



Review article

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Research, practice and innovations in health records and information management in Nigeria between 1966 and 2016: a review

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ABSTRACT

Background/Objective: There is growing demand for patients' health records and healthcare data in the quest to improve quality of care, decrease healthcare cost and medical errors and to facilitate the conduct of meaningful research in healthcare. Interestingly, innovations in ICT such as personal health records, electronic health records, mHealth, consumer health informatics and big data are being deployed to improve the management of health records and information as well as healthcare data. **Methods/Design:** The investigators searched mostly, Google Scholar, ResearchGate and Pubmed to conduct a scoping retrospective review of titles and topics in health information management in relation to Nigerian healthcare system. **Result:** One hundred and sixteen (87.9%) of the 132 articles retrieved were reviewed. Most (86.2%) of these articles were published between 2006 and 2016 largely in international journals (82.4%), were more of cross-sectional designs (22.5%) and conducted most times, by medical practitioners. Electronic health records and other health IT (37.1%) and retrospective review of patient's health records for care quality (31.0%) were the most discussed titles in health records and information management in Nigeria. **Conclusion:** Awareness on Health IT and the use of patient's health records for care quality is on the increase in the Nigerian healthcare systems. This is especially among scholars in healthcare. This gives hope of a better future for healthcare data management in the nation's healthcare systems. There is therefore needs for improved political support from the Federal Government of Nigeria and renewed commitment among healthcare providers with a view to reengineering healthcare data management and in order to reawaken the moribund confidence in the nation's healthcare system.

Keywords: Health Records, Retrospective Review; Health Information Technology; Healthcare Data; Data Quality Assessment; Electronic Health Records; Nigeria

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INTRODUCTION

Health information management is the discipline that is dedicated to the effective management of patients' health records and healthcare data needed to deliver high-quality

treatment and care to the public¹. The demand for healthcare data and information has grown exponentially with increased interests and efforts to improve quality of care, decrease healthcare costs, and implement more efficient and productive means of conducting health services

research². Likewise, Health Information Management (HIM) professionals, who strategically handle patients' health records and healthcare data, utilize increasing levels of technology to link clinical settings, public health departments, research institutions, health maintenance organizations and consumers with health information³. These expanded responsibilities necessitate the deployment of information technology to process and manage the data and information². The use of these technologies is capable of producing the required change that will address the fragmentation and dysfunction of current systems⁴.

The progression in the deployment of information technology has transformed health information management practice and healthcare services management. In today's healthcare for instance, research and innovations have shown upsurge in the adoption of personal health records (PHR) among healthcare providers and consumers^{5,6}. The potentials of personal health records though not yet robustly described, tend to reduce costs and simultaneously improve quality and safety of care especially, if properly designed^{7,8}. Other innovations such as consumer health informatics, which integrates consumers' preferences into health information system and big data, has potentials to address unmet information needs of providers and consumers^{9,10}.

While it is true that not all healthcare providers including clinicians in the consulting room are enthusiastic adaptors of electronic health records, the technology has dramatically changed the way professional skills of health records are applied, has accelerated the need for professionals to add new electronic-based abilities and has opened the door to levels of patient engagement and care coordination hitherto impossible¹¹⁻¹³. Traditionally, the patient's health records have been recognized as a rich source of information needed for quality clinical and health services research, while patients themselves recognize this and they know their right to access, right to consents and can make their preferences¹⁴⁻¹⁷.

The establishment and development of health records and information management in Nigeria began over 50 years ago, when a number of Nigerians went to United Kingdom to train as Medical Records Officers at the established schools in the 1960's and 1970's. Subsequently, they became qualified to diploma level, which was the highest level of qualification at that time and they returned to Nigeria to put their training into practice¹⁸. In the process, they established a national professional association and influenced the structure of the training programmes leading to recognized professional qualifications¹⁸.

In addition to the management of patients' health records and healthcare data, HIM professionals participate in the conduct of research by bringing in their skills, expertise, and knowledge of the importance (and limitations) of data quality, which is capable of improving public health quality. Unlike their colleagues in developed nations however, HIM professionals in Nigeria have not optimally explore the opportunities inherent in research and there is no single scholarly journal to share scientific discourse until 2018, when professionals look forward to the emergence of the International Journal of Health Records & Information Management (IJHRIM).

This current study sought to determine areas of health records and information management covered by scientific researches in Nigeria. This was done through review of relevant literature on studies into patients' health records and studies about health information management practice in Nigeria. It also includes relevant studies by practising HIM professionals in Nigeria, that are not readily available online. When partaking in research teams, these professionals are said to apply their skills, expertise and knowledge of the importance of data quality in improving public health¹⁹.

METHODS

In this scoping review, we carried out electronic search of original articles, review articles, perspectives, commentaries, letters to the

editor, abstracts and editorials using bibliographic databases such as Google Scholar, Pubmed/Medline and the social networking site for scientists and researchers, ResearchGate. The focus of the search was on all published works in health information management practice in Nigeria between 1966 and 2016. There was no language restriction in the search strategy. To retrieve published works, we used the following keywords; medical records in Nigeria, health records in Nigeria, health information management in Nigeria, eHealth in Nigeria, electronic health records in Nigeria, electronic medical records in Nigeria, computer use in healthcare systems in Nigeria, health data quality in Nigeria, disease surveillance in Nigeria, monitoring and evaluation of health services in Nigeria.

Specifically, we used *MeSH* words such as “medical records”, “health information management” “health information systems” “electronic health records”, each of these was suffixed with Nigeria. We manually searched reference list to locate additional studies and we used names of known authors in health information management in Nigeria to obtain their works not readily available online. Data were extracted using the following headings; year of publication, journal details, methods/design, lead author’s profession (retrieved through authors’ information) and focus/outcome of the paper.

RESULTS & DISCUSSION

Characteristics of reviewed articles

Our searches ended in 132 articles, 16 (12.1%) of which were excluded due to; 2 (1.5%) Nigerian authors of studies in diaspora, 7 (5.3%) were not relevant but, included at lease, a published HIM professional, 1 (0.8%), year of publication not known and 6 (4.5%) articles excluded based on incomplete information. Of the 116 articles reviewed, 100 (86.2%) were published between 2006 and 2016; 33 (28.4%) (Fig 1) were of cross-sectional design, and 29 (25.0%) were retrospective review of patients’ health records for care quality (Table 1). Studies on health records

were mostly conducted by medical practitioners (49, 42.2%) and widely disseminated (117, 82.4%) on international platforms. Of all the reviewed articles, 43 (37.1%) were on electronic health records and related health IT (Table 2), 36 (31.0%) were on retrospective review of patient's health records (Table 3), 22 (19.0%) focused knowledge, attitude and practice (KAP) of healthcare providers on health records management and health IT (Table 4) and lastly, 16 (13.8%) focused on the challenges facing health information management practice in Nigeria (Table 5).

Table 1: Characteristics of reviewed articles

<i>Criteria</i>	<i>Year</i>	<i>Articles</i>
	1966-1975	0
	1976-1985	0
By year of publication	1986-1995	1
	1996-2005	15
	2006-2015	89
	2016	11
	medical practice health records	49
By profession of the lead author	IT	23
	Librarianship	22
	others	10
	cross-sectional	12
By study design	retrospective review of health records	32
	descriptive	29
	system design	14
	mixed methods	8
	others	5
	International	28
	Local	85
By Journal	Conference proceedings	21
	Policy statement	2
	others	2
		6

DISCUSSION

Although the deployment of health information systems in Nigeria has been hampered by various factors and as such, has not been able to optimally satisfy providers’ and consumers’ information needs, studies^{37,58,63,67,79,90,93,98,106,100,}

have shown that ICT innovations in health such as electronic health records, National Health Management Information System (NHMIS) and others, have the capacity to enhance healthcare data management and in effect, improve healthcare quality of the nation^{24,29,52,66,67,72,76,82,86,87,102,106,107,108,112,117,121,125,131,132}.

Table 2: Electronic health records and other health ITs

<i>Statement</i>	<i>Articles</i>
All titles on EHRs and other Health IT	43
Factors that militate against effective healthcare data e.g. limited access to ICT	10
Emerging ICT innovations in health such as EHRs, OpenMRS, NHMIS and so on, facilitate better health records and information management for improved healthcare services	9
Health information system fails to optimally meet consumer health information needs	5
Growing deployment of mobile phone in managing health information and communication i.e. mHealth	4
Management information system enables better health records and information management	3
Private sector lacks effective health information systems	2
Quests for consumer health informatics	1

Some studies^{112,125,131} specifically noted that health IT has the potentials to improve medical care safety and quality and that it will enhance medical confidentiality. Challenges working against the adoption of health IT such as low access^{29,55} and post implementations perceived challenges such as concerns over medical confidentiality^{42,116} are addressed by three studies^{112,125,131}. Relatedly, there appears to be widespread use of ICT^{38,116}, especially the adoption of mHealth through the use of mobile phones^{36,47,117,126} and quests for further ICT training^{104,110,112,113,116}, among healthcare providers. Our review data suggests that if given the required infrastructure and training, healthcare providers in

Nigeria would embrace health IT in their work and care processes.

Table 3: Retrospective review of patients' health records

<i>Statement</i>	<i>Articles</i>
All titles on retrospective review of patients' health records	36
Fair and consistent documentation quality	18
No statement on availability, accessibility and quality of documentation in patients' health records	12
Poor data negatively impacted quality of care	6
Inadequate documentation quality	4
Professionalism improved documentation quality	1

More than ever before, the patient's health record is increasingly becoming an essential tool necessary for care evaluation and health services research². Nearly one-third of the articles made use of patients' health records, to either assess quality of care being provided or to assess quality of documentation in the patients' health records. From the 36 literature^{20,25,27,28,30,33,34,41,43-46,48,53,56,57,61,62,68,71,73,74,78,80,84,85,94,96,99,103,105,111,118,119,129,133}, that retrospectively explored health records quality, and contrary to reported challenges of health records in Nigeria^{59,65,77,121}, almost half reported fair and consistent in documentation^{25,34,48,56,71,78,84,85,94,96,99,103,105,111,118,119,129}, and in some cases there was no statement on availability, accessibility and quality of documentation in the patients' health records^{27,28,30,44-46,56,57,61,68,80,134}.

Our findings suggest establishment of data quality improvement programmes and re-orientation of Nigerian healthcare providers on the significance of data quality in healthcare systems.

On the overall, challenges of health records management in Nigeria include, but not limited to misplaced responsibility for medical confidentiality^{70,118,122,127,130}, missing or misplaced patient's health records^{59,65,77,121}, inadequate infrastructure^{40,95,122,130,132}, inadequately trained and poorly motivated

workforce^{42,54,65,69,70,74,75,87,88,97,104,114,116,129}, lack of political will^{115,122} and limited access to ICT^{29,51,55,72,86,87,102,108,117,132}.

Table 4: KAP of healthcare providers on health records management and health IT

<i>Statement</i>	<i>Articles</i>
All titles on knowledge, attitude and practice of health records management and ICT among healthcare providers	22
Low awareness and inadequate knowledge on key health information area	12
Need for training	3
Concerns over medical confidentiality	3
Widespread use of ICT among healthcare providers	
Professionalism improves care quality	2
Inadequate ICT infrastructure	2

Our review suggests the need to motivate healthcare providers, who are the managers and users of patients’ health records and healthcare data generated therefrom in order to facilitate quality healthcare data management.

CONCLUSION

There is growing awareness on Health IT and the use of patients’ health records for care quality in the Nigerian healthcare systems especially, among scholars in healthcare. This gives hope of a better future for data management in the nation’s healthcare systems. There is therefore the need for improved political support from the Federal Government of Nigeria such as deploying only professionally qualified HIM professionals in key positions in ministries of health, health agencies and programmes. Others include provision of adequately needed infrastructure and renewed commitment among HIM professionals and other healthcare providers with a view to reengineering healthcare data management and in order to rebuild the moribund confidence in the nation’s healthcare system.

It is worthy of note to say that scientific research into the patients’ health records is rising by the passage of years among healthcare providers in Nigeria. This study therefore, calls on HIM professionals and other healthcare providers in Nigeria to explore research opportunities

abound in the patients’ health records. Likewise, the birth of a Nigerian scholarly journal in health records tends to increase and improve research into patients’ health records.

Table 5: Challenges of health records and information management

<i>Statement</i>	<i>Articles</i>
All titles on challenges of health records and information management	16
Misplaced responsibility on medical confidentiality	5
Missing and misplaced patients' health records	4
Inadequate infrastructure (including ICT)	3
Erratic access to ICT due to poor power supply	1
Inadequately trained and poorly motivated workforce	1
Lack of political will	1



Fig 1: Articles by year of publication

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REFERENCES

1. Hersh W. A stimulus to define informatics and health information technology. *BMC Medical Informatics and Decision Making* 2009, 9:24.
2. Brodnik MS, Houser SH. Redefining the health information management scholar role. *Perspect Health Information Management* 2009; 6(Summer):1e.
3. Houser SH, Manger BJ, Price BJ, Silvers C, Hart-Hester S. Expanding the health information management public health role. *Perspectives in Health Information Management* 6, Summer 2009.
4. Georgiu A, Callen J. The role of health information management in health reform. *Health Information Management Journal*. 2011;40(2):4-5.
5. Tang PC, Ash JS, Bates DW, Overhage JM, Sands DZ. Personal health records: definitions, benefits, and strategies for overcoming barriers to adoption. *Journal of the American Medical Informatics Association*. 2006;13(2):121-126.
6. Kaelber DC, AK Jha, Johnston D, Middleton B, Bates DW. A research agenda for personal health records (PHRs). *Journal of the American Medical Informatics Association*. 2008;15(6):729-736.
7. Tang PC, Ash JS, Bates DW, Overhage JM, Sands DZ. Personal health records: definitions, benefits, and strategies for overcoming barriers to adoption. *Journal of the American Medical Informatics Association*. 2006;13(2):121-126.
8. Kaelber DC, AK Jha, Johnston D, Middleton B, Bates DW. A research agenda for personal health records (PHRs). *Journal of the American Medical Informatics Association*. 2008;15(6):729-736.
9. Eysenbach G. Consumer health informatics. *BMJ*. 2000;320:1713–6.
10. Krumholz HM. Big data and new knowledge in medicine: the thinking , training , and tools needed for a learning health system. *Health Affairs*. 2014;33(7):1163–1170. doi:10.1377/hlthaff.2014.0053.
11. Beasley JW, Holden RJ, Sullivan F. Electronic health records: research into design and implementation. *British Journal of General Practice*. 2011;604-605.
12. Fenton SH, Low S, Abrams KJ, Butler-Henderson K. Health information management: changing with time. *Yearb Med Inform* 2017:72-7.
13. Feeley TW, Shine KI. Access to the medical record for patients and involved providers: transparency through electronic tools. *Annals of Internal Medicine*. 2011;155(12):853-855.
14. Gregory KE, Radovinsky L. Research strategies that result in optimal data collection from the patient medical record. *Appl Nurs Res*. 2012;25(2):108–116. doi:10.1016/j.apnr.2010.02.004.
15. Adeleke IT, Adekanye AO, Adebisi AA, James JA, Omokanye SA, Babalola A. Patients' health records in research: perceptions and preferences of patients in Bida, Nigeria. *IMAN Medical Journal*. 2018;4(1):16-28.
16. Coster CD, Quhan H, Finlayson A, et al. Identifying priorities in methodological research using ICD-9-CM and ICD-10 administrative data: report from an international consortium. *BMC Health Services Research*. 2006;6:77. doi:10.1186/1472-6963-6-77.
17. Watt G. Using patient records for medical research. *British Journal of General Practice*. 2006;56(529):630–631.
18. Health Records Officers' Registration Board of Nigeria. Origin of Health Records Officers Registration Board of Nigeria. Available at: <http://www.hrorbn.org.ng/origin-of-hrorbn>. Accessed on 23/06/2018.
19. Hernderson J. Research in health information management: An expanding field of enquiry. *Health Information Management Journal*. 2017;46(3):103–104.
20. Fisher-Hoch SP, Tomori O, Nasidi A, et al. Review of cases of nosocomial Lassa fever in Nigeria: the high price of poor medical practice. *BMJ*. 1995;311:857-859.
21. Korpela M, Soriyan HA, Olufokunbi KC, Onayade AA, Davies-Adetugbo A, Adesanmi D. Community participation in health informatics in Africa: an experiment in tripartite partnership in Ile-Ife, Nigeria. In *PDC'96 Proceedings of the Participatory Design Conference*. Computer Professionals for Social Responsibility. 1996;25-34.
22. Ogunbekun I. A management information system for nurse/midwives. *Bulletin of the World Health Organization*. 1999;77(2):186-189.
23. Korpela M, Soriyan HA, Olufokunbi KC. Activity analysis as a method for information systems development: General introduction and experiments from Nigeria and Finland. *Scandinavian J. of Info Systems*. 2000;12(1):191-210.
24. Popoola SO. Consumer health information needs and services in Nigeria. *Library Review*, Vol. 49 Issue: 3, pp.129-134, <https://doi.org/10.1108/00242530010317714>.
25. Solagberu BA. Tuberculosis of the Spine in Ilorin, Nigeria. *East African Medical Journal*. 2001;78(4):197-199.

26. Sorinyan HA, Mursu AS, Akinde AD, Korpela MJ. Information systems development in Nigerian software companies: research methodology and assessment from the healthcare sector's perspective. *The Electronic Journal for Information Systems in Developing Countries*. 2001;5(4):1-18.
27. Ibeziako SN, Ibekwe RC. Pattern and outcome of admissions in the children emergency room of the University of Nigerian Teaching Hospital, Enugu. *Nig. J. of Paed.* 2002;29(4):103-107.
28. Ikpatt OF, Kuopio T, Ndoma-Egba R, Collan Y. Breast cancer in Nigeria and Finland: epidemiological, clinical and histological comparison. *Anticancer Research*. 2002;22(5):3005-3012.
29. Simba D. Application of ICT in strengthening health information systems in developing countries in the wake of globalization. *African Health Sciences*. 2004;4(3):194-198.
30. Ezechi OC, Mabayoje P, Obiesie LO. Ruptured uterus in South Western Nigeria: a reappraisal. *Singapore Med J*. 2004;45(3) :113-116.
31. Idowu PA, Adagunodo ER, Idowu AO, Aderounmu GA, Ogunbodede EO. Electronic referral system for hospitals in Nigeria. *Ife J of Science*. 2004;6(2):161-166.
32. Akande TM, Monehin JO. Health Management Information System in Private Clinics in Ilorin, Nigeria. *Nigerian Medical Practitioner*. 2004;46(5):103-107.
33. Yusuff K, Awotunde M. The frequency of drug history documentation in an institutionalized tertiary care setting in Nigeria. *J Pharm Pharmaceut Sci (www.cspscanada.org)* 8(2):141-146, 2005.
34. Ogun SA, Ojini FI, Ogungbo B, Kolapo KO, Danesi MA. Stroke in South West Nigeria: a 10-year review. *Stroke*. 2005;36:1120-1122. doi:10.1161/01.STR.0000166182.50840.31.
35. Bawa SB, Olumide EAA. The effect of training on the reporting of notifiable diseases among health workers in Yobe State, Nigeria. *The Nigerian Postgraduate Medical Journal*. 2005;12(1).
36. Idowu B, Adagunodo R, Adedoyin R. Information technology infusion model for health sector in a developing country: Nigeria as a case. *Technology and Health Care [Abstract]*. 2006;14(2):69-77.
37. Lambo E. Policy Programme and Strategic Plan of action for National Health Information Management System. FMOH Department of Health Planning and Research.
38. www.cheld.org/wp-content/uploads/2012/04/NATIONAL-HEALTH-MANAGEMENT-INFORMATION-SYSTEM.
39. Ajuwon GA. Use of the Internet for health information by physicians for patient care in a teaching hospital in Ibadan, Nigeria. *Biomedical Digital Libraries*. 3(12):1-9.
40. Runsewe-Abiodun IT, Ogunfowora OB, Fetuga BM. Neonatal malaria in Nigeria -a 2 year review. *BMC Pediatrics* 2006; 6:19.
41. Watts C, Ibegbulam I. Access to electronic healthcare information resources in developing countries: experiences from the Medical Library, College of Medicine, University of Nigeria. *IFLA Journal*. 32(1).
42. Thanni LOA, Kehinde OA. Trauma at a Nigerian teaching hospital: pattern and documentation of presentation. *African Health Sciences* 2006; 6(2): 104-107.
43. Shittu LAJ, Adesanya AO, Izegbu CM, Oyewopo AO, Arigbabuwo A, Ashiru AO. Knowledge and perception of health workers towards tele- medicine application in a new teaching hospital in Lagos. *Scientific Research and Essay*. 2007;2(1):16-19.
44. Tukur J, Umar BA, Rabi'u A. Pattern of eclampsia in a tertiary health facility situated in a semi-rural town in Northern Nigeria. *Annals of African Medicine*. 2007;6(4):164– 167.
45. Sani MU, Mohammed AZ, Bapp A, Borodo MM. A three-year review of mortality patterns in the medical wards of Aminu Kano Teaching Hospital, Kano, Nigeria. *Niger Postgrad Med J*. 2007 Dec;14(4):347-51.
46. Alokori EA, Erhabor ON. Seroprevalence of hepatitis B surface antigenaemia in children in a tertiary health institution in the Niger Delta of Nigeria. *Niger J. Med*. 2007;16(4):326-329.
47. Fasunla J, Ibekwe T, Onakoya P. Otomycosis in western Nigeria. *Mycoses* 51, 67–70 doi:10.1111/j.1439-0507.2007.01441.x.
48. Idowu, P, Cornford D, Bastin L. Health informatics deployment in Nigeria. *Journal of Health Informatics in Developing Countries (e-version)*. 2:15-23.
49. Abe E, Omo-Aghoja LO. Maternal mortality at the Central Hospital, Benin City Nigeria: a ten year review. *Afr J Reprod Health* 2008; 12[3]:17-26.
50. Yusuff KB, Tayo F. Does a physician's specialty influence the recording of medication history in patients' case notes? *Br J Clin Pharmacol*. 2008;66:2:308–312.
51. Ogunlana MO, Adedokun B, Dairo MD, Odunaiya NA. Profile and predictor of health-related quality of life among hypertensive patients in south-western Nigeria. *BMC Cardiovascular Disorders* 2009;9:25.

52. Sood SP, Nwabueze SN, Mbarika VBW. Electronic medical records: a review comparing the challenges in developed and developing countries. Proceedings of the 41st Hawaii International Conference on System Sciences – 2008.
53. Oladapo OT Adetoro OO, Fakeye O. National data system on near miss and maternal death: shifting from maternal risk to public health impact in Nigeria. *Reproductive Health* 2009, 6:8 doi:10.1186/1742-4755-6-8.
54. Adebayo ET, Ajike SO, Adekeye EO. A review of 318 odontogenic tumors in Kaduna, Nigeria. *J Oral Maxillofac Surg* 63:811-819.
55. Abodunrin OL, Akande TM. Knowledge and perception of e-health and telemedicine among health professionals in LAUTECH teaching hospital, Osogbo, Nigeria. *Int J Health Res.* 2009;2(1):51-58.
56. Olatokun WM, Adboyejo OC. Information and communication technology use by reproductive health workers in Nigeria: state of the art, issues, and challenges. *An Interdisciplinary Journal on Humans in ICT Environments.* 2009;5(2):181-207.
57. Mukadas AO, Misbau U. Incidence and patterns of cardiovascular disease in north western Nigeria. *Niger Med J* 2009;50:55-7.
58. Belonwu RO, Gwarzo DG, Adeleke SI. Cerebral palsy in Kano, Nigeria: a review. *Niger J Med.* 2009;18(2):186-189.
59. Oluwagbemi, O, Achimugu, P. Lack of integration in software systems for health practitioners in Nigeria: the way forward. *Journal of Health Informatics in Developing Countries [Electronic Version].* 4(1):47-51.
60. Iliyasu Z, Abubakar IS, Abubakar S, Lawan UM, Gajida AU. Patients' satisfaction with services obtained from Aminu Kano Teaching Hospital, Kano, Northern Nigeria. *Nigerian Journal of Clinical Practice.* 2010; 13(4):371-378.
61. Nwalo KIN, Anasi SNI. Access to and use of reproductive health information among in-school adolescent girls in Lagos State, Nigeria. *Health Education Journal.* 2010;71(1):90–101.
62. Lawoyin TO, Onadeko MO, Asekun-Olarinmoye EO. Neonatal mortality and perinatal risk factors in rural Southwestern Nigeria: a community-based prospective study. *WAJM* 2010; 29(1): 19–23.
63. Yusuff KB, Tayo F, Aina BA. Pharmacists' participation in the documentation of medication history in a developing setting: an exploratory assessment with new criteria. *Pharmacy Practice (Granada).* 2010;(2):139-145.
64. Hammond WE, Bailey C, Boucher P, Spohr M, Whitaker P. Connecting information to improve health. *Health Affairs.* 2010;29(2):285–290. compredoi:10.1377/hlthaff.2009.0903.
65. Thompson A, Castle E, Makarfi PS. Experience implementing OpenMRS to support maternal and reproductive health in Northern Nigeria. *MEDINFO* 2010;332-336. doi:10.3233/978-1-60750-588-4-332.
66. Oguntoké O, Opeolu BO, Babatunde N. Indoor air pollution and health risks among rural dwellers in Odeda area, South-Western Nigeria. *Ethiopian Journal of Environmental Studies and Management.* 2010;3(2):39-46.
67. Adetiba E, Eleanya M, Fatumo SA, Mathes VO, Iruemi OJ. National Hospital Management Portal (NHMP): a framework for e-health implementation. *Int. J. Electronic Healthcare.* 2010;5(3):273-283.
68. Pantuvo JS, Naguib RNG, Wickramasinghe N. Towards implementing a nationwide electronic health record system in Nigeria. *International Journal of Healthcare Delivery Reform Initiatives,* 3(1), 39-55.
69. Onyearugha CN, Onyire BN, Ugboma HAA. Neonatal jaundice: Prevalence and associated factors as seen in Federal Medical Centre Abakaliki, Southeast Nigeria. *Journal of Clinical Med and Research.* 2011;3(3):40-45.
70. Ebuehi OM, Campbell PC. Attraction and retention of qualified health workers to rural areas in Nigeria: a case study of four LGAs in Ogun State, Nigeria. *Rural and Remote Health.* 2011;11:1515(Online).
71. Adeleke IT, Adekanye AO, Adefemi SA, et al. Knowledge, attitude and practice of confidentiality of patient's health records among healthcare providers at Federal Medical Centre, Bida, Nigeria. *Niger J Med.* 2011;20(2):228-235.
72. Ige OK, Adesanmi AA, Asuzu MC. Hospital-acquired infections in a Nigerian tertiary health facility: An audit of surveillance reports. *Niger Med J.* 2011;(4): 239–243. doi: 10.4103/0300-1652.93796.
73. Benson AC. Hospital information systems in Nigeria: a review of literature. *Journal of Global Healthcare Systems.* 2011;1(3):1-26.
74. Babale GN, Baba MM, Hyelelinta C.J, et al. Capacity utilization of University of Maiduguri Teaching Hospital, Nigeria. *Report and Opinion.* 2011;3(8):35-38.
75. Abdulkadir AY, Yunusa GH, Tabari AM, et al. Medical record system in Nigeria: observations from multi-centre auditing of radiographic requests and patients' information documentation practices. *Journal of Medicine and Medical Science.* 2011;2(5):854-858.
76. Igbeneghu BI, Popoola, SO. Influence of locus of control and job satisfaction on organizational commitment: a study of medical records personnel in University Teaching Hospitals in Nigeria. *Library Philosophy and Practice (e-journal).* 575.

77. Menizibeya OW. The Nigerian healthcare system: Need for integrating adequate medical intelligence and surveillance systems. *J Pharm Bioallied Sci.* 2011 Oct-Dec; 3(4): 470–478.
78. Ogunfowokan O, Mora M. Time, expectation and satisfaction: Patients' experience at National Hospital Abuja, Nigeria. *Afr J Prm Health Care Fam Med.* 2012;4(1).
79. Jido TA, Garba ID. Surgical-site Infection Following Cesarean Section in Kano, Nigeria. *Annals of Medical and Health Sciences Research.* 2012;2(1):33-36.
80. Akanbi MO, Ocheke AN, Agaba PA. Use of electronic health records in sub-Saharan Africa: progress and challenges. *J Med Trop.* 2012;14(1): 1–6.
81. Eluwa GI, Badru T, Akpoigbe KJ. Adverse drug reactions to antiretroviral therapy (ARVs): incidence, type and risk factors in Nigeria. *BMC Clinical Pharmacology.* 2012;12:7.
82. Nnebue CC, Onwasigwe CN, Adogu POU, Onyeonoro UU. Awareness and knowledge of disease surveillance and notification by healthcare workers and availability of facility records in Anambra state, Nigeria. *Niger Med J.* 2012 Oct-Dec; 53(4): 220–225. doi: 10.4103/0300-1652.107557.
83. Awokola BI, Abioye-Kuteyi EA, Otoru OO, et al. Practical challenges of setting up an electronic medical record system in a Nigerian tertiary hospital: the Wesley Guild Hospital experience. *Middle East Journal of Family Medicine* 2012;10(2):37.
84. Foster R. Review of developing country health information systems. *Jembi Health Systems for the Health Enterprise Architecture Project*, 2012.
85. Adeleke IT, Adekanye AO, Onawola KA, et al. Data quality assessment in healthcare: a 365-day chart review of inpatients' health records at a Nigerian tertiary hospital. *J Ame Med Info Assoc.* 2012; 2012;19:1039–1042. doi:10.1136/amiajnl-2012-000823.
86. Dosumu EB, Dosumu OO, Lawal FB. Quality of records keeping by undergraduate dental students in Ibadan, Nigeria. *Annals of Ibadan PostgradMed.* 2012;10(1):13-17.
87. Asogwa BE. The challenge of managing electronic records in developing countries: implications for records managers in sub Saharan Africa. *Records Management Journal.* 2012;22(3):198-211.
88. Onadipe TO, Onafowokan MA, Adegbite AA. Information and communications technology (ICT) and health workers proficiency as a determinant of health information management: a case study of health facilities Ogun Southwestern Nigeria. *American Academic & Scholarly Research Journal.* 2013;5(4).
89. Mbachu CO, Uzochukwu BSC, Onwujekwe OE, Ilika AL, Oranuba J. How do health workers perceive and practice monitoring and evaluation of malaria control interventions in South-east Nigeria? *BMC Health Services Research* 2013, 13:81.
90. Iroju O, Soriyan A, Gambo I, Olaleke J. Interoperability in healthcare: benefits, challenges and resolutions. *International Journal of Innovation and Applied Studies.* 3(1):262-270.
91. Samuel OW, Omisore MO, Ojokoh BA, Atajeromavwo EJ. Enhanced cloud based model for healthcare delivery organizations in developing countries. *International Journal of Computer Applications.* 2013;74(2):34-39.
92. Nnebue CC, Onwasigwe CN, Ibeh CC, Adogu POU. Effectiveness of data collection and information transmission process for disease notification in Anambra State, Nigeria. *Nigerian Journal of Clinical Practice.* 2013;16(4):483-489.
93. Awute LN. National Health Information System STRATEGIC PLAN 2014 – 2018. Federal Ministry of Health Department of Health Planning, Research and Statistics. Available at: www.health.gov.ng/doc/National%20HIS%20Strategic%20Plan.
94. Ajami S, Rajabzadeh A. Radio Frequency Identification (RFID) technology and patient safety. *J Res Med Sci.* 2013; 18(9): 809–813.
95. Akhigbe RE, Bamidele JO. Prevalence and pattern of utilization of voluntary counseling and testing services and HIV infection in Ogbomoso, southwestern Nigeria. *J Nat Sci Biol Med.* 2013 Jan-Jun; 4(1): 163–166. doi: 10.4103/0976-9668.107283.
96. Adesoye AE, Amusa OI. Use of electronic resources in health sciences institutions in Ogun State, Nigeria. *PNLA Quarterly* 77:3 (Spring 2013).
97. Olarinde OJ, Olatuji OY. Pattern of deaths in medical wards of a rurally situated tertiary health institution, Ido-Ekiti, Nigeria. *Niger J Clin Pract [serial online]* 2014;17:237-40.
98. Adeleke IT, Adekanye AO, Jibril AD, Danmallam FF, Inyinbor HE, Omokanye SA. Research knowledge and behaviour of health workers at Federal Medical Centre, Bida; a task before learned mentors. *El Mednifico.* 2014;2:2:105-109.

99. Omotosho A, Adegbola O, Adelakin B, Adelokun A, Emuoyibofarhe J. Exploiting multimodal biometrics in e-privacy scheme for electronic health records. *Journal of Biology, Agriculture and Healthcare*. 2014;4(18):22-33.
100. Ejim EC, Anisiuba BC, Oguanobi NI et al. Congenital heart diseases in adults: a review of echocardiogram records in Enugu, South-East Nigeria. *Ann Med Health Sci Res*. 2014 Jul-Aug; 4(4): 522–525. doi: 10.4103/2141-9248.139297.
101. Aminpour F, Sadoughi F, Ahamdi M. Utilization of open source electronic health record around the world: a systematic review. *J Res Med Sci*. 2014; 19(1): 57–64.
102. Makinde OA, Azeez A, Bamidele S, et al. Development of a master health facility list in Nigeria. *Online Journal of Public Health Informatics*. 6(2): e184.
103. Adebayo KJ, Ofoegbu EO. Issues on e-health adoption in Nigeria. *I.J. Modern Education and Computer Science*. 2014;9:36-46.
104. Onafowokan MA, Rufai MO, Onadipe TO. Antenatal enrollment and prevalence of iron deficiency anemia in Specialist Hospital Akure, Nigeria. *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*. 2014;3(6):43-45.
105. Adeleke IT, Lawal AH, Adio RA, Adebisi AA. Information technology skills and training needs of health information management professionals in Nigeria: a nationwide study. *HIMJ*. 2015;44(2):30-38.
106. Alabi O, Nguku P, Chukwukere S, Gaddo A, Nsubuga P, Umoh J. Profile of dog bite victims in Jos Plateau State, Nigeria: a review of dog bite records (2006-2008). *Pan Afr Med J*. 2014;18(Supp 1):12.
107. Abubakar UF. Health information systems in a developing country (case study of e-health system in a Nigerian hospital). *European Scientific Journal*. 2015;3:173-182.
108. Boyinbode O, Toriola G. CloudeMR: A Cloud Based electronic medical record system. *Intl J. of Hybrid Info Tech*. 2015;8(4):201-212.
109. Edje EA, Ekabua A. Funding e-health in Nigeria by NGOS/multinational organization: overview and perspectives. *International Journal of Computer Applications*. 2015;111(11):37-41.
110. Ojo AI, Popoola SO. Some correlates of electronic health information management system success in Nigerian teaching hospitals. *Biomedical Informatics Insights* 2015;7:1-9.
111. Adeleke IT, Asiru MA, Oweghoru BM, Jimoh AB, Ndana AM. Computer and internet use among tertiary healthcare providers and trainees in a Nigerian public hospital. *American Journal of Health Research*. 2015;3(6): 1-10.
112. Adefemi SA, Adeleke IT, Gara P, Abdul-Ghaneey OO, Omokanye SA, Yusuf AMJ. The rate, reasons and predictors of hospital discharge against medical advice among inpatients of a tertiary health facility in North-central Nigeria. *American Journal of Health Research*. 2015;3(6): 11-16.
113. Adeleke IT, Erinle SA, Ndana AM, Anamah TC, Ogundele OA, Aliyu D. Health information technology in Nigeria: Stakeholders' perspectives of nationwide implementations and meaningful use of the emerging technology in the most populous black nation. *American Journal of Health Research*. 2015;3(6):17-24.
114. Oweghoru BM, Adeleke IT, Mshelia PP, Ogundiran LM, Yusuf AMJ, Adeoti DI. Knowledge, access and use of internet-based health information for personal healthcare among employees of the foremost Nigerian University. *American Journal of Health Research*. 2015;3(6): 25-31.
115. Adeleke IT, Ajayi OO, Jimoh AB, Adebisi AA, Omokanye SA, Jegede MK. Current clinical coding practices and implementation of ICD-10 in Africa: a survey of Nigerian hospitals. *American Journal of Health Research*. 2015;3(6):38-46.
116. Oweghoru BM. Health records retention and disposal in Nigerian hospitals: survey of policies, practices and procedures. *African Journal of Library, Archives & Information Science*. 2015;25(1):69-76.
117. Adeleke IT, Salami AA, Achinbe M, Anamah TC, Zakari IB, Wasagi MH. ICT knowledge, utilization and perception among healthcare providers at National Hospital Abuja, Nigeria. *American Journal of Health Research*. 2015;3(6):47-53.
118. Adeleke IT, Ezike SO, Ogundele OA, Ibraheem SO. Freedom of information act and concerns over medical confidentiality among healthcare providers in Nigeria. *IMJ*. 2015;1(1):21-28.
119. West DM. Using mobile technology to improve maternal health and fight Ebola: a case study of mobile innovation in Nigeria. Centre for Technology Innovation at Brookings, 2015:1-19. www.insidepolitics.org/brookingsreports/NigeriaMHealth.pdf.
120. Fagbamigbe AF, Idemudia ES. Barriers to antenatal care use in Nigeria: evidences from non-users and implications for maternal health programming. *BMC Pregnancy and Childbirth*. 2015;15:95. doi:10.1186/s12884-015-0527-y.
121. Oyedeji OA, Ogbenna AA, Iwuala SO. An audit of request forms submitted in a multidisciplinary diagnostic center in Lagos. *Pan African Medical Journal*. 2015; 20:423 doi:10.11604/pamj.2015.20.423.5778.

122. Chaplina B, Meloni S, Eisen G. Scale-up of networked HIV treatment in Nigeria: Creation of an integrated electronic medical records system. *International Journal of Medical Informatics*. 84: 58–68.
123. Soyemi J, Misra S, Omoregbe N. Towards e-healthcare deployment in Nigeria: the open issues. R. Intan et al. (Eds.): *ICSIT 2015, CCIS 516*, pp. 588–599, 2015. doi: 10.1007/978-3-662-46742-8_54.
124. Osundina KS, Kolawole JA, Ogunrewo JO. The role of records management in secondary healthcare delivery system in selected state hospitals in Osun State, Nigeria. *Information and Knowledge Management*. 5(12):105-115.
125. Osundina KS. Unauthorized disclosure of medical information, patient rights and legal consequences as it affect patients and healthcare providers. *Journal of Biology and Genetic Research*. 2016;2(1):39-46.
126. Olagundoye OA, Boven KV, Weel CV. International Classification of Primary Care-2 coding of primary care data at the general out-patients' clinic of General Hospital, Lagos, Nigeria. *J Family Med Prim Care*. 2016 Apr-Jun; 5(2): 291–297.
127. Gusen JN, Ajayi AD, Stephen N, et al. Perception and utilization of standardized electronic health records among nurses in JOS university teaching hospital Plateau State, Nigeria. *International Journal of Medical and Health Research*. 2016;2(9):76-83.
128. Gokhale A. Leveraging mobile and cloud computing technology for growth in Nigeria. *FUTA J. of Management and Tech*. 2016;1(2):13-22.
129. Makinde OA, Azeez A, Adebayo W. Potential use cases for the development of an electronic health facility registry in Nigeria: key informant's perspectives. *Online Journal of Public Health Informatics*. 2106;7(2):e191.
130. Osundina KS, Kolawole JA, Abolaji JA. Legal issues in the management of patients' records in tertiary hospitals in Nigeria. *IOSR Journal of Nursing and Health Science*. 2016;5(5):82-90.
131. Adisa AO, Lawal AO, Effiom OA, et al. A retrospective review of 61 cases of adenomatoid odontogenic tumour seen in five tertiary health facilities in Nigeria. *Pan African Medical Journal*. 2016; 24:102 doi:10.11604/pamj.2016.24.102.9400.
132. Garba KD. Significance and challenges of medical records: a systematic literature review. Available at: www.researchgate.net/publication/309034245_SIGNIFICANCE_AND_CHALLENGES_OF_MEDICAL_RECORDS_A_SYSTEMATIC_LITERATURE_REVIEW. Accessed on 28/4/2018.
133. Abisoye OA, Abisoye BO, Ojonuba BE. An online outpatient database system: a case study of General Hospital, Minna. *Intelligent Information Management*. 8: 103-114.
134. Osundina KS. Health information utilization and decision making in tertiary hospitals in Nigeria. *International Journal of Health and Pharmaceutical Research*. 2016;2(1).
135. Kayode GA, Grobbee DE, Amoakoh-Coleman M, et al. Predicting stillbirth in a low resource setting. *BMC Pregnancy and Childbirth*. 2016;16:274.

Authors Contribution:

AIT conceived of the study, initiated its design, participated in literature search, article selection and review, data analysis and coordination and drafted the manuscript. SQB and ESA participated in the design, literature search, article selection and review, data analysis and coordination and reviewed the final manuscript. OBM, IMM, NOBJ, WA and OOA participated in the design, article selection and review, data analysis and coordination and reviewed the final manuscript.

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