Extent of electronic health billing system and healthcare service delivery in government owned system in Cross River State, Nigeria

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Abstract

This study, titled "Extent of Electronic Health Billing System and Healthcare Service Delivery in Government-Owned Facilities in Cross River State, Nigeria," examines the impact of electronic billing systems on healthcare delivery within the Southern zone of Cross River State. Despite the global transition to digital health records, this region remains reliant on manual record-keeping systems that are prone to damage, deterioration, and loss, thereby compromising the integrity and continuity of healthcare services. The lack of requisite knowledge, manpower, and infrastructure within government healthcare facilities hinders the effective implementation of electronic health record (EHR) systems, perpetuating reliance on traditional analog methods.

To assess the influence of electronic billing systems on healthcare delivery, a survey design was employed. A total of 749 participants, including 355 medical personnel and 355 inpatients from six hospitals, were surveyed using stratified proportionate random sampling. Descriptive statistics, such as mean and standard deviation, were utilized to analyze the collected data.

The results indicates that state-owned hospitals in the Southern Zone of Cross River State fail to provide comprehensive healthcare services adequately. Furthermore, the electronic billing system significantly impacts the efficiency of payment processing in these healthcare facilities. The study advocates for the enhanced implementation of electronic health billing systems, increased training and education on EHRs, and the promotion of research and development in healthcare technology to improve service delivery outcomes.

Keywords: Electronic Health Records, Healthcare Service Delivery, Government-Owned Hospitals, Manual Record-Keeping, Electronic Billing Systems.

Introduction

Health and well-being represent the cornerstone of human existence, constituting not only a fundamental necessity but also an intrinsic right for every individual. Recognising the significance of accessible, high-quality healthcare services, the United Nations (UN) passed a resolution in 2012 urging governments worldwide to ensure that all their citizens have access to affordable healthcare. This resolution underscored the indispensable role of healthcare in international development and called for collaboration between civil society, international organisations, and governments to prioritise healthcare provision on a global scale.

In Nigeria, particularly in states like Cross River, the healthcare sector grapples with challenges related to the delivery of quality medical services. Factors such as population growth, unhealthy lifestyle choices, and the pursuit of an enhanced quality of life according to Bailey-McHale, Ebrahimi and Bailey-McHale (2020) have contributed to an escalating demand for healthcare, placing strain on the limited resources of the healthcare system in developing societies.

The implementation of an electronic healthcare record system is crucial in enhancing the quality of service delivery within healthcare institutions. Comprehensive health records serve as essential tools for hospitals to achieve service efficiency, accuracy, accessibility, authenticity, and overall effectiveness. Therefore, the proficiency of medical service delivery hinges not only on the expertise and knowledge of healthcare professionals but also on the meticulous management of medical records as related by Obotu, Uganneya and Ogezi, (2018).

The primary objective of electronic health records (EHRs) is to elevate healthcare service delivery standards need for technological advancements and the adoption of innovative solutions like cloud computing. The introduction of such technologies could address the current inefficiencies, high costs, and security issues, thereby improving healthcare delivery and decision-making processes. Further research and implementation of cloud-based EHR systems could pave the way for more efficient, reliable, and secure healthcare management in developing regions.

Public confidence on the extent of electronic health billing system

Public confidence in the extent of the Electronic Health Billing System (EHBS) reflects the trust that patients and healthcare providers have in the system's accuracy, reliability, security, and efficiency. This confidence hinges on the EHBS's ability to accurately capture and process billing information, ensure robust data security and privacy, streamline billing processes, and provide transparent and understandable billing practices. Effective customer support and prompt issue resolution further enhance trust. Overall, strong public confidence is crucial for the widespread adoption and success of EHBS, as it ensures users feel secure and satisfied with the system's performance and integrity.

There are significant concerns among social groups, doctors, and patients regarding patient privacy. According to studies conducted by Orion Health (2012), although patients recognise the benefits of data sharing for research and care, they have substantial reservations about the security of their electronic health records (EHRs). An empirical study conducted by Papoutsi, Reed, Marston, Lewis, Majeed, & Bell (2015) revealed that only 133 out of 2,761 patients in London were subscribed to the electronic records system. In other words, 79% of the patients expressed concerns about the security of their EHRs.

In a separate survey by Orion Health (2012), it was found that among 502 doctors, only half believed that the implementation of electronic health record systems had reduced the time spent with patients. This highlights a significant issue with EHRs, as they have been critiqued for weak management, poor value for money, being overly centralised, and lacking sensitivity to local circumstances (Ip, Loose, Tyson, Cesare, Brown, Jain, & Reference Consortium, 2015)

Cline and Luiz (2013) concluded that despite the numerous challenges facing the healthcare sector in developing countries, the application of information technology through automation holds the potential to reduce the inefficiencies associated with manually driven processes and lower transaction costs.

Benefits of hospital information systems

Hospital Information Systems (HIS) provide numerous benefits that enhance both patient care and operational efficiency within healthcare facilities. By offering quick access to centralised patient records, HIS ensures accurate and timely diagnoses and treatments. The system streamlines administrative tasks like scheduling, billing, and inventory management, thereby reducing manual workload and increasing productivity. HIS also minimises errors through standardised processes, improves communication among healthcare providers by enabling seamless information sharing, and helps facilities comply with regulatory standards. Additionally, by reducing paperwork and optimising operations, HIS can lead to significant cost savings. These improvements collectively contribute to higher patient satisfaction and better overall healthcare experiences (Adegbore and Omowumi, 2021).

Hospital Information Systems (HIS) significantly enhance workflow and improve patient access to healthcare services (Ouma & Herselman, 2008). Sisniega (2009) emphasises that information and communication technologies (ICT) can facilitate rapid and pervasive communication between stakeholders and organisations, thereby streamlining healthcare operations. Keenan et al. (2013) suggests that improvements in workflow, patient care, laboratory results, and medication turnaround times can substantially enhance healthcare services. In a diverse society like Nigeria, where healthcare accessibility is often unequal, the implementation of electronic billing systems and healthcare service delivery platforms may help bridge this gap (Ouma & Herselman, 2008).

Sammon et al. (2009) argued that with enhanced storage and analysis of patient information, physicians can make more informed and higher-quality billing decisions through the adoption of patient data analysis systems (PDAs). To avoid failure, organizations need to integrate electronic medical records (EMR) with billing software to effectively implement electronic medical records systems.

Analytical software systems facilitate the proper dissemination and fluidity of information in decision-making processes, thereby giving organizations a competitive edge in the marketplace (Keenan, Nguyen & Srinivasan, 2014). Conversely, not utilising communication and billing software can lead to inefficiencies and potential breakdowns in the healthcare delivery process.

Overview of Southern Zone of Cross River.

The southern zone of Cross River State comprises seven local government areas: Biase, Odukpani, Akamkpa, Calabar Municipal, Calabar South, Akpabuyo, and Bakassi. This

zone was selected for study due to its status as the location of the state capital, which is presumed to have superior healthcare facilities owing to the presence of government institutions, non-governmental organisations (NGOs), companies, and industries. Geographically, the zone is bordered to the north by Yakurr Local Government Area, to the east by Abia State, to the west by Akwa Ibom and Ebonyi States, and to the south by the Atlantic coastline. The population of this region is estimated to be approximately 3.3 million, based on the 2006 census figures from the National Population Commission (NPC).

Methodology

The study employed a survey design utilising questionnaires to gather responses from 749 participants to measure the impact of electronic billing systems on healthcare service delivery. The sample consisted of 710 individuals, equally divided between 355 medical personnel and 355 inpatients. Stratified proportionate random sampling was used to ensure equal representation, dividing the population into strata, with each hospital forming a stratum. Sixty percent of staff and inpatients from each of the six hospitals were selected as samples.

In total, the study included 8 doctors, 119 caregivers, and 90 administrative staff from General Hospital Calabar; 2 doctors, 30 nurses, and 15 administrative staff from St. Joseph Hospital Akpabuyo; 4 doctors, 37 caregivers, and 19 administrative staff from General Hospital Akamkpa; 1 doctor, 8 nurses, and 5 administrative staff from Cottage Hospital Oban; 1 doctor, 14 caregivers, and 21 administrative staff from Cottage Hospital Biase; and 1 doctor, 8 caregivers, and 11 administrative staff from Comprehensive Health Center Okoyong. For the inpatient sample, 60% of the total population, equating to 355 individuals, was included in the study.

Descriptive statistics, including mean and standard deviation, were used to summarise the data collected from the questionnaires. Descriptive statistics are advantageous for initial data analysis as they help identify outliers, summarise key characteristics, and inform the selection of appropriate statistical methods for further analysis. The origins of descriptive statistics date back to John Graunt and William Petty in 1662, who developed early methods for human statistical analysis and census-taking, laying the groundwork for modern demography. Descriptive statistics allow researchers to describe central tendencies (mean, median, mode), dispersion (range, variance, standard deviation), and the shape of data distributions, often employing graphical representations to aid visualisation and understanding.

One-way Analysis of Variance (ANOVA) was employed to test the hypotheses. The distribution of the inpatient sample is detailed in Table 1A.

TABLE 1A
Distribution of population and sample: Health Personnel

S/N	Hospital	Total number of health personnel	Percentage of health personnel used (60%)
1	General Hospital, Calabar	361	217
2	St. Joseph's Hospital, Akpabuyo	79	48
3	General Hospital, Akamkpa	104	62
4	Cottage Hospital, Oban	24	14
5	Cottage Hospital, Akpet	54	33
6	Comprehensive Health Centre, Okoyong	34	20
	Total	**656**	**394**

TABLE 1B.
Distribution of population and sample for inpatients

S/N	Hospital	Total number of in-patients	Percentage of in-patients used (60per cent)
1	General Hospital,Calabar	159	96
2	St. Joseph's Hospital,Akpabuyo	80	48
3	General Hospital,Akamkpa	85	51
4	Cottage Hospital, Oban	80	48
5	Cottage Hospital,Akpet	94	56
6	Comprehensive Health Centre,Okoyong	94	56
	Total	592	355

TABLE 2
Summary of descriptive statistics

Variables	N	Mean	Std. Dev
Healthcare service delivery	355	20.30	2.07
Billing system of Electronic Health Records	355	20.37	2.18

Presentation of results

Hypothesis one: There is no significant relationship between the extent of healthcare service delivery and the billing system of EHR in state-owned hospitals, southern zone of Cross River state.

This hypothesis involves the single variable of healthcare service delivery and the extent of healthcare service delivery in state-owned hospitals within the Southern zone of Cross River State. To test this hypothesis, a population t-test analysis was employed. The results are presented in Table 3.

Table 3 indicates that the p-value (0.78) exceeds the level of significance (0.05), and the calculated t-value of 1.774 ($P > 0.05$) is less than the critical t-value of 1.976 with 345 degrees of freedom. Based on these results, Hypothesis 1 is retained.

TABLE 3

A population t-test analysis of the mean scores of responses on the extent of healthcare service delivery in Southern zone of Cross River State.

	N	Mean	Std. Dev.	Std. Error	Mean di[illegible]	t-cal	Sig.
Healthcare service delivery	355	20.30	2.07	.169	.300	1.774	.078

p> .05 t (354) (not significant at p> .05)

This implies that the extent of healthcare service delivery in Southern zone of Cross River State is not significant or is significantly low.

Hypothesis 2

The electronic health records billing system do not significantly influence healthcare service delivery in the Southern Zone of Cross River State.

For this hypothesis, the dependent variable is healthcare service delivery, while the independent variable is the electronic health records billing system in the Southern Zone of Cross River State. Based on the six items measuring electronic health records billing in hospitals, subjects scoring from 10-17 were classified as low, 18-21 as average, and 21-24 as high.

To test this hypothesis, the mean healthcare service delivery scores across the low, average, and high levels of electronic health records billing were computed and compared using one-way analysis of variance (ANOVA) and descriptive statistics. The results are presented in Tables 4 and 5.

TABLE 4

One way analysis of variance and influence of billing electronic health records and healthcare services

Group	N	Means	Standard Deviation		standard error
Low (10-17)	115	17.67	2.44		.630
Moderate (18-21)	184	20.14	1.75		.196
High (22-24)	56	21. 25	1.70		.230
Total	355	20.30	2.07		.169
Source of variation	SS	Df	MS	F-ratio	P-value
Between groups	148.725	2	74.363	23.763	.000
Within groups	490.772	352	3.339		
Total	639.500	354			

*P<0.05 df=2:352 critical F=3.06

Table 4 indicates that the p-value (.000) is less than the .05 level of significance, and the calculated F-ratio of 23.763 exceeds the critical F-ratio of 3.06 at the .05 level of significance with 2:149 degrees of freedom. Based on these results, the alternative hypothesis is accepted, and the null hypothesis is rejected. This indicates that the electronic health records billing system significantly influences healthcare service delivery in the Southern Zone of Cross River State.

To determine the direction of significance among the three levels of influence, a post hoc multiple comparison test was conducted using Fisher's Least Significant Difference (LSD).

TABLE 5

Fisher's (LSD) multiple comparison test analysis and radiology electronic health records on healthcare service delivery

Group	Low (n=115)	Moderate (n=180)	High (55)
1. Low	17.67a	-2.47	-3.58b
2. Moderate	-4.845*c	20.14a	-1.117b
3. High	-6.795*c	-3.512*c	21.25a

Significant at .05

The results in Table 5 confirm a significant difference between the low and moderate groups (t=4.845), the moderate and high groups (t=3.512), and the low and high groups (t=6.9795). These results suggest a significant difference among all groups, with the greatest difference observed between the low and high groups.

a. Group means are placed on the principal diagonalb. Difference between group means are placed above the diagonal c. Fisher's LSD t-values are placed below the diagonal

Discussion of findings

Extent of Electronic Health Billing System on Healthcare Service Delivery in State-Owned Hospitals in Southern Zone of Cross River State

The hypothesis under examination pertains to the influence of electronic health billing systems on healthcare service delivery in state-owned hospitals within the Southern Zone of Cross River State. The null hypothesis posits that the extent of electronic billing system implementation does not significantly impact healthcare service delivery in this region. The findings of the study support this null hypothesis, indicating that the extent of healthcare service delivery is indeed not significant.

This result suggests that comprehensive healthcare services are not adequately provided to patients seeking care from state-owned hospitals in the Southern Zone of Cross River State. This inadequacy has serious implications for the well-being of residents in this zone, particularly those who cannot afford private healthcare services. The findings imply that morbidity rates in this part of the state could be significantly high.

The low level of healthcare service delivery in the Southern Zone can be attributed to the underutilisation of electronic health records (EHRs). This underutilisation negatively impacts healthcare service delivery in the area. A study by Sharifi et al. (2013) linked poor healthcare services to factors such as inadequate manpower, lack of essential tools, and insufficient financing of healthcare facilities. The study concluded that while the implementation of billing systems in healthcare comes with significant challenges, especially in less-developed regions, it is crucial for the future of healthcare advancements worldwide.

If electronic billing systems are fully implemented, they could offer reliable and valuable information for patient care, protect the legal interests of physicians, patients, and hospitals, and meet the prerequisites for acceptable standards and research, thereby improving healthcare service delivery (Abdulkadir et al., 2010).

Electronic Health Billing System and Healthcare Service Outcomes

The independent variable in this hypothesis is the electronic health billing system, while the dependent variable is healthcare service outcomes. The study revealed that the electronic health billing system significantly influences healthcare service delivery outcomes in state-owned hospitals in the Southern Zone of Cross River State. This finding led to the rejection of the null hypothesis, which suggested otherwise.

The results of hypothesis 2 as presented in table 4 and 5 above indicate that the electronic billing system affects the manner in which payments are processed in state-owned healthcare facilities, organizational expenses are tracked, and patient waiting times in payment queues are managed. Additionally, the electronic billing system impacts the tracking of revenue cycle performance in state-owned health facilities in the Southern Zone of Cross River State.

These findings are supported by Vanita, Narasimha, and Chaitra (2013), who asserted that electronic health billing systems facilitate healthcare service management. The results of the current study align with their findings, showing that electronic health billing systems help track expenses and payments in healthcare facilities, thereby improving healthcare service delivery. Vanitha et al. (2013) argued that the utilization of e-health billing systems enhances healthcare service delivery in health facilities.

Similarly, Rodriguez et al. (2011) demonstrated that electronic medical billing systems enhance privacy and security. This added layer of protection is crucial for maintaining patient trust and ensuring the confidentiality of medical records.

Finally, while the extent of healthcare service delivery in state-owned hospitals in the Southern Zone of Cross River State is currently not significant due to the limited implementation of electronic billing systems, the full adoption of these systems could lead to substantial improvements., such improvements include better tracking of expenses and payments, reduced patient waiting times, and enhanced revenue cycle performance, ultimately leading to more effective and efficient healthcare service delivery.

Conclusion

The research investigates the impact of electronic billing systems on healthcare service delivery in state-owned hospitals within the Southern Zone of Cross River State. The findings indicate that the Electronic Health Records (EHR) billing system does not significantly influence healthcare service delivery in the study area.

According to the study's results, the extent of electronic billing systems on healthcare service delivery in state-owned hospitals in the Southern Zone of Cross River State lacks significance. However, it is evident that the extent of electronic health billing systems does significantly impact healthcare service delivery in these hospitals. In summary, the extent of electronic billing systems profoundly affects the quality of healthcare service outcomes in state-owned hospitals in the Southern Zone of Cross River State.

Recommendations

Based on the study's findings, the following recommendations were proposed to enhance healthcare service delivery in state-owned hospitals in the Southern Zone of Cross River State:

1. Enhance electronic health billing system implementation: By expanding the use of electronic billing systems to streamline payment processes and improve financial transaction efficiency in healthcare facilities.
2. Increase training and education on electronic health records (EHRs): by providing comprehensive training for healthcare professionals to improve EHR utilisation, data management, and patient care outcomes.
3. Improve healthcare infrastructure and resource allocation: By addressing

manpower shortages, lack of essential tools, and inadequate financing by investing in hospital facilities, recruiting skilled staff, and ensuring medical equipment availability.

4. Promote research and development in healthcare technology: Through the encouragement of collaborations to develop innovative healthcare technologies that address local challenges and improve service delivery.
5. Strengthen regulatory framework and data privacy protections: By establishing robust regulations and standards for data security and patient privacy in EHR systems to enhance trust and compliance.

REFERENCES

Abdulkadir, A, Y., Yunusa, G. H., Tabari, A. M., Anas, I., Ojo, J. A., Akinlade, B., Suleman, B. M., & Uyobongl, I., (2011). Medical record system in Nigeria: observations from multicentre auditing of radiographic requests and patients' information documentation practices. *Journal of Medicine and Medical Science, 2(5): 854-858*

Adegbore, A. M., & Omowumi, A. T. (2021). Factors influencing electronic medical record systems success in selected tertiary healthcare facilities in south-west, Nigeria. *Information Impact: Journal of Information and Knowledge Management*, *12*(1), 14-32.

Ahmadi M, Ghazisaeidi & M, Bashiri, A. (2015). Radiology reporting system data exchange with the electronic health record system: A case study in Iran. Glob J Health Sci. 18-7(5):208-14. doi: 0.5539/gjhs.v7n5p208.

Ajala,F., Awokola, J. A., Ozichi, E., (2015). Development of an electronic medical record (EMR) system for a typical Nigerian hospital. *Journal of Multidisciplinary Engineering Science and Technology. 2 (6).673-678*

Alharbi, S. &Steve, D., (2014). Using the technology acceptance model in understanding academics behavioural intention to use learning management systems. *International Journal of Advanced Computer Science and Applications (IJACSA).;5(1).542-547*

Anderson, H. J. (2015). Tackling the challenge of systems integration. *Health Data Management, 13*(4),8. Retrieved from http://www.healthdatamanagement. com/issues/

Ashish K. J. DesRoches, C. M. Campbell, E.G., Donelan, K., Rao, S. R., Ferris, T. G., Shields, A. Sara Rosenbaum, J.D & Blumenthal, D., (2009). Use of electronic health records in U.S. hospitals. N Engl.. *J. Med.* 360:1628-1638DOI: 10.1056/NEJMsa0900592.

Bailey-McHale, R., Ebrahimi, V., & Bailey-McHale, J., (2020). Environmental Determinants of Health. *Good Health and Well-Being*, 171-179.

Blumenthal, D &Tavenner, M., (2010). The meaningful use regulation for electronic health records. N.Engl. J. Med. 363:501-4

Brown, P.J., (2009). Evaluation of the quality of information retrieval of clinics finding from a computerized patient database using a semantic technological. *Journal of Decision Systems*, *30*(4), 378-409.

Cline, B. G & Luiz, J.M. (2013). Information technology systems in public sector health facilities in developing countries: the case of South Africa. *BMC*

Medical Informatics and Decision Making, 2(4). 271-476. https://doi.org/10.1186/1472-6947-13-13

Davis, F. D., (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quart. 13 319-339.*

Efe, S. I., (2013). Health care problem and management in Nigeria. *Journal Geography and Regional Planning, 7(6), 244–254.*

Ip, C. L., Loose, M., Tyson, J. R., de Cesare, M., Brown, B. L., Jain, M., ... & Reference Consortium. (2015). MinION Analysis and Reference Consortium: Phase 1 data release and analysis. *F1000Research*, *4*.

Keenan, G., Yakel, E., Dunn Lopez, K., Tschannen, D., & Ford, Y. B. (2013). Challenges to nurses' efforts of retrieving, documenting, and communicating patient care information. *Journal of the American Medical Informatics Association*, *20*(2), 245-251.

Keenan, C. R., Nguyen, H. H., & Srinivasan, M., (2014). Electronic medical records and their impact on residents and medical student education. *Academic Psychiatry.30*(6), 522-527.doi:10.1176/appi.ap.30.6.522.

Madu, R. (2020). Using Technology to Reduce Barriers in Community Health: An Intersection Between Broadband Access, Ehr & Telehealth Adoption in Federally Qualified Health Centers.

Obotu, A. S., Uganneya, S. & Ogezi, I. C., (2018). Evaluative study of digital record management system in the hospitals in Minna metropolis. (A case study of general hospital Minna, Niger State. Nigeria). *Library Philosophy and Practice* (e-journal). 1699. https://digitalcommons.unl.edu/libphilprac/1699.

Ouma, S., & Herselman, M. E., (2008). E-health in rural areas: Case of developing countries. *International Journal of Biological and Life Sciences, 4*(4), 194-200. Retrieved from http://www.unapcict.org/ecohub/resources/e-health-in-rural-areas-case-of developingcountries-1

Papoutsi, C., Reed, J. E., Marston, C., Lewis, R., Majeed, A., & Bell, D. (2015). Patient and public views about the security and privacy of Electronic Health Records (EHRs) in the UK: results from a mixed methods study. *BMC medical Informatics and Decision making*, *15*, 1-15.

Plsek, P. E., (1999). Innovative thinking for the improvement of medical systems. *Annals of Internal Medicine.*131(6), 438–444.

Rogers, J. L., Haring, O.M., (1979). The impact of a computerized medical record summary system on incidence and length of hospitalization. MedCare. 17(6):618-30.

Sharifi, M., Ayat, M., Jahanbakhsh, Tavakoli, N., Mokhtari, H. & Ismail, W., (2013). E-Health implementation challenges in Iranian medical centers: A qualitative study in Iran. *Telemedcine and e-health, 19*(2), pp. 23 – 55

Sisniega, L. C., (2009). Barriers to electronic government use as perceived by citizens at the municipal level in Mexico. (Doctoral dissertation). Retrieved from ProQuestDissertations & Theses database. (AAT 3364168)

Spyrou, D. (1993). Information systems for primary health care: The case of the Aegean Islands. *European Journal of Information System.* 2:117–27.

Vanita, T. N., Narasimha, M. S. &Chaitra, B., (2013). E-healthcare billing and record

management information system using android with cloud.*IOSR. Journal of Computer Engineering 11*(4), pp. 13-19.

Yusof, M. M., Kuljis, J., Papazafeiropoulou, A., & Stergioulas, L. K., (2008). An evaluation framework for health information systems.*International Journal of Medical information. 77:386–98. [*PubMed*].*