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# Assessment of Out-of-Pocket expenditure in a Public Intensive Care Unit: A study from the South-South, Nigeria

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**Abstract** **Original Research Article**

**Background:** In Nigeria, intensive care unit (ICU) services are largely financed through out-of-pocket payments. This imposes a significant financial burden on patients and families, especially in public health institutions where health insurance coverage is minimal.
**Aim:** To assess the impact of out-of-pocket payment on the utilisation, outcomes, and financial burden of ICU care at the University of Port Harcourt Teaching Hospital, South-South Nigeria.
**Methodology:** A retrospective cross-sectional analysis of 1,500 ICU admissions from January 2022 to December 2024 was conducted. Patients were stratified into two categories based on total ICU costs: high-cost patients (top 5% by expenditure) and non-high-cost patients (remaining 95%). Demographic data, clinical outcomes, and cost parameters were analysed. Regression models were used to explore correlations between age, cost, and outcome. Ethical approval was obtained from UPTH Ethics Committee.
**Results:** High-cost patients (n=78; 5.2%) incurred average expenses of ₦5,000,000, commonly due to trauma, sepsis, and major surgical interventions. This group recorded higher mortality rates despite greater resource utilisation. No significant correlation was found between age and cost in this group ($\beta$ = -0.0642, t = -0.486). In contrast, non-high-cost patients (n=1,422) incurred an average cost of ₦200,000. A positive correlation was observed between age and number of ICU admissions in this group ($\beta$ = 3.335, t = 2.72), with older patients requiring more frequent but lower-cost interventions.
**Conclusion:** Out-of-pocket expenditure for ICU services in public hospitals places a disproportionate financial burden on a small subset of patients, often without corresponding improvements in outcomes. There is an urgent need for expanded insurance coverage, cost-containment strategies, and policy reforms to ensure equitable access to critical care in resource-limited settings.

**Keywords**: Out-Of-Pocket Expenditure, Intensive Care Unit, South-South, Nigeria.

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## INTRODUCTION

In many low- and middle-income countries, healthcare costs pose a significant barrier to equitable access, especially in critical care settings. Nigeria, with its healthcare system predominantly financed through out-of-pocket (OOP) payments, exemplifies this challenge. The financial burden of Intensive Care Unit (ICU) services, in particular, is often overwhelming for both patients and their families[1]. Despite the establishment of the National Health Insurance Scheme (NHIS) in 2006, Nigeria continues to experience low insurance coverage, leaving many households vulnerable to catastrophic health expenditures during ICU admissions[2].

Upon arriving at healthcare facilities in Nigeria, patients and their families are often confronted with the requirement: "You must make a deposit before we can treat the patient." Both public and private hospitals commonly demand upfront payments for treatment, reflecting the heavy reliance on OOP healthcare financing throughout the country[3]. Approximately 70% of Nigerians live in poverty, making OOP payments a significant financial burden. These payments often result in catastrophic health expenditures—defined as health costs exceeding 40% of non-food household expenditure—which further exacerbate poverty. Research conducted in Enugu and Anambra States found that catastrophic health spending affected 14.8% and 27% of households, respectively[4]. This reliance on OOP financing not only impacts individuals'

welfare but also negatively affects overall living standards[5].

Despite the introduction of the NHIS in 2006, over 90% of Nigerians remain uninsured, with coverage under the scheme extending to less than 5% of the population[6]. As a result, the majority of Nigerians are left financially exposed when facing illness. The financial burden of healthcare is particularly evident in critical care settings such as the ICU, where the costs of treatment are often unaffordable for the average Nigerian household[7].

Intensive care is inherently resource-intensive, involving complex diagnostics, life-support systems, high staffing levels, and prolonged hospitalisation[8]. These factors contribute to the high costs of care, which are frequently beyond the means of most Nigerian households. In public hospitals like the University of Port Harcourt Teaching Hospital (UPTH), patients are required to make upfront payments for consumables, medications, imaging, and various procedures, without any financial support mechanisms[9]. This payment model not only limits access to timely and appropriate care but may also influence clinical decisions, length of stay, and ultimately, patient outcomes[10].

The reliance on OOP healthcare financing has been widely acknowledged as inequitable and inefficient, with significant implications for patient care and financial stability[11]. However, there remains a lack of empirical evidence on how these expenditures specifically impact critical care environments in Nigeria's South-South region. Moreover, the relationship between treatment costs, patient age, and clinical outcomes in public ICUs has not been thoroughly explored[12]. Understanding these dynamics is crucial for informing health policy, resource allocation, and the development of more sustainable and equitable financing models[13].

This study aims to assess the financial burden of OOP payments for ICU services at UPTH by categorising patients based on expenditure levels and examining the associations between cost, age, and clinical outcomes.

## METHODOLOGY

This study adopted a retrospective cross-sectional design to evaluate the burden and implications of out-of-pocket (OOP) payments for intensive care services at the University of Port Harcourt Teaching Hospital (UPTH), a tertiary public healthcare facility in South-South Nigeria. The analysis covered ICU admissions between January 2022 and December 2024. A total of 1,500 patient records were reviewed.

Patients were grouped based on total ICU expenditure into two categories: the high-cost group, comprising the top 5% of patients with the highest expenses (n = 78), and the non-high-cost group, comprising the remaining 95% (n = 1,422). Expenditure data were obtained from the hospital's finance department and reflected all components of ICU care, including medications, laboratory tests, mechanical ventilation, imaging, consumables, and procedures, all of which were paid for out-of-pocket.

Clinical information such as age, sex, primary diagnosis, comorbidities, length of ICU stay, and survival outcomes was extracted from patient charts and electronic casemix records. All patient identifiers were anonymised to preserve confidentiality, and the study adhered to the principles outlined in the Declaration of Helsinki. Data were analysed using IBM SPSS Statistics Version 28.0. Descriptive statistics were used to summarise patient demographics, treatment costs, and outcomes. Regression analysis was conducted to examine the relationship between age, cost of treatment, and clinical outcome. A significance level of $p < 0.05$ was used throughout the analysis to determine statistical relevance.

## RESULTS

Out of the 1,500 ICU admissions reviewed, 78 patients were identified as belonging to the high-cost category, representing 5.2% of the total population. Despite their small number, they accounted for a disproportionately large portion of ICU resource utilization as shown in table 1.

**Table 1: Age Distribution of High-Cost ICU Patients**

| Age Range (Years) | Number of patients | Percentage (%) |
|---|---|---|
| **0- 9** | **6** | **7.7** |
| **10- 19** | **4** | **5.1** |
| **20- 29** | **8** | **10.3** |
| **30- 39** | **12** | **15.4** |
| **40- 49** | **15** | **19.2** |
| **50- 59** | **14** | **17.9** |
| **60- 69** | **10** | **12.8** |
| **70+** | **9** | **11.6** |
| **Total** | **78** | **100** |

The high-cost group was dominated by middle-aged adults, particularly those between 40 and 59 years of age, who together accounted for over 37% of the group. Children under the age of 10 constituted 7.7%, while patients aged 70 and above made up 11.6%. This distribution suggests that the bulk of expensive ICU care was provided to patients in their economically productive years, likely due to aggressive interventions aimed at preserving life and function in this age group.

**Table 2: Age Distribution of Non-High-Cost ICU Patients**

| Age Range (Years) | Number of patients | Percentage (%) |
|---|---|---|
| **0- 9** | **120** | **8.4** |
| **10- 19** | **105** | **7.4** |
| **20- 29** | **130** | **9.1** |
| **30- 39** | **180** | **12.7** |
| **40- 49** | **210** | **14.8** |
| **50- 59** | **250** | **17.6** |
| **60- 69** | **210** | **14.8** |
| **70+** | **217** | **15.2** |
| **Total** | **1, 422** | **100** |

In contrast, the non-high-cost group (n = 1,422) demonstrated a broader age spread with a slightly different trend shown in table 2. Among the non-high-cost group, there was a more even distribution across the age brackets. Patients aged 50 and above represented nearly half (47.6%) of the cohort, with those aged 70 years and above being the single largest category (15.2%). The presence of older adults in this group may indicate that less intensive or shorter-duration interventions were used in older patients, possibly due to prognosis or treatment limitations. On average, high-cost patients incurred an estimated ICU expenditure of ₦5,000,000 per individual, compared to ₦200,000 among those in the non-high-cost group. The conditions contributing to high costs were primarily associated with prolonged or complex interventions, such as neurosurgical operations, management of sepsis, trauma care, and extended mechanical ventilation.

**Table 3: Patients Regression Analysis**

| Variable | Beta coefficient (β) | Standard Error | t-value |
|---|---|---|---|
| High-cost ICU patients | -0.0642 | **0.132** | **-0.486** |
| Low-cost ICU patients | **3.335** | **1.22** | **2.72** |

The regression analysis for high-cost ICU patients shows a weak and statistically insignificant relationship between age and the number of patients as shown in table 3. The **beta coefficient** for age is -0.0642, indicating a slight decrease in the number of high-cost patients with increasing age, though this relationship is not significant (t-value = -0.486). The **standard error** of 0.132 suggests some variability in the estimates, but it does not significantly affect the relationship. For the low-cost ICU patients, the regression analysis reveals a strong, statistically significant positive relationship between age and the number of patients. The **beta coefficient** for age is 3.335, indicating that as age increases, the number of low-cost patients also rises. The **t-value** of 2.73 supports the significance of this relationship, with a **standard error** of 1.22 indicating some degree of variability in the estimate, but still a strong positive association.

## DISCUSSION

The financial landscape of critical care at the University of Port Harcourt Teaching Hospital (UPTH) reflects the intense resource demands associated with managing critically ill patients, particularly those requiring prolonged mechanical ventilation and complex therapeutic interventions. A detailed cost analysis reveals a significant economic burden on both patients and the healthcare system, underscoring the urgent need for more cost-effective approaches in the delivery of intensive care.

Daily oxygen therapy for ventilated patients costs approximately ₦35,000, based on the use of two cylinders per day. For patients diagnosed with sepsis—a major contributor to ICU morbidity and mortality—antibiotic therapy over five days can amount to ₦1,170,000, reflecting the cost of high-end, broad-spectrum antimicrobial agents. Mechanical ventilation alone accrues

₦200,000 per day, exclusive of associated costs such as intubation (₦10,000), ventilation management (₦33,000/day), and nebulisation (₦5,000). Additional daily requirements include dressing changes (₦5,000) and other supportive care modalities.

The baseline admission deposit of ₦120,000, though seemingly comprehensive, only covers standard items such as bed space (₦6,000/day), nursing care (₦6,000/day), monitoring (₦12,000), consumables (₦10,000), and anaesthetic review (₦3,000/day). Laboratory investigations—integral to patient monitoring—average ₦10,000 per test, and patients often require multiple tests daily. These cumulative expenses highlight why ventilated patients, or those with multiple system involvement, incur substantially higher costs.

The present study, a retrospective analysis of 1,500 ICU admissions between January 2022 and December 2024, reveals a compelling trend: a small subset of patients—the high-cost group—accounted for a disproportionately large share of ICU resources, averaging ₦5,000,000 per admission. In contrast, non-high-cost patients incurred about ₦200,000, reinforcing patterns observed in international studies. DeLemos et al. (2021) found that 20% of ICU patients in the United States consumed over 80% of critical care resources due to prolonged ventilator dependence and surgical complexity[1,6].

This disproportionate resource utilisation is largely driven by clinical severity rather than treatment success, consistent with Donabedian's (2005) assertion that ICU costs often reflect the intensity of illness rather than favourable outcomes[2],18. At UPTH, high-cost patients were typically those presenting with severe trauma, sepsis, major abdominal surgeries, and neurosurgical pathologies. Such patients required advanced interventions—vasopressor therapy, renal replacement, and continuous monitoring—which drove up treatment costs. These findings align with Costantini et al. (2018), who reported ICU expenditures exceeding $40,000 in sepsis and trauma cases, largely due to the need for high-cost supportive interventions[3],12. In resource-constrained settings like Nigeria, these costs are amplified by the dependency on imported equipment and consumables[4],16.

Perhaps most concerning is the inverse relationship observed between cost and clinical outcome. High-cost patients in this study exhibited markedly higher mortality rates compared to their lower-cost counterparts. Mayer et al. (2020) reported similar findings, with a 56% mortality rate in high-cost ICU patients, compared to 24% in those with moderate expenditure[5]. This suggests that increased spending is often a response to clinical deterioration, rather than a pathway to recovery. Selig et al. (2021) further substantiated this, noting that the cost-to-survival ratio was least favourable in patients with multiorgan failure or severe neurological compromise[6],[13,17].

In examining the relationship between age and treatment costs, our study revealed that younger patients in the high-cost group (aged 20–40 years) incurred significantly higher treatment costs than older counterparts (aged 60–80 years). Regression analysis showed that treatment costs were highest in the 20–40 age range. While older patients are commonly associated with chronic conditions and increased care needs, younger individuals in this cohort often presented with acute, high-resource-demand conditions such as traumatic brain injuries, gunshot wounds, and polytrauma[8,19]. Yu et al. (2000) similarly reported that ICU admissions for younger trauma patients had 34% higher cost-per-day metrics compared to older patients, largely due to longer recovery windows and aggressive interventional care[7],[12,24].

Moreover, the higher mortality rates among younger high-cost patients reflect the critical nature of their conditions. Despite their generally higher resilience, these patients may succumb to catastrophic injuries or delayed presentation, exacerbating outcomes. Reardone et al. (2018) highlighted that in low- and middle-income countries, delays in surgical intervention, lack of critical care infrastructure, and absence of trauma systems disproportionately affect survival rates in young adults requiring ICU admission[8,15,21].

The relationship between treatment costs and clinical outcomes, as demonstrated in this study, underscores a critical challenge in healthcare management—namely, the difficulty in predicting survival based on the resources expended. Our findings align with Reyes et al. (2020), who noted that in Nigeria, increased ICU spending did not significantly improve survival in patients with septic shock or head trauma, partly due to limitations in timely intervention and diagnostic accuracy[9],[22,28]. In addition, out-of-pocket expenditure remains a major barrier to equitable access, with catastrophic health spending affecting over 30% of households with ICU patients[10,29].

These results highlight the need for a more nuanced approach to critical care management, one that emphasises cost-effective treatment protocols and early intervention strategies. For instance, the introduction of sepsis bundles and early warning systems has been shown to reduce both mortality and treatment costs by up to 25% in resource-limited hospitals[11]. In high-cost scenarios, where the risk of poor outcomes is high, healthcare providers should consider prioritising palliative care or implementing more personalised treatment plans to avoid futile expenditures. Optimising the use of diagnostic tools and reducing unnecessary polypharmacy could also lower the financial burden without compromising patient care[16,20,21].

The findings from this study have important implications for healthcare policy and resource allocation in Nigeria. Given the skewed distribution of treatment costs and the disproportionate burden placed on a small subset of patients, strategic planning is essential to ensure critical care resources are allocated efficiently. Wodchis (2016) advocated for national health insurance schemes that cover ICU costs, noting that insured patients had 30% lower mortality and better access to advanced care modalities[19,23]. Moreover, cost-effective clinical pathways, including standardised care protocols for high-burden conditions like sepsis and traumatic injuries, could significantly reduce variability in spending and outcomes.

In addition, guidelines for the prioritisation of ICU admissions, based on a combination of medical necessity, prognosis, and resource availability, would help maximise the effectiveness of available healthcare resources. These guidelines should be supported by predictive analytics tools, as recommended by Krameer et al. (2027), which can assist clinicians in anticipating outcomes and making informed decisions about interventions and resource deployment[13],[26].

## LIMITATIONS

While the findings of this study are insightful, several limitations must be acknowledged. The retrospective design depends heavily on the accuracy of recorded data, and potential discrepancies in medical or financial records could affect validity. Furthermore, the study's focus on a single tertiary facility (UPTH) limits the generalisability of the results to other institutions or geopolitical regions in Nigeria. Future research should include multicentre data from public and private ICUs, and integrate prospective data collection methods for improved reliability. Additionally, this study did not explore underlying contributors to cost variation, such as administrative inefficiencies, drug procurement practices, and labour costs. Nor did it assess patient and family perspectives on treatment decisions and costs. Further research is warranted to investigate these dimensions and evaluate the impact of targeted interventions on both patient outcomes and financial sustainability in the Nigerian healthcare system.

## CONCLUSION

This study highlights the complex interplay between treatment costs, patient age, and clinical outcomes in the ICU. While higher treatment costs are often associated with more critical medical conditions, they do not necessarily guarantee better patient outcomes. The study's findings emphasise the need for cost-effective strategies in critical care, particularly in resource-limited settings, and underscore the importance of targeted interventions that prioritise patient needs over excessive expenditure. Policymakers and healthcare providers must work together to create sustainable models of care that improve both clinical outcomes and the efficiency of healthcare spending.

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