(Research Article)

Extent of use of digital technologies for records and information management in selected hospitals in Southwestern Nigeria

Opeyemi Mary Adesunloye [1], Timothy Oyedepo Oyebisi [1], Foluso John Owotade [2] and Oluwatoyin Seun Ayanlade [1] [*]

[1] African Institute for Science Policy and Innovation (AISPI), Obafemi Awolowo University, Ile Ife, Nigeria.
[2] Department of Oral Medicine, Faculty of Dentistry, Obafemi Awolowo University, Ile-Ife, Nigeria.

Abstract

This cross-sectional survey aimed to identify the extent of the use of digital technologies in dental hospitals for records and information management. Questionnaire were administered to dental practitioners across six purposely selected dental Hospitals in Southwestern Nigeria. Amongst the 210 copies of questionnaire administered, 162 were completed, retrieved, and fit for the analysis, which resulted in a response rate of 77.1%. The extent of use of digital technologies for information management in the selected hospitals was measured by the period of purchase; number owned; frequency of use; current state of the technology; and the level of automation at the selected hospitals. Based on the period of purchase, most of the respondents (82.1%) have been using digital technologies for below 5 years. As regards the number of digital technologies owned; analysis showed that most (91.3%) of the hospitals have less than or equal to three digital technologies in use for information management. The frequency of use shows that majority (45.7% and 21.6% respectively) of the respondents never and rarely uses digital technologies for information management. However, a further investigation into the current state of the technologies owned showed that most of the respondents (65.4%) of the respondents have non-functional technologies. Furthermore, a 0% value was recorded on the question about the present level of automation of the selected hospitals. This showed that none of the hospitals have fully automated their information management processes. Finally, 80.2% of the respondents agreed that information management processes in their hospitals are totally paper-based.

Keywords: Digital technologies; Records management; Information management; Dental hospitals

1. Introduction

To ensure good patient care, it is important to provide comprehensive and accurate information along with efficient and acceptable exchange of information and communication between different healthcare professionals and specialties (Vermeir *et al.*, 2015).

According to Garba-Danladi and Yahaya (2018), a health record is the how, what, why, when, and where of a patient's care during hospitalization or hospital visit, which is a vital asset that ensures that a hospital runs effectively and efficiently. In the same vein, dental records are comprehensive and continuous documentation of the patient's oral condition, which contributes to the diagnosis and methodical delivery of treatment to the patients and aiding the proper and adequate management of patients (Dosumu *et al.*, 2012).

It is therefore important that they are precise, all-inclusive, recent and readily available to dental personnel. This will help them offer the best treatment to a patient, and not wrongly diagnose an illness which can lead to fatal complications

---

[*] Corresponding author: OS Ayanlade

(Charangowda, 2010). Therefore, providing timely, accurate, sustainable and veritable health delivery system can be achieved through the introduction of various digital technologies of which Electronic Health Record system is key.

The use of technology, particularly computers, has been on the rise among dental practices worldwide (Schwei *et al.*, 2016), because many areas of dental practice operations already use digital technologies (Zande *et al.*, 2015). As stated by Schwei *et al.* (2016), usage of computers was found among 11% of dental clinics in the United States as early as 1984. Although the usage of technology, particularly computers, has increased in dental practices globally, Information Technology (IT) revolution has been faster outside the healthcare industry in developing countries than within (Marques *et al.*, 2011). Almost 100% and over 85% of dental services in England/Wales and the United States respectively used computers for work in their practices.

The move to digital technologies from paper will drastically transform clinicians' day-to-day workflow activities and positively support staff. Digital technologies like an Electronic Dental Records (EDR) can be of benefit in patient care, help with diagnosis, minimize mistakes, enhance safety and quality, and offer superior results for patients.

These also provide a means for clinicians to share information with other caregivers and patients. Globally, the value of health care is optimized through the use of electronic medical records, solely by improving efficiency, decreasing volume of work, reducing expenses and establishing a stable relationship between healthcare professionals (Manca, 2015). These have aided its improved adoption by health care institutions around the world, as well as Nigeria, a nation that has given electronic medical records priority.

1.1. Statement of the Problem

Dental records contain specific information related to oral health, treatments, procedures, and diagnostic imaging (Devadiga, 2014). Understanding how digital technologies are utilized to manage these specialized records provides valuable insights into the efficiency and effectiveness of information management in dental settings. Although, electronic medical records have been adopted in various parts of the country, but due to the specialized nature of dental records, there is a dearth of information on the use of digital technologies in this specialty (Radwan et al., 2023). It is therefore imperative that the extent of use of digital technologies in Nigerian dental hospitals be determined.

Thus, the primary purpose of this study is to determine the current extent to which digital technologies are being utilized for records and information management within selected dental hospitals in Southwestern Nigeria. This involved determining the period of purchase, Number owned; frequency of use; current state of the technology; and the level of automation/ degree of integration into daily operations at the selected hospitals. The ultimate goal therefore is to foster innovation, efficiency, and quality improvement in records and information management practices within the dental healthcare context.

2. Methodology

This study was conducted in Southwestern Nigeria officially referred to as the Federal Republic of Nigeria, which is located on the western coast of Africa. The country features 36 states and its Federal Capital Territory, which is known as Abuja. The southwest zone is one of its six geopolitical zones with six states, namely: Lagos, Ogun, Oyo, Osun, Ekiti and Ondo States. This zone is home to the largest number of hospitals with dental clinics. Last projected in 2022 by the Nigerian National Bureau of Statistics, the total population of Nigerians was around 217 million (*Reports | National Bureau of Statistics*, n.d.). A large part of its population lives and works in the south and southwest zone. For the purpose of this study, six hospitals were selected purposively from all the six states of the selected zone, so that each state was represented in the study.

Nigeria has three levels of health institutions: the primary, secondary and tertiary. The three-tier health system in Nigeria (Local Government Areas (LGAs), State and Federal) enjoys significant autonomy and exercises substantial authority in the allocation and utilization of its resources. This study focused on the tertiary health institutions, which consist of the teaching hospitals, the specialist hospitals and the federal medical centres. However, due to the fact that most specialist hospitals in Nigeria are privately owned, they were therefore exempted from this research. The Nigerian government in a bid to meet the health needs of its citizens established at least one tertiary hospital in each state of the federation (Akande, 2004). The teaching hospitals selected for this study are Obafemi Awolowo University Teaching Hospital Complex in Ile-Ife, Osun State; University College Hospital in Ibadan, Oyo State; and Lagos University Teaching Hospital in Lagos State. On the other hand, Federal Medical Centres (FMCs) are general hospitals owned and usually better funded by the Federal Government. They therefore operate at a higher level than other general hospitals. They are tertiary hospitals that operate in departments like the Teaching Hospitals, but are not associated with medical

colleges. The general mandate provided to all FMCs within the context of the laws creating them is to provide people with reliable, accessible, specialized/tertiary hospital care, which will eventually reduce the burden of illness within the population by delivering prompt and emphatic preventive, curative and rehabilitative care (Welcome, 2011). The selected centres are Federal Medical Centre (FMC) Ido in Ekiti State; FMC Abeokuta in Ogun State; and FMC Owo in Ondo State. Therefore, the six hospitals selected for this study are: Obafemi Awolowo University Teaching Hospital Complex in Ile-Ife, Osun State, University College Hospital in Ibadan, Oyo State and Lagos University Teaching Hospital in Lagos State. The selected centres are Federal Medical Centre (FMC) Ido in Ekiti State, FMC Abeokuta in Ogun State and FMC Owo in Ondo State

The sampling technique that was employed for this study is a multi-stage sampling. Multi-stage sampling refers to sampling plans where the sampling is carried out in stages using smaller and smaller sampling units at each stage (Mirakhmedov *et al.*, 2015). The first stage involves purposive selection of the Southwestern zone out of the six (6) geo-political zones in Nigeria. Stage two was the purposive selection of six (6) federal tertiary hospitals in the zone, these are hospitals with functioning dental clinics. The purposive sampling also known as judgment, selective or subjective sampling, is a non-probability sampling method in which researcher relies on his or her own judgment when choosing members of population to participate in the study (Etikan *et al.*, 2016).

Doctors were involved in the study. Altogether, there were two hundred and ten (210) participants selected for the survey, chosen across all the six states, distributed as 35 Doctors per hospital. However, there was a response rate of 77.1%, meaning that although 210 copies of questionnaire were distributed, only 162 copies were retrieved. The rather small number of respondents for this study was because the focus was on a particular clinic and not the entire hospital.

Primary data were collected for this study using a structured questionnaire, and semi-structured personal interviews. Secondary data were also collected from relevant publications, journals, reports and magazines. A structured survey questionnaire was developed to collect quantitative data on the utilization of digital technologies for records and information management in dental hospitals. It included questions about: period of purchase; number owned; frequency of use; current state of the technology; and the level of automation. Data retrieved were analysed using the SPSS 20 package.

3. Results and Discussions

Based on the period of purchase, most of the respondents (82.1%) have been using digital technologies for less than 5 years, while a few others (17.9%) have been using them for more than 5 years. As regards the number of digital technologies owned; analysis shows that most (91.3%) of the hospitals have less than or equal to three digital technologies in use. Few of the hospitals (6.8%) own about four to six digital technologies while only 1.9% own above six digital technologies for information management.

The frequency of use shows that majority (45.7% and 21.6%) of the respondents never and rarely uses digital technologies for information management respectively. However, a further investigation into the current state of the technologies owned showed that most of the respondents (65.4%) have non-functional technologies, whereas 34.6% have functioning ones. However, a 0% value, as seen in Table , showed that none of the hospitals have fully automated their information management processes. Only 19.8% agreed that their information management process is hybrid (that is partially electronic and partially paper-based). Similarly, 80.2% agree that information management processes in their hospitals are totally paper-based, which supports the findings of several researchers (such as Ayanlade, 2018; Ndukwe and Ezeoha, 2018).

Thus, the findings of this study shed light on the current state of digital technology utilization for information management within dental hospitals, providing valuable insights into ownership, usage patterns, functionality, and automation levels. These results prompt a discussion on several key themes, including the duration and extent of digital technology adoption, the adequacy of owned technologies, and the prevailing reliance on traditional paper-based processes.

3.1. Duration and Extent of Digital Technology Adoption

The results indicate that the majority of respondents have adopted digital technologies for information management within the past five years. This suggests a relatively recent trend towards digitalization within dental hospitals, possibly driven by advancements in technology and increasing awareness of the benefits of digital solutions. However, it is noteworthy that a significant proportion of hospitals are yet fully embrace digital technologies, as evidenced by the limited number of digital tools owned and the prevalence of non-functional technologies. This indicates a potential lag

in technology adoption and underscores the need for targeted interventions to promote greater digital readiness among dental practitioners.

Table 1 Extent of Use of Digital Technologies for Information Management in the Selected Dental Hospitals

Variable		Frequency	Percentage (%)
Period of Purchase	Less than 5 years	133	82.1
	More than 5 years	29	17.9
Number Owned	0 - 3	14.8	91.3
	4 - 6	11	6.8
	≥ 6	3	1.9
Frequency of use	Always	18	11.1
	Often	21	13.0
	Sometimes	14	8.6
	Rarely	35	21.6
	Never	74	45.7
Current state of technology	Functional	56	34.6
	Not Functional	106	65.4
Other digital technology deployed in the hospital	Computers	42	25.9
	Internet services	46	28.4
	Mobile phones	46	28.4
	Practice/Hospital website	26	16.1
Level of automation of information management	Full Automation	0	0.0
	Hybrid (partially electronic & partially paper-based)	32	19.8
	Paper-based	130	80.2

3.2. Functional State of Owned Technologies

Despite the widespread adoption of digital technologies, the analysis reveals a striking disparity between the number of technologies owned and their functionality. While the majority of hospitals possess three or fewer digital tools, a significant proportion of these tools are non-functional. This discrepancy suggests that mere ownership of digital technologies does not guarantee effective utilization or meaningful impact on information management practices. It raises questions about the selection, implementation, and maintenance of digital tools within dental hospitals, highlighting potential gaps in technology procurement processes and organizational readiness for digital transformation.

3.3. Reliance on Traditional Paper-Based Processes

Perhaps the most concerning finding is the prevalent reliance on traditional paper-based processes for information management among dental hospitals. The results indicate that the vast majority of hospitals have not fully automated their information management processes, with only a small minority adopting a hybrid approach, combining electronic and paper-based methods. This reliance on paper-based processes is further underscored by the overwhelming majority of hospitals indicating a complete dependence on paper-based information management. Such reliance not only hampers efficiency and productivity, but also poses risks related to data security, accessibility, and accuracy. Moreover, it contradicts the prevailing trend towards digitalization observed in other sectors of healthcare, raising questions about the factors contributing to this apathy and the barriers to digital technology adoption within dental settings. In conclusion, while the findings of this study paint a sobering picture of the current state of digital technology utilization for information management within dental hospitals, they also point towards opportunities for improvement

and innovation. By addressing the identified challenges and barriers, dental practitioners can unlock the full potential of digital technologies to enhance records and information management practices, improve patient care outcomes, and drive efficiency and productivity in dental healthcare delivery.

4. Conclusion

This study determined the extent of use of digital technologies available for dental information management in selected dental hospitals in southwestern Nigeria, which comprises six states. The study area involves six tertiary hospitals with dental clinics: three (3) teaching hospitals and three (3) federal medical centres in the selected zone. Data were collected through a pre-tested and validated questionnaire that were administered to dental practitioners of the selected tertiary hospitals. The collected data were analysed using appropriate descriptive statistics.

The study revealed that the use of listed digital technologies for records and information management in the selected dental hospitals is less than five years. Likewise, it was found that most of the hospitals do not have a sufficient number of digital technologies for records and information management purposes. These findings highlight a notable gap between the ownership and effective utilization of digital technologies for records and information management in dental hospitals.

Despite the presence of digital tools, a considerable number of hospitals face challenges relating to technology functionality and usage frequency. Addressing these issues is essential for optimizing the benefits of digital technologies in enhancing information management practices within dental healthcare settings. The research findings also reveal a significant lack of full automation in the information management processes of dental hospitals, with none of the surveyed hospitals achieving complete automation. Instead, the majority of respondents acknowledge that their information management processes are entirely paper-based, aligning with the findings of previous studies. Only a small minority indicate a hybrid approach, where records and information management processes are partially electronic and partially paper-based.

Recommendations

Based on the research findings regarding the utilization of digital technologies for records and information management in dental hospitals, these following recommendations can be proposed to address the identified gaps and enhance information management practices:

- Dental hospitals should prioritize investments in digital infrastructure to support the implementation and integration of digital technologies. This includes the needed hardware, software, and networking systems to facilitate seamless data capture, storage, and retrieval processes.
- Encourage the adoption of hybrid information management solutions that combine electronic and paper-based processes. This approach allows hospitals to leverage the benefits of digital technologies, while accommodating existing workflows and transitioning gradually towards full automation.
- Collaboration with technology vendors to improve the functionality and usability of digital tools specifically tailored for dental hospitals should be encouraged. This may involve customizing software solutions to address the unique needs and requirements of dental information management.
- Advocate for policy support and regulatory frameworks that incentivize the adoption of digital technologies in healthcare settings. Engage with policymakers, government agencies, and industry stakeholders to promote policies that facilitate interoperability, data exchange, and technology standardization in dental information management.

By implementing the above recommendations, dental hospitals can overcome existing challenges and leverage the full potential of digital technologies to enhance records and information management practices, thus ultimately improving the quality of patient care and operational efficiency in the dental healthcare sector.

Compliance with ethical standards

Acknowledgments

Disclosure of conflict of interest

The authors disclosed no conflict of interest.

References

[1] Akande, O. (2004). Dentistry and medical dominance: Nigeria perspective. African Journal of Biomedical Research, 7(1).

[2] Ayanlade, O. S. (2018). Electronic Medical Record System as a central ICT tool for quality healthcare services: Nigeria as a case study. African Journal of Science, Technology, Innovation and Development, 10(2), 147-157.

[3] Charangowda, B. K. (2010). Dental records: An overview - NCBI. Journal of Forensic Dental Sciences 2(1), 5-10.

[4] Garba-Danladi, K., & Yahaya, I. (2018). Significance and Challeges of Medical Records: A Systematic Literature Review. Advances in Librarianship, 9, 26–31.

[5] Devadiga, A. (2014). What's the deal with dental records for practicing dentists? Importance in general and forensic dentistry. Journal of Forensic Dental Sciences, 6, 9–15. https://doi.org/10.4103/0975-1475.127764

[6] Dosumu, E. B., Dosumu, O. O., & Lawal, F. B. (2012). Quality of Records Keeping By Undergraduate Dental Students in Ibadan, Nigeria. Annals of Ibadan Postgraduate Medicine, 10(1), 13–17.

[7] Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. American journal of theoretical and applied statistics, 5(1), 1-4.

[8] Langabeer, J. R., Lalani, K. H., Yusuf, R. A., Helton, J. R., & Champagne-Langabeer, T. (2018). Strategies of High-Performing Teaching Hospitals. Hospital topics, 96(2), 54-60.

[9] Manca, D. P. J. C. F. P. (2015). Do electronic medical records improve quality of care?: Yes. 61(10), 846-847.

[10] Marques, A., Oliveira, T., Dias, S. S., & Martins, M. F. O. (2011). Medical records system adoption in European hospitals. Electronic Journal of Information Systems Evaluation, 14(1), 89.

[11] Mirakhmedov, S. M., Jammalamadaka, S. R., & Ekström, M. (2015). Edgeworth expansions for two-stage sampling with applications to stratified and cluster sampling. Canadian Journal of Statistics, (4)(43), 578-599.

[12] Ndukwe, C. M., & Ezeoha, B. U. (2018). A Hybrid of Electronic Health Record (EHR) System and Health Maintenance Organizations (HMOs): A Sure Way to Improve Healthcare System in Nigeria. INTERNATIONAL JOURNAL OF COMPUTER SCIENCE AND MATHEMATICAL THEORY, 4(3), 14-22.

[13] Radwan, H. A., Alsharif, A. T., Alsharif, M. T., Aloufi, M. R., & Alshammari, B. S. (2023). Digital technologies in dentistry in Saudi Arabia: Perceptions, practices and challenges. Digital Health, 9, 20552076231197095. https://doi.org/10.1177/20552076231197095

[14] Reports | National Bureau of Statistics. (n.d.). Retrieved March 19, 2024, from https://nigerianstat.gov.ng/elibrary/read/1241422

[15] Schwei, K. M., Cooper, R., Mahnke, A. N., Ye, Z., & Acharya, A. (2016). Exploring Dental Providers' Workflow in an Electronic Dental Record Environment. Applied Clinical Informatics, 7(2), 516–533. https://doi.org/10.4338/ACI-2015-11-RA-0150

[16] Vermeir, P., Vandijck, D., Degroote, S., Peleman, R., Verhaeghe, R., Mortier, E., Hallaert, G., Van Daele, S., Buylaert, W., & Vogelaers, D. (2015). Communication in healthcare: A narrative review of the literature and practical recommendations. International Journal of Clinical Practice, 69(11), 1257–1267. https://doi.org/10.1111/ijcp.12686

[17] Welcome, M. O. (2011). The Nigerian health care system: need for integrating adequate medical intelligence and surveillance systems. Journal of pharmacy & bioallied sciences, 3(4), 470.

[18] World Health Organization. (2018). Digital technologies: shaping the future of primary health care: World Health Organization.

[19] Zande, M. M. van der, Gorter, R. C., Aartman, I. H. A., & Wismeijer, D. (2015). Adoption and Use of Digital Technologies among General Dental Practitioners in the Netherlands. PLOS ONE, 10(3), e0120725. https://doi.org/10.1371/journal.pone.0120725