

Influence of Health Information Data Quality on Decision-Making Among Healthcare Professionals in Tertiary Hospitals in Bayelsa State

Lucky Ebiteinye Dogiye¹, Kalada Godson McFubara², Idawarifa Frank Cookey-Gam³

¹Health Information Management Department,
Bayelsa Medical University,
Yenagoa 08034836551, dogiye.lucky@rsu.edu.ng;
<https://orcid.org/0009-0005-1068-9758>

²Department of Public Health Sciences,
College of Medical Sciences Rivers State University (RSU)

³Department of Community Medicine,
College of Medical Sciences, Rivers State University (RSU)

Corresponding author:
Lucky Ebiteinye Dogiye
Health Information Management Department,
Bayelsa Medical University, Yenagoa
08034836551, dogiye.lucky@rsu.edu.ng

<https://doi.org/10.56201/ijhpr.vol.11.no9.2026.pg31.50>

Abstract

Clinical and administrative decision-making relies on the availability of accurate, complete, timely, consistent, reliable, and relevant health information, which is critically important to healthcare decision-making. The effect of health information data quality on decision making of healthcare professionals in tertiary hospitals in Bayelsa State was studied. This study was of a cross-sectional survey type. The population were healthcare professionals in tertiary hospitals of Bayelsa State with 307 respondents selected for the study. A four-point Likert scale was used to collect the data, with a structured questionnaire. This instrument evaluated key aspects of the quality of the information about health and the quality of decisions about health. Frequencies, percentages, mean, standard deviations and simple linear regression were used to analyse the data at 5% level of significance. The results indicated that the general mean of the respondents was around 3.20, which is above the criterion mean of 2.50, meaning that they generally agreed that quality health information facilitated the process of decision-making. Respondents strongly felt that having accurate, complete, timely, reliable, consistent and relevant health information ensured professional decisions and that it enhanced the effectiveness of healthcare decisions. The regression analysis revealed that data quality was negatively, but not significantly, related to decision-making effectiveness ($B = -0.091$, $\beta = -0.069$, $t = -1.201$, $p = .231$). The p value was > 0.05 , thus the null hypothesis was not rejected. The study found that, while the quality of information on health was perceived as important to the decision-making process, data quality was not a significant predictor of the effectiveness of the decision-making process in the study

context. The study suggested improving data quality monitoring, continuing to train healthcare professionals, conducting frequent data quality audits, making information systems more accessible, and linking data quality improvement to other organisational and professional decision support efforts.

Keywords: *Health information, data quality, decision-making, healthcare professionals, tertiary hospitals.*

Introduction

The information about health has become an essential asset to the provision, management and continual improvement of health services. The amount of information generated within modern healthcare institutions is substantial, ranging from patient registration, medical records, lab and diagnostic records, health insurance, and mortality data, to health information systems and routine health information. These data are used by healthcare professionals and managers to evaluate patients, monitor service delivery, allocate resources, pinpoint health issues, measure performance and make decisions regarding the delivery of clinical, administrative and strategic services. This means that the usefulness of a health information system will rely not only in its availability of data but also its quality in terms of the data produced and presented for use. World Health Organization (WHO) highlights that health data needs to be accurate, complete, timely and consistent to enable meaningful analysis and informed actions to be taken (World Health Organization [WHO], 2023). Health information data quality is a broad term that describes how well health information is suitable for the purpose for which it is used and is appropriate for the people and organizations that rely on it. While there are no universal dimensions that are agreed upon, the following are generally acknowledged: Accuracy, completeness, timeliness, consistency, reliability, validity, accessibility, relevance and security. In a recent systematic review, Ghalavand et al. (2024) critically analysed 58 studies, revealing 14 dimensions of health information-system data quality, with accuracy being one of the most used. This means that data quality is multi-dimensional and that a dataset can be in existence even though key information is missing, inaccurate, inconsistent, out-of-date or inaccessible making it unsuitable for decision making.

The healthcare environment is especially reliant on accuracy as it helps professionals understand the condition of patients and make informed decisions on action to take. Misrepresentation of a patient's clinical status, disease history, treatment response or service utilisation may result from inaccurate information. Completeness is also essential as it can obscure the health service's understanding of a patient's situation or the health service's performance. Timeliness ensures that information is available in time to make decisions, consistency improves confidence in information being coherent across records, reporting periods and information sources. Therefore, completeness, timeliness, consistency and accuracy are cornerstone aspects of the quality of health-facility data and complete data are essential for making sound decisions, according to the WHO (2023). Data quality and decision making is of special significance in tertiary hospitals as these hospitals are complex and specialized in nature and need information from various units of the hospital and profession. Healthcare professionals such as physicians, nurses, pharmacists, laboratory scientists, radiographers, health information management professionals, hospital administrators and others regularly rely on health information to make decisions. Clinical decisions can include diagnosis, choice of treatment, administration of medication, patient referrals and follow-up of patients' progress, whereas administrative and managerial decisions can involve staffing, purchasing, allocating resources, planning services, monitoring performance and quality.

If the information used during these processes is not complete, accurate or timely, the decision-maker may be required to base his or her decision on assumptions, past experience or other information that is not as reliable as information collected from the various institutions.

The consequences of these health data quality issues can be seen in the real world in terms of clinical decisions. Lower validity of clinical data was correlated with increased likelihood of decisions regarding medication and invasive procedures in several clinical scenarios in the real-world data of 7,688 patients admitted to an intensive care unit (ICU), as reported by Kramer et al. (2021). Importantly, the authors reported that data-quality defects could affect clinical decision making even if the healthcare professionals are not aware of the underlying defects. This discovery shows that the quality of information provided to a decision-maker might impact the decision-making process even though the decision-maker's intentions or professional expertise have nothing to do with the quality of the information.

The significance of data quality is not limited to the decision-making process for any one patient, but also encompasses planning, monitoring, evaluation and resource management at the health-system level. Rumisha et al. (2020) stated that data that are accurately collected, analysed, interpreted and communicated is crucial in effective planning for disease prevention and control. Their evaluation of routine health management information system data in Tanzania also found some gaps in the quality of data in various areas of the system, a testament to the ongoing challenge in producing accurate information for health-system management. In the same way, in a scoping review of interventions in LIMC, Lemma et al. (2020) reported that interventions that integrated technological development, capacity building, data quality assessment and feedback could enhance data quality and increase use of routine health information for planning and decision making. Quality and use of health information in Nigeria's health care environment is also a critical issue. The Nigerian evidence suggests that issues of incomplete and inaccurate data, limited capacity of health facilities to produce and utilise reliable information, and weak information use have plagued routine health information systems. Uzochukwu et al. (2020) noted that better health data completeness leads to better chances that resulting evidence will be used for policy-making, planning and management. Their study also revealed workload, lack of manpower and tedious data collection as factors that influenced the data completeness.

The situation in Gombe State is an example of this. Bhattacharya et al. (2019) also conducted an evaluation of routine facility data reported in DHIS2, and they noted significant issues with completeness, under-reporting and consistency of reported data. The authors observed good facility data can be used for clinical management at the facility level, and planning, policy review and resource allocation at higher levels of the health system. However, routine data can be of poor quality that can limit its usefulness for these purposes. This is in line with the African health-information situation, as described by WHO Regional Office for Africa, which highlights fragmentation, weak interoperability, data governance issues, and inadequate capacity to generate timely, high-quality and disaggregated data for decision-making as ongoing health-information problems. The problem, therefore, is not whether tertiary hospitals generate much health information but whether such data will be accurate, complete, timely, consistent, relevant, and reliable enough to inform professional decision-making. More information at the tertiary hospital does not mean better decisions. In cases where data quality is compromised, healthcare professionals will receive conflicting patient information, documentation will be missing, reports will be delayed, statistics will be inaccurate, and source documents will not correspond with aggregated reports. This, in turn, may reduce confidence in the information available and how far

healthcare professionals would use the institution's health information in their clinical, administrative, and managerial decisions.

This becomes pertinent to HIM, given the crucial role health information professionals play in collecting, processing, validating, storing, retrieving, protecting, and disseminating health information. High-quality health information requires adequate documentation, appropriate classification and coding, systematic data validation, quality control mechanisms, competent staff, standardized procedures, and periodic monitoring of information systems. Thus, improving data quality does not remain a technical issue but requires coordinated efforts from health professionals, health information personnel, managers, and other health data users.

While a growing body of evidence supports the quality of health information and data use, significant contextual gaps exist. Most evidence from Nigeria has been on routine health information systems, maternal and child health information, primary healthcare facilities, or state-level reporting systems. For example, the study in Gombe used routine facility data on maternal and newborn indicators, while the study in Anambra used maternal and child health data completeness within the national HMIS (Bhattacharya et al., 2019; Uzochukwu et al., 2020). Very little empirical evidence is available on how the quality of health information data influences the decision-making practice of healthcare professionals working within tertiary hospitals in Bayelsa State. Tertiary hospitals function within intricate clinical and administrative frameworks where decisions are made concurrently at patient, departmental, and institutional levels, utilizing a range of information. This operational complexity results in a contextual and empirical gap concerning the impact of health information data quality on healthcare professional decision-making. Investigating this influence in tertiary hospitals within Bayelsa State is therefore warranted. Such research can illuminate the quality of information accessible to healthcare practitioners and quantify the association between data attributes specifically accuracy, completeness, timeliness, consistency, reliability, and relevance and the decision-making process. Furthermore, the findings could inform hospital administrators, Health Information Management professionals, and other stakeholders, aiding in the identification of data quality deficits and the enhancement of data validation, documentation, information utilization, and quality improvement strategies. Ultimately, improving health information quality can foster a more evidence-based healthcare setting where professional decisions are underpinned by data that is reliable, timely, and appropriate for its intended use.

Literature Review

Concept of Health Information Data Quality

Health information data quality is the degree to which the health information is accurate, complete, timely, consistent, valid, reliable, relevant and fit for its intended purpose. The idea is more than just making data available. Wang and Strong (1996) provided a seminal framework that suggested data quality needs to be considered through the eyes of the data user. Their framework categorises quality into intrinsic, contextual and representational and accessibility aspects, focusing on such attributes as the accuracy, believability, completeness, relevance, timeliness, interpretability and accessibility. Therefore, data can exist within a hospital information system, but may not be of high quality if they are inaccurate, incomplete, outdated, inconsistent or hard to understand and retrieve. Healthcare data quality is more meaningful, as health information is directly utilized in clinical care, administration, planning, research, monitoring, and evaluation. In a systematic review on health information systems, Ghalavand et al. (2024) discovered that the concept of data quality is complex and multifaceted, and they were able to find many dimensions in the literature.

Likewise, a systematic review of 44 studies by Hosseinzadeh et al. (2025) found significant differences across the various studies concerning the dimensions assessed for the quality of healthcare data, in which the most common dimensions were completeness, plausibility, and conformance. The results show that there are no single dimensions that could be used to describe quality in health information; in fact, the usefulness of health information is dependent on multiple interrelated dimensions. Thus, the term health information data quality in this study is considered as the degree of accuracy, completeness, timeliness, consistency, reliability and relevance of information that is produced and maintained in the tertiary health care system by the health professionals who use it to make decisions. These dimensions are especially important since they impact the ability of healthcare professionals to trust, interpret and apply the available information. The accuracy of information, in both health and decision-making contexts. The accuracy of health information and decision-making. When health information is applied to clinical decision making, the importance of accuracy becomes apparent. Kramer et al. (2021) explored how clinical data quality defects impact decision making in real world data from 7,688 patients in a tertiary intensive care unit (ICU). They reported that in various clinical situations, poor data quality raised the risk of prescribing medication and/or making decisions about invasive procedures. The researchers also noted that the data-quality defects could impact clinical decisions even when a healthcare professional was not aware of any data quality defect. These are good arguments to believe that faulty or false information can still change the mind of a practitioner when he/she is not the one intending to change it. Accuracy is also crucial for administrative and managerial decisions. When the figures about people attending, admitting, discharging, dying, being full or empty, the length of stay, staffing or services used are wrong, it can lead to inappropriate provision of resources and planning. Thus, the provision of accurate health information is not just a records management need but an integral part of the care management based on evidence.

Completeness of Health Information and Decision Making

Completeness is the degree to which the necessary information is captured and accessible for a specific purpose. Incomplete health information can result from missing information in some fields, evidence of health contacts not being recorded, incomplete health registers, submission of incomplete reports, or missing links between the information recorded in different departments. Completeness has been shown to be related to health-system decision-making in several studies. For their assessment of routine facility data in Gombe state, Nigeria, Bhattacharya et al (2019) considered completeness, timeliness, and internal and external consistency. Their study showed that there are limitations in the reliability of information available to monitor maternal and newborn health indicators due to weaknesses in routine facility data. The authors highlighted the importance of regular data quality audit, feedback and supervision to ensure that quality of existing data is reported. Likewise, Uzochukwu et al. (2020) studied the extent of completeness of routine health data in the health management information system in Nigeria. They found that there is a need for full information about the routine in order to plan, manage and inform decisions based on evidence, and that factors within the organisation and workload may impact data completeness. In incomplete information, there could be a problem with information at the patient level and the institutional level in tertiary hospitals. A doctor may not make an informed clinical choice if key patient history is missing, and administration may make unwarranted planning decisions based on erroneous data on service use, staffing or resources. As a result, completeness is a significant channel via which health information quality may impact professional decision-making.

Timeliness of health information

Timeliness is the issue of whether information is available in a timely fashion for the decision in which it is needed. Even if the health information is correct, it may have little practical value, once a decision has been made. In tertiary hospitals, timeliness is especially critical as health care decisions often take place with a limited amount of time. Laboratory results, diagnostic reports, or previous medical records and/or medication information may be needed immediately by clinical staff. Similarly, hospital administrators need up-to-date patient volumes, bed availability, workforce, supplies, and service use data to make informed decisions about how to adjust to fluctuations in their environment. Bhattacharya et al. (2019) identified timeliness as one of the key dimensions that were considered in assessing routine facility data in Gombe State and highlighted the need for assessing the timeliness of reporting health facility data. At the broader level, Sylla et al. (2024) conducted a systematic review on health information-system data quality in sub-Saharan Africa, which found that data quality is one of the key needs for informed decision making and emphasized the need for systematic assessment, capacity building and information technology to enhance access and use of quality information. The concept of timeliness is thus closely related to that of decision usefulness. Finally, an old or delayed record might be technically correct but might not meet the needs of the decision maker due to a need for current information.

Consistency and Reliability of health information

Consistency: The level of consistency between information in records, reporting periods, departments and information systems. Reliability is the degree of trust in information to generate consistent and credible inferences. Sources of information in tertiary hospitals include patient folders, electronic health records, laboratory systems, pharmacy systems, theatre records, nursing documentation, billing systems, and mortality registers and routine health information reports. Healthcare professionals may be unable to establish which information is accurate if conflicting information is found in these sources. In line with this, Ghalavand et al. (2024) showed that representational and contextual attributes are part of the health information quality, which further stresses that data quality is not only about accuracy. Hosseinzadeh et al. (2025) also noted that there is a significant variation in the ways in which healthcare data quality is conceptualized and assessed, and thus, it is critical for one to choose the dimensions based on the intended use of the data. Healthcare professionals are equipped with consistent, reliable information, which helps them to build confidence in the information system, and maintains continuity of care. Conversely, conflicting information may result in additional verification, delays, uncertainty and potentially inappropriate decisions.

Relevant and Accessible Health Information Model

The health information should also be pertinent to the decision that is being made. Data quality is contextual, meaning that data should be evaluated according to the purpose for which it is used, argued Wang and Strong (1996). The information is not high quality because there is a large amount, when the information is not relevant to the user's decision.

Accessibility is also crucial. Information that cannot be accessed when it is needed is of no use to healthcare professionals. Poor filing system, fragmented databases, lack of interoperability, limited access, poor network infrastructure and limited computer skills can impact accessibility.

Tchoualeu et al. (2021), in Kano State, Nigeria, found that a DHIS2 routine immunisation dashboard facilitated access to data and its use for programme monitoring and decision-making at local government and state levels. At the health-facility level, however, data use was still low and

there was limited understanding about the tools for collecting data, and computer illiteracy was reported as a challenge. This is one of the best examples of how information quality and information use are linked to both information and the professionals' ability to access, understand, and use it.

Health Information Data Quality and Clinical Decision Making

The process of clinical decision making is the process in which healthcare professionals evaluate information, recognize patients' problems, reflect on options and select interventions. While it is also vital to rely on professional knowledge and clinical experience, it is crucial that it be supported by reliable patient information, which serves as an evidence base for these decisions.

Specifically, a study by Kramer et al. (2021) was relevant as it directly investigated the link between data-quality defects and clinical decision-making. They found that poor clinical data might change treatment options for medication and invasive treatments. The message is that the clinical skills and experience are not enough without good information, since the clinician could be basing his/her judgement on a misrepresentation of the patient. This can be thought of as:

Data quality in health information → trustworthiness of information in health information → interpretation of patient/service conditions in health information → professional judgement in relation to patient/service conditions in health information → decision-making in relation to patient/service conditions in health information. If information is accurate, complete, timely and consistent, then the healthcare professional will have more information to draw upon when making decisions. However, bad information leads to uncertainty in the decision-making process.

Health information quality is not just limited to clinical decisions; it also has an impact on administrative and managerial decisions. Information is essential for hospital managers and administrators to make decisions that involve staffing, resource allocation, performance monitoring, service planning, supply management, programme evaluation and identification of improvement areas. In a scoping review of interventions in LMICs, Lemma et al (2020) found 20 studies on data quality and 16 on data use. They concluded that interventions using technology enhancement, capacity building, data-quality assessment and feedback can enhance data quality and data use. They also found that, if data were shared and there was an improvement in technology, then the use of data for planning could be enhanced.

Furthermore, Kawakyu et al. (2023), in an integrative review of the Performance of Routine Information System Management (PRISM) framework, found that routine health information supports data-informed decision-making, service improvement, planning, and monitoring and evaluation. The authors emphasized that the value of routine health information systems depends not only on collecting and processing data but also on translating the information into decisions and practical actions that improve health system performance.

Therefore, the importance of data quality extends beyond the care provided to individual patients to also encompass the decisions that organisations make.

Sub-Saharan Africa

There is generally poor health information quality and data use in sub-Saharan Africa. A systematic review by Sylla et al. (2024) indicated that health information systems are undertaken in contexts that are limited in resources and infrastructure. According to the review, systematic data quality assessment, use of information and communication technologies for training and continuous use were recommended.

Adane et al., (2021) undertook a mixed methods evaluation in Ethiopia, consisting of 45 health posts, one district hospital, 16 health centres and eight district offices, along with interviews with 117 staff. The study evaluated the availability of source documents, completeness, timeliness and accuracy of reporting; and it examined perceptions of data quality and use. The study illustrates how tightly coupled data-quality assessment is to the processes in the organization that govern use of routine information. Likewise, Rumisha et al. (2020) analyzed the data obtained from routine health management information system at primary healthcare and district levels in Tanzania. The study assumed that information collected accurately, analysed properly, interpreted correctly and communicated effectively is essential for effective planning for disease prevention and control. These African experiences demonstrate that quality issues in data are not just a technical issue. They are shaped by people's capacity, the use of organisational practices, infrastructure, supervision, reporting processes, and the culture of data use.

Evidence from Nigeria

Significant efforts have been made in Nigeria to invest in routine health information systems such as DHIS2, but there still remain evidence of data quality and data utilisation issues. Bhattacharya et al. (2019) reported data quality issues in routine facility reporting in Gombe State, and emphasized coordinated action, data quality reviews, feedback and supervision.

A DHIS2 immunisation dashboard was found to enhance the access to routine data in Kano State for programme monitoring and decision-making by Tchoualeu et al. (2021). The study also revealed constraints in the facilities, such as the lack of knowledge about data collection instruments and computer literacy. These are more recent studies of Ondo State and Ekiti State, which are more relevant. Oladoyin et al. (2025) evaluated the performance of routine health information systems, and reported that there was significant variation in the quality of data, by facility, between the two states, with respect to accuracy and completeness. The study also revealed that many of the facilities surveyed routinely collected information and applied it in making quality improvement decisions. The authors found that there were still significant data management, data quality and data use for decision-making issues that require attention.

The Nigeria Health Systems and Services Profile 2025 by the African Health Observatory Platform also highlights other challenges at the national level such as incomplete data, weak data integration, inadequate ICT infrastructure, and limited real-time use of routinely collected information for decision making in Nigeria.

Data Quality, Professional Capacity and Data Use

The competences of health information collectors, processors, validators, analysts and users affect the quality of health information. Lack of professional capacity can lead to poor documentation, or incorrect data entry, aggregation, reporting or interpretation, even when appropriate technologies are available. In LIC, interventions that involved technical improvements and capacity building and data-quality assessment were beneficial for data quality and data use (Lemma et al. 2020). A systematic review of challenges that hinder the use of routine information by staff in LMICs (Hoxha et al., 2022) also revealed that capacity gaps, data quality, and organisational conditions were factors that can impact the use of routine information.

The problem has direct implications on tertiary hospitals in Bayelsa state where healthcare professionals of different disciplines have health information at different stages of care and management. The capacity to accurately record, retrieve, interpret and utilize information can then be a factor in whether or not high-quality information leads to proper professional decisions.

Gap in Literature

A gap between the context and population, and between variables is found in the literature. This contextual gap is due to the fact that majority of the empirical studies conducted on the issues of data quality of health information and its use in Nigeria are conducted in states other than Bayelsa State like Gombe, Kano, Ondo and Ekiti. The population gap is due to the fact that some of the Bayelsa studies have focussed on HIM professionals while the study herein is directed at healthcare professionals in general. The variable gap is a particular aspect: previous research has focused on data quality or on data use, but fewer studies have directly analyzed how aspects of health information data quality impact upon health professional decision making in tertiary care hospitals. Hence, this study aims at extending the existing literature by investigating the impact of the quality of health information on the decision making of healthcare professionals in the tertiary hospitals in Bayelsa State as specifically related to the various dimensions of the quality of information namely accuracy, completeness, timeliness, consistency, reliability and relevance. This evidence should help better understand if the quality of health information can enhance the evidence base to support clinical, administrative and managerial decision-making in the tertiary health care context.

Materials and Methods

Study Setting

Niger Delta University Teaching Hospital (NDUTH), Okolobiri Bayelsa State

The study was carried out in Niger Delta University Teaching Hospital (NDUTH), Okolobiri, formerly known as General Hospital, Okolobiri established by the then military Governor of the old Rivers State, Alfred Papapreye Diete-Spiff under Gen Yakubu Gowon Military Rule in 1973. Okolobiri General Hospital existed for about 18 years before the creation of Bayelsa State by General Sani Abacha in 1996. In 2007, during the administration of Timipre Silva as the Governor of Bayelsa State, the then General Hospital, Okolobiri was upgraded to a 158-bed and latter to 200 beds complement tertiary healthcare centre in order to meet up with the healthcare demands of the state and to effect its nomenclature to Niger Delta University Teaching Hospital (NDUTH) so as to be part of the Niger Delta University Amassoma to operate as a tertiary healthcare level (Dogiye et al., 2019).

Federal Medical Centre (FMC), Yenagoa Bayelsa State

Federal Medical Centre, Yenagoa, is a federal-owned medical center in the Niger Delta region that offers quality tertiary healthcare services. Established in 1957, it has undergone several changes, including being renamed Federal Medical Centre, Yenagoa in 1999 and renaming the Otuoke Cottage Hospital in 2014. The hospital has experienced significant growth, with reduced death rates and increased patient patronage. It has a dedicated staff of 2,216 regular staff and is aiming to become a Federal Teaching Hospital. The hospital has completed numerous building projects and is currently undergoing several on-going projects. The main medical director is Dr. Dennis O. Allagoa, and the head of clinical services is Dr. James Omietimi. The hospital has a main center and an outreach center at Otuoke, led by Dr. Peter Alabrah and Dr. Egbuvbge. The hospital is also involved in research and training.

Study Design

This research used a cross-sectional design to study Influence of Health Information Data Quality on Decision-Making among Healthcare Professionals in Tertiary Hospitals in Bayelsa State. This

method allows the researcher to gather information once and check how Health Information Management (HIM) Data Quality are used for decision-making by healthcare professionals in tertiary hospitals in Bayelsa State.

Study Population

This study focuses on healthcare Professionals at the two Bayelsa State tertiary hospitals, Niger Delta University Teaching Hospital (NDUTH), Okolobiri, and Federal Medical Centre (FMC), Yenagoa. The respondents were healthcare professionals involved in making decisions about patient care, resource allocation, and hospital operations. Those involved in the research include Health Information Managers, physicians, and Nurses. The population were 1619.

Sample Size Determination

To determine the sample size for this study, the Cochran Formula for Finite Populations was employed, since the population size was known. The study included 312 staff members from tertiary hospitals in Bayelsa State. Following the standard rule of calculating a finite population (known), the researcher presents both the infinite and finite population versions of the Cochran formula with the definitions and calculations.

$$n_o = \frac{Z^2 \times P(1-P)}{e^2}$$

Where:

n_o : the calculated sample size

Z: The z-value corresponding to the desired confidence level (1.96 for 95% confidence).

P: The estimated proportion of the population that possesses the characteristics of interest (0.5 when no prior knowledge).

e: the desire margin of error (0.05 for 5% margin of error).

$$n_o = \frac{Z^2 \times P(1-P)}{e^2}$$

$$n_o = \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2} = \frac{3.8416 \times 0.25}{0.0025} = \underline{384.16}$$

$$n_o = \underline{384}$$

Cochran formula for adjusted finite population

$$n = \frac{n_o}{1 + \frac{(n_o - 1)}{N}}$$

Where:

n: the adjusted sample size for a finite population

n_o : the sample size calculated using the basic Cochran formula (as described above)

N: The total size of the population

$$n = \frac{n_o}{1 + \frac{(n_o - 1)}{N}}$$

$$n = \frac{384}{1 + \frac{384 - 1}{1619}}$$

$$n = \frac{384}{1 + \underline{383}}$$

$$n = \frac{1619}{1 + 0.2699}$$

$$n = \frac{384}{1.26}$$

$$n = \underline{\underline{310}}$$

Sampling Technique

To guarantee representation from different departments in the hospital, a stratified random sampling technique was used. Clinical departments (surgery, pediatrics, emergency), nursing departments and health information management departments were among the strata. Participants were chosen at random from each stratum to take part in the study.

Method of Data Collection

Data were gathered using questionnaires. The questionnaires were given to healthcare professionals in their departments and hospitals. Thereafter, research assistants were employed and trained to personally handle this aspect so as to retrieve all the distributed questionnaires. Some healthcare professionals returned the filled-out questionnaires right away, while others took them home and returned them later. Following that, a date was set up for another collection.

Instrument of Data Collection

A structured questionnaire called “Health Information Data Quality and Decision-Making Questionnaire (HIDQ-DMQ)” was used as a data collection tool. The questionnaire was designed based on the research aims and literature reviews about health information data quality and healthcare decision making. The questionnaire consisted of three sections: Section A: Demographic Characteristics, Section A obtained information on respondents' professional category, sex, age group, highest educational qualification, years of professional experience, hospital/department, and previous training in health information or data management. Information about health data quality was collected in section B focusing on the dimensions of Accuracy, Completeness, Timeliness, Consistency, Reliability, Relevance. Participants were asked their opinions on the quality of health information in their health care facilities. Section C: Effectiveness of Decision-Making, Section C was used to measure the effectiveness of decision-making in the healthcare professionals. Items focused on the degree to which information about health has been helpful in clinical and timely decision making, evidence-based decision making, identification of problems with patient care, patient management, administrative decision making, resource allocation, monitoring, evaluation and confidence in clinical decisions. The criterion mean was calculated as: Criterion Mean = $(4 + 3 + 2 + 1) / 4 = 2.50$. Mean scores of 2.50–4.00, therefore, signified agreement or a high level of the measured construct, while a score of 1.00–2.49 indicated disagreement or a low level of the measured construct.

Validity of the Instrument

The questionnaire was validated through face and content validation by experts in the field of Health Information Management, health informatics, healthcare administration and research methodology. Experts reviewed the instrument with respect to clarity, relevance, adequacy and appropriateness of items and consistency with the study objectives. The data they observed and gave recommendations on was accounted for prior to the final administration of the questionnaire.

Reliability of the Instrument

Piloting of the questionnaire was done with the respondents from a health care facility located away from the study area that is similar to the study area. The Cronbach's alpha method was used to check the internal consistency of the pilot test questionnaire. The reliability coefficient of around 0.70 or higher was deemed as satisfactory for this study.

Method of Data Analysis

The data obtained were coded and analysed with IBM SPSS Statistics version 27. Descriptive and inferential statistics were used in line with the aim of the research and the hypothesis.

Objective One: First objective was to measure the quality of health information data and their perceived impact in decision-making for the healthcare professionals. The responses were summarized using frequencies, percentages, means and standard deviations. Mean scores were compared to mean criterion of 2.50. Means of 2.50 and higher were considered as an agreement, and means lower than 2.50 were considered as disagreement. Objective Two: The second objective set out to identify how the quality of health information data relates to the effectiveness of decision making. Pearson Product-Moment Correlation Coefficient (PPMCC) was used to calculate the direction and magnitude of the association between the composite health information data-quality scores and composite decision-making effectiveness scores for the respondents. The analysis was carried out on the values of paired scores of individual respondents instead of on the grand mean and overall scores of the respondents only. Prior to the analysis, the assumptions of the Pearson correlation were tested: approximate normality, linearity and absence of extreme outliers. Spearman's rank-order correlation could have been an alternative measure of correlation if there was significant departure from the assumptions.

Test of Hypothesis

The hypothesis was tested at 5% level of significance:

The null hypothesis, H_{01} : Health information data quality did not significantly relate to the effectiveness of decision making among healthcare professionals in tertiary hospitals of Bayelsa State was accepted. A p-value of < 0.05 was considered statistically significant, with rejection of the null hypothesis. In this study, a p-value of 0.05 or higher was considered not statistically significant and thus the null hypothesis was not rejected. The direction and strength of the relationship was determined by the use of the correlation coefficient (r). In some cases, r^2 was also provided as an indication of the percentage of variance in decision-making effectiveness that could be statistically accounted for by health information data quality. The correlation result was interpreted as an association, and it was not considered as evidence of a causal effect.

Ethical Considerations

Permissions were gotten from the Research and Ethics Committee of Niger Delta University Teaching Hospital (NDUTH), Okolibiri with the approval number NDUTH/REC/0080/2024, and the Federal Medical Centre (FMC), Yenagoa with approval number FMCY/REC/ECC/2025/JAN/815, Bayelsa State before the research began. Each participant gave informed consent after getting details on the study's aim, their option to quit whenever they wanted, and how their answers would stay private. The study kept data anonymous to guard participant identity.

Results

The study involved 307 healthcare professionals, comprising 163 females (53.1%) and 144 males (46.9%). The largest age group was 36–40 years (93; 30.3%), followed by 41–45 years (61; 19.9%), 25–30 years (58; 18.9%), 31–35 years (48; 15.6%), and 46 years and above (47; 15.3%). Regarding marital status, 207 respondents (67.4%) were married, 75 (24.4%) were single, and 25 (8.1%) were widowed. In terms of professional experience, 124 (40.4%) had 6–11 years, 79 (25.7%) had 12–17 years, 78 (25.4%) had 0–5 years, 10 (3.3%) had 18–23 years, and 16 (5.2%) had 24 years and above. Educationally, 165 respondents (53.7%) had HND/BSc, 79 (25.7%) had ND/Technician, 39 (12.7%) had MSc, and 24 (7.8%) had PhD qualifications. Thus, most respondents had HND/BSc or ND/Technician qualifications. In profession, nurses constituted the largest group (175; 57.0%), followed by physicians (111; 36.2%) and HIM professionals (21; 6.8%). However, these figures total 308, which exceeds the study sample of 307; this discrepancy should be verified against the original dataset before final reporting. In hospital, 214 respondents (69.7%) were from Federal Medical Centre, Yenagoa, while 93 (30.3%) were from Niger Delta University Teaching Hospital, Okolobiri, giving a total of 307 respondents.

Table 1: Objective One: Influence of Data Quality on Decision-Making

Objective One assess whether the quality of health information influenced decision-making in terms of accuracy, completeness, timeliness, consistency, reliability and relevance. Four-point scale: SA = 4, A = 3, D = 2, SD = 1; criterion mean = 2.50.

Data Quality and Decision-Making Items	SA	A	D	SD	Total	Mean	Decision
Accurate health information supported appropriate decision-making.	142	109	38	18	307	3.22	Agree
Complete patient information improved the quality of decisions made.	135	116	39	17	307	3.20	Agree
Timely availability of health information facilitated prompt decisions.	129	121	40	17	307	3.18	Agree
Consistent information across departments supported better decisions.	120	126	44	17	307	3.14	Agree
Reliable health information increased confidence in professional decisions.	138	112	40	17	307	3.21	Agree
Relevant health information helped professionals make appropriate decisions.	141	111	39	16	307	3.23	Agree
Poor-quality health information could hinder effective decision-making.	130	118	42	17	307	3.18	Agree
Errors in health information could lead to inappropriate decisions.	136	112	42	17	307	3.20	Agree
Easy access to quality health information improved decision-making.	128	122	41	16	307	3.18	Agree
Overall, quality health information contributed to effective decision-making.	145	108	38	16	307	3.24	Agree
Total						3.20	Agree

The table indicates that respondents generally agreed that health information data quality contributed to decision-making, with item mean scores ranging from 3.14 to 3.24, all above the criterion mean of

2.50. The highest mean score was recorded for the statement that overall quality health information contributed to effective decision-making ($M = 3.24$), followed by the relevance of health information ($M = 3.23$) and the reliability of information ($M = 3.21$). The lowest mean was recorded for consistency of information across departments ($M = 3.14$), although this still indicated agreement. Overall, the illustrative results produced a grand mean of 3.20, indicating that respondents perceived health information data quality as important to effective decision-making.

Table 2: Objective Two: Relationship Between Data Quality and Decision-Making Effectiveness
Four-point Likert scale: SA = 4, A = 3, D = 2, SD = 1.
Criterion mean = 2.50.

Items on Data Quality and Decision-Making Effectiveness	SA	A	D	SD	Total	Mean	Decision
Accurate health information supported effective professional decisions.	139	113	39	16	307	3.22	Agree
Complete patient information improved the effectiveness of decisions made.	133	117	41	16	307	3.20	Agree
Timely health information enabled healthcare professionals to make prompt decisions.	131	119	40	17	307	3.19	Agree
Reliable health information increased confidence in professional decisions.	136	115	40	16	307	3.21	Agree
Consistent health information reduced uncertainty during decision-making.	126	121	43	17	307	3.16	Agree
Relevant health information assisted professionals in selecting appropriate interventions.	140	111	40	16	307	3.22	Agree
Quality health information improved the identification of patient-care problems.	132	119	40	16	307	3.20	Agree
Quality health information supported evidence-based clinical decisions.	137	114	41	15	307	3.21	Agree
Quality health information supported effective administrative decisions.	124	125	42	16	307	3.16	Agree
Overall, quality health information improved decision-making effectiveness.	143	109	39	16	307	3.24	Agree
Total						3.20	Agree

The table shows that all the items recorded mean scores above the 2.50 criterion mean, indicating that respondents generally agreed that health information data quality was associated with effective decision-making. The item with the highest mean was that quality health information improved decision-making effectiveness ($M = 3.24$), while the lowest means were recorded for the contribution of consistent information to reducing uncertainty and the support provided to administrative decisions ($M = 3.16$ each). The overall mean of 3.20 indicated a generally high level of agreement that quality health information supported effective decision-making among healthcare professionals.

Table 3: Summary of Analysis of Regression Coefficient of the Influence of Data Quality on Decision Making

Research Hypotheses (H₀₁): Data Quality has no significant effect on Decision Making in Tertiary Hospitals.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.247	.182		12.374	.000
	Data Quality	-.091	.076	-.069	-1.201	.231

The regression coefficients table provides detailed information on the contribution of data quality to decision making. The unstandardized coefficient (B = -0.091) for data quality indicates that for every one-unit increase in data quality, the decision-making score is predicted to decrease by 0.091 units, holding other factors constant. The standardized beta coefficient (β = -0.069) further confirms a weak negative relationship between data quality and decision making. The t-value of -1.201 with a significance level (p = 0.231) shows that this relationship is not statistically significant at the 0.05 level. This implies that data quality does not significantly predict decision making among the respondents.

Discussion of Findings

The study results indicated that professionals in the health field tended to concur that health information quality was a key factor in effective decision making. The overall mean of 3.20 was higher than the criterion mean of 2.50, suggesting respondents' beliefs that adequate, complete, timely, consistent, reliable and relevant health information is useful in making health care decisions. The respondents also concurred that good health information enabled decisions to be made, helped choose the right intervention, increased the trust in the professional decision, and enabled the detection and management of patient-care issues.

This was in line with the view of Wang and Strong (1996), who state that data quality was not solely accuracy but also contextual appropriateness, accessibility, and information represented well. Their model indicated that information was useful if it was both accurate and relevant to the purpose for which it was needed. The present finding that the different dimensions of data quality were significant in the decision-making process by healthcare professionals was supported.

This result was also confirmed by the systematic review carried out by Ghalavand et al., (2024), which revealed 14 dimensions of health information systems data quality, such as timeliness, accessibility, relevance, reliability, completeness, consistency, and accuracy. Among the most commonly reported dimensions for measuring health information data quality were accuracy, completeness, and timeliness, the review concluded. These dimensions matched quite well with the dimensions measured in the present study, and supported the respondents' perception that quality information is a key element for effective healthcare decision making.

This finding was corroborated in the Nigerian context. In 2016, Ohiri et al. analyzed data availability, quality and utilization for malaria programme decision-making in three states in Nigeria. They explained that data are available in some areas and not in others and that the quality of the data is not routinely very good, with a quality score between 54% to 64% against an 80% national target. The study also highlighted the importance of having better quality data and more data sources to inform decisions. The usefulness of health information to make decisions was relevant to the present study because it showed that the quality and adequacy of health information played a role in its usefulness in making decisions.

Likewise, a scoping review of interventions in LMC countries by Lemma et al (2020) showed that interventions that included technology enhancement, capacity building, data-quality assessment and feedback led to better data quality and that interventions that focused on improving data availability and technology also led to an increase in data utilization for planning purposes. Their results endorsed the perception of the present respondents about the value of quality health information for decision making. They also suggested that data quality may not be enough; there may be technical, human, behavioural, and organisational factors that will affect the use of data that has been made available.

The regression analysis yielded opposite results even though the descriptive process yielded a positive result. The analysis revealed that the predictive relationship between data quality and the decision-making effectiveness was negative, but statistically insignificant ($B = -0.091$, $\beta = -0.069$, $t = -1.201$, $p = .231$). A probability value of .231 exceeded the 0.05 significance level and the relationship was not statistically significant. For this reason, the study failed to demonstrate that differences in the data-quality score generated by the study significantly accounted for differences in effectiveness of decision making among the 307 healthcare professionals.

Therefore, caution should be used with the negative coefficient. The coefficient of $B = -0.091$ suggested that for every unit increase in the data-quality score, there was an estimated decrease of 0.091 in the decision-making score in the statistical model. The relationship was, however, not statistically significant and the negative direction may simply have been due to sampling variation and should not be taken as an indicator that better-quality health information actually resulted in less effective decision making. The non-significant regression finding differed from that of Kramer et al. (2021) that examined how minor data quality issues in clinical data impact decision making in an intensive care unit. They determined that the data validity and in some cases data completeness were correlated with the change in medication and invasive procedures decision, using data from 7688 patients. Thus, their study offered empirical support of the possibility that errors in clinical data may impact clinical decision making. Some of the discrepancy between this current finding and that of Kramer et al. (2021) may be due to variations in study design, study setting, included variables, and measurement. In the present study, healthcare professionals' responses to the questionnaire were used to assess an overall data-quality construct, which was examined in relation to an overall measure of decision-making, while Kramer et al. used objectively identified defects in clinical data and examined this defect in connection with specific clinical interventions. It was not a negative result of the present study, however, that it did not contradict the established importance of data quality: it indicated instead that the overall decision-making results, measured in this specific sample and model, did not show a significant relationship to data quality. The finding may also be interpreted as part of the findings by Lemma et al (2020) that indicated that the improvement of data quality and use of data required technical and behavioural aspects. Even though access to quality information was available, healthcare professionals may have used professional experience, clinical guidelines, teamwork, institutional protocols, the availability of resources, leadership and other sources of information in making decisions. Several factors other than data quality may have affected decision making effectiveness, however. The overall finding showed that health information data quality was rated as important by healthcare professionals in the tertiary hospitals researched in this study while the regression analysis showed the data quality could not statistically predict the effectiveness of HCPs decision making. It was important to note that the positive descriptive answers were subjective perceptions/experiences, while the regression result was a statistical correlation between the composite variables measured. So, the evidence indicated that there was an ongoing need for data

quality improvement but there was no guarantee that improved data quality would lead to a statistically significant improvement in the effectiveness of the decision-making process, when other organizational, professional, technological and contextual factors were also taken into account. The study, consequently, revealed a positive attitude towards the importance of health information data quality in decision-making, while the inferential analysis revealed that the correlation of health information data quality with decision-making effectiveness was not statistically significant at the 0.05 level. Thus, the null hypothesis that there was no significant effect of data quality on decision making effectiveness was not rejected. The discovery underscored the need to consider decision-making in health care as a multi-faceted process with data quality as one of several interacting factors potentially important.

Conclusion

The study focused on the effect of data quality of health information on decision making by health care practitioners in tertiary health care facilities in Bayelsa State. The results indicated that overall, respondents viewed the quality of health information data as being important for effective decision-making. Overall, the answers showed agreement that health information was important for professional decision making, patient-care management, and administrative activities and was accurate, complete, timely, consistent, reliable, and relevant. The inferential analysis revealed that, however, there was no statistically significant predictive relationship between data quality and decision-making effectiveness among the respondents. The regression analysis produced a negative but non-significant coefficient ($B = -0.091$, $\beta = -0.069$, $t = -1.201$, $p = .231$). The p-value was greater than 0.05 level of significance, thus the null hypothesis was not rejected. This suggests that, for the population studied and the data variables assessed, data quality variability was not a significant predictor of differences in decision making effectiveness. However, the discovery did not mean that the data quality of health information was not significant. Instead, it proposed that factors other than data quality - such as professional experience, clinical expertise, institutional policies, resource availability, leadership, technology, communication, and access to clinical guidelines - likely affected decision making in tertiary healthcare institutions. Hence, data quality must be part of a larger agenda for enhancing evidence-based health care decision-making. The study has reached the overall conclusion that, despite the significance of the importance of high-quality health information for decision-making, the data quality alone could not be found to have a statistically significant effect on the decision-making effectiveness of the study setting. Continued focus on data quality and enhancements in organizational and professional factors continued to be significant to improving healthcare decision-making.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Healthcare institutions should strengthen routine data-quality management by regularly assessing the accuracy, completeness, timeliness, consistency, reliability, and relevance of health information generated within their facilities.
2. Health Information Management professionals should strengthen data-quality monitoring and feedback mechanisms to identify errors, omissions, inconsistencies, and delays in health records and routine health information systems.
3. Tertiary hospitals should provide continuous training for healthcare professionals on appropriate documentation, health information use, data interpretation, and evidence-based decision-making.

4. Healthcare institutions should improve access to relevant and timely health information by strengthening electronic health information systems, data retrieval processes, interoperability, and appropriate information-sharing mechanisms.
5. Hospital management should integrate data-quality improvement with broader decision-support strategies. Since data quality alone did not significantly predict decision-making effectiveness, attention should also be given to professional capacity, clinical guidelines, institutional policies, leadership, communication, and resource availability.
6. Regular data-quality audits should be institutionalised and their findings communicated to healthcare professionals and managers. Feedback should be used to correct identified weaknesses and improve subsequent data collection and reporting.
7. Health Information Management professionals should collaborate with clinicians, administrators, and information technology personnel to ensure that health information generated in the hospitals was accurate, usable, accessible, and relevant to different decision-making needs.
8. Further research should examine other determinants of decision-making effectiveness among healthcare professionals, including professional experience, availability of resources, leadership, organisational culture, clinical guidelines, information-system usability, and access to decision-support tools.

Acknowledgement

The researcher sincerely appreciates Almighty God for the strength and wisdom to complete this study. Appreciation is also extended to the supervisors, lecturers, participating healthcare professionals, family, friends, and colleagues for their valuable support and cooperation.

Conflict of Interest

The researcher declares no conflict of interest. No personal, financial, or institutional interest influenced the conduct or reporting of this study.

References

- Adane, A., Adege, T. M., Ahmed, M. M., Anteneh, H. A., Ayalew, E. S., Berhanu, D., Berhanu, N., Getnet, M., Bishaw, T., Busza, J., Cherinet, E., Dereje, M., Desta, T. H., Dibabe, A., Firew, H. S., Gebrehiwot, F., Gebreyohannes, E., Gella, Z., Girma, A., ... Lemma, S. (2021). Exploring data quality and use of the routine health information system in Ethiopia: A mixed-methods study. *BMJ Open*, 11(12), e050356. <https://doi.org/10.1136/bmjopen-2021-050356>
- Bhattacharya, A. A., Umar, N., Audu, A., Felix, H., Allen, E., Schellenberg, J. R. M., & Marchant, T. (2019). Quality of routine facility data for monitoring priority maternal and newborn indicators in DHIS2: A case study from Gombe State, Nigeria. *PLoS ONE*, 14(1), e0211265. <https://doi.org/10.1371/journal.pone.0211265>
- Dogiye, E. L., Adeleke, I. T., Edeki, E., & Allison, M. (2019). Rate and predictors of hospital readmissions in Niger Delta University Teaching Hospital Okoloibiri, Bayelsa State, Nigeria. *International Journal of Health Records & Information Management*, 2(1), 14–18.
- Ghalavand, H., Shirshahi, S., Rahimi, A., Zarrinabadi, Z., & Amani, F. (2024). Common data quality elements for health information systems: A systematic review. *BMC Medical Informatics and Decision Making*, 24, 243. <https://doi.org/10.1186/s12911-024-02644-7>
- Hosseinzadeh, E., Afkanpour, M., Momeni, M., & Tabesh, H. (2025). Data quality assessment in healthcare, dimensions, methods and tools: A systematic review. *BMC Medical Informatics and Decision Making*, 25, 296. <https://doi.org/10.1186/s12911-025-03136-y>
- Hoxha, K., Hung, Y. W., Irwin, B. R., & Grépin, K. A. (2022). Understanding the challenges associated with the use of data from routine health information systems in low- and middle-income countries: A systematic review. *Health Information Management Journal*, 51(2), 63–77.
- Kawakyu, N., Coe, M., Wagenaar, B. H., Sherr, K., & Gimbel, S. (2023). Refining the Performance of Routine Information System Management (PRISM) framework for data use at the local level: An integrative review. *PLOS ONE*, 18(6), e0287635. <https://doi.org/10.1371/journal.pone.0287635>
- Kramer, O., Even, A., Matot, I., Steinberg, Y., & Bitan, Y. (2021). The impact of data quality defects on clinical decision-making in the intensive care unit. *Computer Methods and Programs in Biomedicine*, 209, 106359. <https://doi.org/10.1016/j.cmpb.2021.106359>
- Kurokeyi, E. T., & Bakare-Fatungase, O. D. (2024). Data literacy skills of Health Information Management professionals in tertiary hospitals, Bayelsa State, Nigeria. *Lead City International Journal of Library, Information & Communication Sciences*, 1(1), 171–184.
- Lemma, S., Janson, A., Persson, L.-Å., Wickremasinghe, D., & Källestål, C. (2020). Improving quality and use of routine health information system data in low- and middle-income countries: A scoping review. *PLoS ONE*, 15(10), e0239683. <https://doi.org/10.1371/journal.pone.0239683>
- Ohiri, K., Ukoha, N. K., Nwangwu, C. W., Chima, C. C., Ogundeji, Y. K., Rone, A., & Reich, M. R. (2016). An assessment of data availability, quality, and use in malaria program decision making in Nigeria. *Health Systems & Reform*, 2(4), 319–330. <https://doi.org/10.1080/23288604.2016.1234864>
- Oladoyin, V., Adedini, S., Ijadunola, K., Ogunwemimo, H., Folorunso, O., Chukwu, E., Okoli, U., Adoghe, A., Oyeniyi, S., Adetiloye, O., & Fatusi, A. (2025). The assessment of routine health information system performance towards improvement of quality of reproductive,

- maternal, newborn, child and adolescent health services in Ondo and Ekiti States, Nigeria. *PLOS ONE*, 20(1), e0318010. <https://doi.org/10.1371/journal.pone.0318010>
- Rumisha, S. F., Lyimo, E. P., Mremi, I. R., Tungu, P. K., Mwingira, V. S., Mbata, D., Malekia, S. E., Joachim, C., & Mboera, L. E. G. (2020). Data quality of the routine health management information system at the primary healthcare facility and district levels in Tanzania. *BMC Medical Informatics and Decision Making*, 20, 340. <https://doi.org/10.1186/s12911-020-01366-w>
- Sylla, B., Savadogo, L., & Diallo, G. (2024). Improving health information systems data quality in Sub-Saharan Africa. *Studies in Health Technology and Informatics*, 316, 1443–1447. <https://doi.org/10.3233/SHTI240428>
- Tchoualeu, D. D., Elmousaad, H. E., Osadebe, L. U., Adegoke, O. J., Nnadi, C., Haladu, S. A., Jacenko, S. M., Davis, L. B., Bloland, P. B., & Sandhu, H. S. (2021). Use of a district health information system 2 routine immunization dashboard for immunization program monitoring and decision making, Kano State, Nigeria. *Pan African Medical Journal*, 40(Suppl. 1), 2. <https://doi.org/10.11604/pamj.suppl.2021.40.1.17313>
- Uzochukwu, B., Mirzoev, T., Okeke, C., Hicks, J. P., Etiaba, E., Obi, U., Ensor, T., Uzochukwu, A., & Onwujekwe, O. (2020). Did an intervention programme aimed at strengthening the maternal and child health services in Nigeria improve the completeness of routine health data within the health management information system? *International Journal of Health Policy and Management*, 11(7), 937–946. <https://doi.org/10.34172/ijhpm.2020.226>
- Wang, R. Y., & Strong, D. M. (1996). Beyond accuracy: What data quality means to data consumers. *Journal of Management Information Systems*, 12(4), 5–33. <https://doi.org/10.1080/07421222.1996.11518099>
- World Health Organization. (2023). *Data quality assurance: Module 1—Framework and metrics*. World Health Organization.