

CLINICAL INFORMATION SYSTEM AND SERVICE DELIVERY OF HOSPITALS IN SOUTH-SOUTH, NIGERIA

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ABSTRACT

The study examined the relationship between clinical information system and service delivery of hospitals in South-South, Nigeria. The objective of the study was to examine how clinical information system influence measures of service delivery of hospitals in South-South, Nigeria. The cross-sectional explanatory survey research design was adopted for the study. The population of this study consisted of nine (9) Teaching Hospitals in the South-South, Nigeria of Nigeria. By the adoption of census, the entire population of nine (9) Teaching Hospitals in the South-South, Nigeria was studied. Thus, ten (10) respondents were selected from each of the Teaching Hospitals giving us a total of ninety (90) respondents. Structure questionnaire was use as instrument for data collection after face-validation. Cronbach alpha was used to test the internal consistency of the instrument. Out of ninety (90) copies of the questionnaire administered, a total of 79 were retrieved. Arithmetic mean was used for the univariate analysis while the test of hypotheses was done using Correlational Statistical tools of Spearman Rank Order Correlation and Partial Correlation. The findings revealed that clinical information system have significant positive influence on service delivery of hospitals in South-South, Nigeria. The study concluded that the implementation of clinical information system, patient information system, and mobile medical information system in a hospital enhances service delivery in terms of patient turnaround time, patient treatment consistency, and patient record status. It was also recommended that there should be regular training and retraining of medical practitioners to equip them with the prerequisite digital capabilities needed to use health information systems for better service delivery.

Keywords: Clinical Information System, Service Delivery, Patience Records, Patience Treatment

INTRODUCTION

Clinical Information System refers to a set of computer software and networks that manage clinical information such as test results, prescriptions, and other critical health information to enhance clinical decisions and facilitate the healthcare delivery process. Examples of such platforms include laboratory information system, nursing information system, radiology information system and intensive unit information system. The adoption of these clinical information systems provides real time information update about patients' laboratory test results, radiology test results, prescriptions and other medical details which help any doctor or nurse attending to patients to make informed decisions and take medical procedures based on available information (David et al., 2017; Saka in Demokaan, 2018). Clinical Information System eliminates the issues of carrying test results on papers from desk to desk and possibly misplacing such files. The physician simply accesses the clinical data/information of the patient on their device by simply searching the patient's name on the clinical information platform. However, it appears that Clinical Information System is available only in few hospitals in South-South, Nigeria. Thus, patient clinical information is still documented on paper and as such, faces the risk of misplacement or damage.

Another issue of concern in the hospital system of Nigeria in general and South-South, Nigeria in particular is low medical manpower. Medical manpower refers to the number and quality of healthcare personnel with the required experience available to provide medical services in a hospital. The Nigerian healthcare system appears to be suffering from shortage of medical manpower. As noted by Akindaro (2020), the Nigerian hospital system has [3.8 doctors per 10,000 people](#) or 0.38 doctors per 1,000 people; and this means approximately four (4) doctors per 10,000 persons. According to the recommendations of the [Global Goals](#), a series of targets set by the United Nations in 2015, countries should aim for a minimum of 1 doctor per 1,000 people. This would mean that Nigeria would need at least 200,000 doctors to sufficiently cater for its 200 million people. To make matters worse, digital literacy appears to be very low among the few health professionals manning the hospital system in Nigeria and South-South, Nigeria in particular (Asangansi et al., 2008; Kirubel et al., 2020). It is perhaps not surprising that adoption of health information systems in some of the hospitals is still low since those that are supposed to use it do not appear to be prepared for it. Yet, in the face of the covid-19, there has been a serious clamour for adoption of health information systems in the delivery of medical services in hospitals across the country. This study therefore, seeks to examine how clinical information systems influences the service delivery of hospitals in South-South, Nigeria.

Research Hypotheses

The following hypotheses were formulated to be tested in the course of this study

- Ho₁ There is no significant correlation between clinical information system and patient turnaround time of hospitals in South-South, Nigeria.
- Ho₂ There is no significant correlation between clinical information system and patient treatment consistency of hospitals in South-South, Nigeria.
- Ho₃ There is no significant correlation between clinical information system and patient record status of hospitals in South-South, Nigeria.

Clinical Information System and Service Delivery

Sickness is inevitable in human life, as such medical treatment must be given in order to restore health condition of an ailing individual. This medical treatment could be administered in a place called hospital or clinic. In a clinical or hospital settings, these ill individuals are regarded as patient. Due to the influx of patient with different kinds of illness, clinicians found it difficult in keeping accurate records, this is because of their busy nature while in the office, and this triggered them to adopt a computer base kind of information keeping called clinical information system. Therefore, Clinical Information System refers to a computer-based system that is designed for collecting, storing, manipulating and making available clinical information important to the healthcare delivery process. Clinical Information System helps healthcare such as hospitals in South-South, Nigeria improve the delivery of clinical services. Hospital information systems present clinical information and reports that enable clinicians to make more informed decisions at the point of care (Lenhard et al., 2010).

These reports presented and utilized by clinicians enable them to keep records of patient status, save patient time and enhances patient treatment consistency. Hospitals in South-South, Nigeria whose patient turnaround time is minimized, strict to consistency treatment of patient and keeping proper record of patient status, are said to have provided a quality service delivery. This is in relation with the assertion of Petrides et al. (2017) revealed that clinical information systems clearly offer excellent opportunities for improving healthcare quality. Although, Ngafeeson (2015) opined that implementing Clinical Information System in hospitals poses a series of challenges. The adoption of information technology in healthcare has been particularly slow and lagging behind as compared to other domains. This is due to the complexity in issues like interoperability, technological rationality, acceptability, managerial rationality, data security, data quality, and standards. Thus, it provides a wide range of data repositories, medical reports, clinical decision

support systems etc. that are generally not accessible in an integrated fashion. Further, current Clinical Information System implementations tend to have a lack of functionality to provide easy access and to create reminders. In general, one can observe poor or even absent support for the exchange of patient-related information within the healthcare system, preventing immediate access to up-to-date and complete patient information.

Similarly, Doebbeling et al. (2020) supported that Clinical information systems (CISs) have generated opportunities for meaningful improvements both in patient care and workflow but there is still a long way to perfection. Healthcare providers are still facing challenges of data exchange, management, and integration due to lack of functionality among these systems. Clinical information systems provide tremendous opportunities to reduce clinical errors such as medication errors and diagnostic errors and to support healthcare professionals by offering up-to-date patient information. Clinical information systems (CISs) are crucial to delivering the best in evidence-based and patient-centered care which can be tagged as quality service delivery of hospital in terms of patient turnaround time, patient treatment consistency and patient records status. Whereas, Wright et al. (2018) postulated that a good Clinical Information System contributes positively to patient's safety, workflow efficiency, and to point-of-care decision support. The development of clinical information has posed some new challenges and, at the same time, has also generated new opportunities. However, the healthcare delivery system is changing in many ways this is because technological advances are providing opportunities to optimize patient care. Therefore, Clinical Information System have the potential to address many problems encountered in healthcare, namely, managing large amounts of patient and research data, reduce healthcare costs/ errors, increase legibility, and boost the quality of healthcare

The manifestation of Clinical Information System in terms of laboratory information system enhances service delivery of hospitals especially in South-South, Nigeria in the sense that laboratory information system foster accuracy and accessibility to the flow of samples and data in clinical laboratories. Physicians may easily track each step in the testing process, from the administration of tests to the receipt of test results which supports timely decision-making and diagnosis. This is in line with the postulation of Lima-Oliveira et al. (2015) that laboratory information system enters patient's information and test orders and the system generates electronic invoice for health insurance organization, without any further need for additional actions of admission personnel. Complete electronic register of patients is printed at the end of the day, so that personnel are not required to manually write paper register in order to be in accordance with legislative. Sequentially, Becich (2019) supported the above assertion that laboratory information systems (LIS) have been shown to help reduce laboratory errors, little information is available on the implementation of these in low-resource settings which drives towards rendering quality service delivery of hospitals in terms of patient turnaround time (records access time, doctors access time, doctor-patient time & auxiliary service duration), patient treatment consistency (history consistency, treatment consistency & appointment consistency) and patient record status (record security, record availability & health state).

Nevertheless, nursing information system equally indicates the existence of Clinical Information System and it also manifest to improve service delivery of hospitals. This is drawn from the fact that nursing information system the system is made available in a timely and orderly fashion to aid nurses in providing and improving patient care. In day-to-day nursing practice, nursing information system can be applied to model the processing of data, information, and knowledge within a computer system. As averred by Mamta (2014), a good nursing information system can perform a number of functions and deliver benefits such as improving staff schedules, accurate patient charting and improve clinical data integration. The nursing department can have a better managed work force through schedule applications enabling managers to handle absences and overtime which will affect quality service delivery of hospitals especially in South-South, Nigeria.

More so, service delivery of hospitals in South-South, Nigeria can equally be improved by radiology information system this is because of its usefulness in tracking *radiology* imaging orders and billing *information*, and is often used in conjunction with Picture Archiving and Communication System (PACS) and Vendor Neutral Archives (VNAs) to manage image archives, record-keeping and billing. So to say, service delivery of hospitals is enhanced by radiology information system considering the assertion of Braga (2015) that the primary advantage of these systems lies in their ability to keep huge amounts of data readily accessible to ensure rapid workflow management and facilitate rapid communication. However, these systems only ensure high security, reliability, and privacy because they are only accessible by authorized physicians and technicians. This for sure will increase service delivery of hospitals in South-South, Nigeria in terms of patient turnaround time (records access time, doctors access time, doctor-patient time & auxiliary service duration), patient treatment consistency (history consistency, treatment consistency & appointment consistency) and patient record status (record security, record availability & health state).

Quality service delivery of hospitals could be also be enhanced through Clinical Information System in terms of intensive care unit (ICU) information system. So to say, they provides care to critically ill patients that provides intensive/specialized medical and nursing care, an enhanced capacity for monitoring, and multiple modalities of physiologic organ support to sustain life during a period of acute organ system insufficiency. It provides special expertise and the facilities for the support of vital functions and uses the skills of medical, nursing, and other personnel experienced in the management of these problems. However, they support the continuous assessment and adjustment of medication, the automatic capture of physiologic parameters from patient monitors, the display of patients' vital conditions, and the categorization of patients based on SOFA and APACHE score for proper decision-making. Moreover, Haupt, (2013) maintained that Intensive care unit information systems (ICUISs) reduce physicians time spending on documentation and increase the time available for direct patient care by providing protocol templates and flow sheets. Thereby making them time efficient which will enable them have time to do other things in the hospital, this could maximize the performance of the hospital in terms of rendering quality services in terms of patient turnaround time, patient treatment consistency and patient record status (PRS).

Diffusion of Innovation Theory

The last theory as adopted by this study is the Diffusion of Innovation Theory. Diffusion of Innovation Theory was postulated by Roger in 1962. It posits that individuals and social systems will adopt new technologies and innovative ideas at different points and that the point an innovation is accepted into a system determines subsequent outcomes of the system. The diffusion of innovation theory assumes that

- i) In a social system, there will always be a disparity in the level and time at which individuals within a given social system adopt new ideas, techniques, and technology.
- ii) Individuals and arms of institutions that adopt innovations early will naturally outperform late adopters and the laggards (Odu, 2017).

The implication of this theory is that as hospital's interaction would be effective and efficient when there is reasonable adoption of health information system (clinical information system, Patient Information System & mobile medical information system) in the clinical or hospital system, sickbay's interaction would be enhanced through patient turnaround time, patient treatment consistency and patient records status among parties involved in the interactive process.

In hospitals, among others, both management and non-management clinicians are advised to adopt health information in their respective designations. The fact is that parties (message sender and receiver) who fail to interact effectively and efficiently through the adoption of innovative

equipment are bound to face difficulties carrying out their tasks and responsibilities, permeating slow operations, high level inconsistency in patient treatment, and keeping inappropriate record, while those who embrace and adapt health information system in terms of Clinical Information System (laboratory information system, nursing information system, radiology information system & intensive care unit information system), Patient Information System (patient registration App, client-resource management App and health billing system) and mobile medical information system (patient mobile portal, medical examination application and store and forward telemedicine) stand a better chance to enjoy speed, efficiency and high level effectiveness in service delivery in terms of patient turnaround time (record access time, doctors access time, doctor-patient time and auxiliary service duration), patient treatment consistency (history consistency, treatment consistency and appointment consistency) and patient records status (record security, record availability and health state). However, these theoretical assumptions have not been adequately tested and verified among hospitals in South-South, Nigeria Nigeria, even at a time where application of health information system is metaphorically on the increase. There is need therefore, to empirically investigate how health information system influences the service delivery of hospitals in South-South, Nigeria.

METHODOLOGY

The cross-sectional explanatory survey research design was adopted for the study. The population of the study consisted of nine (9) Teaching Hospitals in the South-South, Nigeria of Nigeria.

Table 1 Study Population

S/N	Teaching Hospitals in South-South
1.	University of Port Harcourt Teaching Hospital, Rivers State.
2.	Rivers State University Teaching Hospital, Rivers State
3.	Pamo Medical University Teaching Hospital, Rivers State
4.	University of Uyo Teaching Hospital, Akwa Ibom
5.	University of Calabar Teaching Hospital, Cross Rivers State
6.	University of Benin Teaching Hospital, Benin City, Edo State
7.	Delta State University Teaching Hospital, Oghara, Delta State
8.	Igbinedion University Teaching Hospital, Okada, Delta State
9.	Niger Delta University Teaching Hospital, Okolobiri, Bayelsa State

Source Federal Ministry of Health.

The study covered the entire nine (9) Teaching Hospitals operating in South-South, Nigeria. Thus, the study was a census research using the entire study population. Considering the framework of the study, both primary and secondary sources of data were employed in order to generate valid information. For the primary source, structured questionnaire was used. Mean and standard deviation were used for the univariate analysis while the bivariate analysis was done using Spearman rank order correlation with the aid of SPSS Version 25.0. The spearman rank order (Rho) was considered to be the most appropriate for the study as it measures the degree of relationship between the two set of ranked observations.

Results

Clinical Information System and Service Delivery

- Ho₁ There is no significant correlation between Clinical Information System and patient turnaround time of hospitals in South-South, Nigeria.
- Ho₂ There is no significant correlation between Clinical Information System and patient treatment consistency of hospitals in South-South, Nigeria.
- Ho₃ There is no significant correlation between Clinical Information System and patient record status of hospitals in South-South, Nigeria.

Table 1 Correlations between Clinical Information System and Service Delivery

			Clinical Information System	Patient Turnaround Time	Patient Treatment Consistency	Patient Record Status
Spearman's rho	Clinical Information System	Correlation Coefficient	1.000	0.776**	0.675**	0.862**
		Sig. (2-tailed)		.000	.000	.000
		N	79	79	79	79
	Patient Turnaround Time	Correlation Coefficient	0.776**	1.000	0.755**	0.767**
		Sig. (2-tailed)	.000		.000	.000
		N	79	79	79	79
	Patient Treatment Consistency	Correlation Coefficient	0.675**	0.755**	1.000	0.632**
		Sig. (2-tailed)	.000	.000		.000
		N	79	79	79	79
	Patient Record Status	Correlation Coefficient	0.862**	0.767**	0.632**	1.000
		Sig. (2-tailed)	.000	.000	.000	
		N	79	79	79	79

** . Correlation is Significant at the 0.01 level (2-tailed).

Source SPSS Output

Column two of table 1 above shows r value of 0.776 at a significance level of 0.00 which is less than the chosen alpha level of 0.05 for the hypothesis relating Clinical Information System and patient turnaround time. Since the significance value is less than the alpha level of 0.05, the null hypothesis (H_{01}) which states that there is no significant correlation between Clinical Information System and patient turnaround time of hospitals in South-South, Nigeria is rejected and the alternate hypothesis (H_{a1}) is accepted. This implies that there is a strong positive correlation between Clinical Information System and patient turnaround time of hospitals in South-South, Nigeria.

Column three of table 1 above shows r value of 0.675 at a significance level of 0.00 which is less than the chosen alpha level of 0.05 for the hypothesis relating Clinical Information System and patient treatment consistency. Since the significance value is less than the alpha level of 0.05, the null hypothesis (H_{02}) which states that there is no significant correlation between Clinical Information System and patient treatment consistency of hospitals in South-South, Nigeria is rejected and the alternate hypothesis (H_{a2}) is accepted. This implies that there is a strong positive correlation between Clinical Information System and patient treatment consistency of hospitals in South-South, Nigeria.

Column four of table 1 above shows r value of 0.862 at a significance level of 0.00 which is less than the chosen alpha level of 0.05 for the hypothesis relating Clinical Information System and patient record status. Since the significance value is less than the alpha level of 0.05, the null hypothesis (H_{03}) which states that there is no significant correlation between Clinical Information System and patient record status of hospitals in South-South, Nigeria is rejected and the alternate hypothesis (H_{a3}) is accepted. This implies that there is a very strong positive correlation between Clinical Information System and patient record status of hospitals in South-South, Nigeria. These results show that Clinical Information System brings about improved service delivery.

Discussion of Findings

Clinical Information System and Service Delivery

The tests of hypotheses one to two revealed that there is a strong positive correlation between Clinical Information System and service delivery of hospitals in South-South, Nigeria, and the test of hypothesis three showed that there is a very strong positive correlation between Clinical Information System and patient record status of hospitals in South-South, Nigeria. This implies that the utilizing of Clinical Information System births improved service delivery, especially in terms of patient record status. These findings are in agreement with the position of Lenhard et al. (2010)

that hospital information systems present clinical information and reports that enable clinicians to make more informed decisions at the point of care. Being that Clinical Information System is a computer-based system that is designed for collecting, storing, manipulating and making available clinical information important to the healthcare delivery process, it helps the hospital continually have up-to-date information about all the happenings around the hospital. This goes further to enhance the hospital's ability to make informed decisions that will impart on all and sundry around the hospital environment. A patient without an updated record status may suffer haphazard treatment process. This is as a result of the fact that the caregiver does not have a comprehensive/updated treatment record status of the said patient.

Petrides et al. (2017) revealed that clinical information systems clearly offer excellent opportunities for improving healthcare quality. This implies that hospitals in South-South, Nigeria whose patient turnaround time is minimized, strict to consistency treatment of patient and keeping proper record of patient status by reason of their use of clinical information systems, are said to have provided a quality service delivery. Clinical information systems (CISs) are crucial to delivering the best in evidence-based and patient-centered care which can be tagged as quality service delivery of hospital in terms of patient turnaround time, patient treatment consistency and patient records status. Whereas Wright et al. (2018) postulated that good Clinical Information System contributes positively to patient's safety, workflow efficiency, and to point-of-care decision support. The development of clinical information has posed some new challenges and, at the same time, has also generated new opportunities. However, the healthcare delivery system is changing in many ways. This is because technological advances are providing opportunities to optimize patient care. Therefore, Clinical Information System has the potential to address many problems encountered in healthcare, namely, managing large amounts of patient and research data, reduce healthcare costs/ errors, and boost the quality of healthcare.

Laboratory information system, being a subset of Clinical Information System, enhances service delivery of hospitals especially in South-South, Nigeria in the sense that laboratory information system foster accuracy and accessibility to the flow of samples and data in clinical laboratories. In the last few decades, medical laboratories have experienced dramatic transformation and development of information technology. Electronic request enabled the quality of communication between laboratory and clinicians. Moreover, laboratory information system performs automated printing of receipts and bills for analyses which patients pay at admission desk. Printing of patient's informed consent for venipuncture is also automated (Lima-Oliveira et al., 2015). By entering patient's information and test orders in laboratory information system, system generates electronic invoice for health insurance organization, without any further need for additional actions of admission personnel. Complete electronic register of patients is printed at the end of the day, so that personnel are not required to manually write paper register in order to be in accordance with legislative. This obviously enhances patient record status in the hospital, thereby improving the service delivery of the hospital.

Physicians may easily track each step in the testing process, from the administration of tests to the receipt of test results which supports timely decision-making and diagnosis. Supportively, Lima-Oliveira et al. (2015) averred that laboratory information system enters patient's information and test orders and the system generates electronic invoice for health insurance organization, without any further need for additional actions of admission personnel. Complete electronic register of patients is printed at the end of the day, so that personnel are not required to manually write paper register in order to be in accordance with legislative. Sequentially, Becich (2019) supported the above assertion that laboratory information systems (LIS) have been shown to help reduce laboratory errors. Little information is available on the implementation of these in low-resource settings which drives towards rendering quality service delivery of hospitals in terms of patient turnaround time (records access time, doctors access time, doctor-patient time & auxiliary service duration), patient treatment consistency (history consistency, treatment consistency &

appointment consistency) and patient record status (record security, record availability & health state).

When nursing information system is made available in a timely and orderly fashion to aid nurses in providing and improving patient care, it enhances the service delivery of the hospital. In day-to-day nursing practice, nursing information system can be applied to model the processing of data, information, and knowledge within a computer system. As averred by Mamta (2014), a good nursing information system can perform a number of functions and deliver benefits such as improving staff schedules, accurate patient charting and improve clinical data integration. The nursing department can have a better managed work force through schedule applications enabling managers to handle absences and overtime which will affect quality service delivery of hospitals.

Furthermore, the adoption of nursing information system in a hospital saves time through reducing clerical activities, telephone calls between departments, handwritten information transfer (Haupt, 2013). It also ensures greater accuracy and speed of information transfer. There is continuity of care through the current and status documentation available on the system for the nurse, elimination of duplicate effort and more effective use of personnel, which provides financial savings for the patient and time savings for the nurse in a hospital. Additionally, there is said to be more complete patient records and data for patient care, quality assurance, and research. All of these impart positively on patient turnaround time, patient treatment consistency and patient record status of hospitals.

CONCLUSIONS

The study has shown that the timely adoption of health information system such as clinical information system brings about the service delivery of hospitals, especially in terms of patient turnaround time, patient treatment consistency, and patient record status. Based on this, it suffices to conclude that the implementation of clinical information system in a hospital enhances service delivery in terms of patient turnaround time, patient treatment consistency, and patient record status, amongst other things. It therefore implies that hospitals that do not see this opportunity and make judicious use of it might be eluded of the benefits that accrue it.

RECOMMENDATIONS

Base on the findings of the study, the following suggestions are advanced

1. Management should hire competent hands that will effectively man their Clinical Information System such that will give accurate and timely clinical information, thereby improving their service delivery, especially in terms of patient turnaround time, patient treatment consistency and patient record status.
2. Management should employ adequate number of staff to handle the influx of patients for clinical purposes, as this will enhance patient turnaround time, among others.
3. Managements should set up training sessions for training their health practitioners on the effective use of Health Information System in order to enhance service delivery and economic growth in them.

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