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AN APPRAISAL OF TECHNICAL EFFICIENCY OF PRIMARY HEALTH CARE SERVICES IN MUBI NORTH L.G.A, ADAMAWA STATE, NIGERIA

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Abstract

This study examined the analysis of efficiency of Primary HealthCare Services in Mubi-North Local Government Area, Adamawa State. The study addresses the issue of poor staffing, inadequate utilization of resources, specifically lack of residential doctors in most of the Primary Health Care centers. Primary and secondary data are employed through close ended questionnaire in the study area. Data Envelopment Analysis and Tobit Regression Analysis were used to achieve the objectives of the study. Inputs used in this study are health technicians and number of beds in the primary health care centers while the outputs are inpatients and outpatients. The study revealed that, majority of the Primary Healthcare centers in Mubi North is technically efficient at 100%. Similarly, the result showed that average working experience inversely influence technical efficiency of the Primary Health Care centers in Mubi North and it is statistically significant at 5%. Therefore, the study recommends that; Primary HealthCare centers should adopt 2017 and 2018 managerial service, for effective resources utilization and proper administrative services of health technicians in order enhance the level of performance of the health care centers in Mubi North, through proper check and balance in the system by the government. Secondly, there is need to improve the working ability of the health technicians through proper supervision, consistence in service, create training ground for the health technicians and conducive environment to exercise their duty by the government.

Key word: Technical Efficiency, Scale Efficiency, Inpatients, Outpatients, Data Envelopment Analysis

1. Introduction

Primary Health Care (PHC) centers are key players in achieving health care services in relation to sustainable development goals (SDGs). Hence, it has been recognized as a fundamental key for improving health outcomes. According to Alma Ata declaration in 1978, defined Primary Health Care (PHC) as an indispensable healthcare that meets the demands of societies, which is accessible, acceptable and cheap (Declaration of Alma Ata, 1983&Rifkin, 2018). Similarly, World Health Organization (WHO) states that, the quality of health care services provide by the primary health care centers to individuals patients and populations is effective, timely, safe, efficient, just and people-

oriented to improve desired health indicators (Akinyinka, Oluwole & Odusanya, 2019)

Relating different countries' health care systems determines if a healthcare system is realizing the desired results and today datasets allowing the evaluation of the performance and efficiency levels of health care systems of various countries can be easily accessed (OECD, 2019). More than 65% of rural Indians cannot access crucial medicines and about 30% of the rural population travels for over 30 km to seek for primary healthcare centers (Khorakiwala, 2022). In a study that was carried out in Bolivia, almost 23% of the child morbidities reported within the study period lack access to medical assistance (Hill, 2022). Statistics

collected from 42 countries with populations of different socioeconomic situations, women in the richest municipalities were almost 5 times more than men in the poorest community to access medical assistance for childbirth. Therefore, providing healthcare to the poor can be difficult to reach underserved areas (Gwatkin & Deveshwar-Bahl, 2002).

However, in Nigeria, both foreign donations and domestic spending in the health sector has been on increase towards improving primary health care centers but the outcome is inefficient. Though the health care system of every country is exceptional because of their historical and socioeconomic variances, all health care systems have responsibilities such as providing reachable and effective healthcare centers to people at an optimal cost.

Generally, majority of the Primary Healthcare centers in Nigeria don't have the capacity to deliver basic healthcare centers like good staffing, adequate equipment and distribution of health workers, quality of health-care centers, adequate infrastructure and essential drugs. Specifically, poor staffing more especially the absence of residential physician in these primary health care facilities (Akinyinka et, al., 2019). Several studies were conducted on the efficiency Primary Health Care centers in Nigeria. For instance, Mohammed-Pour et, al. (2020), Adejoh et, al (2022), Paul and Okolie (2022) and Me et, al. (2023). This study discovers period gap, geographical gap and scope gap. More importantly, most of these studies reviewed neglect to look residential doctor in the Primary Health Care centers in the study carried out by Mohammed-Pour et' al. (2020) but this study tries to cover the gap. Therefore, there is need to have one in each of the facilities.

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primary health care facilities (Akinyinka et, al., 2019). Several studies were conducted on the efficiency Primary Health Care centers in Nigeria. For instance, Mohammed-Pour et, al. (2020), Adejoh et, al (2022), Paul and Okolie (2022) and Me et, al. (2023). This paper identified period and geographical gap. More importantly, most of these studies reviewed neglect to look residential doctor in the Primary Health Care centers in the study carried out by Mohammed-Pour et' al. (2020) but this study tries to cover the gap. Therefore, there is need to have one in each of the facilities.

The broad objective of the study is to analyze the efficiency of primary health care centers in Mubi North, Adamawa state while the specific objectives are to examine technical efficiency of primary health and their determinants in the study area.

2. Literature Review

Hollingsworth and Parkin (1998) viewed production efficiency analysis of or services unit as the compares among the input and output used in the course of providing a product or services.

According to Zainal & Ismail (2010) efficiency is also relates to how best a firm utilizes the resources (inputs) to provide the desirable output or services, which indicates the success of firm.

As stated in World Health Report (2010). Technical efficiency represents the degree of how resources are being misused. It measures the extend of producing the maximum quantity of outputs from a given quantity of inputs or conversely, using minimum amount of input to produce a given output.

Efficiency is commonly described as the allocation of scarce resources that maximizes the achievement of aims (Ottawa, Ont & Cih, 2012). Efficiency is also well-defined as the accomplishment in providing as large as possible health output from a given set of inputs (Akanni, 2015).

Wu, Wang and Zhang (2015) Efficiency represents the amount of output in relation to a given level of input whereas, technical efficiency (TE) is mostly used to represent the efficiency of healthcare services.

The 1978 Alma Ata declaration well-defined Primary Health Care (PHC) as a basic health care centers that satisfy the desires of communities, which is accessible, acceptable and affordable (Declaration of Alma Ata, 1983 & Rifkin, 2018).

According to Servan-Mori, Chivardi, Mendoza and Nigenda. (2018) Primary healthcare is extensively perceived as the mainstay of a national healthcare system that delivers wide-ranging services to the people, but equally developing and developed economies have been trapped in the impasse of wastefulness in PHC services. Improved Efficiency is perilous for minimizing unexploited resources and reaching sustainable health outcomes especially in developing states.

2.1 Theoretical Review

Lucas (1988) advanced a growth model in which output is formed via a production function where $Y = AK\alpha (hL)^{1-\alpha}$ (1) where Y , A , and K are as usually well-defined and $0 < \alpha < 1$, where L is denotes the proportion of total labour time spent working, and h is what Lucas refers as stock of human capital. The production function can be rewritten in per-capita terms as $y = A\alpha (h)^{1-\alpha}$ (2) which is a constant returns to scale production function in k and h . Capital accumulation proceeds via the usual differential equation, $k = y - c - (\xi + \delta)k$, (3) while h accumulates according to $\dot{h} = \phi h(1 - \alpha)$ (4) $\dot{h}/h = \phi(1 - \alpha)$ (5) 1 interpreting before examining model, and Mankiw (1995) has realistically maintained for defining 'knowledge' as the sum total of technological and scientific discoveries (what is written in textbooks, scholarly journals, websites, and the like), and defining 'human capital' as the stock of knowledge that has been transmitted from those sources into human brains via studying.

Zero Profit Theorems: In the long-run, all firms in a competitive firm will earn nil economic returns.

Essentially, firms in a competitive market incline toward this outcome because this does not mean the firms are receiving zero returns, rather an average return. The Zero-Profit Theorem conclude that entry into a competitive industry will continue until all opportunity for positive economic return is reduced to zero. A competitive firm maximizes profits by producing at a price and output where marginal cost (MC) is equal to marginal revenue (MR), or in other words, where MC is equal to price. When this price is more than average costs (AC), the firm earns a positive economic profit. In figure 1, this is the blue shaded area. When price is \$90, the firm maximizes profits by producing at an output of 140 units, resulting in profits equal to the shaded area, above the AC. If price falls to \$60 then the output produced will also fall to 80 units and there will be no positive economic profits and the firm will earn an average return.

Theory of Neo-Liberalism: A Theory of Neo-Liberalism the German scholar Alexander Rustow Invented the concept Neo-liberalism in 1938 at the Collogue water Lippmann. The Conference defined the term Neo-Liberalism as involving the importance of the price mechanism, free enterprise, the system of the competition and a solid and neutral state. The consequence of Neo-liberalism on global health, predominantly the aspect of transnational aid, involves key actors such as the government, the private sector, Non-Governmental Organization (NGOs), International Monetary Fund (IMF) and the World Bank. Neo-liberal emphasis has been placed on free markets and privatization which has been tied to the "New Policy Agenda", an agenda in which the private sector and NGOs are viewed to provide better social welfare services than that of a nation or government.

2.2 Empirical Review

Data Envelopment Analysis was used by Mohammadpour, Javan-Noughabi, Zangeneh, Yousefi, Nouhi and Jahangiri (2020) in calculating technical efficiency of some health facilities whereas Tobit Panel Analysis was used to compute and forecast factors associated with efficiency levels. The results showed

that there is fluctuation in the average efficiency scores through the time frame of the study, the average performance scores mostly declined in 2016, in relation to 2002. The maximum and minimum average performance scores recorded in 2003 was 0.78 and 0.56 2013 correspondingly. If the scope of the study had been extended beyond 2016, the study might have look at what happened to those years if include in the study.

Adejoh, Ali, Ismail and Mukhtar (2022) carried out study on Cross Efficiency PHC in Nigeria. Primary and secondary data collection methods were used to collect 2019 data from fifteen primary healthcare facilities (PHCs) on four input variables (beds, medical and non-medical staff, outpatients and inpatients), and three output values (antenatal, deliveries, and quality of care). The results indicate that nine PHCs were efficient and six were inefficient, with cross-efficiency ratings ranging from 0.2491 to 0.6815 for aggressive PHCs and 0.3977 to 0.9206 for benevolent PHCs, respectively. Since the study was conducted in 2022, the used in the study should have up to date may be the cross efficiency will robust.

Similarly, Paul and Okolie (2022) carried a research on An Overview of the Worsening Situation of PHCs in Nigerian. The paper used Urban Bias Theory and revealed that there is the pervasiveness of epileptic health care services, inadequate infrastructural facility maintenance and limited skilled manpower, derisory political will for policy implementation and evaluation, the scantiness of funds and its management, and community boredom. This paper applied a different technique like SFA to look at the efficiency of the Health Care center than looking at their situation.

Me, Kou, Bi, Liu, Huang and Li (2023) carried studied on Efficiency of PHC centers and Spatial Correlation in China. The result revealed that the number of PHC institutions rise from 918,000 in 2011 to 970,000 in 2020. The mean PHC institution service efficiency in the north-east and northern regions were 0.324, 0.460, 0.453, 0.344 and 0.403 was at a low level, while the

eastern coastal regions (1.116), (1.211) and (1.402) have higher average service efficiency levels. This study revealed excellent performance but reverse is the case, because most of the primary health care in the northeastern region exhibit lower efficiency than that of the eastern region which showed higher performances. One the reason the Northeastern region does not exhibit higher level of efficiency as that of eastern coastal region may be as a result of underutilization of resources.

This study adopted the theory of Lucas growth model which presented that output is generated via a production function of the form $Y = AK^\alpha (hL)^{1-\alpha}$ (1) where Y, A, and K are as usually defined and $0 < \alpha < 1$, where L is defined as the proportion of total labour time spent working, and h is what Lucas calls the stock of human capital. The production function can be rewritten in per-capita terms as $y = Ak^\alpha (h)^{1-\alpha}$ (2) which is a constant returns to scale production function in k and h. Capital accumulation proceeds via the usual differential equation, $k = y - c - (\xi + \delta)k$, (3) while h accumulates according to $\dot{h} = \phi h (1 - \alpha)$, (4) $\dot{h}/h = \phi (1 - \alpha)$, (5) 1.

3. Methodology

The survey research design was adopted by the study, field data was computed from the selected respondents and the Primary Health Care centers records. Close ended questionnaire and interview was used to collect data from health technicians (physicians, nurses, CHEW, JCHEW) and management of the Primary Health Care centers, to examine analysis of the efficiency of primary health care centers in Mubi-North Local Government, Adamawa State.

The sources of data collection used in this study were Primary and Secondary data which was obtained from field survey, interview, close ended questionnaire, and the Primary Health Care centers records.

3.1 DEA Model Specification

This study employs both the Charnes, Cooper & Rhodes (CCR) and Barker, Charnes & Cooper (BCC) input-oriented model for 6 Primary Health Care (PHC)

with each DMU having Y output and X inputs (where Y = 2 and X = 2). In order to achieve the objectives of this research, the modified DEA model is stated. Where the outputs Y are two i.e. in-patients and outpatients while the inputs X are two i.e. health technician and number of beds. The selection of Primary Health Care inputs and outputs is done with conformity of the existing literature. According to Charnes, Cooper & Rhodes (1981) the modified model for DEA is as follows:

$$\text{Max } E_0 = \sum_{t=1}^6 u_j y_{j0} + u_0; y.t \sum_{t=1}^3 v_i x_{i0} = 1 \dots (1)$$

$$\sum_{t=1}^6 u_j y_{jk} - \sum_{t=1}^3 v_i x_{ik} + u_0 \leq 0; v_i \geq 0, u_j \geq 0, u_0 \text{ is free sign}$$

Where E_0 is the efficiency score for DMU_0 , x_{i0} is the quantity of input i used by DMU_0 , y_{j0} is the quantity of output x_{i0} produced by DMU_0 , x_{ik} is the actual amount of input i used by efficient DMU_k , y_{jk} is the actual amount of output j produced by efficient DMU_k . While u_i and v_i are the weight attached to output j and input i. E_0 equals to 1 if DMU_0 is efficient and E_0 is less than 1 if otherwise.

3.2 Tobit Model Specification

The factor that determines inefficiency determinants of Primary Health Care centers can be analyze using Tobit regression analysis and the determinants factors such as average working experience, average income and average working hours (knowlegiate, 2016).

The modified Tobit model is written as:

$$Y_{ij} = \beta_0 + \beta_1 X_{1ij} + \beta_2 X_{2ij} + \beta_3 X_{3i} \dots (2)$$

Where:

Y_{ij} = technical efficiency of the ith PHCs

Table1: The Inputs and Outputs Variables

Variables	Definition
INPUTS	
Health Technician	Health Technicians includes: Doctors, Nurses, CHEW, JCHEW and others
Number of Beds	Beds includes: Regular beds, monitory beds and extra bed
OUTPUTS	
Outpatients	Number of outpatients visit the Primary Health Care for consultation not admitted.
Inpatients	Number of patients admitted in the primary healthcare

X_1 = average working experience

X_2 = average Income

X_3 = average working hours

The population of this study is the aggregate of all elements within the study area. It consists of the total Primary HealthCare centers in Mubi-North, Adamawa State.

3.3 Sample Size and Sampling Techniques

This research used convenience sampling where six (6) out of the 21 Primary Health care centers in Mubi North, Adamawa State were selected. In the cause of administering the questionnaire, simple random sampling technique was used because of the nature of the study.

3.4 Techniques of Analysis

The techniques of analysis used in this paper is DEA to determine the efficiency and Tobit Regression was employed to examine efficiency determinants of PHC centers in Mubi-North, Adamawa state.

4. Results and Discussion

Table 1 shows the number inputs and outputs used in the study. The inputs includes the total numbers of doctors, nurses, CHEW, JCHEW, Others and total number of beds per Primary Health Care centers. While the outputs includes total number of in-patients admitted in the Primary Health Care centers and the total number of Outpatients visit the Primary Health Care centers for consultation not admitted.

Table 2 revealed that PHC 1, 2, 3, 4 and 6 are efficient at 1.000 (100.0%) while PHC5 is efficient at 0.907

(90.7%) which is less than 100% in 2015. In 2016 only PHC5 that is not efficient (76.9%), while PHC 1, 2, 3, 4

and 6 are efficient. From 2017 to 2018 all the primary health care centers are efficient at 100% as a result of proper utilization of materials. From 2019 to 2021 PHC3 is having lower efficiency as 66.55%, 55.0%, 46.8% and 52.95% respectively this implies that during

the period of 2021 the PHC was inefficient. In the same way PHC 6 was having lower efficiency level compared to previous years, may be as result of improper utilization of resources and poor services delivery by the technicians in the Primary Health Care centers.

Table 2: Technical Efficiency Values

DMUS	2015	2016	2017	2018	2019	2020	2021	2022
PHC1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PHC2	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PHC3	1.000	1.000	1.000	1.000	0.665	0.550	0.468	0.529
PHC4	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PHC5	0.907	0.769	1.000	1.000	1.000	1.000	1.000	1.000
PHC6	1.000	1.000	1.000	1.000	1.000	1.000	0.633	1.000

Source: author's computation, 2023.

Table 3 revealed that, the coefficient of average working experience (X1) and average working hours (X3) turns to be negative. The negative relationship between X1 and X3 on output (Y) implies that an increase in X1 and X3 by 1% will reduce output (Y) by approximately -271.68% and -20.08% respectively. Therefore, X1 is statistical significance at 5%. While

X3 is not significant because of the nature shifting for services done in the primary healthcare and hours of services. In the same way, the average income (X2) which turn to be positive, this implies that 1% increase in X2 will increase output (Y) by 0.00827% and it is not significant at 5% as a result of not remitting revenue generated in the PHC properly.

Table 3: Efficiency Determinants of the DMUs

Variables	Parameters	coefficient	standard error	P-value
Working experience (X1)	β_1	-2.716758	0.8204199	0.021
Average Income (x2)	β_2	0.0000827	0.00005	0.059
Average Working hour(x3)	β_3	-0.2008196	0.1306142	0.085
C	β_0	118.0252	11.40417	0.000
Sigma	γ	2.831633	0.7827324	

Source: author's computation, 2023.

4.1 Summary of Major Findings

This study examines technical efficiency and efficiency determinants of primary health care services in Mubi. Primary source of data collection was employment, Data Envelopment Analysis (DEA) and Tobit Regression Techniques of Analysis was employed to take care of the objectives. Table 2 revealed that, most of the Primary Health Care centers were technically efficient at 100% from 2015 to 2022 as a result proper utilization of resources and adequate services. While PHC 3 in 2019, 2020, 2022, PHC 4 in 2021 and PHC5 from 2015 to 2016 were not efficient at 100% as a result of poor

management and utilization of resources. Table 3 results revealed that, average working experience (X1) turns to be negative and statistical significance at 5%. Similarly, average income (X2) which turns to be positive and statistical significant at 10%. At last average working hour (X3) turns to be negative and statistical significant at 10%.

5. Conclusion and Recommendations

From the results of technical efficiency, most of the primary health care services were efficient at 100% and concluded that to determine technical efficiency in Mubi

North Local Government Area 2017 and 2018 are highly recommended, because its exhibit excellent performance compared to other years. In the same vein, for the scale efficiency only in 2017 that 5 Primary health care were efficient at 100% and recommended as based years for testing efficiency level. While for the Tobit result, the coefficient of average working experience turns to be negative and statistical significant at 5% then we reject null hypothesis and concluded that out of three factors considered as efficiency determinants of the primary health care services, average working experience is the best. Since average income and working hours are not statistical significance at 5% this necessitate for further studies.

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