiency change and technological change in the hospitals which is driving the total factor productivity of the hospitals for the years.

Table 3: Technical Efficiency Change, Technological Change and Total Factor Productivity Change of Private Hospitals in Lagos State

Year	Δ EFF	Δ TECH	Δ TFP	Decision Δ EFF	Decision. Δ TECH	Decision. Δ TFP
2008/2009	0.733	0.654	0.479	Deteriorating	Deteriorating	Deteriorating
2009/2010	0.654	1.180	0.772	Deteriorating	Progressing	Deteriorating
2010/2011	0.834	0.767	0.640	Deteriorating	Deteriorating	Deteriorating
2011/2012	1.088	0.654	0.711	Progressing	Deteriorating	Deteriorating
2012/2013	0.876	1.684	1.475	Deteriorating	Progressing	Progressing
2013/2014	1.023	0.842	0.861	Progressing	Deteriorating	Deteriorating
2014/2015	0.852	0.742	0.632	Deteriorating	Deteriorating	Deteriorating
2015/2016	1.114	0.924	1.029	Progressing	Deteriorating	Progressing
2016/2017	0.897	0.931	0.825	Deteriorating	Deteriorating	Deteriorating

Source: Authors computation, 2019.

For the private hospitals also, the productivity growth displayed inconsistency with technical efficiency change progressing in 2011/2012, 2013/2014 and 2015/2016 with their values greater than 1 in those periods and deteriorating in the other periods. For Δ TECH it progressed in 2009/2010, and 2012/2013 and deteriorated in the other years while for Total factor productivity (Δ TFP) (the product of technical efficiency changes and technological change) behaved prototype with technical efficiency change and technological change for both public and private hospitals, but are generally deteriorating with productivity scores of 1.475 and 1.029 in 2012/2013 and 2015/2016.

Conclusion and Recommendations

The objective of this study was to compare public and private hospitals in terms of their relative efficiency and their pattern of productivity growth over the years with the sole aim of providing policy direction towards improving the health outcomes of the Nigerian population. To achieve this, the technical, allocative and cost efficiency as well as the productivity pattern were examined among the selected hospitals in the State. Using DEA and MPI, on the data collected, it was found that the efficiency parameters considered generally displayed inconsistency by all the hospitals. This is

because, where the private is more technically, allocatively and cost efficient in some years, the public does not and some periods were the public were also efficient, the private do not and as such there is no dominance but rather a mixed performance between the private and public hospitals in Lagos State and likely in Nigeria. Efficiency differences of various hospital types therefore can be leveraged to guide future reforms by emphasizing the strengths of general hospitals and improving the referral system from county hospitals to general hospitals. Encouraging resource sharing across hospitals, as being done by the 2011 reforms, should further improve hospital efficiency. Government should reduce the health budget gap so as to bring the public hospitals into healthy competition with their foreign counterpart in order to reduce medical tourism and invariably reduce capital flight from Nigeria. Also, for private hospitals with inefficiency related to allocation and cost, government may need to intervene in the spatial location to warrant fair distribution of the facilities. This will reduce unnecessary competition among them and improve proper utilization of available resources.

Limitation of the Study

The current study contributes to the empirical literature on the service delivery of public and private hospitals in Nigeria. However, it is imperative that the limitations of this study be identified within the framework of the study and future studies can expand on these. Hospitals data are not like other parastatals which can be seen from different source; hence one limitation of the study was easy access to data from the hospitals selected. In addition, the time consumed for completion of the questionnaire for both the public and private hospitals delay the easy completion of the analysis of the study due to their different locations and the traffic in the State.

Guides for Future Study

This study assesses the service delivery for both private and public hospitals in Lagos State, Nigeria. However, there are several theoretical, methodological and empirical issues that may be investigated for further discussion and closer examination. For example, among the four principal objectives of health system which include effectiveness, efficiency, equity and quality, only one of the objectives was examined. Further research can look into equity, effectiveness and quality. Also, there are two major methodologies used in examining service delivery of hospitals. These are the Data Envelopment Analysis (DEA) and the Stochastic Frontier Analysis (SFA). This study employed the DEA techniques. Further studies may make

use of the SFA. Finally, the study only focused on Lagos State which is one of the Southwest States. Further studies may look at other South west States.

Ethical Consideration

The researcher obtained ethical approval from the ethical committee of the Lagos State Hospital Management Board. This committee is recognized as the regional ethical review board and its approval was acceptable by the private and public hospitals where this study was conducted. Permission to administer the questionnaires was also sought from the heads of department/units in the public hospital and the medical directors of the private hospitals. All information collected were treated confidentially (i.e., no name or initials were recorded, instead identification numbers recognizable by only the researchers).

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