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EVALUATING RESOURCE ALLOCATION MANAGEMENT TO HOSPITALS IN BAUCHI STATE: A CASE STUDY OF FEDERAL MEDICAL CENTRE AZARE AND PRIMARY HEALTHCARE CENTRE AZARE

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ABSTRACT

Background: *This study evaluates resource allocation management in hospitals in Bauchi State, focusing on Federal Medical Centre (FMC) Azare and Primary Healthcare Centre (PHC) Azare. The research addresses significant disparities in resource allocation that affect healthcare service delivery and patient outcomes.*

Methods: *Using a mixed-method approach, the study combines quantitative data analysis of financial records, resource allocation reports, and healthcare service delivery metrics with qualitative insights from interviews and focus group discussions. Data Envelopment Analysis (DEA) was utilized to measure the relative efficiency of the hospitals in converting inputs such as financial resources, staff, and infrastructure into healthcare services and outputs. Additionally, descriptive analysis was conducted using IBM SPSS version 27 to analyze 100 questionnaire responses and demographic data.*

Results: *The findings reveal significant disparities between FMC Azare and PHC Azare, with FMC Azare benefiting from more adequate financial resources, human resources, medical supplies, and infrastructure. These disparities lead to differences in patient satisfaction, service delivery efficiency, patient outcomes, and waiting times.*

Conclusions: *The study underscores the need for more equitable resource allocation to improve healthcare delivery and patient outcomes at under-resourced centers like PHC Azare. Recommendations for policy interventions include addressing resource allocation inequities, staffing solutions, supply chain improvements, and infrastructure development. These recommendations aim to enhance resource allocation management, thereby improving healthcare services in Bauchi State and providing insights applicable to similar contexts in Nigeria, Africa, and globally.*

KEYWORDS: *Resource Allocation Management, Healthcare Delivery, Data Envelopment Analysis (DEA), Federal Medical Centre, Primary Healthcare Centre.*

BACKGROUND

The management of resource allocation in healthcare systems is essential for ensuring equitable access to services, optimizing the use of resources, and enhancing the quality of care provided. In Bauchi State, Nigeria, the healthcare sector faces significant challenges, including inadequate financial resources and infrastructural deficiencies. Therefore, it is crucial to understand and evaluate the effectiveness of resource allocation management in hospitals [1, 2].

Ensuring the appropriate allocation of beds is crucial to facilitate the prompt provision of care, prioritize critical cases, and enhance patient outcomes. The implementation of effective bed management practices has been found to have a positive impact on resource utilization, waiting times, and patient satisfaction [3]. Nevertheless, persistent difficulties such as overcrowding and insufficient discharge planning continue to affect the quality of patient care and the operations of hospitals [4]. Additionally, in times of crises such as natural disasters or disease outbreaks, the presence of a dependable bed allocation system becomes essential to effectively address sudden increases in the number of patients seeking medical care [5]. According to Lai et al. [6], the appropriate allocation of beds serves the dual purpose of safeguarding patient well-being and promoting efficient patient transfers while also alleviating administrative constraints.

Effective management of human resources is equally crucial for ensuring optimal healthcare delivery, including bed distribution. According to Gruen et al. [7], it is imperative to maintain sufficient workforce levels, provide continuous training, and cultivate employee engagement to effectively deliver high-quality care, mitigate burnout, and retain highly competent individuals. Furthermore, effective systems and processes are important for optimizing workflows, decreasing redundancies, and enhancing

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overall operating efficiency [8]. According to Lai et al. [6], the implementation of standardized procedures in healthcare organizations can lead to improvements in service delivery, increased responsiveness to patient demands, and optimized allocation of resources.

To address these concerns fully, this research attempts to analyze the effectiveness of resource allocation management in Bauchi State's healthcare system. By examining present procedures, identifying challenges, and offering solutions for improvement, this study intends to enhance healthcare delivery, maximize resource usage, and ultimately improve patient outcomes. The research will involve both qualitative and quantitative methodologies. Qualitative interviews and focus groups will be performed with healthcare administrators, frontline workers, and patients to collect perspectives into existing resource allocation procedures, issues faced, and opportunities for improvement. Additionally, quantitative data such as bed occupancy rates, treatment rates, and the number of consultations provided will be collected from hospital records and analyzed to measure the effectiveness of resource allocation.

Furthermore, the study will apply a comparative analysis approach to assess Bauchi State's healthcare system against best practices in resource allocation management globally. This would involve studying literature and case studies from other regions or countries having comparable healthcare concerns to find successful techniques and treatments that may be applied to the local environment. Based on the findings, the research will give recommendations for enhancing resource allocation management in Bauchi State's healthcare system. These proposals may include investing in infrastructure upgrades, deploying technology solutions for bed management, boosting staff training and retention programs, and enhancing collaboration amongst healthcare facilities. By addressing the issues in resource allocation management, this research aims to contribute to the improvement of healthcare service in Bauchi State, Nigeria. By optimizing resource use, enhancing patient care quality, and improving overall healthcare outcomes, the study hopes to make a beneficial influence on the health and well-being of the community.

METHODS

Data Collection

The design of this research is shaped by the complexity of analyzing resource allocation management in hospitals, specifically within Bauchi State. A mixed-methods approach was deemed appropriate for this study, allowing for a comprehensive integration of both quantitative and qualitative data collection and analysis techniques. This methodological choice is intended to provide a nuanced understanding of resource allocation practices within healthcare facilities, particularly focusing on the Federal Medical Centre Azare and the primary healthcare center Azare.

The research design serves as the overarching framework for this study, ensuring a cohesive integration of various components to address the research problem effectively. As articulated by Thakur and Shah [9], the research design is the blueprint guiding data collection, measurement, and analysis. For this study, a case study approach was selected due to its capacity for in-depth examination of a single entity. This design was chosen for its ability to delve deeply into the subject matter, enabling the researcher to gather detailed information rather than merely making predictions. The research was structured as a descriptive case study, where the research questions were tested, and relevant data were collected through carefully designed instruments. The target population for this study includes stakeholders directly involved in resource allocation management within the Federal Medical Centre Azare and the primary healthcare center Azare. This encompasses hospital management, healthcare providers, and patients. To ensure a representative sample across various departments and functions within the hospitals, purposive sampling was employed.

In determining the sample size, the concept of selecting a sufficient number of observations for meaningful statistical analysis was considered, as discussed by Charan et al. [10]. For the quantitative component of this study, a sample size of 100 respondents was purposefully selected to capture a broad spectrum of perspectives. Additionally, respondents from different units of the hospital including doctors, nurses, administrators, and support staff were interviewed to provide qualitative insights based on their experiences. The use of purposive sampling techniques ensured that the data collected were both precise and relevant to the study's objectives.

The research employed a combination of primary and secondary data collection methods to obtain a comprehensive view of resource allocation management. Approval for data collection was sought from the relevant hospital authorities on October 18th, 2023, through a formal request. Primary data were gathered through interviews with key stakeholders, such as hospital administrators, healthcare providers, and patients. Surveys were also administered to collect quantitative data on resource allocation practices and perceptions. In addition, secondary data were sourced from an extensive review of existing literature, reports, and records related to healthcare resource distribution in Bauchi State.

To capture both quantitative and qualitative data, the research employed a mixed-methods instrument design. A structured questionnaire was used to collect quantitative data, focusing on participants' views on resource allocation processes, perceived barriers, and outcomes. This questionnaire featured closed-ended questions, utilizing Likert scales to measure the degree of agreement or disagreement with various statements related to resource allocation.

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Qualitative data were collected through semi-structured interviews with key stakeholders. These interviews were designed to explore participants' perspectives on resource allocation decision-making processes, the factors influencing these decisions, and the perceived outcomes. Open-ended questions allowed participants to share detailed insights and experiences related to resource allocation management.

Selection of specific input and output variables for DEA

The indicators chosen for the DEA analysis were selected due to their critical relevance and ability to provide comprehensive insights into resource allocation and healthcare service delivery. Human resources, including medical and administrative staff, are essential for patient care and operational management. The number and competency of medical personnel directly affect the quality-of-care patients receive, while administrative staff ensure that the healthcare facility runs smoothly. Financial resources, such as budget allocations, determine the facility's capacity to procure necessary supplies, maintain infrastructure, and support staff salaries. Without adequate financial resources, even the best-planned healthcare services cannot be effectively implemented.

Physical resources, like the number of beds and medical equipment, directly impact the ability to treat patients effectively. For instance, the availability of advanced medical equipment can enhance diagnostic accuracy and treatment outcomes, while the number of beds affects the facility's capacity to admit and care for patients. Output variables, such as healthcare outcomes (patients treated, consultations provided, bed occupancy rates) and operational indicators (waiting times, patient flow), reflect the efficiency and quality of service delivery. These outcomes are crucial for assessing the effectiveness of resource allocation, as they provide measurable evidence of how well the healthcare facility is meeting patient needs.

These indicators were carefully selected to ensure they accurately capture the complex nature of resource allocation and its impact on patient care and operational efficiency. By including a broad range of inputs and outputs, the DEA analysis can provide a holistic view of the healthcare facilities' performance. This comprehensive approach ensures that the study considers all relevant aspects of resource allocation, from the availability of human and physical resources to the final healthcare outcomes experienced by patients. Such a detailed examination helps in identifying areas of inefficiency and potential improvements, ultimately contributing to better healthcare service delivery.

Table 1: Input-Output Indicators for Evaluating Operational Efficiency of FMC AZARE and PHC AZARE Hospitals

Primary Indicators	Secondary Indicators	Unit
Input	Budget Allocation	Naira
	Healthcare Professionals (doctors, nurses, pharmacists)	Staff
	Total No. of Beds	Sheets
Output	Total No. of Patients Treated	People
	No. of Consultation Provided	Units
	Bed occupancy Rates	Percentage

Input & Output indicators

DATA ANALYSIS

DEA model

Data Envelopment Analysis (DEA) is a method that uses linear programming to measure the relative efficiency of decision-making units (DMUs). It can simultaneously handle multiple input and output indicators, with the BCC model being the most widely used.

Assuming there are n decision-making units (DMUs), each DMU has m inputs and s outputs. For a specific DMU, the input-oriented BCC model is as follows:

$$\max(\mu^T y_0 - \mu^0)$$
$$s.t. \omega^T x_j - \mu^T y_j + \mu_0 \geq 0$$
$$\omega^T x_0 = 1$$
$$\omega \geq 0, \mu \geq 0, j = 1, \ldots, n.$$

x_j y_j u^T v^T In Formula 1.1, X and Y represent input and output vectors, respectively, and λ and θ are weight variables. By using the Charnes-Cooper transformation, the linear programming formulation of the BCC model is obtained:

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$$\min \theta$$

$$s.t. \sum_{j=1}^{n} x_j \lambda_j \leq \theta x_0$$

$$\sum_{j=1}^{n} y_j \lambda_j \geq y_0$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0,\ j = 1, \ldots, n.$$

Empirical analysis of data was conducted in this research which the use of graphs, tables and charts. This aims to provide a graphical, detailed result and well explained result gotten from the DEA model.

This study adopts DEA analysis as it is most suitable in evaluating the efficiency of hospitals in converting inputs such as financial resources, staff, and infrastructure into healthcare services and outputs. It also enables bench-marking by comparing the performance of healthcare facilities against each other or within a single facility. Considering the above performance of DEA analysis, the researcher deems it fit to use the DEA for the analysis.

The researcher used IBM SPSS version 27 for analyzing the questionnaire and demographics. The researcher also used the BCC model of DEA, with the use of DEAP 2.1 to analyse the input and output variables.

BCC model

Data Envelopment Analysis (DEA) is a method that uses linear programming to measure the relative efficiency of decision-making units (DMUs). It can simultaneously handle multiple input and output indicators, with the BCC model being the most widely used.

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$x_j\ y_j\ u^T\ v^T$ In Formula 1.1, X and Y represent input and output vectors, respectively, and λ and θ are weight variables. By using the Charnes-Cooper transformation, the linear programming formulation of the BCC model is obtained:

$$\min \theta$$

$$s.t. \sum_{j=1}^{n} x_j \lambda_j \leq \theta x_0$$

$$\sum_{j=1}^{n} y_j \lambda_j \geq y_0$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0,\ j = 1, \ldots, n.$$

In this study, the BCC model will be used to evaluate the operational efficiency of FMC AZARE and PHC AZARE hospitals from 2021 to 2023.

Table 2: Data from FMC and PHC 2021-2023

YEAR	HOSPITAL	Budget Allocation (Input 1)	Healthcare Professionals (Input 2)	Total No. of Beds (Input 3)	Total No. of Patients Treated (Output 1)	No. of Consultation Provided (Output 2	Bed occupancy Rates (Output 3)
2021	FMC AZARE	N1,533,633,100.00	105	280	125,000	122,000	96%
2022	FMC AZARE	N1,883,963,102.00	150	350	133,000	122,876	84%
2023	FMC AZARE	N1,900,536,000.00	288	412	140,000	123,000	82%
2021	PHC AZARE	N6,000,000	9	24	137	120	90%
2022	PHC AZARE	N8,000,000	11	24	155	144	97%
2023	PHC AZARE	N8,000,000	11	24	168	159	91%

Source: Quantitative data, 2024
Note: ₦ = Nigerian naira

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Descriptive statistics

Quantitative data gathered through questionnaires are evaluated using descriptive and inferential statistical approaches. Descriptive statistics such as frequencies, percentages, and measures of central tendency are used to summarize demographic variables and replies to closed-ended questions. Inferential statistics, such as correlation analysis and regression analysis, are applied to evaluate correlations between variables and uncover predictors of resource allocation efficiency.

RESULTS

Assessment of Hospital Resource Efficiency in FMC and PHC

Table 3 provides a detailed evaluation of resource allocation practices and healthcare quality at Federal Medical Centre (FMC) Azare and the primary healthcare center (PHC) Azare based on various indicators. The availability of healthcare resources was rated by the majority, 59% (Mean=2.64, SD=0.785), as average. This indicates a general perception that resource availability is neither particularly good nor very poor, but adequate. Despite a mean rating closer to average, the fact that a significant percentage (33%) rated it as poor or very poor suggests that there are notable concerns about the adequacy and availability of necessary healthcare resources. In terms of healthcare provider satisfaction, most respondents, 61% (Mean=3.05, SD=0.835), rated their satisfaction with healthcare providers as average. This suggests that while there are areas for improvement, the overall satisfaction level is acceptable. The distribution of responses indicates that a considerable number of respondents see room for enhancement in the satisfaction levels with their healthcare providers. Healthcare quality received a relatively favorable rating, with 41% (Mean=3.40, SD=0.752) of respondents rating it as good. This indicates that the quality of healthcare provided is generally seen as above average. The mean rating of 3.40 suggests that many respondents are satisfied with the quality of care they receive, although there is still a significant portion (54%) that sees room for improvement. The availability of healthcare workers was a significant concern, with 52% (Mean=2.41, SD=0.683) rating it as poor. This highlights a critical issue in staffing levels at these healthcare facilities. The low mean rating and the high percentage of respondents rating it as poor underscore the need for urgent measures to improve the availability and accessibility of healthcare personnel. Bed occupancy was rated more positively, with nearly half, 49% (Mean=3.24, SD=0.780), rating bed availability as average, and an additional 32% rating it as good. This suggests a generally satisfactory situation regarding bed occupancy, although there remains a substantial portion of respondents who believe that improvements can still be made.

Factors Influencing Resource Allocation

Table 4 provides an analysis of the primary factors shaping resource allocation decisions in Federal Medical Centre (FMC) Azare and the primary healthcare center (PHC) Azare. The table evaluates several indicators based on the responses from the survey. The influence of government policy on resource allocation received a neutral rating from the majority of respondents, with 48% selecting this option (Mean=2.88, SD=0.868). This suggests that while government policies play a role in resource allocation decisions, their impact is perceived as moderate and not particularly strong or weak. The distribution of responses indicates a balanced view on the effect of government policies, with a mix of agreement and disagreement among the respondents. Patient demand was viewed as a more significant factor, with 35% agreeing and 9% strongly agreeing that it influences resource allocation (Mean=3.31, SD=0.950). The higher mean rating indicates that patient demand is considered an important factor in the decision-making process. This highlights the need for healthcare facilities to align their resource allocation with patient needs and demands, ensuring that services are responsive to the patient population. Institutional priorities were generally rated as a less significant influence, with a majority, 51% (Mean=2.38, SD=0.801), disagreeing that they play a major role. This suggests that internal institutional goals and priorities may not be the primary drivers of resource allocation decisions. The relatively low mean rating reflects a perception that institutional priorities are not at the forefront of resource allocation considerations in these healthcare settings. Resource availability was highlighted as a significant factor influencing decisions, with 59% agreeing and 5% strongly agreeing (Mean=3.60, SD=0.752). This indicates that the availability of resources is a key determinant in how resources are allocated within these healthcare facilities. The high mean rating underscores the critical importance of ensuring that adequate resources are available to meet the operational needs of healthcare providers. The influence of staff availability on resource allocation decisions was rated relatively low, with 46% disagreeing (Mean=2.44, SD=0.783). This suggests that although staff availability is a factor, it is not seen as a predominant influence compared to other factors like patient demand and resource availability. The low mean rating indicates a perception that while important, staff availability is secondary to other more pressing factors in resource allocation decisions.

Impact of Resource Allocation Management

Table 5 provides an analysis of the impact of resource allocation management on healthcare service delivery and patient outcomes at Federal Medical Centre (FMC) Azare and the primary healthcare center (PHC) Azare. The perception of efficient allocation in FMC and PHC was rated as neutral by the majority, with 62% selecting this option (Mean=2.80, SD=0.725). This suggests that while resource allocation is generally viewed as adequate, there is room for improvement in terms of efficiency. The fact that a significant proportion of respondents rated it as poor or very poor indicates that there are notable concerns about how efficiently resources are being allocated. This indicator received a relatively high rating, with 46% agreeing and 9% strongly agreeing that resource allocation is based on patients' needs (Mean=3.54, SD=0.797). This highlights a positive aspect of the resource allocation process, suggesting that decisions are often made with a focus on meeting patient requirements, which is crucial for improving patient outcomes and overall service

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delivery. Transparency in allocation practices was rated poorly, with 56% disagreeing and 18% strongly disagreeing (Mean=2.11, SD=0.723). This indicates a significant concern about the openness and clarity of the allocation process, suggesting a need for greater transparency to build trust and ensure fair distribution of resources. This indicator received positive ratings, with 52% agreeing and 18% strongly agreeing that resource allocation is based on departmental priorities (Mean=3.82, SD=0.809). The high mean rating suggests that departmental needs are a key consideration in the allocation process, which can help ensure that specific areas within the healthcare facilities receive the resources they need to function effectively. The influence of institutional priorities on resource allocation was rated poorly, with 46% disagreeing and 26% strongly disagreeing (Mean=2.08, SD=0.872). This indicates that institutional goals and priorities are not seen as major drivers of resource allocation decisions, which may reflect a disconnect between higher-level strategic goals and practical allocation practices.

Empirical Analysis of Hospital Operational Efficiency Evaluation

Using deap2.1 software, the BCC model was selected to calculate the input-output data of FMC AZARE and PHC AZARE hospitals from 2021 to 2023, obtaining their comprehensive efficiency, pure technical efficiency, and scale efficiency values.

Table 2: Three Types of Operational Efficiency for FMC AZARE and PHC AZARE from 2021 to 2023

DMU	Overall Efficiency	Pure Technical Efficiency	Scale Efficiency	Scale Returns
FMC AZARE2021	1.0000	1.0000	1.0000	Constant
FMC AZARE2022	0.8661	1.0000	0.8661	Decreasing
FMC AZARE2023	0.9038	1.0000	0.9038	Decreasing
PHC AZARE2021	1.0000	1.0000	1.0000	Constant
PHC AZARE2022	1.0000	1.0000	1.0000	Constant
PHC AZARE2023	0.9515	1.0000	0.9515	Decreasing

The operational efficiency of FMC Azare and PHC Azare from 2021 to 2023 shows varying trends. The figures indicate changes in key performance metrics such as service efficiency (se) and patient treatment efficiency (pte), highlighting the dynamic nature of operational performance in these healthcare institutions. *See Figure 1: Trends in the Operational Efficiency of FMC AZARE and PHC AZARE from 2021 to 2023.*

DISCUSSION

The study utilized a blended strategy approach, integrating both qualitative and quantitative information. The quantitative stage included examining emergency clinic records, monetary reports, and patient information to accumulate mathematical data for factual assessment. This information was gathered to survey asset designation and the board at the Federal Medical Center and Primary Healthcare Center Azare in Bauchi State. This approach is consistent with recent literature that emphasizes the importance of mixed-methods research in healthcare settings to provide a comprehensive understanding of resource allocation dynamics [11, 12].

Table 3: Assessment of Hospital Resource Efficiency in FMC and PHC

Statement/Indicator	Level of occurrence					Mean	Std Deviation
	1-Very poor	2-Poor	3-Average	4-Good	5-Very good		
Resource allocation practices: How would you rate availability of healthcare resources in FMC & PHC	11(11%)	22(22%)	59(59%)	8(8%)	0(0%)	2.64	.785
Healthcare provider satisfaction: How satisfied are you with the health care providers in FMC & PHC	5(5%)	14(14%)	61(61%)	15(15%)	5(5%)	3.05	.835
Healthcare quality: How would you rate the healthcare quality in FMC & PHC	**0(0%)**	**11(11%)**	**43(43%)**	**41(41%)**	**5(5%)**	**3.40**	**.752**
Healthcare staffing: How would you rate the availability of healthcare workers in FMC & PHC	6(6%)	52(52%)	37(37%)	5(5%)	0(0%)	2.41	.683
Bed occupancy: How would you rate the availability of beds to sick patient in FMC & PHC	1(1%)	14(14%)	49(49%)	32(32%)	4(4%)	3.24	.780

Source: Field Survey 2024.

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The information assortment instrument picked for this intention was a poll, which was intended to oblige closed ended questions. Close ended questions were organized as different decision sets, permitting respondents to choose from foreordained choices. Furthermore, the survey incorporated a five-direct Likert scale for specific inquiries toward measure reactions. The codes from the reactions were utilized for examination. The survey was pre-tried on numerous occasions to guarantee its adequacy and to gather foundation data about the respondents, empowering similar and relative examination. The concentrate additionally elaborate meetings with partners, including medical clinic executives, medical care suppliers, and patients, to assemble subjective experiences into the dynamic cycles and discernments encompassing asset portion the board. This mixed-methods approach is critical for capturing the multifaceted nature of healthcare resource allocation [13].

The survey results were analyzed using IBM SPSS version 27. the analysis showed that the majority of the demographics were men which accounts for 65%, and were of age 41 above which was 39% of the respondents. It further showed that majority of the respondents were married which were 68%. The survey focused on questions pertaining to the objectives of the study which the researcher put the questions in the following categories; resource allocation practice, healthcare provider satisfaction, healthcare quality, healthcare staffing and bed occupancy. for resource allocation practice, the survey shows that majority of the respondents 59% (Mean=2.6, SD=.785) believe the availability of resources in both FMC and PHC are of average, for healthcare provider satisfaction, the majority of the respondents believe that the services provided to patients are average with 61% (Mean=3.05, SD=.835). looking and healthcare quality, majority of the respondents 43% (Mean=3.40, SD=.752) also believe that the quality of the healthcare services provided are of average basis, for healthcare staffing, majority 52% (Mean=2.41, SD=.683) believe that the availability of healthcare staff in both FMC and PHC is poor. Bed occupancy, majority of the respondents 49% (Mean=3.24, SD=.780) believe that the availability of beds in these facilities are average.

Table 4: Factors Influencing Resource Allocation

Statement/Indicator	Level of occurrence					Mean	Std Deviation
	1- Strongly Disagree	2 - Disagree	3 – Neutral	4 – Agree	5- Strongly Agree		
Government Policy Influence in FMC & PHC	5(5%)	26(26%)	48(48%)	18(18%)	3(3%)	2.88	.868
Patient Demand Influence in FMC & PHC	3(3%)	16(16%)	37(37%)	35(35%)	9(9%)	3.31	.950
Institutional Priorities Influence in FMC & PHC	10(10%)	51(51%)	31(31%)	7(7%)	1(1%)	2.38	.801
Resource Availability Influence in FMC & PHC	**2(2%)**	**5(5%)**	**29(29%)**	**59(59%)**	**5(5%)**	**3.60**	**.752**
Staff Availability Influence in FMC & PHC	9(9%)	46(46%)	38(38%)	6(6%)	1(1%)	2.44	.783

Source: Field Survey, 2024

The results reveals a perspective on resource allocation efficiency and effectiveness. It indicates that while a majority of respondents rated resource allocation as neutral (62%, Mean=2.80), suggesting adequacy, there is notable room for improvement in enhancing efficiency. This finding underscores the importance of optimizing resource use to better meet the operational demands of healthcare facilities. Moreover, transparency in allocation practices received a particularly low rating (Mean=2.11), with a significant portion of respondents expressing disagreement (56%) or strong disagreement (18%). This indicates a crucial area for improvement to foster trust and fairness in resource distribution processes [12].

The results shows positive feedback regarding allocation based on patients' needs (Mean=3.54) and departmental priorities (Mean=3.82). These high ratings indicate a strong alignment with patient-centered care and department-specific requirements, suggesting that resources are often allocated in ways that directly benefit patient outcomes and operational efficiency within departments. The factors influencing resource allocation decisions, revealing that while government policies play a moderate role (Mean=2.88), their impact is perceived as neither overwhelmingly strong nor weak. Institutional priorities, however, were rated lower (Mean=2.38), indicating that internal goals and strategies may not heavily influence resource allocation decisions compared to factors like resource availability (Mean=3.60) and patient demand (Mean=3.31) [11].

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Table 5: Impact of Resource Allocation Management

Statement/Indicator	Level of occurrence					Mean	Std Deviation
	1- Strongly Disagree	2 - Disagree	3 – Neutral	4 – Agree	5- Strongly Agree		
Efficient Allocation in FMC & PHC	6(6%)	20(20%)	62(62%)	12(12%)	0(0)	2.80	.725
Allocation Based on Patients' Needs in FMC & PHC	0(0)	10(10%)	35(35%)	46(46%)	9(9%)	3.54	.797
Transparency in Allocation Practices in FMC & PHC	18(18%)	56(56%)	23(23%)	3(3%)	0(0)	2.11	.723
Allocation Based on Departmental Priorities in FMC & PHC	**1(1%)**	**4(4%)**	**25(25%)**	**52(52%)**	**18(18%)**	**3.82**	**.809**
Allocation Based on Institutional Priorities in FMC & PHC	26(26%)	46(46%)	24(24%)	2(2%)	2(2%)	2.08	.872

Source: Field Survey, 2024

The information got for the assessment of asset distribution to the board in Federal Medical Center and Primary healthcare center Azare envelops an extensive arrangement of information and result factors. The info factors incorporate the quantity of specialists, attendants, drug specialists, authoritative staff, and careful hardware, mirroring the human asset limit and clinical gear accessibility in the medical clinic. Also, the dataset remembers data for yearly monetary speculations and the typical number of guests, giving bits of knowledge into the emergency clinic's monetary standing and patient convergence. Then again, the result factors center around medical care results, openness, reasonableness, and quality, including recuperation rates, readmission rates, patient fulfilment, medical care availability, moderateness of administrations, and medical care quality given by the clinic. This broad dataset takes into consideration a comprehensive assessment of asset portion and the board inside the clinical focus.

The choice of information and result factors for the DEA (Data Envelopment Analysis) model utilized in the assessment was painstakingly thought of. The information factors were looked over different sources, including HR, clinic divisions, patients, and government authorities engaged with strategy settling on and asset distribution choices. This comprehensive methodology guarantees that the assessment catches the complex variables affecting asset distribution and the board at the Federal medical Center Azare. Moreover, the utilization of a disperse plot to portray the connection between the quantity of specialists and patients further underscores the meaning of medical services asset distribution, giving important bits of knowledge to managers and policy-makers to upgrade asset designation and guarantee compelling patient consideration [13].

Considering the framework used, the investigation used both abstract and quantitative ways of managing survey resource apportioning the board at the FMC and PHC Azare. The quantitative stage included looking at clinical facility records, financial reports, and patient data, while the abstract stage included interviews with accomplices like center supervisors, clinical consideration providers, and patients. The use of a survey as the inclined toward data combination instrument thought about the social event of both close-gotten done and honest responses, giving a total viewpoint on the perspectives and dynamic cycles enveloping resource segment the leaders [14, 15].

The assessment framework gave a nuanced cognizance of the complexities drew in with resource segment and the board at FMC and PHC Azare, working with informed choice creation for future improvements in clinical consideration transport. The decision of data and result factors for the evaluation of resource conveyance the leaders at the FMC and PHC Azare was an essential piece of the investigation method. The data factors included monetary allocation, staffing levels (trained professionals, administrative staff), and clinical stuff, while the outcome variable was the treatment rates, number of consultations, and bed occupancy rate. These elements were chosen to assess the center's human resource limit, patient thought, practical efficiency, and the reasonability of available staff in dealing with patient weight [16].

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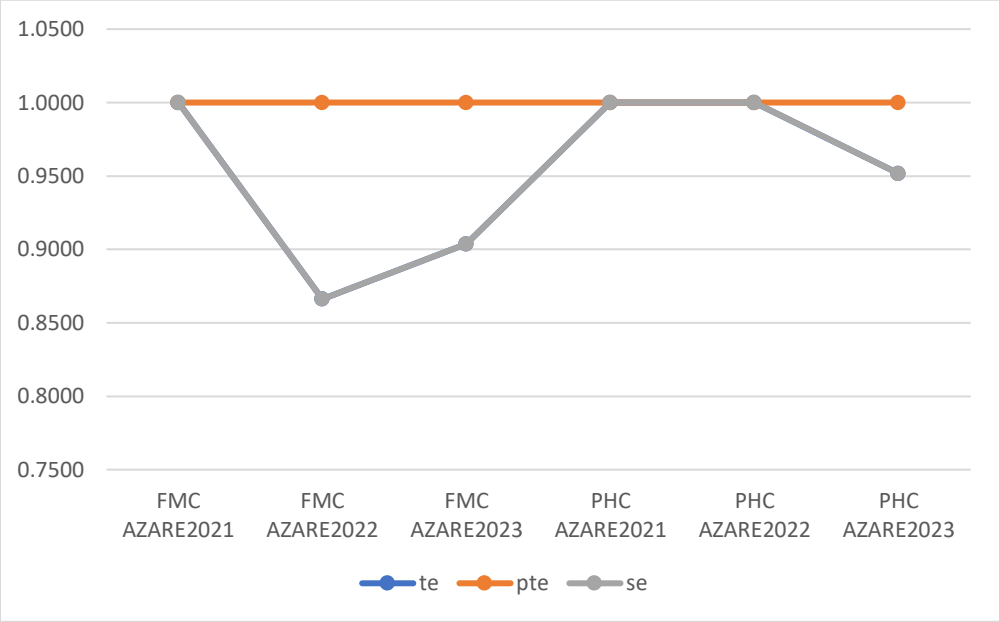


Figure 1: Trends in the Operational Efficiency of FMC AZARE and PHC AZARE from 2021 to 2023

Through the quantitative data gotten from the survey, the researcher was able to get the number of healthcare professionals, number of beds, number of patients treated, number of consultations, bed occupancy rates, and budget allocation to both FMC and PHC during the period of three years (2021-2023). For 2021, FMC had a budget allocation of N1,533,633,100.00, 105 healthcare professionals, 280 number of beds, treated 125,000 patients, provided consultations to 122,000 patients, and their bed occupancy rate was at 96%. As at 2022 their budget allocation rose to N1,883,963,102.00, had 150 healthcare professionals, 350 number of beds, treated 133,000 patients, provided consultations to 122,876 patients, and bed occupancy was 84%. as at 2023, their budget allocation was N1,900,536,000.00, with 288 healthcare professionals, 412 number of beds, treated 140,000 patients, provided consultations to 123,000 patients, and had a bed occupancy rate of 82%.

On the other hand, PMC had N6,000,000 budget allocation for the year 2021, 9 healthcare professionals, 24 beds, and treated a total 137 patients, provided consultations to 120 patients and had a bed occupancy rate of 90%. for the year 2022, they had a budget allocation of N8,000,000, 11 healthcare professionals, 24 number of beds, treated 155 patients, provided consultations to 144 patients, and had a bed occupancy rate of 97%. for 2023, the budget allocation was still same as 2022 which is N8,000,000, and 11 healthcare professionals, 24 number of beds, treated 168 patients, provided consultations to 159 patients, and had a bed occupancy rate of 91%.

Additionally, the survey utilized a data envelopment assessment (DEA) method for managing and evaluating resource dispersion to the facilities. Data and result factors were looked over HR, facility divisions, patients, and government specialists drew in with methodology making and resource segment decisions. This extensive dataset gave a concentrated layout of the factors affecting resource assignment and the board at the Federal Medical Center Azare (Gai et al., 2017).

From Table 4 and Figure 13, it can be observed that in terms of overall efficiency, the values for FMC AZARE 2021, PHC AZARE 2021, and PHC AZARE 2022 are all 1, indicating that they are DEA efficient and serve as benchmarks for all years. However, the values for FMC AZARE 2022, FMC AZARE 2023, and PHC AZARE 2023 are less than 1, indicating that they are DEA inefficient. Among them, FMC AZARE 2022 has the lowest efficiency value of only 0.8661, indicating a need for improvement in terms of technological and scale levels. In terms of pure technical efficiency, both hospitals have a value of 1 from 2021 to 2023, indicating that they are DEA efficient and do not require any adjustments, suggesting that both hospitals have high levels of technological and organizational management. In terms of scale efficiency, since the pure technical efficiency values for both hospitals from 2021 to 2023 are 1, the scale efficiency values for both hospitals are consistent with the overall efficiency values. Therefore, FMC AZARE 2022, FMC AZARE 2023, and PHC AZARE 2023 urgently need to improve their scale levels in order to continuously enhance their operational efficiency (Alotaibi et al., 2016; Tappenden et al., 2017).

CONCLUSION

The aim of this study has been to provide first hand empirical information about the efficiency of resource allocation to hospitals in Bauchi state with the hope that this can provide some lessons for the hospital sector in North-eastern region of Nigeria. Bauchi state is among one of the poor states in Nigeria situated in one of the poorest regions of the north. The state is facing large

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number of issues including healthcare crisis which prompted the evaluation of resources at Federal medical centre and Primary healthcare centre Azare. This is considered critical in view of the scarcity of resources and the severe implications of inefficient utilization of available resources for saving lives.

The data gotten from the hospitals showed there were wide variations in inputs and outputs of the hospitals. The scale efficiency result showed that FMC was more scale efficient in the year 2021 (1.0000), and more inefficient in the year 2022 (0.8661) and 2023(0.9038). The level of technical efficiency was at constant level in the year 2021 (1.0000), 2022 (1.0000) and 2023 (1.0000). and for the overall efficiency, FMC was more efficient in the year 2021(1.0000) and then it decreased in the subsequent years 2022 (0.8661) and 2023 (0.9038). For PHC the scale efficiency was at a constant level for year 2021 (1.0000) and 2022 (1.0000), the it decreased in the year 2023 (0.9515). same thing goes for the overall and technical efficiency. Going by the analysis and questionnaire administered, most respondents were not happy with the current state of these facilities and should be open for much more improvement.

The analysis also identified why any given inefficient unit was inefficient relative to the efficient ones. This yielded critical management information about the potential improvements that could be made to improve the efficiency of each inefficient unit. This research provides limited examples of how much each inefficient unit must reduce its input or increase each output to become efficient. However, it is possible that the facilities may expend resources to ensure quality environment for its patients or one that hires compassionate health staff may be rated less efficient than one whose staff are rude and lacking in compassion just on the basis of output. This is an important weakness of this study and needs to be taken into account.

Abbreviations
FMC: Federal Medical Centre
PHC: Primary Healthcare Centre
DEA: Data Envelopment Analysis

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