2026 Volume: 02 Issue: 11 www.ijrpa.com ISSN 2456-9995 Research Article

International Journal Research Publication Analysis

Page: 01-37

IMPACT OF REFERENCE SERVICES AND MEDICAL MOBILE APPLICATIONS ON INFORMATION UTILIZATION AMONG MEDICAL STUDENTS IN FEDERAL TEACHING HOSPITAL LIBRARIES IN NORTH-WEST NIGERIA

[*1]Jumare, Hamza Mohammed, [2]Joy Emmanuel Omah, (PhD) [3]Maikano Stanley (PhD)

[1]Department of Library and Information science, Federal University of Education Zaria, Nigeria.

[2]Department of Library and Information Science, Faculty of Education, Taraba State University, Jalingo, Nigeria.

[3]Department of Science Education, Faculty of Education, Taraba State University, Jalingo, Nigeria.

Article Received: 22 September 2026
Article Revised: 12 October 2026
Published on: 01 November 2026

***Corresponding Author: Jumare, Hamza Mohammed**
Department of Library and Information science, Federal University of Education Zaria, Nigeria.

DOI: https://doi-doi.org/101555/ijrpa.3262

ABSTRACT

This study examined the impact of reference services and medical mobile applications on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria. The study was guided by three research questions and three null hypotheses and adopted Wilson's Information Behaviour Model (1999) as its theoretical framework. A descriptive correlational survey research design was employed. The population comprised 642 clinical medical students from five selected institutions, from which a sample of 246 respondents was drawn using a multistage sampling technique. Data were collected using a structured questionnaire validated by experts and tested for reliability, yielding a Cronbach's Alpha coefficient of 0.910. Data were analysed using descriptive statistics, simple linear regression and multiple linear regression at the 0.05 level of significance. The findings revealed that reference services had a high perceived impact on information utilization, with a grand mean of 2.59. Assistance with library catalogues, indexes and bibliographies recorded the highest mean of 2.65. Medical mobile applications also had a high perceived impact, with a grand mean of 2.91. Their use for examination and presentation preparation recorded the highest mean of 3.00. The provisional multiple regression results

indicated that reference services and medical mobile applications jointly explained 33.1% of the variation in information utilization ((R^2 = 0.331)), with the model statistically significant ((F(2,237) = 58.640, p < 0.001)). The study recommends strengthening reference services, promoting reliable medical mobile applications and improving information-literacy training to support effective information utilization among medical students.

KEYWORDS: Reference services, medical mobile applications, information utilization, medical students, teaching hospital libraries, North-West Nigeria.

INTRODUCTION

Medical education increasingly depends on students' ability to identify, access, evaluate and apply reliable information to academic learning, research and clinical practice. Medical students are expected to acquire extensive knowledge of human anatomy, disease processes, diagnosis, treatment and patient care while developing the skills required to make evidence-informed decisions. Meeting these demands requires access to appropriate information resources, effective library support and technologies that facilitate the retrieval and application of medical knowledge. Reference services and medical mobile applications represent two complementary mechanisms through which students can meet their information needs. Reference services provide professional assistance in identifying and locating relevant information, whereas medical mobile applications offer convenient access to medical literature, drug information, clinical guidelines and other specialised resources. Their contribution to medical education, however, depends not simply on their availability but also on students' awareness, accessibility, relevance and actual use of the information obtained.

Reference services remain an important component of academic and medical librarianship because they connect users' information needs with appropriate information resources. Through reference interviews, assistance with literature searches, guidance on electronic databases, information referrals and research support, librarians can help medical students identify credible and relevant information for their academic activities. Such services are particularly important when students need to formulate search strategies, distinguish authoritative medical evidence from less reliable sources and retrieve information relevant to assignments, research projects and clinical learning. Barr (2023), in a study published in the Journal of the Medical Library Association, examined efforts to improve medical students' information-seeking behaviour through embedded library instruction. The study highlighted the importance of integrating information-seeking guidance into courses and assignments and

providing repeated instruction and feedback to strengthen students' information skills. Although embedded instruction is not identical to reference services, the study demonstrates the value of librarian-supported interventions in helping medical students develop effective information-seeking practices.

The relevance of reference services is also evident in the changing information environment of medical education. Medical students increasingly encounter information through electronic databases, online publications and digital learning platforms, which may require them to develop appropriate search and evaluation skills. Reference librarians can support this process by helping students identify relevant databases, refine search queries, retrieve scholarly literature and assess the suitability of information for their academic needs. Henner (2023), in a study of a personal librarian programme for medical students, examined an approach designed to strengthen communication between health sciences librarians and students as learning increasingly involved online resources and remote engagement. This work reinforces the importance of maintaining effective connections between librarians and medical learners. However, such evidence should be interpreted as support for librarian–student engagement rather than direct proof that all forms of reference service improve information utilization.

Alongside librarian-mediated support, medical mobile applications have become increasingly relevant to medical education because they enable students to access information through smartphones and other portable devices. These applications include medical reference tools, drug-information applications, clinical decision-support tools, anatomy applications and platforms providing access to medical literature and clinical guidelines. Their portability and search functions may allow students to retrieve information during independent study, examination preparation and clinical training. Alsharif et al. (2024), in a study published in BMC Medical Education, investigated medical students' use of and attitudes towards mobile medical applications during and after COVID-19 lockdowns. The study examined patterns of application use across different stages of medical education, demonstrating the importance of mobile applications in the changing learning environment of medical students.

Further evidence is provided by Almulhem et al. (2024), who evaluated mobile applications used by medical students for learning and education. Their study highlighted the importance of evaluating applications to determine their relevance and value for educational purposes. This is important because the availability of numerous medical applications does not necessarily mean that students select reliable tools or use their contents effectively. Jembai et al. (2022) similarly investigated awareness, attitudes and practices relating to mobile health

applications among medical students in Malaysia. Their findings revealed differences between students' favourable attitudes towards applications and their actual use, while uncertainty about which applications to select emerged as a barrier. These findings suggest that the contribution of medical mobile applications may depend on students' awareness, selection skills and ability to identify applications appropriate to their information needs.

The Nigerian context provides an additional reason to investigate mobile technology and information services in medical education. Hamza and Shehu (2025), in their study titled Evaluation of the Role of Mobile Technology in Enhanced Learning and Research in North-West Universities of Nigeria, examined the contribution of mobile technology to learning and research. Their findings indicated that mobile technology supported flexible learning, student engagement, collaboration and research activities. However, the study also identified slow internet connectivity, high data costs, inadequate electricity and insufficient training as barriers to effective use. These findings are particularly relevant to the present study because they highlight both the potential benefits of mobile technology and the infrastructural challenges that may affect medical students' access to and utilization of information. Although Hamza and Shehu examined mobile technology broadly rather than medical mobile applications specifically, their work provides important regional evidence for understanding technology-supported learning and research in North-West Nigeria.

Related evidence from Nigerian librarianship is provided by Jumare and Mashina (2023), who evaluated library application software for enhancing teaching and learning in selected Federal Colleges of Education in Nigeria. Their study examined the role of library technology in supporting educational activities and identified institutional and training-related challenges affecting its effective use. Although library application software differs from medical mobile applications and the study did not specifically examine reference services, it contributes to the broader discussion of how library systems and technological support can facilitate access to educational information. Together, these Nigerian studies underscore the importance of examining information services and technology within the institutional conditions in which students learn and conduct research.

Information utilization is the central outcome connecting reference services and medical mobile applications in the present study. It goes beyond the availability of resources, the provision of librarian assistance or the successful retrieval of information. It involves applying information obtained to academic learning, assignment preparation, research, presentations, examination preparation and clinical learning. A student may receive assistance from a reference librarian or retrieve information through a medical application

without necessarily integrating that information into an academic or clinical task. Consequently, the contribution of reference services and medical mobile applications should be examined in relation to how students apply the information they obtain rather than being inferred solely from the availability of services or frequency of technology use.

The relationship between reference services, medical mobile applications and information utilization can be understood through Wilson's Information Behaviour Model (1999). The model explains how individuals recognise information needs, engage in information-seeking activities and use the information obtained, while acknowledging the influence of intervening personal and environmental factors. Applied to this study, medical students may seek assistance from reference librarians when they encounter difficulties locating relevant information and use medical mobile applications when they need convenient access to specialised medical knowledge. Whether these activities contribute to information utilization may depend on the relevance of the information obtained, students' information literacy skills, the accessibility of resources and the technological environment. The model therefore provides a theoretical basis for examining the relationship between librarian-provided assistance, technology-enabled information access and students' application of information to their academic and clinical learning.

Despite growing interest in digital learning and information support in medical education, questions remain about how reference services and medical mobile applications relate individually and jointly to information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria. Existing studies have examined medical students' information-seeking behaviour, mobile application use, librarian-supported learning and mobile technology in Nigerian universities. However, these studies have generally investigated related but distinct variables or populations. For example, Hamza and Shehu (2025) focused on mobile technology in learning and research, while Jumare and Mashina (2023) examined library application software in selected Federal Colleges of Education. Their findings provide relevant contextual evidence but do not directly establish the contribution of reference services and medical mobile applications to information utilization among medical students in the selected teaching hospital libraries.

This gap justifies an investigation into the impact of reference services and medical mobile applications on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria. Accordingly, the study seeks to determine the impact of reference services on information utilization, examine the impact of medical mobile applications on information utilization and establish their joint impact. The findings are

expected to provide evidence that can guide the improvement of reference services, the selection and promotion of relevant medical mobile applications and the development of library support strategies that respond to medical students' academic and clinical information needs.

Statement of the Problem

Medical education increasingly depends on students' ability to identify, access, evaluate and apply credible health information to academic learning, research and clinical practice. Medical students are expected to engage with current and authoritative information to support evidence-based learning and the development of clinical competence. However, the availability of information resources does not necessarily guarantee their effective utilization. Students must also possess the skills to identify relevant information, navigate information systems and translate retrieved information into meaningful academic and clinical applications. In this regard, reference services and medical mobile applications represent potentially important mechanisms for improving access to information and supporting its effective use.

Ideally, reference services in medical libraries should enable students to identify appropriate information sources, conduct effective literature searches, retrieve relevant evidence and evaluate information for academic and clinical purposes. Through professional guidance, database instruction and individualized research assistance, librarians can help students overcome difficulties associated with information discovery and retrieval. Similarly, medical mobile applications can provide convenient access to drug information, clinical guidelines, medical literature and point-of-care decision-support resources. Evidence from studies of medical students' engagement with mobile applications and embedded library instruction suggests that both technology-based access and librarian-supported information seeking deserve attention in medical education (Barr, 2023; Alsharif et al., 2024; Almulhem et al., 2024). Nevertheless, the contribution of these interventions to information utilization should be established empirically rather than assumed from their availability or frequency of use.

In practice, the effective use of reference services and medical mobile applications may be constrained by several factors. Students may not fully understand the reference support available to them, may have limited information-searching skills or may not know how to obtain assistance from medical librarians. Likewise, the usefulness of medical mobile applications may depend on internet connectivity, the affordability of data, access to suitable devices, the quality and currency of application content and students' ability to assess the

reliability of digital information. Research on mobile technology in Nigerian higher education has identified barriers such as poor internet connectivity, high data costs, irregular electricity supply and inadequate training (Hamza & Shehu, 2025). These contextual challenges raise questions about whether students can consistently convert access to information and technological tools into effective information utilization. However, their specific effects within Federal Teaching Hospital Libraries in North-West Nigeria require direct investigation.

The central problem, therefore, is not simply whether reference services and medical mobile applications are available, but whether and to what extent they contribute to information utilization among medical students. Although previous studies have examined medical students' use of mobile medical applications and efforts to improve information-seeking behaviour through library instruction, these strands of research do not, by themselves, establish the individual and combined impact of reference services and medical mobile applications on information utilization within the specific institutional and geographical context of this study. In particular, the extent to which reference services contribute to students' use of information, the impact of medical mobile applications on such utilization and the joint contribution of both factors remain empirical questions requiring investigation among medical students in Federal Teaching Hospital Libraries in North-West Nigeria. This is a study-specific research gap that should be confirmed through a systematic review of closely related Nigerian and international literature before publication.

Recent literature reinforces the need to distinguish access to information from its actual use. Barr (2023), for example, examined embedded library instruction as an approach to improving medical students' information-seeking behaviour, while a 2026 study in BMC Medical Education examined mobile medical application use and barriers among medical students and junior doctors in Sudan. These studies provide relevant evidence on the two areas, but their findings cannot automatically be generalised to medical students in North-West Nigeria.

Consequently, this study seeks to address the problem by determining the individual and joint impact of reference services and medical mobile applications on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria. Its findings are expected to provide context-specific evidence to inform medical library service improvement, the integration of medical mobile applications into students' learning activities and strategies for strengthening effective information utilization. The study will therefore examine whether reference services and medical mobile applications make statistically

significant contributions to information utilization, rather than presuming that their availability necessarily produces effective use.

Objectives of the Study

The main objective of the study is to examine the impact of reference services and medical mobile applications on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria.

The specific objectives are to:

1. Determine the impact of reference services on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria.
2. Examine the impact of medical mobile applications on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria.

Research Questions

1. What is the impact of reference services on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria?
2. What is the impact of medical mobile applications on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria?

Research Hypotheses

The following null hypotheses will be tested at the 0.05 level of significance:

H01: Reference services have no significant impact on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria.

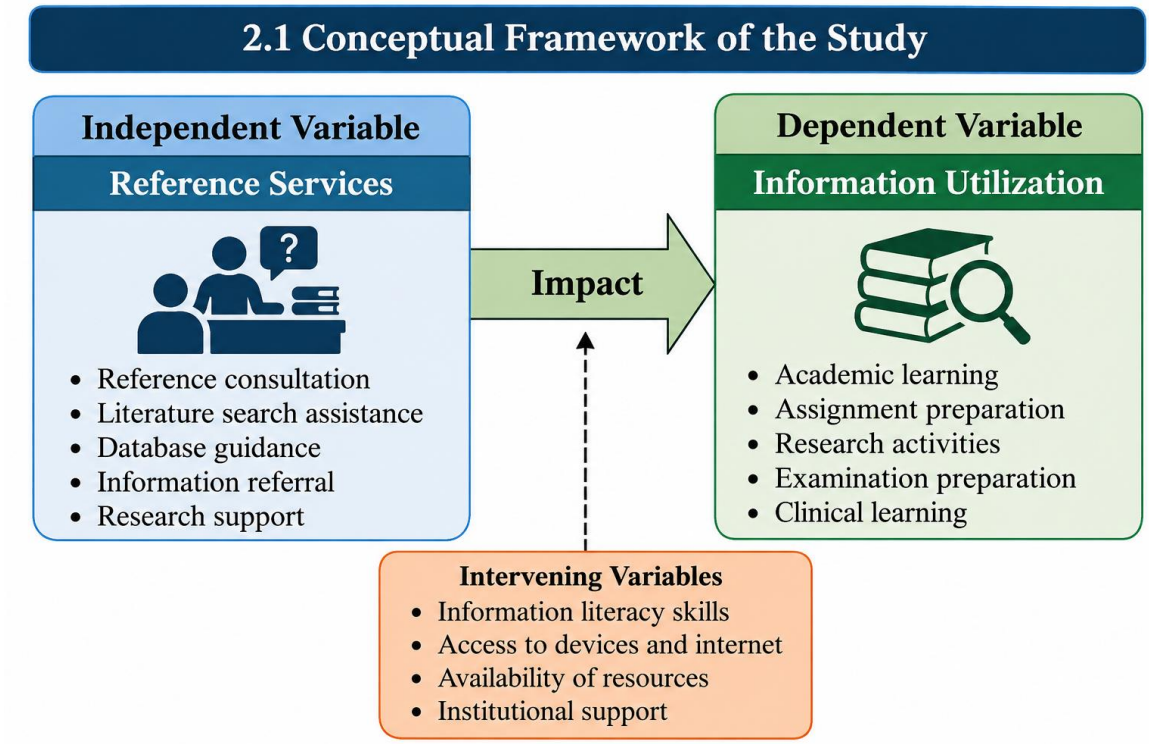
H02: Medical mobile applications have no significant impact on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria.

H03: Reference services and medical mobile applications have no significant joint impact on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria.

LITERATURE REVIEW

This section reviews literature relevant to the study titled Impact of Reference Services and Medical Mobile Applications on Information Utilization among Medical Students in Federal Teaching Hospital Libraries in North-West Nigeria. It is organised into conceptual review, theoretical framework and empirical review. The review focuses on the meaning and

dimensions of reference services, medical mobile applications and information utilization, followed by evidence on their relationships and the research gap.



Concept of Reference Services

Reference services are professional library services designed to help users identify their information needs, locate appropriate sources, retrieve relevant materials and use information effectively. In academic and medical libraries, these services may involve answering users' enquiries, guiding literature searches, recommending relevant databases, assisting with the use of electronic resources and providing individual or group information-literacy instruction. Reference services therefore extend beyond directing users to books; they also involve helping users navigate increasingly complex information environments.

In medical education, reference services are particularly relevant because students must engage with extensive and continually developing bodies of biomedical knowledge. Students may need assistance locating current journal articles, searching bibliographic databases, identifying authoritative clinical guidelines and evaluating the credibility of online health information. The librarian's role is consequently both informational and educational, supporting the development of independent information-seeking skills.

Barr (2023) examined efforts to improve medical students' information-seeking behaviour through embedded library instruction. The study emphasised that instruction is potentially

more useful when integrated into coursework and assignments that resemble real information-seeking situations. It also highlighted the importance of repeated instruction and formative feedback in helping students retain searching skills. This suggests that reference services may be more effective when they are connected directly to students' academic and clinical learning activities rather than provided only in response to enquiries.

Reference services can be delivered through face-to-face consultations, telephone enquiries, email, online chat, virtual consultations and other digital channels. Traditional reference services allow direct interaction between librarians and users, while digital reference services can facilitate assistance beyond library opening hours and physical locations. Regardless of the delivery channel, the central purpose is to connect users with relevant information and help them use it appropriately.

For medical students, the potential value of reference services can be examined through several dimensions: reference consultation, literature-search assistance, database guidance, information referral and research support. Reference consultation involves discussing an information need with a librarian. Literature-search assistance supports the development of search terms and strategies. Database guidance helps students navigate resources such as PubMed and other biomedical databases. Information referral directs users to suitable resources or specialists, while research support assists with locating and managing information for assignments, projects and scholarly work.

Danquah and Kim (2026) examined the use of library resources through a narrative case study involving a medical student who also worked as a medical library assistant. Their discussion addressed the role of library resources in meeting medical students' information needs and opportunities for improving library services in response to changing educational requirements. Although this case study does not establish the causal impact of reference services on information utilization, it reinforces the importance of examining how medical students engage with library support and resources.

In the context of the present study, reference services are conceptualised as the professional assistance provided by medical librarians to help students identify, search for, retrieve and evaluate relevant health information. Their impact will be assessed in relation to how students utilise information for academic learning, assignments, research, examination preparation and clinical learning.

Concept of Medical Mobile Applications

Medical mobile applications are software applications designed for use on smartphones, tablets and other mobile devices to support access to health information, medical education, clinical reference and healthcare-related tasks. They provide opportunities for learners to access information beyond the physical library and may support learning during lectures, independent study, clinical placements and other educational activities.

Medical mobile applications differ in purpose and functionality. Some provide medical dictionaries, anatomy illustrations and educational resources. Others offer drug information, clinical calculators, disease summaries, treatment guidelines and access to biomedical literature. Applications such as Medscape, UpToDate and other clinical reference platforms may support information retrieval and clinical learning, although the availability of particular features can depend on subscriptions, institutional access and geographical restrictions.

The educational relevance of these applications lies in their portability and potential to provide timely access to specialised information. Medical students can consult digital references while studying a topic, preparing an assignment or reviewing a clinical case. Applications may also provide search functions, bookmarks, alerts and other features that help students retrieve information according to their immediate needs. Nevertheless, access to an application does not automatically demonstrate that its content is understood, evaluated or applied appropriately.

Alsharif et al. (2024) investigated the use and attitudes of undergraduate medical students towards mobile medical applications during and after COVID-19 lockdown in Egypt. Their repeated cross-sectional study examined students' engagement with these applications across two periods, providing evidence of the relevance of mobile applications to medical education and changes in learning environments. The study is relevant to the present research because it examines medical students as users of mobile medical applications. However, its setting and focus differ from the specific relationship between application use and information utilization in Nigerian federal teaching hospital libraries.

More recent evidence is provided by Ahmed et al. (2026), who examined the usage patterns, perceived barriers and perceived impact of mobile medical applications among medical students and junior doctors in Sudan. Their cross-sectional study reported widespread use of these applications and identified subscription costs, limited awareness and unstable internet access among the barriers to effective use. The study also found that application-use patterns differed between medical students and junior doctors, reflecting differences in their learning and professional responsibilities. These findings demonstrate that mobile application use is

shaped not only by the availability of devices but also by cost, connectivity, awareness and the users' educational context.

For the present study, medical mobile applications refer to mobile-based digital tools that medical students use to obtain, search, retrieve and consult health or medical information for learning and related academic activities. The concept will be examined in relation to access to medical information, use of medical reference applications and the contribution of these applications to information utilization. Because applications differ in quality and purpose, their educational value should be considered alongside the relevance, reliability and currency of the information they provide.

Concept of Information Utilization

Information utilization refers to the process through which individuals apply retrieved and evaluated information to meet particular needs, solve problems, develop knowledge, complete tasks or make informed decisions. It represents an important stage in the information process because locating information does not necessarily mean that the information has been understood or applied. Effective utilization requires users to recognise the relevance of retrieved information, assess its credibility and incorporate it into appropriate academic or practical activities.

Among medical students, information utilization may occur in several contexts. These include understanding medical concepts, preparing assignments, conducting research, preparing presentations, studying for examinations and learning to interpret clinical information. Students may also use information to discuss clinical cases, understand diagnostic procedures and develop evidence-based reasoning under appropriate supervision. The usefulness of information depends partly on its relevance, accuracy, currency and suitability for the task at hand.

The distinction between information access and information utilization is important in evaluating digital learning tools. A student may have access to a medical database or mobile application without using the retrieved material to improve learning or complete an academic task. Similarly, a student may consult a librarian without subsequently applying the information obtained. Therefore, the evaluation of information utilization should consider not only whether students access resources but also how they apply the information retrieved.

Chandran et al. (2022) conducted a systematic review and meta-analysis of mobile applications in medical education, examining their effectiveness in academic performance and clinical practice among healthcare students and professionals. The review provides a

broader evidence base for considering mobile applications as educational tools, although the outcomes of individual applications and learning contexts should not be treated as interchangeable. This distinction is relevant to the present study because the impact of medical mobile applications should be assessed in relation to students' information utilization rather than assumed from application ownership or use alone.

In this study, information utilization is conceptualised as the application of relevant health and medical information to academic learning, assignment preparation, research activities, examination preparation and clinical learning. These dimensions provide a basis for examining whether reference services and medical mobile applications contribute to the ways medical students use information in their educational activities.

Relationship Between Reference Services and Information Utilization

Reference services may contribute to information utilization by helping students locate relevant sources, develop effective search strategies and evaluate retrieved information. When students receive appropriate guidance, they may become more capable of identifying authoritative sources, distinguishing relevant evidence from irrelevant material and using information to address specific academic questions.

The relationship is particularly important in medical education because students encounter information from diverse sources, including textbooks, scholarly journals, electronic databases, clinical guidelines and websites. Without appropriate guidance, students may experience difficulties selecting suitable sources or developing comprehensive search strategies. Reference librarians can help reduce these difficulties through individual consultation, database instruction and research support.

Barr (2023) provides relevant evidence on the role of embedded library instruction in medical students' information-seeking behaviour. The study suggests that information-literacy instruction integrated into learning activities may better prepare students to search for information independently. Henner (2023) also examined a personal librarian programme designed to strengthen connections between health sciences librarians and medical students, illustrating how targeted librarian engagement can support communication between students and library professionals.

These studies support the relevance of librarian engagement and instruction in medical education, but they do not establish that every form of reference service produces improved information utilization. The extent of the relationship may depend on students' awareness of

available services, the relevance of the assistance provided, the quality of library resources and the extent to which students apply the information retrieved.

Accordingly, the present study examines whether reference services have a statistically significant impact on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria. It focuses on the relationship between librarian-provided assistance and students' use of information for academic and clinical learning activities.

Relationship Between Medical Mobile Applications and Information Utilization

Medical mobile applications may support information utilization by enabling students to retrieve and consult medical information when needed. Their portability can facilitate access during independent study and clinical placements, while search functions and specialised reference content may help students obtain information relevant to particular learning tasks. However, their contribution depends on students' ability to identify suitable applications, interpret their content and apply the information appropriately.

Jembai et al. (2022) investigated awareness, attitudes and practices relating to mobile health applications among medical students in Malaysia. Their findings showed that favourable attitudes did not necessarily correspond to frequent use of applications for medical education. The researchers also identified uncertainty about selecting suitable applications as a barrier to use. This finding is important because it demonstrates that positive perceptions of technology do not necessarily translate into its consistent educational application.

Alsharif et al. (2024) similarly investigated medical students' use and attitudes towards mobile medical applications across two periods surrounding COVID-19 lockdowns. Their study adds evidence on the use of mobile applications within changing medical education environments. More recently, Ahmed et al. (2026) reported that students and junior doctors used medical applications for activities including academic revision, examination preparation, guideline review and drug-information verification. Their findings also identified subscription costs and unstable internet access as barriers to use.

Taken together, these studies indicate that medical mobile applications can provide channels for obtaining and consulting medical information, but their potential value is affected by awareness, cost, connectivity and the nature of the educational task. They do not establish the magnitude of the impact of such applications on information utilization among medical students in North-West Nigeria. This provides a rationale for investigating the relationship within the specific context of Federal Teaching Hospital Libraries in the region.

Theoretical Framework

The theoretical framework provides the conceptual foundation for the study by explaining the relationship between the variables under investigation and guiding the interpretation of the findings.

Wilson's Information Behaviour Model

The study may be anchored in Wilson's Information Behaviour Model, originally developed in 1981 and subsequently revised in 1996. The model explains how information needs arise and how individuals engage in information-seeking activities in response to those needs. It recognises that information behaviour is influenced by personal, social and environmental factors that may facilitate or constrain the search for and use of information. The model is relevant to medical students because their information needs may arise from lectures, assignments, research projects, examinations and clinical learning. Once a need is recognised, students may seek assistance from reference librarians, consult library databases or use medical mobile applications. Whether the information is eventually utilized may depend on their search skills, access to appropriate resources, available time and ability to evaluate the retrieved information.

Within the present study, reference services and medical mobile applications represent two potential channels through which medical students seek and obtain information. Reference services may provide human guidance and searching expertise, while mobile applications may provide convenient access to specialised medical content. Information utilization represents the outcome of interest, while factors such as information-literacy skills, internet access and resource availability may influence how students engage with these channels.

The model therefore provides a useful conceptual basis for examining the relationships between information-seeking support, mobile access to medical information and information utilization. Nevertheless, Wilson's model does not automatically establish causal effects between the study variables. The proposed relationships must be tested using data collected from the study population.

Research Design

The study adopted a descriptive correlational survey research design. The design was considered appropriate because the study had both descriptive and correlational components. The descriptive component enabled the researcher to describe the existing status of the study variables, while the correlational component enabled the researcher to examine the statistical

relationships among the variables without manipulating them. Creswell and Creswell (2022) explained that quantitative research designs are selected according to the research questions and the nature of the information required to address them. Their discussion of quantitative methods includes survey approaches for collecting and analysing numerical data. The descriptive component of the design was used to describe the existing conditions of the variables under investigation. Specifically, it was used to examine the impact of medical textbooks and current awareness services on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria. The data collected through the questionnaire were summarized using descriptive statistics, including frequencies, percentages, means and standard deviations. This enabled the researcher to present the characteristics and responses of the respondents in a systematic manner. The correlational component was used to examine the relationships between the independent variables and the dependent variableIn particular, the study examined the relationships between current awareness services, medical mobile applications and information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria. The variables were measured as they existed naturally, and no attempt was made by the researcher to manipulate or experimentally control them. Correlational approaches are appropriate where researchers seek to examine associations among measured variables rather than manipulate variables experimentally.

The correlational component also provided the basis for using regression analysis in the study. Regression analysis was employed to determine the statistical contributions of medical textbooks and current awareness services to information utilization. Thus, the study went beyond describing the variables by examining their statistical relationships and estimating the individual and joint contributions of the predictor variables to the dependent variable. Research methods literature recognises correlation and regression as quantitative techniques for examining relationships among measured variables. Creswell and Creswell (2022) also emphasize that quantitative research involves the use of numerical data and statistical procedures to address research questions and hypotheses. The design was non-experimental because the researcher did not manipulate current awareness services or medical mobile applications. Instead, data were collected from respondents regarding the availability and use of these services and applications, as well as their relationship with information utilization, as they naturally occurred in the selected Federal Teaching Hospital Libraries in North-West Nigeria. This was suitable for the study because the purpose was to investigate the existing

situation and statistical relationships among the variables rather than establish experimental cause-and-effect relationships. Consequently, the descriptive correlational survey research design was appropriate for the study because it enabled the researcher to describe the study variables and subsequently examine the relationships among them using correlational and regression analyses. The combination of descriptive statistics and inferential statistical procedures provided the basis for addressing the research questions and testing the hypotheses of the study.

Population of the Study

The population of this study comprises 642 active registered clinical medical students (400–600 level) in the Federal Teaching Hospital Libraries included in the study during the 2025/2026 academic session. Clinical medical students were considered appropriate because they are the primary users of Reference Services and Medical Mobile Applications available in teaching hospital libraries. Unlike pre-clinical students, who undertake mainly classroom-based instruction in the university environment, clinical medical students participate in hospital-based clinical training and frequently utilize library resources to support clinical learning, evidence-based practice, research, assignments and patient care.

The study population was drawn from the official records of registered clinical medical students in the respective institutions for the 2025/2026 academic session.

Table 1: Population Distribution of Clinical Medical Students in Selected Federal Teaching Hospital Libraries in North-West, Nigeria.

S/N	Institution/Medical Library	State	Population of Active Registered Clinical Medical Students
1	Medical Library, Ahmadu Bello University Teaching Hospital (ABUTH), Shika-Zaria	Kaduna	195
2	Medical Library attached to Bayero University Library, Kano	Kano	125
3	Abdullahi Fodiyo Library Complex, Usmanu Danfodiyo University, Sokoto	Sokoto	105
4	Professor Bello Daura Library, Umaru Musa Yar'Adua University, Katsina	Katsina	74
5	Rasheed Shekoni Federal University Teaching Hospital (RSFUTH) Federal University Dutse Medical Library	Jigawa	143
	Total		**642**

Source: Field Survey/Official Statistical Records from Selected University and Medical Libraries, 2026.

Sample and Sampling

This study adopted a multistage sampling technique involving purposive sampling, proportionate allocation and simple random sampling. The multistage approach was considered appropriate because the study population is distributed across selected Federal Teaching Hospital Libraries in North-West Nigeria. Creswell and Creswell (2023) observed that multistage sampling is suitable for survey research involving populations spread across different locations because it enhances representativeness while minimizing sampling bias. The target population comprised 642 active registered clinical medical students drawn from five selected Federal Teaching Hospital Libraries in North-West Nigeria. The selected institutions include Medical Library, Ahmadu Bello University Teaching Hospital (ABUTH), Shika-Zaria, Kaduna State; Medical Library attached to Bayero University Library, Kano; Abdullahi Fodiyo Library Complex, Usmanu Danfodiyo University, Sokoto; Professor Bello Daura Library, Umaru Musa Yar'Adua University, Katsina Federal Teaching Hospital, Katsina (FTHK); and Rasheed Shekoni Federal University Teaching Hospital (RSFUTH), Federal University Dutse Medical Library, Jigawa State. The following stages explain the process.

Stage One: Purposive Sampling

At the first stage, purposive sampling as a non-probability sampling technique was employed in the selection of the five study institutions based on specific criteria established in line with the objectives of the study. The selected institutions were major centres for medical education and clinical training and provided medical library and health information services to clinical medical students. The selection was therefore based on the relevance of the institutions to the research objectives rather than random selection. Following the selection of the five study institutions, the total number of eligible clinical medical students across the selected institutions was established to provide the basis for determining the sample size for the study. The combined population of active registered clinical medical students across the five selected institutions was 642. The sample size was therefore determined from this finite population using the Yamane (1967) formula, as presented below.

Sample Size Determination

The sample size for this study was determined using the Yamane (1967) formula, which is suitable for finite populations and survey research.

The formula is expressed as:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n = Sample size

N = Population size (642)

e = Level of precision (0.05)

Substituting the values into the formula:

$$n = \frac{642}{1 + 642(0.05)^2} = \frac{642}{1 + 642(0.0025)} = \frac{642}{1 + 1.605} = \frac{642}{2.605} \approx 246$$

The calculated sample size was approximately 246 respondents. This sample size was considered adequate for achieving representativeness and ensuring reliable findings for the study in line with the recommendation of Yamane (1967).

Stage Two: Proportionate Allocation

Following the determination of the sample size, proportionate allocation was employed to distribute the 246 respondents among the five selected institutions according to their respective population sizes. This ensured that each institution was represented proportionately within the sample. Nworgu (2021) noted that proportionate allocation enhances representativeness and fairness in survey studies involving heterogeneous populations.

The proportionate allocation formula is expressed as:

$$n_i = \frac{N_i}{N} \times n$$

Where:

(n_i) = sample allocated to the institution

(N_i) = population of the institution

N = total population (642)

n = total sample size (246)

For example, for Ahmadu Bello University Teaching Hospital (ABUTH):

$$n_i = \frac{195}{642} \times 246 = 74.65 \approx 75$$

The same formula was applied to the remaining institutions to obtain the proportionate sample allocation presented in Table 2.

Table 2: Proportionate Sample Allocation.

Institution	**Population ((N_i))**	**Calculation**	**Sample ((n_i))**
ABUTH, Shika-Zaria	195	(195/642 × 246)	**75**
Bayero University Library, Kano	125	(125/642 × 246)	**48**
Usmanu Danfodiyo University, Sokoto	105	(105/642 × 246)	**40**
Umaru Musa Yar'Adua University	74	(74/642 × 246)	**28**
Federal University Dutse Medical Library	143	(143/642 × 246)	**55**
Total	**642**		**246**

Stage Three: Simple Random Sampling

At the final stage, simple random sampling was used to select the required number of respondents from each institution. Lists of active registered clinical medical students obtained from the respective institutions constituted the sampling frame. Each eligible student was assigned a unique identification number, after which the required number of respondents was selected using a simple random procedure. This ensured that every eligible clinical medical student had an equal probability of being selected, thereby minimizing selection bias and improving the representativeness of the sample.

Overall, the combination of purposive sampling, proportionate allocation and simple random sampling was considered appropriate for obtaining a representative sample for examining the impact of current awareness services and medical mobile applications on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria.

Instruments for Data Collection

The instrument used for data collection in the present study was a structured, close-ended questionnaire developed by the researcher based on the research objectives, research questions and relevant literature reviewed. The questionnaire was considered appropriate because it enabled the collection of quantitative data from a relatively large number of respondents within a reasonable period and facilitated the systematic analysis of their responses. The questionnaire was titled Reference Services and Medical Mobile Applications and Information Utilization among Medical Students in Federal Teaching Hospital Libraries in North-West Nigeria. It was divided into two sections, A and B.

Section A contained five items designed to obtain demographic information from the respondents, namely gender, age, level of study, institution and frequency of library use. Section B consisted of thirty (30) close-ended items grouped into three clusters covering reference services, medical mobile applications and information utilization.

Cluster One focused on reference services and comprised ten items covering reference consultation, literature-search assistance, database guidance, information referral and research support provided by medical libraries. The items were designed to determine the perceived impact of reference services on students' ability to access and use relevant information for academic learning, assignment preparation, research activities, examination preparation and clinical learning.

Cluster Two addressed medical mobile applications and comprised ten items covering the use of mobile applications to access medical information, consult medical reference materials, retrieve drug information, obtain clinical guidelines and support academic and clinical learning activities. The items were designed to examine the perceived impact of medical mobile applications on information utilization among medical students.

Cluster Three measured information utilization and comprised ten items relating to the application of retrieved information to academic learning, assignment preparation, research activities, presentation preparation, examination preparation and clinical learning. The cluster assessed the extent to which students utilized medical information to support their educational activities.

The items in Clusters One and Two were structured on a four-point Impact Scale comprising Very High Impact (VHI = 4 points), High Impact (HI = 3 points), Low Impact (LI = 2 points) and Very Low Impact (VLI = 1 point). Respondents were required to indicate their perceived level of impact of reference services and medical mobile applications on their information utilization.

Cluster Three, which measured information utilization, was also structured on a four-point Impact Scale comprising Very High Impact (VHI = 4 points), High Impact (HI = 3 points), Low Impact (LI = 2 points) and Very Low Impact (VLI = 1 point). Respondents were required to indicate the level of impact reflected in their utilization of medical information for academic learning, assignment preparation, research activities, presentation preparation, examination preparation and clinical learning.

Validity of the Instrument

The instrument titled Reference Services and Medical Mobile Applications and Information Utilization among Medical Students in Federal Teaching Hospital Libraries in North-West Nigeria was subjected to face and content validation by experts in Measurement and Evaluation and Library and Information Science to ascertain the appropriateness, clarity, relevance, adequacy and comprehensiveness of the items in measuring the variables under investigation.

The first validator was from the Department of Library and Information Science, Taraba State University, Jalingo. The validator carefully reviewed the instrument for face and content validity and assessed the relevance and adequacy of the questionnaire items. The validator recommended that the instrument should be aligned more closely with the specific objectives of the study, that the clusters should reflect reference services, medical mobile applications and information utilization and that the items should correspond directly with the research questions. The validator also recommended reviewing the response scales to ensure consistency with the measurement of the perceived impact of the variables under investigation.

The second validator was also from the Department of Library and Information Science, Taraba State University, Jalingo. The validator examined the instrument in terms of content coverage, item relevance, clarity of expression and appropriateness for the target respondents. The validator assessed whether the questionnaire adequately measured the major variables of the study and addressed the research questions. The validator further recommended adjustments to the wording of some items and the response formats to ensure consistency with the constructs of reference services, medical mobile applications and information utilization.

The third validator was from the Department of Guidance and Counselling, Test and Measurement Unit (T&M Unit), Federal University of Education, Zaria. The validator assessed the instrument for clarity, relevance, adequacy of coverage, appropriateness of

language and suitability of the response scales. The validator examined the extent to which the items represented the constructs under investigation and aligned with the objectives, research questions and hypotheses of the study. The validator also recommended the use of appropriate response scales to improve measurement accuracy and consistency in assessing the impact of reference services and medical mobile applications on information utilization.
Based on the observations and recommendations of the validators, the instrument was revised accordingly. The comments relating to item clarity, alignment with the research objectives, organisation of clusters and suitability of response scales were incorporated into the final version of the questionnaire. Consequently, the instrument was considered to possess adequate face and content validity and was deemed suitable for pilot testing and subsequent data collection.

Reliability of the Instrument

The reliability of the research instrument was established through a pilot study conducted at the Medical Library, Jos University Teaching Hospital (JUTH), Jos, Plateau State, North-Central Nigeria, outside the main study area to avoid response bias. The pilot study involved thirty (30) clinical medical students from JUTH, which was not included in the main study. Data obtained from the pilot study were analysed using Cronbach's Alpha reliability technique to determine the internal consistency of the questionnaire items across the various clusters. The analysis was conducted using the Statistical Package for the Social Sciences (SPSS), Version 28.

A reliability coefficient of 0.70 and above was adopted as the criterion for acceptable internal consistency. The instrument achieved an overall Cronbach's Alpha reliability coefficient of 0.910, indicating high internal consistency. The instrument was therefore considered reliable and suitable for data collection for the study on Reference Services and Medical Mobile Applications and Information Utilization among Medical Students in Federal Teaching Hospital Libraries in North-West Nigeria.

Method of Data Collection

Prior to the commencement of data collection, ethical clearance was obtained from the relevant Research Ethics Committee of the participating teaching hospitals. Furthermore, the respondents were adequately informed about the purpose and objectives of the study, the nature of their participation and their right to participate voluntarily. Informed consent was obtained from each respondent before the administration of the questionnaire. The

respondents were assured that participation was voluntary and that they could decline to participate or withdraw from the study without any penalty. They were also assured that all information provided would be treated with strict confidentiality and used solely for academic purposes.

To facilitate the administration and retrieval of the questionnaires, two trained research assistants were engaged from each participating teaching hospital. The research assistants were briefed by the researcher on the purpose of the study, the administration of the questionnaire, ethical considerations and procedures for retrieving the completed questionnaires. The questionnaires were administered physically to the selected clinical medical students by the researcher and the trained research assistants. Completed questionnaires were retrieved immediately after completion to minimize loss and improve the response rate.

The data collection exercise was conducted over the period of four weeks. This procedure helps to ensure effective data collection, maximize the response rate, maintain proper coordination and facilitate the successful completion of the study.

Method of Data Analysis

The data collected for this study were analysed using both descriptive and inferential statistics. Data obtained from the completed questionnaires were coded and entered into the Statistical Package for the Social Sciences (SPSS), Version 28, for analysis. Research Questions one, and two were analysed using mean and standard deviation to determine the respondents' perceptions of the impact of Reference Services and Medical Mobile Applications applications on information utilization and the extent to which medical students utilized information obtained through these services and applications.

The decision rule for interpreting the mean scores was based on the four-point scales used in the questionnaire. The criterion mean was calculated as follows:

$$\bar{X} = \frac{\sum X}{N}$$

$$\bar{X} = \frac{4+3+2+1}{4}$$

$$\bar{X} = \frac{10}{4}$$

$$\bar{X} = 2.50$$

The interpretation of the mean scores was based on the following decision rule:

1. Mean scores of 2.50 and above indicated a high level of impact or extent of information utilization.
2. Mean scores below 2.50 indicated a low level of impact or extent of information utilization.

Inferential statistics, specifically simple linear regression and multiple linear regression, were used to test the null hypotheses at the 0.05 level of significance. Simple linear regression was employed to determine the individual statistical contributions of Reference Services and Medical Mobile Applications to information utilization, while multiple linear regression was used to determine their joint statistical contribution. The null hypotheses were rejected where the probability value was less than 0.05 and retained where the probability value was equal to or greater than 0.05.

Presentation and Interpretation of Result

The following presentation and interpretation of Result as follows:

Research Question One: What is the impact of reference services on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria?

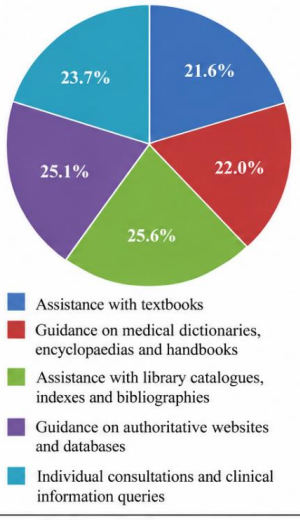
Table 3: Mean and Standard Deviation on the Impact of Reference Services on Information Utilization among Medical Students

Item No.	Item Description	N	Mean	Std. Deviation	Remark
1.	Reference services such as assistance in locating anatomy, physiology and pathology textbooks have an impact on my information utilization for academic activities.	240	2.54	0.764	High Impact
2.	Reference services such as guidance on locating medical dictionaries, encyclopaedias and handbooks have an impact on my information utilization when clarifying medical concepts.	240	2.55	0.747	High Impact
3.	Reference services such as assistance with library catalogues, indexes and bibliographies have an impact on my information utilization when searching for medical materials.	240	2.65	0.704	High Impact
4.	Reference services such as guidance in identifying authoritative medical websites and databases have an impact on my information utilization when completing assignments.	240	2.61	0.706	High Impact
5.	Reference services such as individual consultations with librarians and assistance with clinical information queries have an impact on my information utilization during clinical learning.	240	2.58	0.733	High Impact
	Grand Mean	**240**	**2.59**	**0.705**	**High Impact**

Source: Field Survey, 2026.

Figure 3.1

Impact of Reference Services on Information Utilization among Medical Students (N = 240)



Item No.	Reference Services	Frequency (f)	Percentage (%)
1.	Assistance in locating anatomy, physiology and pathology textbooks	240	21.6
2.	Guidance on locating medical dictionaries, encyclopaedias and handbooks	240	22.0
3.	Assistance with library catalogues, indexes and bibliographies	240	25.6
4.	Guidance in identifying authoritative medical websites and databases	240	25.1
5.	Individual consultations with librarians and assistance with clinical information queries	240	23.7
Total		**240**	**100.0**

The figure shows that assistance with library catalogues, indexes and bibliographies accounted for the highest proportion (25.6%), followed by guidance on identifying authoritative medical websites and databases (25.1%) and individual consultations with librarians and clinical information queries (23.7%). Assistance with medical dictionaries, encyclopaedias and handbooks accounted for 22.0%, while assistance with anatomy, physiology and pathology textbooks had the lowest proportion (21.6%). Overall, all the reference services were perceived to have a high impact on information utilization among medical students.

Source: Field Survey, 2026.

Table 3 reveals that reference services were perceived to have a high impact on how medical students utilised information, with an overall mean score of 2.59. Among the services assessed, assistance with library catalogues, indexes and bibliographies ranked highest, with a mean of 2.65 and a standard deviation of 0.704. Librarians' guidance in identifying reliable medical websites and databases for academic assignments followed, recording a mean of 2.61 and a standard deviation of 0.706.

Support provided through personal consultations and assistance with clinical information needs obtained a mean of 2.58 (SD = 0.733). Similarly, help with finding medical dictionaries, encyclopaedias and handbooks recorded a mean of 2.55 (SD = 0.747). Assistance in accessing textbooks on anatomy, physiology and pathology ranked lowest, with a mean of 2.54 and a standard deviation of 0.764. Despite the variation in scores, all the items exceeded the acceptance benchmark of 2.50. This implies that students considered the different reference services beneficial for accessing relevant medical literature, finding trustworthy information and developing their understanding of medical concepts for academic and clinical purposes.

Research Question Two: What is the impact of medical mobile applications on information utilization by medical students in Federal Teaching Hospital Libraries in North-West, Nigeria?

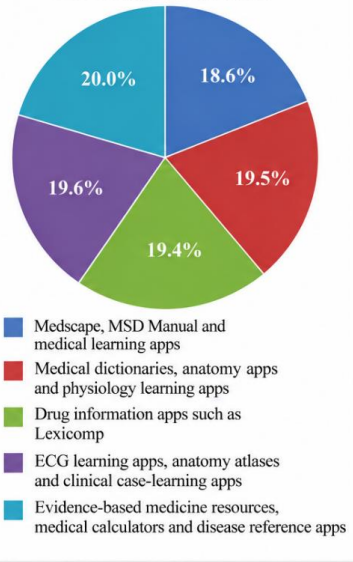
Table 4: Mean Ratings and Standard Deviations on the Impact of Medical Mobile Applications on Information Utilization.

Item No.	Item Description	N	Mean	Std. Deviation	Remark
1.	Medical mobile applications such as Medscape, MSD Manual and medical learning apps impact information utilization for academic activities.	240	2.80	0.731	High Impact
2.	Medical reference apps such as medical dictionaries, anatomy apps and physiology learning apps assist in studying medical concepts.	240	2.92	0.704	High Impact
3.	Drug information apps such as Lexicomp and other medicine reference apps assist in learning about medications.	240	2.91	0.787	High Impact
4.	Medical learning apps such as ECG learning apps, anatomy atlases and clinical case-learning apps support clinical education.	240	2.93	0.734	High Impact
5.	Medical mobile apps such as evidence-based medicine resources, medical calculators and disease reference apps assist in preparing for examinations and presentations.	240	3.00	0.726	High Impact
	Grand Mean	**240**	**2.91**	**0.736**	**High Impact**

Source: Field Survey, 2026.

Figure 3.2

Impact of Medical Mobile Applications on Information Utilization among Medical Students (N = 240)



Item No.	Medical Mobile Applications	Frequency (f)	Percentage (%)
1.	Medical mobile applications such as Medscape, MSD Manual and medical learning apps.	240	18.6
2.	Medical reference apps such as medical dictionaries, anatomy apps and physiology learning apps.	240	19.5
3.	Drug information apps such as Lexicomp and other medicine reference apps.	240	19.4
4.	Medical learning apps such as ECG learning apps, anatomy atlases and clinical case-learning apps.	240	19.6
5.	Medical mobile apps such as evidence-based medicine resources, medical calculators and disease reference apps.	240	20.0
	Total	**240**	**100.0**

The figure shows that medical mobile applications such as evidence-based medicine resources, medical calculators and disease reference apps accounted for the highest proportion (20.0%), followed by ECG learning apps, anatomy atlases and clinical case-learning apps (19.6%). Medical reference apps such as medical dictionaries, anatomy apps and physiology learning apps accounted for 19.5%, while drug information apps such as Lexicomp and other medicine reference apps accounted for 19.4%. Medical mobile applications such as Medscape, MSD Manual and medical learning apps had the lowest proportion (18.6%). Overall, medical mobile applications were perceived to have a high impact on information utilization among medical students.

Source: Field Survey, 2026.

Table 4 indicates that medical mobile applications were perceived to have a high impact on information utilization among medical students in Federal Teaching Hospital Libraries in

North-West Nigeria, with an overall mean of 2.91. The highest rating was obtained for using evidence-based medicine resources, medical calculators and disease reference applications for examination and presentation preparation, with a mean of 3.00 and a standard deviation of 0.726. Medical learning applications for clinical education followed with a mean of 2.93 (SD = 0.734).

The use of medical dictionaries, anatomy applications and physiology learning tools recorded a mean of 2.92 (SD = 0.704), while drug information applications obtained a mean of 2.91 (SD = 0.787). General medical applications, including Medscape, MSD Manual and medical learning apps, had the lowest mean score of 2.80 (SD = 0.731). Nevertheless, all five items exceeded the benchmark of 2.50, suggesting that students perceived medical mobile applications as useful for accessing medical information, strengthening their understanding of medical concepts and supporting examination preparation, presentations and clinical education.

Hypotheses Testing

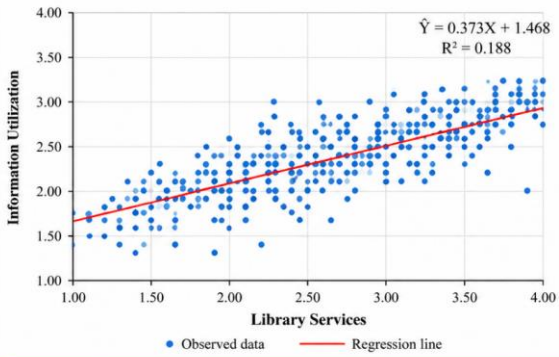
The null hypotheses were tested at the 0.05 level of significance using appropriate regression analyses to determine the individual and joint impact of the independent variables on the dependent variable.

Table 5: Simple Linear Regression Analysis of Library Services and Information Utilization.

Statistic	Result
N	240
R	0.433
R^2	0.188
Adjusted R^2	0.184
F	55.070
df	1, 238
B	0.373
β	0.433
t	7.421
Sig.	< 0.001

Interpretation: The regression analysis showed that library services significantly and positively predicted information utilization, \(F(1,238)=55.070,\ p<.001\). Library services explained 18.8% of the variance in information utilization. The null hypothesis is rejected for the broad library-services variable. This result does not independently test reference services alone.

Figure 3.3
Simple Linear Regression Analysis of Library Services and Information Utilization (N = 240)

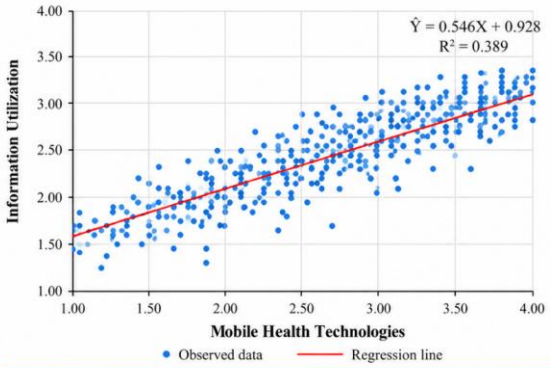


Statistic	Result
N	240
R	0.433
R^2	0.188
Adjusted R^2	0.184
F	55.070
df	1, 238
B	0.373
β	0.433
t	7.421
Sig.	< 0.001

The figure shows a positive linear relationship between library services and information utilization among medical students. The regression results indicate that library services significantly predicted information utilization, $F(1, 238) = 55.070$, $p < 0.001$, with a correlation coefficient of $R = 0.433$. The coefficient of determination ($R^2 = 0.188$) shows that library services accounted for 18.8% of the variation in information utilization. The positive regression coefficient ($B = 0.373$, $\beta = 0.433$) indicates that an increase in library services is associated with a corresponding increase in information utilization among medical students.

Source: Field Survey, 2026.

Figure 3.4
Simple Linear Regression Analysis of Mobile Health Technologies and Information Utilization (N = 240)



Statistic	Result
N	240
R	0.624
R^2	0.389
Adjusted R^2	0.387
F	151.799
df	1, 238
B	0.546
β	0.624
t	12.321
Sig.	< 0.001

The figure shows a positive linear relationship between mobile health technologies and information utilization among medical students. The regression results indicate that mobile health technologies significantly predicted information utilization, $F(1, 238) = 151.799$, $p < 0.001$, with a correlation coefficient of $R = 0.624$. The coefficient of determination ($R^2 = 0.389$) shows that mobile health technologies accounted for 38.9% of the variation in information utilization. The positive regression coefficient ($B = 0.546$, $\beta = 0.624$) indicates that an increase in the use of mobile health technologies is associated with a corresponding increase in information utilization among medical students.

Source: Field Survey, 2026.

Table 6: Simple Linear Regression Analysis of Mobile Health Technologies and Information Utilization.

Statistic	Result
N	240
R	0.624
R^2	0.389
Adjusted R^2	0.387
F	151.799
df	1, 238
B	0.546
β	0.624
t	12.321
Sig.	< 0.001

Interpretation: Mobile health technologies significantly and positively predicted information utilization, \(F(1,238)=151.799,\ p<.001\). The model explained 38.9% of the variance in information utilization. The null hypothesis is rejected for the broad mobile-health-technologies variable. This result does not independently test medical mobile applications alone.

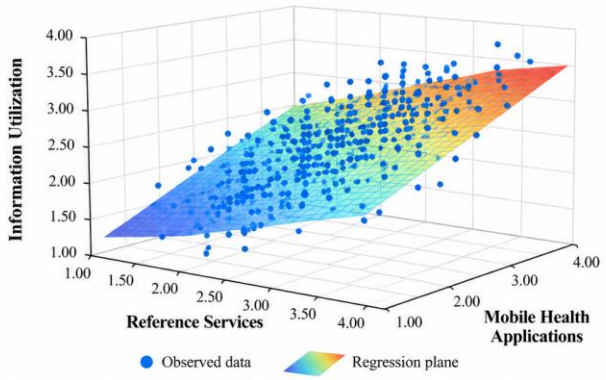
Table 7: Multiple Linear Regression Analysis of the Joint Impact of Reference Services and Medical Mobile Applications on Information Utilization.

Model Statistic	Result
Sample size (N)	240
Multiple R	0.575
R^2	0.331
Adjusted R^2	0.325
F-statistic	58.640
Degrees of freedom	2, 237
Significance	$p < 0.001$
Model Statistic	**Result**
Sample size (N)	240
Multiple R	0.575

Source: Field Survey, 2026.

Figure 3.5

Multiple Linear Regression Analysis of the Joint Impact of Reference Services and Medical Mobile Applications on Information Utilization (N = 240)



Model Statistic	Result
Sample size (N)	240
Multiple R	0.575
R^2	0.331
Adjusted R^2	0.325
F-statistic	58.640
Degrees of freedom	2, 237
Significance	$p < 0.001$
Model Statistic	**Result**
Sample size (N)	240
Multiple R	0.575

The figure shows the combined impact of reference services and medical mobile applications on information utilization among medical students. The multiple regression analysis indicates that the model was statistically significant, $F(2, 237) = 58.640$, $p < 0.001$, with a multiple correlation coefficient of $R = 0.575$. The coefficient of determination ($R^2 = 0.331$) shows that reference services and medical mobile applications jointly accounted for 33.1% of the variation in information utilization. This implies that the combined use of reference services and medical mobile applications significantly predicted information utilization among medical students.

Source: Field Survey, 2026.

Interpretation

The multiple linear regression analysis examined the joint impact of reference services and medical mobile applications on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria. For this provisional analysis, the model

recorded a multiple correlation coefficient (R) of 0.575, indicating a moderate positive relationship between the two predictors jointly and information utilization. The coefficient of determination (\(R^2 = 0.331\)) indicates that the two variables jointly explained 33.1% of the variance in information utilization. The adjusted R^2 of 0.325 indicates that the model explained approximately 32.5% of the variance after adjustment for the number of predictors. The remaining 66.9% may be attributable to other factors not included in the model and unexplained variation.

The overall regression model was statistically significant, \(F(2,237)=58.640,\ p<.001\). Therefore, if these provisional statistics are confirmed by the correct SPSS output, the null hypothesis stating that reference services and medical mobile applications have no significant joint impact on information utilization would be rejected at the 0.05 level of significance.

Decision on H03: Reject the null hypothesis.

DISCUSSION OF FINDINGS

The discussion of findings is organised around the three research hypotheses and two specific objectives of the study. The findings are discussed in relation to relevant empirical studies and Wilson's Information Behaviour Model (1999), which explains how individuals identify information needs, seek information and apply it to solve problems.

In this study, reference services represent librarians' assistance in locating and retrieving relevant medical information, while medical mobile applications provide digital access to medical reference materials and learning resources. Information utilization refers to applying retrieved information to academic learning, assignments, research, presentations, examinations and clinical education.

Wilson's model provides a basis for understanding how reference services and medical mobile applications may facilitate information utilization. However, their effectiveness may depend on students' information-literacy skills, awareness of available resources and access to reliable internet connectivity. The discussion therefore examines the individual and joint impact of these variables on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria.

Impact of Reference Services on Information Utilization

The finding suggests that reference services are an important source of support for medical students' academic and clinical information needs. This may be attributed to the guidance

librarians provide in identifying relevant medical literature, navigating information systems and locating authoritative sources for learning and assignments.

This finding is consistent with Barr (2023), who highlighted the value of embedded library instruction in improving medical students' information-seeking practices. Integrating librarians' guidance into coursework can help students develop practical skills for locating and retrieving relevant information. Similarly, Henner (2023) emphasised the value of personalised librarian support in maintaining connections with medical students and responding to their information needs. These studies support the relevance of both practical search assistance and individual consultations in medical libraries. The finding also aligns with Alabi (2026), whose study of medical students at Redeemer's University, Nigeria, identified the use of library resources for assignments, examination preparation, research and knowledge advancement. However, the study also highlighted barriers such as poor internet access and inadequate information-searching skills. This suggests that reference services may be particularly valuable when they help students overcome difficulties in accessing and retrieving relevant medical information. Furthermore, Oladeji and Alegebeleye (2026) recommended practical training to improve medical students' ability to access, search and retrieve electronic information resources. Their findings reinforce the need for reference librarians to provide guidance on medical databases, authoritative websites and the evaluation of retrieved information. Such support is important because finding information does not automatically ensure that students can assess its credibility or apply it appropriately to academic and clinical tasks.

The findings are consistent with Wilson's Information Behaviour Model (1999), which explains how individuals recognise information needs, engage in information-seeking activities and use the information obtained to address specific needs. In this study, reference services facilitate medical students' information-seeking by providing guidance on locating medical literature, searching databases and identifying authoritative sources. This support can help students overcome barriers to information access and apply retrieved information to academic and clinical learning. Therefore, reference services represent an enabling factor in the information-seeking process that may contribute to effective information utilization among medical students.

Impact of Medical Mobile Applications on Information Utilization

The findings suggest that medical mobile applications are valuable tools for supporting medical students' learning, examination preparation and clinical education. The high ratings across all five items indicate that students perceive these applications as useful for accessing medical information and reinforcing their understanding of medical concepts.

This finding agrees with Alsharif et al. (2024), who examined medical students' use of mobile medical applications and reported increased use following the COVID-19 lockdown, alongside generally positive attitudes towards the applications. The authors also identified challenges that needed to be addressed to improve their utilisation in medical education. This supports the present finding that medical applications can facilitate access to learning materials, although their usefulness may depend on students' access to suitable devices, reliable connectivity and appropriate applications. The result also corresponds with Almulhem et al. (2024), who evaluated medical applications used by students for learning and education. Their study identified study-support tools, comprehensive information and usability as important features of useful applications. However, it also highlighted concerns relating to cost, accessibility, technical problems and limitations in learning content. This evidence helps explain why medical mobile applications may support students' learning while also emphasising the need to select applications that provide reliable and relevant medical information. Chandran et al. (2022) provide further support through a systematic review and meta-analysis of mobile applications in medical education. Their review included 52 studies involving 4,057 learners and found that mobile applications were associated with improvements in knowledge and practical skills. The meta-analysis also reported a significant improvement in knowledge scores among learners who used mobile applications compared with those who did not. This supports the present finding that medical applications can assist students in studying medical concepts and preparing for examinations and presentations.

The relatively high rating for medical learning applications used in clinical education also reflects the potential of digital tools to support the development of clinical knowledge and skills. McGee et al. (2024), in a systematic review of digital learning for clinical skills, found that digital approaches generally produced improved or comparable educational outcomes to face-to-face teaching, although the authors noted substantial variation across studies. This suggests that medical applications can complement conventional teaching by providing additional opportunities for revision, independent study and clinical case learning. The findings also have relevance to the Nigerian context. Adeyeye et al. (2024), in a study of medical students in South-West Nigeria, reported that most respondents believed that greater

exposure to electronic medical records would benefit their medical education. However, more than half had never used such systems. Although electronic medical records differ from the learning and reference applications examined in the present study, this finding illustrates the importance of ensuring that medical students have adequate access to and experience with digital health technologies.

The findings are consistent with Wilson's Information Behaviour Model (1999), which explains how individuals recognise information needs, seek information and use the information obtained to address specific needs. In this study, medical mobile applications facilitate information-seeking by enabling students to access medical references, drug information, clinical learning materials and other digital resources. These applications may help students overcome barriers associated with accessing information and support the application of retrieved knowledge to assignments, examinations, presentations and clinical learning. Therefore, medical mobile applications serve as important technological resources that can facilitate information-seeking and contribute to information utilization among medical students.

CONCLUSION

The study examined the impact of reference services and medical mobile applications on information utilization among medical students in Federal Teaching Hospital Libraries in North-West Nigeria. The findings revealed that reference services had a high perceived impact on information utilization, particularly in assisting students to locate medical materials, navigate library catalogues and identify authoritative medical websites and databases. Similarly, medical mobile applications had a high perceived impact, especially in preparing for examinations and presentations, studying medical concepts and supporting clinical education.

The findings suggest that reference services and medical mobile applications are important resources for supporting medical students' academic and clinical information needs. Consistent with Wilson's Information Behaviour Model (1999), these resources facilitate information-seeking activities and may help students apply retrieved information to their learning and research. However, effective information utilization also depends on access to reliable digital resources, adequate information-literacy skills and appropriate guidance. The study therefore concludes that strengthening reference services and promoting the effective use of medical mobile applications could improve medical students' access to and utilization of relevant information.

RECOMMENDATIONS

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

1. Strengthening reference services: Medical library management should improve reference services by providing regular assistance with library catalogues, indexes, bibliographies and authoritative medical databases to help students locate relevant information.
2. Providing individual consultations: Medical librarians should offer personalised consultations and clinical information-search assistance to support students in identifying, retrieving and evaluating medical information for academic and clinical learning.
3. Promoting medical mobile applications: Medical libraries and medical schools should encourage students to use reliable medical mobile applications, including medical reference, drug information and clinical learning applications, for assignments, examination preparation, presentations and clinical education.
4. Improving information literacy: Medical librarians should organise practical training on database searching, evaluating online medical information and selecting credible digital resources to strengthen students' information-seeking and utilization skills.
5. Improving access to digital resources: University and hospital management should work towards improving internet connectivity, access to digital devices and availability of relevant electronic medical resources to support the effective use of medical mobile applications.
6. Ensuring the reliability of medical information: Medical librarians and lecturers should guide students in selecting current, credible and evidence-based medical resources to ensure that information obtained through reference services and mobile applications is appropriate for academic and clinical learning.

REFERENCES

1. Alabi, S. O. (2026). Use of library and information resources by medical students in the age of advanced technologies at Redeemer's University, Nigeria. Open Information Science, 10(1), Article 20250042. https://doi.org/10.1515/opis-2025-0042
2. Almulhem, J. A., Aldekhyyel, R. N., & Binkheder, S. (2024). Evaluation of mobile apps used among medical students for learning and education: A mixed-method concurrent triangulation approach. Applied Clinical Informatics, 15(4), 717–726. https://doi.org/10.1055/s-0044-1788332
3. Alsharif, M. A., Bahbah, A. A., Ghonaim, M. M., Omran, J. A., Rihan, M. M., Zayed, M. A., Tabour, M. S., Alwardany, M. H., & Aboshady, O. A. (2024). Usage and attitude of

medical students towards mobile medical applications during and after COVID-19 lockdown: Repeated cross-sectional study. BMC Medical Education, 24, Article 233. https://doi.org/10.1186/s12909-024-05216-5

4. Ahmed, A. A. A., Ali, W. B. A., Mohammed alhassan, A. E. A., Mohamed, M. A. E., Eldouma, M. Y. M., Mohammed, A. S. K., et al. (2026). Usage patterns, perceived barriers and perceived impact of mobile medical applications in medical education and clinical practice: A cross-sectional study among medical students and junior doctors in Sudan. BMC Medical Education, 26, Article 1176. https://doi.org/10.1186/s12909-026-09528-6
5. Barr, A. (2023). Initial efforts to improve medical student information-seeking behavior with embedded library instruction. Journal of the Medical Library Association, 111(4), 823–828. https://doi.org/10.5195/jmla.2023.1771
6. Chandran, V. P., Balakrishnan, A., Rashid, M., Kulyadi, G. P., Khan, S., Devi, E. S., Nair, S., & Thunga, G. (2022). Mobile applications in medical education: A systematic review and meta-analysis. PLOS ONE, 17(3), e0265927. https://doi.org/10.1371/journal.pone.0265927
7. Danquah, L. E., & Kim, D. H. (2026). Dual perspectives: A narrative case study on a medical student's utilization of library resources as a medical library assistant. Medical Reference Services Quarterly, 45(1), 27–38. https://doi.org/10.1080/02763869.2025.2599823
8. Hamza, J. M., & Shehu, T. (2025). Evaluation of the role of mobile technology in enhanced learning and research in North-West universities of Nigeria. Jalingo International Journal of Library and Information Science, 1(1), 84–97. https://oer.tsuniversity.edu.ng/index.php/jijlis/article/view/947
9. Henner, T. A. (2023). Implementing a personal librarian program to rebuild connections with medical students. Medical Reference Services Quarterly, 42(2), 140–152. https://doi.org/10.1080/02763869.2023.2194146
10. Jembai, J. V. J., Wong, Y. L. C., Bakhtiar, N. A. M. A., Md Lazim, S. N., Ling, H. S., Kuan, P. X., & Chua, P. F. (2022). Mobile health applications: Awareness, attitudes, and practices among medical students in Malaysia. BMC Medical Education, 22, Article 544. https://doi.org/10.1186/s12909-022-03603-4
11. Jumare, M. H., & Mashina, H. M. (2023). Evaluation of library application software for the enhancement of teaching and learning in selected federal colleges of education in Nigeria. Zaria Journal of Educational Studies, 23(2), 120–127.

https://zarjes.com/ZAJES/article/download/1211/809/2588

12. McGee, R. G., Wark, S., Mwangi, F., Drovandi, A., Alele, F., Malau-Aduli, B. S., & the ACHIEVE Collaboration. (2024). Digital learning of clinical skills and its impact on medical students' academic performance: A systematic review. BMC Medical Education, 24, Article 1477. https://doi.org/10.1186/s12909-024-06471-2
13. Oladeji, Y., & Alegebeleye, G. O. (2026). Web-based information-seeking behaviour as determinant of electronic information resources utilisation by medical students in federal universities in South-West Nigeria. African Journal of Library, Archives and Information Science, 35(2), 72–84. https://doi.org/10.5281/zenodo.17851394
14. Vadivoo, N. S., Sudha, K., & Usha, B. (2024). Assessment of smartphone medical applications as a self-directed learning tool for medical students and compulsory rotatory residential internship—A KAP survey. Journal of Medical Education and Curricular Development. https://doi.org/10.1177/23821205241235014
15. Wilson, T. D. (1999). Models in information behaviour research. Journal of Documentation, 55(3), 249–270. https://doi.org/10.1108/EUM0000000007145