IJIMM, Volume 2, Issue 6, 2024 ISSN: 2995-5319
http://medicaljournals.eu/index.php/IJIMM

INTERNATIONAL JOURNAL OF INTEGRATIVE AND MODERN MEDICINE

Data Analytics and Health Information as Tools for Driving Insights and Innovation in Healthcare

OMOLE, Segun Michael (PhD)
School of Health Information Management
Osun State College of Health Technology, Ilesa, Nigeria
(+2348035896256, E-mail: osegunmicheal@gmail.com)

OLANREWAJU, Saheed Adewale (PhD)
Osun-State Ministry of Health, Osogbo, Nigeria
(Director of Pharmaceutical Services)
(+2347064987934, E-mail: pholanrewaju71@gmail.com)

BUSOYE, Abiodun Oluwatosin (M.Sc.)
School of Health Information Management
Osun State College of Health Technology, Ilesa, Nigeria
(+2347033779597, E-mail: awotonaoluwatosin@gmail.com)
&
ADENIRAN, Isaac Ayobami (PhD)
Department of Health Information Management
Lead City University, Ibadan, Nigeria
(+2348141101770, E-mail: mrayobami123@gmail.com)

Macaulay Oluropo Babafemi (PhD)
Lagos State College of Health Technology, Yaba Lagos

Peter Olaoluwa ADEDIJI
Nigeria Centre for Disease Control and Prevention.
(Surveillance and Epidemiology Department)

Abstract

This paper aimed at combining insights of how data analytics and health information bridges different aspects of driving insights and innovations in healthcare; through objective examination of data analytics skills and methods of managing health information and their place in driving insights and innovations in healthcare

The method used for this study are; literature review, theoretical discussion, and qualitative analysis. Inferences drawn from existing literatures and qualitative analysis indicated that, data analytics and health information interplayed to drive insights and innovation in healthcare

Findings revealed that; the strategy for driving insights and innovation in healthcare is technology adoption patterns in the healthcare settings. Findings revealed that the basic models used for data analytics are; Descriptive analytics, Diagnostic analytics, Predictive analytics, Prescriptive analytics and Cognitive analytics. Findings also revealed that the methods of managing health information are: manual and electronic methods, in agreement with health information life span which are; health information creation, maintenance, use, evaluation, disposal and continuum.

This study recommended the need for Government at all levels should encourage the use of data analytics software, Health information professionals should get acquainted with the use of data analytics applications, for them to be able to navigate the software successfully in order to enhance their data analytics skills. And Government should organize regular training and re-orientation workshop for health information professionals on data analytics skills for driving insights and innovation in healthcare

Keywords: Data Analytics, Health Information, Insights, Innovations, Healthcare

Introduction:

Insight and innovation in healthcare involves the capacity to gain an accurate and deep understanding of the entire healthcare practices through collection and use information with a view to develop the process of bringing about new ideas, methods, products, services, or solutions that have a significant positive impact and value on patient and the entire healthcare organization.

It involves transforming creative concepts into tangible outcomes that improve efficiency, and effectiveness, or address unmet needs via accurate understanding and systematic application of the knowledge gained from a well analyzed health information into healthcare practices in order to create a new way of doing things in better perspective to have a leading edge in the healthcare system.

Data analytics is the collection, transformation, and organization of data in order to draw conclusions, make predictions, and drive informed decision making.

Data analysis is the process of inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, informed conclusions, and supporting decision-making.

Depending on the nature of information to be extracted and decisions to be made; there are 5 main types of data analytics that could be invested in: descriptive analytics, diagnostic analytics, predictive analytics, prescriptive analytics, and cognitive analytics.

The five-step - framework to analyze data. The five steps are: 1) Identify business questions, 2) Collect and store data, 3) Clean and prepare data, 4) Analyze data, and 5) Visualize and communicate data.

Health information consists of collection of recorded facts concerning a particular patient, his or her illness and the events occurring in the course of professional care for the purpose of providing the best medical care to the patient, for teaching, research, study appraisal of medical practice and legal requirements (Benjamin, 2001). Osundina (2014) opines that health records contain history of illness, medical investigations and tests, results of examinations, diagnosis and treatment.

It is therefore assumed that, healthcare provider makes an entry into the medical records with the actual occurrence of the event and the ability to maintain accurate and timely record is critical to drive insights and innovation: Hence, it is important to find out the influence of data analytics and health information on driving insights and innovation in healthcare. Based on this assumption, this paper examined the influence of data analytics and health information on driving insights and innovation in healthcare

1.2. Statement of the Problem

It is assumed that driving insights and innovation in healthcare is critical to development of healthcare delivery system. Personal observation of the investigator, has shown that there is partial use of data analytics models and health information for informed conclusions, and decision-making in most of the healthcare facilities in Nigeria, which has devastating consequence on driving insights and innovation in healthcare.

Hence, it is important to find out the influence of data analytics and health information on driving insights and innovation in healthcare. Based on this assumption, this paper examined the influence of data analytics and health information on driving insights and innovation in healthcare with a view to contributing to finding solutions to problems associated with data analytics and health information in relation to driving insights and innovation in healthcare.

1.3, Objective of the Study

T

h 1. find out the existing strategies for driving insights and innovation in healthcare

i 2. identify the basic models used for data analytics

s 3. ascertain the methods of managing health information

4. determine the nexus between data analytics and driving insights and innovation in healthcare

s 5. determine the nexus between health information and driving insights and innovation in

t healthcare

u 6. identify the challenges of data analytics and health information.

d

2.0. Review of Literature

y

2.1. Strategies for Driving Insights and Innovation in Healthcare

e

x

a

m

Application of organized knowledge and skills in the form of devices, medicines, vaccines, procedures and systems, developed to solve a health problem and improve quality of lives," have exerted growing pressure on health system financing and governance.

It has raised important social and ethical concerns and threatened the sustainability of health systems. Health policy-makers increasingly voiced their concerns regarding the diffusion of new medical technologies as "the enormous challenges and needs confronting healthcare systems today make the governance of innovation extremely complex (Pascale et. al. 2019).

Pascale et. al. (2019) further iterates that health services and policy researchers generated knowledge on the individual, clinical and organizational barriers and facilitators that affect technology adoption patterns in healthcare settings. Therefore the strategies for driving insights and innovation in healthcare involve diffusion of new medical technologies into healthcare and technology adoption patterns in the healthcare settings.

2.2. Models Used for Data Analytics

Deliotte (2023) posits that data analytics is often confused with data analysis. While these are related terms, they aren't exactly the same. In fact, data analysis is a subcategory of data analytics that deals specifically with extracting meaning from data. Data analytics, as a whole, includes processes beyond analysis, including data science (using data to theorize and forecast) and data engineering (building data systems)

Data analytics is a multidisciplinary field that employs a wide range of analysis techniques, including math, statistics, and computer science, to draw insights from data sets. Data analytics is a broad term that includes everything from simply analyzing data to theorizing ways of collecting data and creating the frameworks needed to store it.

2.2.1. Types of Data Analytics

Depending on the nature of information to be extracted and decisions to be made; there are 5 main types of data analytics that could be invested in: descriptive analytics, diagnostic analytics, predictive analytics, prescriptive analytics, and cognitive analytics

Together, these five (5) types of data analytics can help an organization make data-driven decisions. At a glance, each of them tells us the following:

- **Descriptive analytics** tell us what happened.
- **Diagnostic analytics** tell us why something happened.
- **Predictive analytics** tell us what will likely happen in the future.
- **Prescriptive analytics** tell us how to act.

- **Cognitive analytics** tell us what to think about

Therefore the basic models used for data analytics are; descriptive analytics, diagnostic analytics, predictive analytics, prescriptive analytics and cognitive analytics. However, people who work with data analytics will typically explore each of these five (5) areas using the data analysis process, which includes; identifying the question, collecting raw data, cleaning data, analyzing data, and interpreting the results

2.2.2. Five-Step - Framework to Analyze Data.

Omole et. al (2024) identify the five steps, which are:

1) Identify business questions,

2) Collect and store data,

3) Clean and prepare data,

4) Analyze data, and

5) Visualize and communicate data

2.2.3. Data Analytics Skills

Coursera (2024) submits that, data analytics requires a wide range of skills to be performed effectively, these are the top-in-demand data science skills, as of December 2021:

- **Structured Query Language (SQL)**, a programming language commonly used for databases
- **Statistical programming languages**, such as R and Python, commonly used to create advanced data analysis programs
- **Machine learning**, a branch of artificial intelligence that involves using algorithms to spot data patterns
- **Probability and statistics**, in order to better analyze and interpret data trends
- **Data management**, or the practices around collecting, organizing and storing data
- **Data visualization**, or the ability to use charts and graphs to tell a story with data
- **Econometrics**, or the ability to use data trends to create mathematical models that forecast future trends based.

Hence, careers in data analytics require a certain amount of technical knowledge, approaching the above skills methodically—for example by learning a little bit each day or learning from your mistakes—can help lead to mastery, and it's never too late to get started.

2.3. Methods of Managing Health Information

Data and information are the life blood of the health care delivery system, and vital to the decision making process surrounding insights and innovation in healthcare (Osundina, 2014). Managing health

information encompasses services in planning, collecting, monitoring, analyzing and disseminating, individual patient and clinical data (Russel, 2011)

Therefore, health information is a complete compilation of scientific data about patient's life and illness, derived from many sources, coordinated into an orderly documented file, packaged, organized and stored by health information management professionals for various uses.

Health information may be managed in manual form, computer assisted form and electronic form (Olaniyan, 2015):

1. Manual Method: This involves the use of paper, ink and paper product in the creation, storage, maintenance and use of patient records. The strategies used in the manual method include the adoption of the basic health records management systems such as; numbering system, tracing system, filing system, appointment system, coding and indexing system. Information is made available to the users manually based on their needs and requests (Makata, 2015).

2. Computer Assisted Method: This method is a synthesis of the use of computer and manual methods in managing health information, which entails automation of certain aspects of health information management services while other aspect are maintained in a manual form.

3. Electronic Method: This involves the application of computer system and other electronic devices into the creation, maintenance and use of patient records. The strategies used in electronic health records method include the use of hardware, software, human ware, procedures and storage devices (Oyeniran, 2013).

2.3.1. Stages in Life Span of Health Information

It is worthy of note that; in managing health information, adequate attention must be paid to the stages in life span of health information as explained by Popoola (2000), which are; health information creation, maintenance, use, evaluation, disposal and continuum.

(a) Creation of Health Information: Health information creation starts with the documentation and registration of patient in the health information management department of the health institution. This will be followed by entering of clinical information such as; patient's complains, diagnosis, reports of medical investigations and treatment rendered into the record. At the registration point, a unique hospital number would be assigned to the patient record to facilitate distinct identification of the record.

(b) Maintenance of Health Information: Health information maintenance phase involves storage facilities, retrieval tools, filing and classification. Effective maintenance of patient records requires the adoption of appropriate filing system, numbering system, appointment system, tracing system, storage system, coding and indexing systems. Applications of these systems enhance accessibility to patient records for specific use.

(c) Health Information Use: Health information use begins with an initiation stage, during which the information user first becomes aware of the need to gather information from the existing records, by recognizing the initial need for information, and attempt to facilitate effective use of the records through systematic organization pattern of the patient records based upon his / her needs. Coding and indexing systems are the tools that facilitate patient records use (Omole, 2016)

(d) Evaluation of Health Information: Evaluation is a process of determining the value of records for further use, and the length of time for which that value will continue. Evaluation must be done based on the existing policy, which will stipulate how long records should be kept in their original form and what to be done after the expiration of the stipulated period. Evaluation helps in the categorization of health information into active, semi-active and inactive records.

(i) Active Patient Records: Active patient records are records needed to perform current operations (such as direct patient care and treatment) they are subject to frequent use and usually located near the user, and may be managed in a centralized or decentralized health records library.

(ii) Semi-active Patient Records: Semi-active phase occurs, when the patients have been discharged home and only need to visit the hospital on appointment or at will

(iii) Inactive Patient Records: An inactive record is a record that is no longer needed to conduct current business but is being preserved until it meets the end of its retention period as stipulated in the enabling policy.

(e) Disposal of Health Information: When the records are no longer useful, a decision is taken whether the records should be preserved or disposed. This decision is based on the existing policy that is related records disposition in the organization (Agrell, 1998).

(f) Health Information Continuum: Records Continuum involves making arrangement for the continuous reference of the chosen ones that reincarnated as archive as a result of their enduring value by way of scanning, digitization and electronic indexing (i.e. ***Digitization of the chosen ones that reincarnated as archive***)

The goal of health information management practices is to support the process of decision making for driving insight and innovation in healthcare. Therefore, health information management professionals carefully generate and collect health information, take custody of health information, manage health

information and selectively disseminate them to the legitimate users in the health care setting, for the purpose of driving insight and innovation in healthcare for improved service delivery, that guarantee socio-economic development of the nation. In view of this health information promotes insight and innovation in healthcare

2.4. Nexus between Data Analytics and Driving Insights and Innovation

Simplilearn (2024) reports that, data analysts plan decision-making, improve efficiency, enhance customer experiences, and manage risks by interpreting complex data sets. Success in data analysis demands a blend of technical skills (data cleaning and statistical analysis) and soft skills (critical thinking and communication). The surge in data usage has significantly increased the demand for skilled data analysts across various sectors.

Omole (2023) agrees with above as he analyzes some data analytics models and their decision rule for driving insights and innovation in healthcare, as follows:

1. If a hypothesis is trying to ***establish relationship or association*** between two variables (the independent and the dependent): The researcher is expended to use **chi – square test (x^2) or correlation (test) analysis**. When chi-square test is used; ***the researcher is expected to look for and compare the chi-square calculated with the chi-square tabulated*** (if x^2 calculated is $\leq$ x^2 tabulated, accept H_0: but if x^2 calculated > x^2 tabulated, reject H_0).

2. When **correlation analysis** is used to ***establish relationship*** between two variables, ***the researcher is expected to look for the value of 'r' and the P- value*** (if P-value association with the relevant 'r' statistics is less than 0,05 level of significance, reject H_0; but if otherwise accept H_0).

3. If a hypothesis is trying to find out the ***influence or effect or impact*** of one variable on the other (the independent on the dependent): The researcher is expected to **use regression analysis (β)**. When **regression test** is used to determine the effect or influence or impact of one variable on the other, ***the researcher is expected to look for the value of Beta (β) and the P-value***. (If the p-value associated with the relevant Beta (β) statistics is less than 0.05 level of significance, reject H_0; but if otherwise accept H_0)

4. In the case of ascertaining the ***relative effect*** of each, of the two or more variables on one variable (two or more variables on the dependent variable) the researcher is expected to use **simple regression analysis** in this situation, ***the researcher is expected to look for the value of Beta (β), t – statistic and the P-value***. (If the P-value associated with the Beta (β) and t –statistics is less than 0.05 level of significance, reject H_0; but if otherwise accept H_0).

5. If a hypothesis is trying to determine the joint contribution or combined influence or effect or impact of two or more variables on one variable (joint contribution of two or more variables to the dependent variable), ***the researcher is expected to use multiple regression analysis in this situation: In doing so, he/she is to look for the value of adjusted r^2, F-statistic and the p-value*** (if P-value associated with the adjusted r^2 and F-statistics is less than the 0.05 level of significance, reject H_0; but if otherwise accept H_0)

Therefore data analytics facilitates the establishment of specific inference drawn from the analysis table, which provides a categorical answer to the question posed or hypothesis tested and generate insightful statement that will explain the way through which the empirical statements expressed in the results provide answers to the question raised (posed) or the hypothesis tested in order drive insights and innovation in healthcare.

2.5. Nexus between Health Information and Driving Insights and Innovation

The Six (6) Primary Objectives of managing health information as explained by Omole and Adebayo (2018) are:

1. **Continuous Care:** Health Information assists in providing the best medical care to the patient via the collection of recorded facts about health and illnesses that are contained therein.
2. **Communication:** Health Information provides a means of communication between the physician and other professional contributing to patients care.
3. **Planning and Administration:** Health Information provides documentary evidence of care rendered during each hospital visit or admission which serves as a means of generating statistical data for health care planning and effective health services administration.
4. **Medical Care Evaluation:** Health Information serves as basis for analysis study and evaluation of the quality of care rendered to the patient.
5. **Education and Research**: Health Information provides clinical data for use in the research and education in various Health and Medical Disciplines.
6. **Medico-Legal Purposes:** Health Information assists in protecting the legal interest of the patient, the hospital and the physician

In line with the above stated objectives, health information management professionals carefully generate and collect health information, take custody of health information, manage health information and selectively disseminate them to the legitimate users in the health care setting for the purpose of driving insight and innovation in healthcare**.**

Therefore the main goal of health information management practices is to support the process of decision making, which contributes to driving insight and innovation in healthcare

2.6. Challenges of Data Analytics and Health Information in Nigeria

Inadequate skilled manpower in information and communication technologies, and lack of mission oriented leadership with the right perception of health data/information as national health care resource are some of the limitations of data analytics and health information in Nigeria (Popoola, 2010)

Osundina (2014) identifies high starting cost, low budgetary allocation to health sector, epileptic power supply, network issues, and delay in data entries at the starting point as impediments to data analytics and health information

Omole et. al (2024) buttresses that unauthorized access, data corruption, destruction of backup, reduced productivity at the initial stage, staff retrenchment and unstable network availability may impede data analytics and health information

Amber (2023) reports that, nowadays, data analytics began with a transition from purely paper-based tracking to digitized information. However, many types of health data are yet to be digitized. He states further that; fragmented health data, changes to health data sets, regulations and compliance, also militate against data analytics and health information

3.0. Methodology

Analytical research design was used for the study. The method used in this paper is literature review, theoretical discussions and qualitative analysis, to draw inferences from existing literatures that; nexus between data analytics and driving insights and innovation in healthcare, nexus between health information and driving insights and innovation in healthcare and that data analytics and health information interplayed to drive insights and innovation in healthcare, as evident in previous research work and case studies.

4.0. Summary of Findings

Major findings of the study are outlined below:

1. Findings revealed that, the strategies for driving insights and innovation in healthcare is diffusion of new medical technologies into healthcare and technology adoption patterns in the healthcare settings.
2. Findings unveiled that, the basic models used for data analytics are; Descriptive analytics, Diagnostic analytics, Predictive analytics, Prescriptive analytics and Cognitive analytics
3. Findings revealed that, the methods of managing health information: manual and electronic methods and in agreement with health information life span, which are; health information creation, maintenance, use, evaluation, disposal and continuum.
4. Findings established that nexus exists between nexus between data analytics and driving insights and innovation in healthcare in Nigeria.

5. Findings revealed that nexus between health information and driving insights and innovation in healthcare in Nigeria.
6. Findings identified the challenges of health data management skills in the light of electronic health records, among these are: Low budgetary allocation to health sector, epileptic power supply, network issues, inadequate skilled manpower and delay in data entries, fragmented health data, changes to health data, regulations and compliance.

5.0. Conclusion

In the course of the study, inferences were drawn from existing literatures and theoretical analysis that, there is interconnection between data analytics and health information issues in driving insights and innovation in healthcare.

Health data analytic skills of health information professionals involve the ability to navigate data analytics software successfully. Because, possessing a strong comprehension of how various components of this software relate to each other is key to driving insights and innovation in healthcare.

Driving insights and innovation in healthcare depends on the extent to which data analytics skills are taken seriously by health information professionals, so as to promote availability of accurate, timely, reliable, and relevant health information, which is the most fundamental step towards driving insights and innovation in healthcare.

6.0. Recommendations

On the basis of the findings and conclusion of this study, the following recommendations are made;

1. Government at all levels are advised to give maximum support and required encouragement for the use of data analytics software to drive insights and innovation in healthcare

2. Government and owners of healthcare organizations should provide data analytics infrastructure that facilitates availability of hardware, software and procedures for enhancing health information that promotes insights and innovation in healthcare.

2. Health information professionals should get acquainted with the use of data analytics applications, for them to be able to navigate the software successfully in order to enhance their data analytics skills.

4. Government at all levels should also organize regular training and re-orientation workshop for health information professionals on data analytics skills to drive insights and innovation in healthcare.

Reference

1. Corbett, C. E. (2003). HIV-TB Co-infection: Epidemiology, Diagnosis and Management. Indian Journal of Medical Research, 121(4), 480-495.
2. Ejikeme, N., & Peter, G. A. (2010). Prevalence of Mycobacterium Tuberculosis and Human Immunodeficiency Virus (HIV) Infections in Umuahia, Abia State, Nigeria. African Journal of Microbiology Research, 4(14), 1486-1490.
3. Federal Ministry of Health. (2000). Tuberculosis and Leprosy Control Efforts in Nigeria. National Tuberculosis and Leprosy Control Programme (NTBLCP), 150.
4. Griffith, D., & Kerr, C. (1996). Tuberculosis: Disease of the Past, Disease of the Present. Journal of Perianesthesia Nursing, 11(4), 240–5.
5. Harries, A. D. (1990). Tuberculosis and HIV Infection in Developing Countries. The Lancet, 1, 387-390.
6. Idigbe, E. O., Nasidi, A., Anyiwo, C. E., Onubogu, C., Alabi, S., Okoye, R., Ugwu, O., & John E. K. (1994). Prevalence of Human Immunodeficiency Virus Antibodies in Tuberculosis Patients in Lagos, Nigeria. Journal of Tropical Medicine and Hygiene, 97(2), 91-97.
7. International Union Against Tuberculosis and Lung Disease (IUATLD). (2000). TB and HIV in: Management of TB, A Guide for Low-Income Countries, 15th Ed., 12.
8. Knoll, B., Lassmann, B., & Temesgen, Z. (2007). Current Status of HIV Infection: A Review for Non-HIV Treating Physicians. International Journal of Dermatology, 46(12), 1219–1228.
9. Olaniran, O., Hassan-Olajokun, R. E., Oyovwevotu, M. A., & Agunlejika, R. A. (2011). Prevalence of Tuberculosis among HIV/AIDS Patients in Obafemi Awolowo University Teaching Hospital Complex OAUTHC, ILE – IFE. International Journal of Biological and Medical Research, 2(4), 874-877.
10. Okodua, M. A., Nwobu, G. O., Tatfeng, Y. M., Ongey, J. Y., & Agwu, E. (2004). Incidence of HIV-Related Pulmonary Tuberculosis in Edo State, Nigeria. Shiraz E-Medical Journal, 5(1), 10–15.
11. Onipede, A. O., Idigbe, O., Ako-Nai, A. K., Omojola, O., Oyelese, A. O., Aboderin, A. O., Komolafe, A. O., & Wemambu, S. N. C. (1999). Seroprevalence of HIV Antibodies in TB Patients in Ile-Ife. East African Medical Journal, 76(3), 127-132.
12. Rothenberg, R. B., Scarlett, M., del Rio, C., Reznik, D., & O'Daniels, C. (1998). Oral Transmission of HIV. AIDS, 12(16), 2095–2105.
13. Salami, A. K., & Katibi, I. A. (2006). Human Immunodeficiency Virus Associated Tuberculosis: Pattern and Trend in the University of Ilorin Teaching Hospital. African Journal of Medical Sciences, 2, 12-15.
14. Silvero, A. M., Acevedo-Gadea, C. R., & Pantanowitz, L. (2009). Unsuspected Parvovirus B19 Infection in a Person with AIDS. The AIDS Reader, 19(6), 121-124.
15. World Health Organization. (2006). Global Tuberculosis Control – Surveillance, Planning, Financing. WHO Report 2006.
16. World Health Organization. (2007). Male Circumcision: Global Trends and Determinants of Prevalence, Safety and Acceptability, 1-30.
17. World Health Organization. (2008). WHO Report 2008: Global Tuberculosis Control. Retrieved from http://www.who.int/tb/publications/global_report/2008/annex_3/en/index.html
18. World Health Organization. (2010). Tuberculosis Fact sheet N°104. Retrieved from http://www.who.int/mediacentre/factsheets/fs104/en/index.html