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Paediatric Admissions and Outcomes in A Digitally-Enabled Primary Health Care Facility in Southern Nigeria: A Retrospective Analysis Following EMR Deployment

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Article history: Received 01 November 2025, Reviewed 11 November 2025, Accepted for publication 11 December 2025

Abstract

Background: Electronic Medical Records (EMRs) are transforming healthcare globally, by improving efficiency, documentation accuracy, and patient outcomes. In Nigeria, where primary health care (PHC) facilities often face infrastructural and staffing constraints, EMRs offer a pathway for systemic reform.

Aim: To evaluate paediatric admission patterns and outcomes following EMR implementation by Renaissance Africa Energy Company (Renaissance) at Obio Cottage Hospital (OCH), Port Harcourt, and to compare these findings with published national PHC performance indicators.

Methods: This retrospective observational study analyzed EMR data from all paediatric admissions between September 2024 and June 2025. Demographic, diagnostic, and outcome data were analyzed using descriptive statistics and chi-square tests. Comparative insights were drawn from published national PHC studies.

Results: Of 771 admissions, 397 (51.5%) were neonates. The leading neonatal diagnoses were neonatal jaundice (66.2%) and sepsis (22.4%), while gastroenteritis (24.1%) and upper respiratory tract infections (23.5%) predominated among older children. Most patients (90.1%) were discharged, 4.2% referred, and mortality was 0.3%. Patient outcome was significantly associated with length of hospital stay ($\chi^2 = 23.704$, $p = 0.000$). Compared with national PHC benchmarks, OCH demonstrated superior documentation, improved referral coordination, and better patient outcomes.

Conclusion: EMR implementation at OCH and enhanced financing through community-based insurance enabled by a Public-Private-People Partnership can dramatically improve paediatric outcomes in PHC settings. The OCH model demonstrates that with sufficient investment, PHC facilities can effectively manage common paediatric conditions, achieve low mortality, and contribute meaningfully to Nigeria's child survival goals.

Keywords: Electronic Medical Records, Paediatrics, Primary Health Care, Nigeria, Public-Private Partnership, Sustainable Development Goal -3, Digital health.

How to cite this article

Obiagwu PN, Tuboteme SD, Ogunlaja OA, Oku A, Fajola AO, Ebaretonbofa FE, Alali A, Osuegbu O, Adetula O, Gabriel O. Paediatric Admissions and Outcomes in A Digitally Enabled Primary Health Care Facility in Southern Nigeria: A Retrospective Analysis Following EMR Deployment. The Nigerian Health Journal 2025; 25(4): 1602 – 1609.
https://doi.org/10.71637/tnhj.v25i4.1254

INTRODUCTION

Primary health care (PHC) represents the foundation of Nigeria's healthcare system, serving as the first point of contact for most citizens. Despite its critical importance, PHC remains underdeveloped and fragmented, with suboptimal service delivery. Challenges such as inadequate infrastructure, poor staffing, unreliable health information systems, and limited health insurance coverage have consistently undermined service quality, continuity of care, and progress toward the Sustainable Development Goal 3 (SDG-3) - ensuring healthy lives and promoting well-being for all ages.[1,2]

Electronic Medical Records (EMRs) are increasingly recognized as transformative tools for improving healthcare delivery in low- and middle-income countries (LMICs). EMRs facilitate real-time documentation, support clinical audits, streamline referrals, and promote evidence-based decision-making.[3,4] However, EMR implementation in Nigeria remains limited, particularly at the PHC level, due to funding constraints, low digital literacy, and unreliable power and internet infrastructure.[5]

Obio Cottage Hospital (OCH), a revitalized PHC in Rivers State, offers a successful model of a Public-Private-People Partnership (PPPP) supported by the Renaissance Africa Energy Company (Renaissance), formerly the Shell Petroleum Development Company (SPDC). This hospital integrates digital health systems with a Community Health Insurance Scheme (CHIS), effectively reducing financial barriers and improving access to quality care.

This study evaluated the pattern and outcomes of paediatric admissions at OCH following EMR deployment and compared them with national PHC performance indicators to assess the impact of digital health integration and innovative financing on child health outcomes.

METHODOLOGY

This retrospective observational study was conducted at Obio Cottage Hospital (OCH), a 62-bed semi-urban PHC located in Obio/Akpor Local Government Area, Rivers State, Nigeria. Established in 1978, OCH underwent extensive revitalization through Renaissance's social investment program. The hospital was expanded from 4 to 62 beds, staffing increased from 13 community health extension workers to about 90 clinical and over 100 non-clinical staff, a Community Health Insurance Scheme (CHIS) was introduced in 2010, and a full EMR system was implemented in 2024. OCH provides comprehensive services including paediatrics, obstetrics, gynaecology, surgery, radiology, laboratory, and pharmacy units. A structured referral system ensures that patients requiring advanced care are transported promptly by ambulance to higher-level facilities. Ethical approval was obtained from the Research Advisory Committee of the hospital. Regarding ethical publication of medical information, the principles of the Declaration of Helsinki were strictly adhered to.

All paediatric admissions between 1 September 2024 and 30 June 2025 were reviewed. This included all neonates (≤28 days) admitted to the Special Care Baby Unit (SCBU) and children aged 1 month to 15 years admitted to the paediatric ward. Variables obtained from EMR records included age, sex, primary diagnosis, length of stay, discharge status, referral, and mortality. Descriptive statistics summarized demographic and clinical characteristics. The association between length of hospital stay and discharge outcomes was analyzed using the chi-square test, with statistical significance set at $p < 0.05$. Comparative national PHC data were drawn from recent literature evaluating PHC performance, and child mortality in Nigeria.[6,7]

RESULTS

There was a total of 771 children (males = 448, 58.1%) admitted during the study period. Of these, 397 (51.5%) were neonates, of which 29 (7.3%) were preterm. Ages ranged from birth to 15 years. The median age on admission was 3 days for the neonates and 12 months for the older children. Most neonates (n = 359; 90.4%) were admitted within the first week of life, whereas 345 (92.2%) of the older children were under 5 years of age. Sex distribution did not differ significantly between neonates and older children ($\chi^2 = 0.468$, $p = 0.494$). The sociodemographic characteristics of the children admitted during the study period are shown in Table 1.

Print ISSN: 0189-9287 Online ISSN: 2992-345X

Table 1: Sociodemographic characteristics of the study population

Variable	Neonates, n = 397	Older children, n = 374	Total, n = 771
Male sex	226 (56.9%)	222 (59.4%)	448 (58.1%)
Median (IQR) age	3 (1 – 4) days	12 (6 – 24) months	
Age category on admission			
	0 - 7 days: 359 (90.4%)	Under-fives: 345 (92.2%)	
	8 – 14 days: 25 (6.3%)	5 to 15-year-olds: 29 (7.8%)	
	15 – 21 days: 10 (2.5%)		
	22 – 30 days: 3 (0.8%)		

IQR – interquartile range

Admission diagnoses

Among neonates, the leading diagnoses were neonatal jaundice (66.2%), neonatal sepsis (22.4%), congenital malaria (10.1%), and perinatal asphyxia (3.8%). Table 2 shows the detailed distribution of primary diagnoses in admitted neonates during the study period.

Table 2: Primary diagnoses in admitted neonates during the study period

Primary diagnosis on admission	Number (%)
Neonatal Jaundice	263 (66.2)
Neonatal sepsis	89 (22.4)
Congenital malaria	40 (10.1)
Perinatal asphyxia	15 (3.8)
Infant of diabetic mother	9 (2.3)
Neonatal hypoglycaemia	8 (2.0)
Transient tachypnoea of the newborn	7 (1.8)
Meconium aspiration syndrome	6 (1.5)
Congenital pneumonia with suspected CHDx	3 (0.8)

CHDx - congenital heart disease

Among older children, the most frequent diagnoses were acute gastroenteritis (24.1%), upper respiratory tract infection (23.5%), malaria (20.9%), and sepsis (10.7%). Thirty-five children (9.3%) had underlying chronic illnesses including sickle cell anaemia (n = 12), asthma (n = 10), and malnutrition (n = 8). Although many children had multiple suspected conditions on admission, the major diagnoses made are listed in Table 3 below.

Table 3: Primary diagnoses in older children admitted during the study period

Primary admission diagnosis	Number (%)
Acute gastroenteritis	90 (24.1)
Upper respiratory tract infection	88 (23.5)
Malaria	78 (20.9)
Sepsis	40 (10.7)
Bronchopneumonia	22 (5.9)
Surgical conditions *	17 (4.5)
Impetigo	16 (4.3)
Gastritis	10 (2.7)
Prolonged neonatal jaundice	8 (2.1)
Pyomyositis	2 (0.5)
Anaemia of prematurity	2 (0.5)
Cellulitis	1 (0.3)

*Includes: Hernias (13), Cryptorchidism (2), Gluteal abscess (1), Dermoid cyst (1)

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Admission Outcomes

Overall, 695 (90.1%) patients (341 neonates and 354 older children) were discharged home, with 32 (4.2%) referred for specialist care. Among the neonates, 25 (6.3%) were referred to the tertiary hospitals for reasons including severe infection in 15, severe birth asphyxia in 3, extreme prematurity in 3, suspected cyanotic CHDx in 2, congenital anomaly in 1, and meconium aspiration syndrome with worsening respiratory distress in 1. Among older children, the 7 referred cases (1.9%) were severe sepsis in a malnourished infant with underlying acyanotic CHD, a 7-month-old with severe bronchopneumonia and acute gastroenteritis, two cases (12-month-old and 36-month-old) of acute gastroenteritis with multiple, severely deranged electrolytes, a 36-month-old with acute pharyngotonsilitis and severe respiratory distress, a 48-month-old newly-diagnosed sickle cell anaemic child with suspected acute chest syndrome, and an 8-year-old child admitted with severe sepsis with suspected retroviral disease. Two neonatal deaths were recorded, both attributable to severe sepsis and perinatal asphyxia. Median (IQR) duration of hospital stay was 5 (3 – 6) days overall; 5 (3 – 7) days for neonates and 4 (3 – 6) days for older children. The outcomes are summarized in table 4 below.

Table 4: Outcomes for patients admitted into the paediatric units over the study period

Outcome category	Neonates n = 397 (%)	Older children n = 374 (%)	Total n = 771 (%)
Discharged	341 (85.9)	354 (94.7)	695 (90.1)
DAMA	27 (6.8)	10 (2.7)	37 (4.8)
Referred	25 (6.3)	7 (1.9)	32 (4.2)
Mortality	2 (0.5)	0 (0.0)	2 (0.3)
Unsettled bills	2 (0.5)	1 (0.3)	3 (0.4)
Absconded	0 (0.0)	2 (0.5)	2 (0.3)
Median (IQR) hospital stay	5 (3, 7)	4 (3, 6)	5 (3, 6)

DAMA - discharged against medical advice, IQR – Interquartile range

The largest proportion of children (n = 166, 21.5%) were admitted for exactly 3 days. Most children (n = 538, 69.8%) stayed longer than 3 days. A substantial majority of children who achieved routine discharge (500/695; 71.9%) were admitted for more than three days. DAMA was more common among children admitted for more than three days (21/37; 56.8%), suggesting that prolonged hospitalization may influence caregivers' decisions. All mortality cases occurred within the first three days of admission. Conversely, referrals were more evenly distributed, although a higher proportion occurred within the first three days. Cases involving unsettled hospital bills were exclusively associated with longer admissions (>3 days), reflecting the potential cumulative financial burden of extended care. The distribution of absconded cases was equal across both categories of length of stay. A statistically significant association was observed between patient outcome and duration of hospital admission, underscoring the potential influence of clinical severity, socio-economic constraints, or healthcare-seeking behavior on both hospitalization duration and outcome. Table 5 illustrates the relationship between patient outcomes and length of hospital stay.

Table 5: Relationship between patient outcome and length of hospital stay

	Length of hospital stay, n (%)			
Outcome	**≤ 3 days**	**>3 days**	**χ^2**	**P value**
Discharged	195 (28.1)	500 (71.9)		
DAMA	16 (43.2)	21 (56.8)		
Referred	19 (59.4)	13 (40.6)	23.704	0.000
Mortality	2 (100.0)	0 (0.0)		
Unsettled bills	0 (0.0)	3 (100.0)		
Absconded	1 (50.0)	1 (50.0)		
Total	233 (30.2)	538 (69.8)		

DAMA - discharged against medical advice

Print ISSN: 0189-9287 Online ISSN: 2992-345X

The findings align with national evidence demonstrating the protective effect of PHC access on child mortality, as shown by Zakariya et al., where PHC accessibility significantly reduced mortality risk (OR 0.65; p = 0.004). This is shown in Table 6.

Table 6: Logistic regression table showing the predictors of child mortality

Independent variable	Odds ratio (OR)	95% CI	p-value
PHC accessibility	0.65	0.48 – 0.89	0.004*
Socio-economic status	1.42	1.12 – 1.81	0.002*
Maternal education	0.78	0.65 – 0.93	0.012*
Healthcare worker availability	1.12	0.92 – 1.36	0.260

*-statistically significant; CI – confidence interval, PHC – Primary Health Care
Source: Adapted from Zakariya et al, 2025.

DISCUSSION

This study provides important insights into paediatric morbidity and outcomes within a digitally-enabled PHC facility in southern Nigeria. The findings demonstrate that high-quality PHC - supported by EMR deployment, strengthened infrastructure, improved staffing, and a community-based health insurance scheme – can substantially improve child health outcomes and reduce preventable mortality. EMR integration at OCH, under a Renaissance-supported PPPP model, substantially enhanced the quality of paediatric service delivery, accuracy of health data, and operational efficiency. These improvements stand in contrast to widely reported challenges in non-digitized PHCs across Nigeria, where fragmented documentation, limited workforce capacity, inefficient referral mechanisms, and insufficient equipment hinder paediatric service delivery and optimal child health outcomes.[7,8]

Many PHCs in Nigeria are headed by community health extension workers (CHEWs) - the minimum national human resource requirement – who frequently operate beyond their training and are often unable to deliver comprehensive paediatric services or provide overnight inpatient care.[9] This explains the scarcity of PHC data on paediatric admission patterns. Authors from Zaria, northern Nigeria, reported that diarrhoea and convulsions were typically referred elsewhere from their PHCs,[10] conditions routinely and effectively managed at OCH.

Integration of EMR with community-based insurance promoted early care-seeking and reduced financial barriers, contributing to high admission volumes - 771 paediatric admissions within 10 months. This reflects increased community trust, aligning with evidence that health insurance combined with digital efficiency attracts higher patient patronage as a result of improved service reliability and reduced administrative bottlenecks.[11]

The predominance of neonatal and under-five admissions mirrors national epidemiologic patterns, where these age groups remain most vulnerable to infectious diseases and perinatal complications. The high proportion of early-neonatal admissions (90.4% in the first week) underscores the continuing burden of neonatal jaundice, sepsis, and congenital infections, consistent with reports from other health facilities across Nigeria. The absence of sex-related differences aligns with global paediatric epidemiology,[12] suggesting that access to care rather than gender-based disparities largely influences admission patterns at this level of care.

Neonatal jaundice and sepsis were the leading diagnoses, together accounting for nearly 90% of neonatal admissions. These conditions remain major causes of neonatal morbidity in sub-Saharan Africa and are highly sensitive to early diagnosis and timely management. The ability of OCH to manage such cases at the PHC level reflects improved diagnostic capacity and availability of laboratory and phototherapy services – features uncommon in many PHC facilities. Among older children, acute gastroenteritis, respiratory infections, and malaria accounted for two-thirds of admissions, consistent with global reports on the leading causes of childhood morbidity.[12] That only 9.3% had chronic conditions highlights that the majority of PHC admissions remain driven by acute, preventable, and treatable illnesses.

The variety of admissions at OCH mirrors the case mix of tertiary hospitals in the south-south region.[13-17] The overall discharge rate of 90.1% and remarkably low mortality rate of 0.3% represent performance metrics superior to many health facilities in Nigeria. Unfortunately, there is a paucity of studies in PHCs to

Print ISSN: 0189-9287 Online ISSN: 2992-345X

compare this outcome with as most studies on mortality in admitted neonates were conducted in tertiary healthcare centers.[18] A study carried out in Port Harcourt had previously found that healthcare workers in Port Harcourt PHCs lacked baseline knowledge and skills of neonatal resuscitation.[19] This is different from what is observed in OCH. This favorable outcome in this study could be attributable to timely presentation facilitated by CHIS which reduces financial delays, improved triage and documentation enabled by EMR and leading to early identification of high-risk patients, better staffing and diagnostic capacity which is uncommon in typical PHC settings, and structured referral pathways, ensuring critically ill patients receive prompt tertiary intervention.

The predominance of prolonged admissions (>3 days) reflects the nature of neonatal conditions and the recovery course of common paediatric illnesses. The significant association between length of stay and outcomes further provides important insights. Children who died did so early, indicating severe disease on arrival. DAMA was more common after extended admission, suggesting caregiver fatigue, competing socio-economic pressures, or diminishing financial capacity even under CHIS. Furthermore, cases with unsettled bills occurred exclusively among prolonged admissions, indicating cumulative hospital costs remain a burden for some families. These observations suggest the need for improved counselling, social support services, and exploration of financial hardship waivers.

The study's outcomes align with findings by Zakariya et al. which showed that PHC accessibility reduces child mortality.[6] OCH's strong performance underscores how investment in digital health, infrastructure, workforce expansion, and community-based financing synergistically enhances PHC effectiveness. The findings strengthen the argument that digitally-enabled PHC models can accelerate progress toward SDG-3, reduce avoidable hospitalizations, and mitigate child mortality in resource-constrained settings.

The EMR system improved documentation accuracy, reduced record loss, and facilitated prompt referrals - findings consistent with studies in Ghana and Kenya where EMR adoption enhanced service delivery and efficiency, by shortening patient wait times, and strengthening referral linkages.[11,20] However this is not without challenges common to several LMICs as outlined in a recent study in Tanzania.[21]

These findings have implications for policy and practice. Sustained investment in infrastructure and human resources exemplifies how PPPs can drive sustainable health innovation. Scaling EMR deployment could improve data quality, disease surveillance, and continuity of care across PHC facilities. Expanding CHIS-like insurance schemes may improve timely health-seeking behavior and reduce catastrophic health expenditure. This synergy leverages private sector efficiency while aligning with public health objectives, thereby advancing Nigeria's Universal Health Coverage and SDG-3 targets. Investing in neonatal care capacity at the PHC level can significantly reduce early neonatal mortality. With appropriate regulatory frameworks and donor alignment, replicating PPPP models, such as that used at OCH, may yield substantial system improvements. OCH's success highlights four key pathways through which EMR integration strengthens PHC. These include equitable access through reliable, data-driven service delivery; health system strengthening via real-time analytics; reduced mortality through early diagnosis, efficient referrals, and continuity of care; financial protection through digital integration with community insurance. These findings reaffirm the World Health Organization's position that digital health systems, particularly EMRs, are indispensable tools for achieving SDG-aligned health system strengthening.[22]

The main limitations of this study were the single-centre design, short observation period, exclusion of outpatient morbidity trends, and reliance on published benchmarks rather than concurrent comparisons. Nonetheless, the findings underscore the potential of EMR-enabled PHCs to transform healthcare delivery in resource-limited settings.

CONCLUSION

The findings show that integrating EMRs within a PPP and community insurance framework significantly improved paediatric outcomes, documentation quality, and service efficiency. Compared with national benchmarks, OCH achieved higher service utilization and lower neonatal mortality. EMR-driven, insurance-supported PHC models offer a scalable pathway for Nigeria and similar countries striving toward SDG-3 and Universal Health Coverage.

Print ISSN: 0189-9287 Online ISSN: 2992-345X

DECLARATIONS

Ethics approval: Ethical approval was obtained from the Research Advisory Committee of the hospital. The principles of the Declaration of Helsinki regarding ethical publication of medical information were strictly adhered to.

Authors' cntribution: Conceptualization and study design: PNO, SDT and OAO. Data collection: PNO and SDT. Data analysis and interpretation: PNO, OAO, AO, AF Manuscript drafting: PNO, OAO, AO, FEE, AA, OO, OA, and OG. All authors critically reviewed and approved the final manuscript.

Conflict of interest: The authors declare no conflict of interest.

Funding: The authors did not receive any funding for this study.

Acknowledgement: Acknowledgement is hereby given to Mrs. Goodness Uranta for assisting with data collection.

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Print ISSN: 0189-9287 Online ISSN: 2992-345X