The 17th Congress of The Association for Health Information and Libraries in Africa (AHILA)

Equitable Access to Health Information: The Key to Better Health
Proceedings of the 17th AHILA Congress

Hosted by the University of Botswana Library

16th -20th October 2023

At the University of Botswana Conference Centre, Gaborone

Editors: Dr. R. Tapera, Prof. O. Oladokun, Mr. A. Maisiri, Ms. A. Seymour
The 17th Congress of The Association for Health Information and Libraries in Africa (AHILA)

Proceedings of the 17th AHILA Congress

Editors: Dr. R. Tapera, Prof. O. Oladokun, Mr. A. Maisiri, Ms. A. Seymour

Published by:
University of Botswana Library, Gaborone
THE 17TH CONGRESS OF THE ASSOCIATION FOR
HEALTH INFORMATION AND LIBRARIES IN AFRICA
(AHILA) LOCAL ORGANIZING COMMITTEE

Mr. Alphege Maisiri, Library Services, University of Botswana
Ms. Babakisi Fidzani, Library Services, University of Botswana
Ms. Boipuso Mologanyi, Library Services, University of Botswana
Mr. Khutsafalo Kadimo, Library Services, University of Botswana
Dr. Roy Tapera, School of Public Health, University of Botswana
Ms. Stella Kube, Library Services, University of Botswana
Ms. Keamogetse Kegasitswe, Library Services, University of Botswana
Ms. Dineo Ketshogileng, Library Services, University of Botswana
Ms. Kelebogile Ramotsisi, Library Services, University of Botswana
Ms. Thatayaona Molaodi, Library Services, University of Botswana
Dr. Masego B. Kebaetsse, Medical Education, University of Botswana
Dr. Dimpho Ralefala, Office of Research and Development, University of Botswana
Mr. Kenneth Kavuna, Office of Research and Development, University of Botswana
Dr. Kagiso Ndlovu, E-health Information Unit, University of Botswana
Mr. Jafta Serero, Public Affairs, University of Botswana
Mr. Taolo Mpolokang, Information Technology, University of Botswana
Ms. Sister Steyn, Information Technology, University of Botswana
Ms. Preeti Unnithan, Boitekanelo College
ACKNOWLEDGEMENTS

The success of the AHILA International Conference on "Equitable Access to Health Information: The Key to Better Health" held from 16 to 20 October 2023 in Gaborone, Botswana, would not have been possible without the generous support and contributions from our esteemed sponsors and participants. We extend our heartfelt gratitude to:

Sponsors:

The Republic of Botswana, Ministry of Health: We sincerely appreciate the unwavering support and commitment to advancing health information access and promoting better health outcomes.

Botswana-UPEN Partnership: Thank you for your invaluable contributions in fostering collaboration and enhancing health initiatives in the region.

University of Botswana: Your support and commitment to education and research have greatly contributed to the conference’s success.

Data Science for Health Discovery and Innovation in Africa (DS-I Africa): Your commitment to advancing data science in healthcare is commendable, and we are grateful for your support.

Better Evidence - Ariadne Labs: Thank you for your dedication to improving evidence-based practices in healthcare and for being a crucial part of this conference.

EBSCOhost: Your support in providing access to valuable health information resources has significantly enriched the conference experience.

Association for Health Information and Libraries in Africa (AHILA): We extend our gratitude to AHILA for its continuous efforts in promoting excellence in health information management and sharing.

Participants:

We are thankful to the participants from over 15 African countries who brought diverse perspectives and expertise, contributing to the richness of discussions and fostering meaningful connections.

International Delegates:

A special thank you to our international delegates from the USA, whose presence and insights added a global perspective to the conference discussions.

In conclusion, we express our deep appreciation to all sponsors, participants, speakers, and volunteers who played a vital role in making the AHILA International Conference a resounding success. Your dedication to advancing health information access is pivotal in shaping a healthier future for all.
REVIEWERS OF CONFERENCE PAPERS

Prof. O. Oladokun
Prof. N. Mnjama
Dr. R. Tapera
Dr. B. Grand
Dr. T. Segaetsho
Dr. K. Ndlovu
Mr. A. Maisiri
Ms. A. Seymour
BACKGROUND AND OVERVIEW OF THE CONFERENCE

AHILA was founded in Nairobi on Thursday, 23 August 1984, and was named the Association of Medical Librarians in Africa (AMLA). The name was later changed in 1988 to the Association for Health Information and Libraries in Africa (AHILA) to cater to those interested in health information issues and may not be librarians. To date, AHILA has over 252 members from 46 member countries, 15 country chapters, 17 international conferences, and more than 45 partners and collaborators worldwide. AHILA members are librarians, information specialists, organisations, and commercial companies with an interest in health science information. AHILA recognises that tremendous progress has been made toward providing health information in Africa, partly because of technological advancements. Nevertheless, ensuring that information is accessible, comprehensible, and usable remains problematic, and there is a need in many settings to address issues such as computer skills, literacy, and the infrastructure to access information.

It is on that premise that AHILA developed a vision to become a leader in promoting access and use of health information in Africa through the provision of up-to-date and relevant health information. The association encourages the professional development of health librarians and promotes resource sharing in Africa through the development and standardisation of health databases. AHILA realised that to achieve its goal, it must actively engage with key stakeholders for technical support and sometimes funding projects or capacity-building initiatives. Such realisation saw the forming of partnerships with institutions or organisations, including the National Library of Medicine, World Health Organisation, ITOCA, INASP, Network of African Medical Librarians (NAMLA), HINARI (WHO and Major Publishers introduced in 2002 by former UN secretary General Kofi Anan at UN summit).

The goal of the 17th Congress of The Association for Health Information and Libraries in Africa (AHILA) is a deeper and more practical interpretation of health information. The theme of the conference is "Equitable Access to Health Information: The Key to Better Health." It thus aims to draw lessons and benchmarks around digital technologies, data science, research, modern library spaces, and structures as contributors to equitable access to health information and services. It will provide participants with the tools necessary to implement the above-mentioned lessons and benchmarks by offering hands-on workshops on evidence synthesis (systematic reviews), research and data management (RedCap), information brokering, and an array of health information tools.
# Table of Contents

THE 17TH CONGRESS OF THE ASSOCIATION FOR HEALTH INFORMATION AND LIBRARIES IN AFRICA (AHILA) LOCAL ORGANIZING COMMITTEE ........................................ iii

ACKNOWLEDGEMENTS .................................................................................................................... iv

REVIEWERS OF CONFERENCE PAPERS .......................................................................................... v

CONFERENCE HOSTS AND SPONSORS .............................................................................................. vi

BACKGROUND AND OVERVIEW OF THE CONFERENCE ................................................................... vii

## PART ONE: DIGITAL TECHNOLOGIES AND HEALTH INFORMATION SYSTEMS .......... 1

1. Undergraduate students' attitude and perception towards learning health information science course - Rajabu M. Simba and Hussein Haruna .............................................................................. 1

2. Knowledge and awareness of Health Information Professionals towards telemedicine services in Tanzania - Mary J Charles, Haruna Hussein and Peter A Sala ........................................ 18

3. The Application of Artificial Intelligence in Health Information Services - Tefo Kgosietsile and Ezekiel U. Okike ......................................................................................... 31


5. Access is not enough: A look at what Better Evidence for Training Champions are doing to promote the use and uptake of evidence-based digital tools in Africa - Grace A. Ajuwon, Aminu Musa Umar and Julie Rosenberg .................................................. 63


7. Experiences, Challenges and Lessons while Implementing a Clinical Decision Support System in Botswana - Kagiso Ndlovu, Nate Stein, Ruth Gaopelo and Mmoloki Molwantwa ........................................................................................................... 97

## PART TWO: EQUITY TO HEALTH INFORMATION AND SERVICES .......................... 118

1. A survey of medical students and faculty shows demand for evidence-based digital tools - Bezawit Teshale Bekele, Assurance Sipho and Julie Rosenberg .............................................. 118

## PART THREE: DATA SCIENCE & RESEARCH DRIVEN HEALTH INFORMATION .......... 122

1. Health Sciences Librarians 'Roles in Research and Community Service' - Twinamasiko Emmanuel .................................................................................................................. 122


4. Big Data Management in Libraries: A Case of Busitema University, Uganda - Glorias Asiimwe, Joyce Bukirwa and Alison Annet Kinengyere ................................................................. 173

5. 21st Century Mandatory Peer Review of Manuscript: How have the Policy and Technology Applications Impacted the Research Productivity of African Health Librarians? - Samuel A. Bello, Grace A. Ajuwon, Felix C. Azubuike ................................................................................................................................. 192
PART FOUR: RETHINKING HEALTH LIBRARIES AND LIBRARIANSHIP IN THE 21st CENTURY ................................................................. 221

1. Health Science Librarians’ Roles in Community Service, Faculty & Relationship Building - Kathryn J. Philip ........................................................................................................... 221

2. The Roles of Librarians in the Dissemination of Health Information Towards the Attainment of the Sustainable Development Goals (SDGs): A Case Study of Tanzania Food and Nutrition Library - Monica Chipungahelo, Emmanuel Twaha and Hamza Mwangomale ........................................................................................................... 239

Author Biographies................................................................................................................... 252
PART ONE: DIGITAL TECHNOLOGIES AND HEALTH INFORMATION SYSTEMS

1. Undergraduate students' attitude and perception towards learning health information science course: Rajabu M. Simba and Hussein Haruna

Rajabu M. Simba¹ & Hussein Haruna²

¹Department of Public Health and Community Nursing, School of Nursing and Public Health, The University of Dodoma, Dodoma, Tanzania
²Department of Human Resource Development, Ministry of Health, Dodoma, Tanzania

Background: Health information science programme is a multidisciplinary undergraduate degree programme that concentrates on the management of health records, health information services, data science, and usage of information technologies in healthcare settings. Since health information science is a new programme, little is known about the attitudes and perceptions of the first cohort students towards this course. This study is aimed at assessing and establishing student’s perceptions and attitudes of undertaking the newly established health information science course to inform prospective students.

Methods: The research involved enrolling first-year students from the University of Dodoma's health information science programme. A web-based survey was used to reach 250 students through email, WhatsApp, and Telegram. Quantitative data collected was analysed using SPSS 26, employing descriptive statistics to summarize and identify student attitudes and perceptions regarding the programme.

Result: A significant majority, 245 (98%) of health information science students, had a positive attitude toward the course as they showed that it was interesting and engaging. Most students 248 (99%) perceived the course as relevant to their future career goals as they presume opportunities available in the health sector within and outside the country. Foremost, the findings of this study highlight the advantages of providing adequate support and guidance to students, including instructors, to make course content relevant and engaging to the students.

Conclusion: This study revealed that the first cohort of health information science students have positive attitudes and perceptions of pursuing the course. This is a good indication that the course could attract more students and address the country's current health information challenges. Thus, the findings could inform stakeholders to create opportunities for the graduates to apply gained skills and competencies to address health information challenges to improve health outcomes.

Keywords: Health Information Science, Undergraduate Degree Programme, Student Perception, Attitudes, Data Science, Information Technologies
INTRODUCTION

Background

Health Information Science (HIS) is a multidisciplinary undergraduate degree programme based on the management of health records, health information services, data science, and use of information technologies in healthcare settings. A rapidly evolving field that plays a crucial role in healthcare delivery and management. As the demand for skilled professionals in health information continues to grow, it is essential to understand the attitudes and perceptions of undergraduate students towards learning HIS courses. This research aims to explore how students perceive HIS education, their attitudes towards the course, and the factors that influence their learning experiences.

Understanding undergraduate students' attitudes toward Health Information Science (HIS) courses holds key significance for curriculum improvement, aligning education with students' needs (Smith & Johnson, 2019). It's crucial for career readiness, equipping students for HIS-related professions. Knowledge of their perspectives aids in identifying areas requiring support to prepare students for success in the field (Lee & McAlearney, 2018). Furthermore, acknowledging their views aids student recruitment and retention by tailoring programmes to their interests (Anderson & Rainey, 2012). Smith and Johnson (2019) explored students' perceptions of health informatics, revealing insights into their understanding, relevance, and educational impact on their attitudes.

Lee and McAlearney (2018) investigated the role of self-efficacy in health information technology adoption among undergraduate health management students. The study highlighted the influence of self-efficacy beliefs on students' attitudes towards and engagement with health information technology. Anderson and Rainey (2012) examined the transformation of medical education through e-health technologies, providing insights into the impact of technology on students' attitudes and perceptions. The study emphasized the need to incorporate e-health into the medical curriculum to enhance students' understanding and preparedness for future healthcare practice.

These studies have contributed valuable insights into the factors influencing students' attitudes towards HIS education, including perceptions of relevance, self-efficacy, and the impact of technology on learning experiences. Since health information science is
a new programme in Tanzania, slight is known about the attitudes and perceptions of the first cohort students towards this course. This research aims to fill this gap by investigating the objectives and addressing this research objectives by seeking to provide a comprehensive understanding of undergraduate students' attitudes and perceptions towards learning health information science courses.

Statement of problem
This study investigates how undergraduate students perceive and engage with the Health Information Science (HIS) course, a critical yet underexplored area despite the course's significance in modern healthcare. It encompasses various elements such as health informatics, data management, electronic health records, and healthcare analytics. Understanding students' perceptions regarding its relevance and how they engage with the course is essential, as existing research gaps hinder effective curriculum development and student engagement. To address this, exploring factors influencing students' attitudes, including prior knowledge, perceived career relevance, instructional methods, and practical applications, is vital. Identifying potential barriers like technical complexities or resource limitations is crucial. This research aims to shed light on students' attitudes and perceptions towards HIS, offering valuable insights for institutions to adapt curricula, instructional methods, and support systems, optimizing learning outcomes in health information science.

Significance of the study
The study's importance concerning undergraduate students' attitudes and perceptions towards learning health information science courses offers substantial benefits to educational institutions, educators, curriculum designers, and the healthcare sector. The key significance lies in several aspects:

Curriculum Enhancement: Understanding students' attitudes provides vital insights for curriculum refinement, aligning content with student interests, motivations, and career goals. This can lead to more relevant, engaging course materials and practical learning opportunities (Abate et al., 2011).

Improved Teaching and Learning: Exploring attitudes helps educators identify effective teaching methods and materials, enhancing student engagement and learning outcomes in health information science courses.
Career Guidance: Insight into students' perceptions aids in offering targeted career advice, highlighting potential paths and opportunities in the field, and enabling informed decisions.

Healthcare Industry Impact: Understanding students' readiness and potential contributions to healthcare is crucial, ensuring graduates possess skills aligned with industry needs.

Research Contribution: The study fills a research gap, offering focused insights into undergraduate students' views on health information science, enriching the broader health informatics and education field.

Scope of the Study
The study focuses on understanding undergraduate students' perspectives and beliefs regarding their experiences with health information science courses. It delves into their attitudes and perceptions about various aspects, including the courses' relevance, satisfaction with teaching methods, interest in pursuing a career, intentions to apply gained knowledge and skills, and potential learning challenges (Abdulhamed, 2005).

It primarily involves collecting data from undergraduate students currently enrolled or recently completed in health information science courses from various educational institutions. The study might utilize surveys, interviews, or focus groups to gather data on participants' attitudes and experiences related to the courses (Abdulhamed, 2005).

The study specifically centers on undergraduate students' views about health information science courses and does not assess specific teaching methods or overall programme quality. Instead, it aims to provide insights guiding improvements in curriculum design, instructional methods, and support systems to enrich their learning experiences in health information science.

Broad Objective
To assess and establish students' perceptions and attitudes toward undertaking the newly established health information science course to inform prospective students.

Specific Objectives
To identify the sociodemographic data of health information science students.
To assess undergraduate students' perceptions of the relevance and importance of learning.
To assess the attitudes of undergraduate students towards the teaching methods and materials.

To identify the factors influencing undergraduate students' interest in pursuing a career in health information science.

To identify the intentions of undergraduate students in applying the knowledge and skills gained.

To identify potential challenges faced by undergraduate students in learning.

To identify the strategies to enhance their learning experience.

Questions

Q1. What are the perceptions of undergraduate students regarding the relevance and importance of learning health information science courses?

Q2. How do undergraduate students perceive the teaching methods and materials used in health information science courses?

Q3. What factors influence the interest of undergraduate students in pursuing a career in health information science?

Q4. What are the intentions of undergraduate students in applying the knowledge and skills gained from health information science courses in their future healthcare-related endeavors?

Q5. What are the potential barriers or challenges faced by undergraduate students in learning health information sciences?

Q6. What strategies can be implemented to enhance their learning experience?

Hypotheses

H0. Undergraduate students' perceptions of the relevance and importance of learning health information science courses positively influence their motivation and engagement in the subject matter.

H1. The teaching methods and materials used in health information science courses significantly impact undergraduate students' attitudes and satisfaction towards the course.

H2. Factors such as prior knowledge, career aspirations, and exposure to health information science significantly influence undergraduate students' interest in pursuing a career in the field.

H3. Undergraduate students who perceive the knowledge and skills gained from health information science courses as applicable and valuable to their future healthcare-related endeavors are more likely to have intentions to apply them in practice.

H4. The presence of supportive learning environments, resources, and effective instructional strategies positively contributes to undergraduate students' learning...
experience in health information science courses, overcoming potential barriers or challenges.

**METHODOLOGY**

**Research Approach**

The study used the Quantitative approach to collect data to answer the research questions. The use of this approach is due to the nature of the specific objectives of this study, which are the quantity nature of the demand. Quantitative data refers to numerical data that can be analysed statistically. Web-based Questionnaire was used to collect both types of data. For example, the questionnaire could include closed-ended questions that elicit quantitative data, such as demographic information or ratings on a scale.

**Research Design**

A cross-sectional Design, data is collected from Health information students at a specific point in time to provide a snapshot of a particular population or phenomenon. (Wyatt, 2000).

**Population**

The target population of this study was 250 First-year Students of health information science, whereby 235 of them were sample of students enrolled with form six qualifications, while 15 had enrolled with a diploma qualification at the University of Dodoma, Tanzania (Ebert, 2018).

**Sampling Procedures**

Wyatt (2000) states that simple random sampling, also known as chance sampling, is where every item in the population has an equal chance of inclusion in the sample, and each one of the possible samples has the same probability of being selected. The simple random sampling helps to make sure that Health Information science students have an equal chance of participating in the study without any bias.

**Data Collection Methods**

**Observation**
The study used observation as a data collection method in the form of non-participant observation. In this method, observed were things such as learning style, skills gained or applied, intentions and interests of students.

**Web-based Questionnaire**

An online data collection tool typically requires subjects to answer a series of closed and open questions tailored to the study's purpose and the participants' characteristics (Ebert, 2018). Questionnaires sent via email links were designed to suit the study's objectives (Wyatt, 2000).

**Data Analysis and Presentation**

**Quantitative data analysis**

Quantitative data was analysed using quantitative methods; quantitative data were entered into IBM SPSS version 26 for analysis. Categorized variables were summarized using frequency and percentages, while continuous were summarized as the median (Jiyenze, MK, 2019). Descriptive statistics were calculated for the following: sociodemographic, perception, attitudes, intention and interest level.

**Ethical Issues and Consideration**

The ethical issue addressed by the research was obtaining permission from the Head of Department (HOD) at the University of Dodoma, Department of Public Health and Community Nursing. In addition, consent was sought to collect data in strict confidence from HIS students around the University of Dodoma. The study adhered to ethical guidelines by giving assurance to respondents on privacy and confidentiality.

**RESULTS**

**Characteristics of Health Information Science Students**

The study involved 250 HIS students, 43% Male and 57% Female, and the median age of HIS students was 23 years. The majority, 92%, had enrolled with form six entry qualification (Table 1)

**Table 1:** Demographic characteristics of respondents

<table>
<thead>
<tr>
<th>Characteristics of respondents (%)</th>
<th>Frequency (N=250)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Perceptions of HIS students towards of the relevance of learning HIS

Most students 248 (99%) perceived the course was relevant to their future career goals as they presume opportunities available in the health sector within and outside the country as useful, and 1% (2 of 250) of students perceived it as not useful. (Figure 1)

Figure 1: Students perceptions

Attitudes of HIS students towards the teaching methods and materials

The majority, 98% of health information science students (245 individuals), expressed positive views about the course. They found the teaching methods and materials engaging, aligning with seven areas of effective learning, where skills were acquired through instructor involvement, discussions, content presentation, teaching methods, course materials, formats, and additional supplementary resources. (Table 2).
Table 2: Attitudes towards teaching methods and materials

<table>
<thead>
<tr>
<th>Teaching methods and materials</th>
<th>N=250</th>
<th>Agree (%)</th>
<th>Disagree (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor effective use multimedia (slides, video)</td>
<td>250</td>
<td>44 (17.6%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Instructors encourage active participation and class discussion</td>
<td>250</td>
<td>31 (12.4%)</td>
<td>1 (0.4%)</td>
</tr>
<tr>
<td>Content presentation in a clear and organized manner</td>
<td>250</td>
<td>33 (13.2%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Teaching methods promote critical thinking and problem-solving skills</td>
<td>250</td>
<td>20 (8%)</td>
<td>1 (0.4%)</td>
</tr>
<tr>
<td>Course material (textbooks) are relevant and up to date</td>
<td>250</td>
<td>33 (13.2%)</td>
<td>1 (0.4%)</td>
</tr>
<tr>
<td>The course materials are accessible and available in various formats (e.g., Print, digital)</td>
<td>250</td>
<td>54 (21.6%)</td>
<td>1 (0.4%)</td>
</tr>
<tr>
<td>The instructors provide additional supplementary material (e.g., Online resources) to enhance learning</td>
<td>250</td>
<td>30 (12%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td><strong>Total attitude of students</strong></td>
<td></td>
<td>245 (98%)</td>
<td>5 (2%)</td>
</tr>
</tbody>
</table>

Factors influencing HIS students’ interest in pursuing a career in HIS

A total of 245 (90%) agreed useful factors that influencing them pursuing a career in HIS (Table 3.). But most of students interested with factors such as Health technologies, job opportunities, demand of professionals and high opportunity to get job in NGOs

Table 3: Factors influencing HIS students’ interest with HIS

<table>
<thead>
<tr>
<th>Factors influencing interest in pursuing a career in HIS</th>
<th>N=250</th>
<th>Agree (%)</th>
<th>Disagree (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunity to work with IA and data analytics</td>
<td>250</td>
<td>36 (14.4%)</td>
<td>3 (1.2%)</td>
</tr>
<tr>
<td>Improving healthcare outcomes</td>
<td>250</td>
<td>32 (12.8%)</td>
<td>4 (1.6%)</td>
</tr>
</tbody>
</table>
Opportunity to work with digital health technologies 31(12.4%) 2(0.8%)
Job prospects and demand for professionals in HIS 38(15.2%) 1(0.4)
Career guidance and counselling provided by academic advisors 23(9.2%) 6(2.4%)
Opportunities for internship or practical experiences in HIS 25(10%) 5(2%)
High opportunity to get job in NGOs and Government 40(16%) 4(1.6%)
Total 225(90%) 25(10%)

Intentions of HIS students in applying the knowledge and skills gained from HIS

The HIS students mostly had high intention in applying the knowledge and skills gained, with 255 (90%) agreeing that the skills listed will be used for their future healthcare services (Table 4), such as improving healthcare, patient care and safety, data-driven decision making in healthcare setting, healthcare research and analysis, streamline healthcare data management.

Table 4: Intentions of HIS students in applying the knowledge and skills gained

<table>
<thead>
<tr>
<th>Intention of students in applying Health Information knowledge and skills</th>
<th>Response on Intention of students in applying HIS Skills and knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use knowledge gained in HIS to improve healthcare processes and efficiency</td>
<td>Agree (%)</td>
</tr>
<tr>
<td>Applying the skills learned in HIS to enhance patient care and safety</td>
<td>36(14.4%)</td>
</tr>
<tr>
<td>Utilize HIS concepts to contribute to data-driven decision-making in a healthcare setting</td>
<td>32(12.8%)</td>
</tr>
<tr>
<td>Incorporate HIS methodologies in healthcare research and analysis</td>
<td>31(12.4%)</td>
</tr>
<tr>
<td>Using HIS principles to support evidence-based practices in healthcare</td>
<td>38(15.2%)</td>
</tr>
<tr>
<td>Total</td>
<td>225(90%)</td>
</tr>
</tbody>
</table>
Leverage HIS knowledge to promote data security and privacy in the healthcare system 25(10%) 5(2%)
Using HIS tools and technologies to streamline healthcare data management 40(16%) 4(1.6%)
Total 225(90%) 25(10%)

Potential challenges faced by undergraduate HIS students in learning

Table 5 outlines the learning challenges of undergraduate Health Information Science (HIS) students, detailing seven statements highlighting obstacles in gaining knowledge and skills in the field. Challenges are ranked by the percentage of respondents; notably, 22% found complexities in data analysis and interpretation challenging, a significant hurdle for students.

Table 5: challenges faced by HIS students in learning

<table>
<thead>
<tr>
<th>Statement</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited access to up-to-date and relevant course materials and resources</td>
<td>45</td>
<td>18%</td>
</tr>
<tr>
<td>Insufficient hands-on practical experience in health information</td>
<td>32</td>
<td>12.8%</td>
</tr>
<tr>
<td>Complex and technical terminology used in health information course</td>
<td>33</td>
<td>13.2%</td>
</tr>
<tr>
<td>Lack of personalized feedback and support from instructors</td>
<td>21</td>
<td>8.4%</td>
</tr>
<tr>
<td>Time constraints and heavy workload affecting the ability to focus on HIS studies</td>
<td>34</td>
<td>13.6%</td>
</tr>
<tr>
<td>Difficulty in understanding complex data analysis and interpretation techniques</td>
<td>55</td>
<td>22%</td>
</tr>
<tr>
<td>Limited access to specialized software and tools used in HIS</td>
<td>30</td>
<td>12%</td>
</tr>
</tbody>
</table>

Strategies to enhance their learning experience

Table 6 details strategies proposed to enhance the learning experience for Health Information Science (HIS) undergraduate students. Seven statements outline approaches to improve their educational journey, ranked by the percentage of
respondents. Notably, 22% favoured more practical exercises and real-life case studies in the curriculum.

**Table 6: Strategies to enhance their learning experience**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>More practical hands-on exercises and real-life case studies in the curriculum.</td>
<td>55</td>
<td>22%</td>
</tr>
<tr>
<td>Enhanced use of multimedia and visual aids to support learning.</td>
<td>32</td>
<td>12.8%</td>
</tr>
<tr>
<td>Regular and timely feedback from instructors to monitor progress</td>
<td>33</td>
<td>13.2%</td>
</tr>
<tr>
<td>Smaller class sizes or group discussions for better interaction and personalized attention.</td>
<td>21</td>
<td>8.4%</td>
</tr>
<tr>
<td>Access to additional resources, such as online tutorials and webinars.</td>
<td>34</td>
<td>13.6%</td>
</tr>
<tr>
<td>Opportunities for collaborative projects and team-based learning</td>
<td>45</td>
<td>18%</td>
</tr>
<tr>
<td>Faculty availability for academic support and clarification of course concepts.</td>
<td>30</td>
<td>12%</td>
</tr>
</tbody>
</table>

**DISCUSSION**

**Perceptions of HIS students towards the relevance of learning HIS**

The study's findings reveal a high level of confidence among Health Information Science (HIS) students, with 99% acknowledging the value of opportunities in the healthcare sector, both locally and internationally. This perception highlights the importance of acquiring skills and knowledge in HIS for professional advancement. Similar to Smith et al.'s 2019 study on Information Science, where 80% of students expressed a positive view, this study also underscores a substantial gap in the practical application of health information systems and data analysis techniques. While students recognize the importance of HIS courses, they need to enhance the practical aspects of their learning. The substantial acknowledgement of HIS relevance to career goals emphasizes its significance in healthcare. In an era where technology is pivotal in healthcare, providing students with such knowledge is essential. Addressing the concerns of the 1% who found the course not useful is crucial. Understanding their
perspectives can help identify areas for improvement, enhancing the overall learning experience for all students in HIS.

**Attitudes of HIS students towards the teaching methods and materials**

The findings reveal that a substantial majority of undergraduate students in Health Information Science (HIS), 98% of respondents, hold a favourable view of the course. Their agreement reflects an appreciation for engaging teaching methods and materials, as indicated in Table 2. The positive reception spans various facets of effective learning, including mentor involvement, content delivery, instructional techniques, course materials, formats, and additional resources. Similar trends were observed in a study by Johnson et al. in 2020, where 75% of students exhibited enthusiasm for learning about health information systems, electronic health records, and data analysis techniques. This positive attitude underlines their keenness to acquire knowledge and skills in health information science.

Despite the overall positive attitudes, the study emphasizes a concern regarding students' limited awareness of career prospects. Addressing this gap by informing students about potential career paths in health information science could heighten their motivation and understanding of the course's significance for their future aspirations.

The upbeat reception of teaching methods and materials among undergraduate students in health information science suggests effective and engaging instructional practices. Such positive learning experiences contribute to better educational outcomes and increased interest in the field.

**Factors influencing HIS students' interest in pursuing a career in HIS**

The study data reveals that approximately 90% of Health Information Science (HIS) students identify various factors fueling their interest in pursuing a career in the field, as shown in Table 3. Key factors of interest among students include health technologies, job prospects, demand for professionals, and potential employment in non-governmental organizations (NGOs). This study's findings align with Lee and Brown's 2018 research, exploring undergraduate students' interest in Health Informatics, in which 60% of students in that study expressed interest, recognizing the increasing demand for health information professionals and potential career advancements. It suggests that a significant portion of undergraduates perceive
potential and opportunities within the HIS sector, thus driving their interest. The strong interest in health technologies and the recognition of the demand for health information professionals signify students' awareness of technology's significance in healthcare and its potential to reshape the industry, potentially feeling their interest in pursuing a career in Health Information Science.

**Intentions of undergraduate students to apply the knowledge and skills gained from HIS**

The research demonstrates that a substantial majority of Health Information Science (HIS) students, approximately 90%, as indicated in Table 4, are eager to apply their acquired knowledge and skills to advance healthcare. Their intentions encompass enhancing patient care, utilizing data for decision-making, conducting healthcare research, and improving data management. These findings align with Thompson and Johnson's 2017 study, where 85% of students aimed to apply knowledge from Information Science courses. It underscores students' recognition of the practical worth of HIS courses and their drive to enhance healthcare. The strong intent to apply knowledge highlights their commitment to improving healthcare. Nonetheless, the study acknowledges a lack of practical training opportunities, suggesting the need for internships and hands-on projects to better prepare students for practical application.

**Potential challenges faced by undergraduate HIS students in learning**

Table 5 outlines potential challenges faced by undergraduate students studying Health Information Science (HIS) in their educational journey. Seven statements in the table highlight various obstacles encountered by students striving to acquire knowledge and skills in this field. These challenges are ranked based on the percentage of respondents who identified each issue, with a notable hurdle being that 22% found understanding complex data analysis and interpretation techniques challenging. Ngowi et al.'s 2021 empirical review, which also examined challenges faced by undergraduate students in learning Information Science, corroborates these findings. Their study revealed different challenges, including limited access to practical training resources (65%), complex health information systems (55%), and the need for specialized technical skills (70%). These challenges impeded students' learning progress and proficiency in the subject. The substantial challenges in understanding complex data analysis underscore the need for enhanced instructor support in this area, crucial for success in Health Information Science (HIS). Additionally, the
limitations in practical training and complex health information systems indicate the
necessity for increased hands-on experiences, bridging theoretical and practical skills
for future healthcare careers. Moreover, the demand for specialized technical skills
stresses the importance of tailored training programmes, equipping students for
industry demands in HIS.

Strategies to enhance their learning experience
Table 6 outlines seven strategies aimed at improving the learning experience for
undergraduate students in Health Information Science (HIS). These strategies are
ranked by the level of support from respondents, with 22% advocating for more
practical exercises and real-life case studies. Smith and Johnson's 2018 study aligns
with these tactics, emphasizing hands-on training (80%), real-world case studies
(75%), interdisciplinary collaboration (70%), and technology access (85%) to enhance
undergraduate HIS education. The substantial support for practical exercises and case
studies indicates students' appreciation for applying theory in practical settings. These
methods foster critical thinking and problem-solving. Furthermore, the strategies
underscore the importance of interdisciplinary collaboration and technology access in
HIS education, enriching the learning experience across diverse disciplines and
keeping students updated on healthcare advancements. Incorporating these
approaches could significantly benefit undergraduate HIS students.

CONCLUSION
Undergraduate students studying Health Information Science (HIS) generally hold
positive perceptions of the course's importance, emphasizing the need for continued
improvement in merging theoretical and practical knowledge. Educational institutions
must focus on enhancing students' competence and success in the health information
science field. Results demonstrate the predominantly positive attitudes of
undergraduate HIS students, largely influenced by engaging teaching methods and
materials. Educators and institutions should create awareness about the career
prospects within health information science, nurturing student enthusiasm and
commitment to the field. Various factors impact students' interest in HIS careers,
including the focus on health technologies, promising job opportunities, and potential
roles in NGOs. To further encourage students' interest, providing enhanced career
guidance and practical field experiences is vital for shaping their aspirations and
preparing them for HIS careers. Undergraduate HIS students are keen to apply their
acquired knowledge and skills in future healthcare endeavours, aiming to contribute to healthcare improvement through patient care, data-driven decision-making, research, and data management. To support this, institutions must offer practical training opportunities in real healthcare settings. The data highlights challenges faced by undergraduate HIS students, suggesting the need for enhanced practical training, improved support in understanding complex data analysis, and specialized technical skills development programmes. Addressing these challenges could better prepare students for their studies and future HIS careers. The study underscores the significance of strategies to enrich the learning experience of undergraduate HIS students. Integrating hands-on exercises, real-life case studies, interdisciplinary collaboration, and access to updated technology can significantly enhance education quality in HIS. These approaches will better equip students for successful healthcare careers in Health Information Science.

REFERENCES:


2. Knowledge and awareness of Health Information Professionals towards telemedicine services in Tanzania- Mary J Charles, Haruna Hussein and Peter A Sala

Mary J Charles¹, Haruna Hussein ² Dr Peter A Sala ³

¹CEDHA, Tanzania. Department of Health Information Services – Health Information Professional

²Ministry of Health (MoH), Tanzania. Department of Human Resource Development-Head of Health Information Services

³CEDHA, Tanzania. Department of Paramedical

ABSTRACT

Introduction: Health Information Professionals (HIP) should be eHealth literate and able to search, evaluate and apply online health information. Telemedicine is the provision of healthcare services through the use of telecommunications technology. Nowadays, Telemedicine is the most popular means of healthcare delivery worldwide utilizing information technologies and electronic communications to provide online information. However, there is little awareness and knowledge of Health Information Professionals on telemedicine services in Tanzania. This study addressed the knowledge gap.

Objectives: This study aimed to determine the knowledge and awareness of Health Information Professionals towards telemedicine services in Tanzania.

Methods: An analytical cross-sectional study was utilized involving 50 Health Information Professionals working in healthcare settings in Tanzania selected by snowball sampling and web-based questionnaire via email.

Results: The study revealed that 66% of Professionals have high knowledge, 30% have partial, and 4% have low knowledge of Telemedicine. The majority, 66%, are using telemedicine, while the minority, 34%, are not using it. About 14% said telemedicine can be used in disease outbreaks, 12% in tracking patients, 10% in treating patients, 6% in communication, 5% in healthcare training, 2% save costs. Approximately 30% apply in hospitals, 20% apply online, and 16% apply in institutions/colleges.
Conclusion: The majority of the participants were aware of telemedicine applications, having IT support, information sharing, information sources, and awareness, which are significant for telemedicine services knowledge. As a result, health information professionals should receive appropriate and ongoing awareness raising training on telemedicine systems. Moreover, future health services need research on telemedicine, observational and diary methods should be used to collect data on job tasks and competencies of HIP in Institutions and Health facilities.

Keywords: Telemedicine, telecare, Health Information Professionals, attitude, cross-sectional study, knowledge, telemedicine services.

BACKGROUND
Health Information Science was first established and had its curriculum first implemented in the CEDHA College in Arusha, Tanzania, in the year 2017 having only six students undertaking the course for a duration of three years, selected by the admission requirements of Holders of Certificate of Secondary Education Examination (CSEE) with four (4) Passes in non-religious Subjects including “D” passes in chemistry, biology, and physics/engineering sciences, as well as a pass in basic mathematics and English language, are added advantages.

The vision of the Health Information Science programme is to have competent Health Information Professionals who will provide health information services effectively at different health training and care settings to cope with the existing and emerging health information issues.

The mission is to establish a conducive and sustainable training environment that will allow students and graduates to perform competently at their relevant levels and aspire for the attainment of higher knowledge, skills and attitudes in promoting healthcare services.

Currently, there is much progress in the intake and graduation of students with Health Information Science Diplomas from CEDHA College in Arusha and Bugando College in Mwanza. Health information Science now produces Health Information
Professionals who are competent in making and utilizing different health systems for much more efficient healthcare service delivery.

Currently, some Colleges offer Health Information Science courses, including CEDHA Bugando, for the Diploma level and The University of Dodoma (UDOM) offering at a Bachelor's Degree level.

INTRODUCTION

More advanced and innovative technology has resulted in many and varied changes in every sector. This has resulted in a new area of health care in which medical practitioners, hospitals, health centers, and financial and medical insurance experts cooperate together in a digital environment to improve fairness in the distribution of medical services and the quality of these services as well as reducing the costs of services (Biruk and Abetu 2018).

As the expansion and scale-up of the telemedicine system are still ongoing in sub-Saharan Africa, a key concern of the implementation team’s efforts was that physicians’ and health professionals' reactions to the telemedicine system would impact implementation success. The success of any new technology depends on many factors, including the knowledge and understanding of the concept, skills, acquired attitude, and working environment of the concerned professionals. This applies to any technology-supported medical service providing method such as telemedicine, where it is important to train the new concept and assess how far they are professionally ready to accept and provide telemedicine services. Since telemedicine is an emerging technology in the health sector of Ethiopia, facilitating its adoption, it prominently requires information about the knowledge and attitude toward telemedicine among health professionals. This study is, therefore, aimed at assessing the knowledge and attitude of health professionals regarding telemedicine. (Biruk. 2018)

Health Information Professionals (HIP) should be eHealth literate and able to search, evaluate and apply online health information. Electronic health (eHealth) literacy is the ability to search, locate and understand electronic resources, evaluate information quality and apply them to address a health problem. Telemedicine is the provision of healthcare services through the use of telecommunications technology. Telemedicine
is the most popular means of healthcare delivery worldwide utilizing information technologies and electronic communications providing online information. However, there is little awareness and knowledge of Health Information Professionals on telemedicine services in Tanzania. This study addressed the knowledge gap.

OBJECTIVES
The research investigates the knowledge, attitudes, and application of telemedicine services among Health Information Professionals in Tanzania and also supports health professionals by providing timely data capturing and organizing patient data, extracting relevant information, and identifying patterns or trends for better decision-making in healthcare settings.

METHODS

Study design
This was an analytical cross-sectional study approach suited to understanding the knowledge of telemedicine among Health Information Professionals. We employed a convergent mixed methods study design, which allowed us to collect quantitative and qualitative data on the knowledge, awareness, and application of telemedicine among health information professionals simultaneously.

Study settings
The study setting was in health care settings at council and regional level in Tanzania where 50 Health Information Professionals are performing their duties. Specifically, we conducted the study to assess the knowledge, attitudes and application of Telemedicine among Health Information Professionals working at the primary health facility (dispensaries, health centres, and district hospitals), council, and regional levels in Tanzania. We focused on these levels mainly because this is where the majority of Health Information Professionals are seemed to be working.

Population, sampling technique, and sample size
The study population included 50 Health Information Professionals working in healthcare settings council, regional level in Tanzania selected by snowball sampling, which was convenient as it allowed us to reach the study populations that are quite
difficult to sample as they are widely distributed and the technique needed little planning and fewer workforce compared to other techniques.

**Data collection methods and tools**
Both quantitative and qualitative data were collected from the Health Information Professionals working in healthcare facilities in councils and at regional levels, who were administered web-based questionnaire containing both open-ended and closed-ended questions delivered through email to the Health Information Professionals. The data were then processed and analysed using SPSS version 26.

The web-based questionnaire was developed based on existing information needs towards knowing how Health Information Professionals are quite equipped to carry out their daily prescribed duties and roles as per their curriculum and job description context.

**Data analysis and presentation**
Quantitative data were processed, and the data were later analysed using quantitative methods; quantitative data were entered into Statistical Package for Social Science (SPSS) version 26 for analysis and later presented through tables.

**Ethical issues**
Data were able to be collected after obtaining an informed consent from the study participants. The participants were ensured the confidentiality of the collected information and were granted the right to withdraw from the study at any time they wished.

**RESULTS**

**Knowledge of telemedicine among Health Information Professionals**
The study revealed that 66% (33 of 50) of professionals have high knowledge, 30% (15 of 50) have partial knowledge, and 4% (2 of 50) have low knowledge of telemedicine.
### Variables

<table>
<thead>
<tr>
<th>Categories</th>
<th>Frequency (#)</th>
<th>Percentages (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of Telemedicine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>33</td>
<td>66</td>
</tr>
<tr>
<td>Partial</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Low</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

### Application of Telemedicine among Health Information Professionals

The majority, 66% (33 of 50) Health Information Professionals, are using while the minority of them, 34% (17 of 50) are not using telemedicine.

<table>
<thead>
<tr>
<th>Categories</th>
<th>Frequency (#)</th>
<th>Percentages (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of applying Telemedicine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Majority</td>
<td>33</td>
<td>66</td>
</tr>
<tr>
<td>Minority</td>
<td>17</td>
<td>34</td>
</tr>
</tbody>
</table>

About 14% (28 of 50) of the Health Information Professionals said that telemedicine can be used in disease outbreaks, 12% (24 of 50) in tracking patients, 10% (20 of 50) in treating patients, 6% (12 of 50) in communication, 5% (10 of 50) in healthcare training, 2% (4 of 50) save costs.
<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>Frequency (#)</th>
<th>Percentages (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application of Telemedicine</td>
<td>Disease outbreak</td>
<td>28</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Tracking patients</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Treating patients</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Communication</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Healthcare training</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Save costs</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

Approximately 66% (33 of 50) of Health Information Professionals are applying telemedicine in various settings which 30% (15 of 33) of them are applying telemedicine in hospitals, 20% (10 of 33) apply online, while 16% (8 of 33) apply in institutions/college. The rest, 34% (17 of 50) have not yet applied telemedicine in their work settings.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>Frequency (#)</th>
<th>Percentages (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Areas of Telemedicine application</td>
<td>Hospitals</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Online</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Institutions/ Colleges</td>
<td>8</td>
<td>16</td>
</tr>
</tbody>
</table>

Attitudes of Health Information Professionals towards the application of telemedicine.
Concerning the need to have knowledge on telemedicine, 56% (28 of 50) of Health Information Professionals strongly agree on the aspect, 24% (12 of 50) agree, 6% (3
of 50) neither agree or disagree, 8% (4 of 50) disagree while 6% (3 of 50) of the Health Information Professionals strongly disagree on having knowledge on telemedicine.

Also concerning the need to apply telemedicine, 60% (30 of 50) of Health Information Professionals strongly agree on the need to apply telemedicine in their work setting, 20% (10 of 50) agree, 10% (5 of 50) disagree and 10% (5 of 50) strongly disagree.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>Frequency (#)</th>
<th>Percentages (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need to have knowledge on</td>
<td>Strongly Agree</td>
<td>28</td>
<td>56</td>
</tr>
<tr>
<td>Telemedicine</td>
<td>Agree</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Neither agree nor disagree</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Disagree</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Strongly disagree</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Need to apply Telemedicine</td>
<td>Strongly Agree</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Disagree</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Strongly disagree</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

DISCUSSION

Knowledge of telemedicine among Health Information Professionals

The study revealed that 66% (33 of 50) of Health Information Professionals have high knowledge. This is in line with the study conducted by Wubante and Tegegne (2022), who revealed that about 65.8% of health professionals have good knowledge of Telemedicine, and approximately 56.4% of professionals also had good knowledge.
Thus, the studies have shown that there is high knowledge concerning telemedicine among Health Information Professionals.

**Application of Telemedicine among Health Information Professionals**

The majority, 66% (33 of 50) Health Information Professionals are using telemedicine, while the minority of them, 34% (17 of 50), are not using it. This contradicts the study conducted by Sharma *et al.* (2023), whereby 35% were practicing telemedicine while the majority, 56% of the participants, were unskilled and incapable of practicing telemedicine.

Approximately 20% (10 of 33) apply telemedicine online, while 16% (8 of 33) apply in institutions/colleges, and 34% (17 of 50) have not yet applied telemedicine in their work settings. This contradicts the study conducted in Sindh, Pakistan, which revealed that 52.8% of the participants practiced telemedicine by delivering healthcare services through online consultations. Thus, there is a need to increase the online application of telemedicine.

**The attitude of Health Information Professionals towards the application of telemedicine.**

Concerning the need to have knowledge of telemedicine, 56% (28) of Health Information Professionals strongly agree on this aspect. This is in line with the study by Kumar (2022) conducted in Sindh, Pakistan, in which 54.0% of the participants strongly agreed that telemedicine improves the quality of clinical decisions. Approximately 24% (12 of 50) agree, 6% (3 of 50) neither agree nor disagree, and 8% (4 of 50).

Also concerning the need to apply telemedicine, 60% (30 of 50) of Health Information Professionals strongly agree on the need to apply telemedicine in their work setting, which is also in line with the study conducted in Sindh, Pakistan, in which 61% of health care professionals in this study appeared to know the benefit of telemedicine in saving time and 56.4% of them knew that it reduced unnecessary transportation cost. Approximately 20% (10 of 50) agree, 10% (5 of 50) disagree, and 10% (5 of 50) strongly disagree.
CONCLUSION
The majority of the participants were aware of telemedicine applications, having Information Technology support, information sharing, information sources, and awareness are significant for telemedicine services knowledge. As a result, health information professionals should receive appropriate and ongoing training to raise awareness of telemedicine systems. Telemedicine has technologically revolutionized the medical sciences worldwide and thus should be utilized to provide quality healthcare in underprivileged areas by investing in infrastructure and education. Moreover, future health services need research on telemedicine, observational and diary methods should be used to collect data on job tasks and competencies of HIP in Institutions and Health facilities.

RECOMMENDATION
The study findings will help provide guidance and emphasis in providing education and training to the Health Information Professionals to fill the knowledge gap and thus increase their impacts on the overall healthcare service delivery.

Also, the study will emphasise the integration of telemedicine into the school curriculum so as to promote more knowledge and coverage concerning telemedicine to a large population. By including coursework on telemedicine and giving Health Information Professionals more experience with telemedicine-related technologies, it is essential to close the gap between theoretical knowledge and practical application. By doing this, students studying health information science can be better equipped to employ more applications of Advanced telemedicine in their future careers.

The study findings will also put more emphasis on the application of telemedicine to effectively increase its impact throughout the country and have more effects on future studies and upcoming research projects. The study findings will also facilitate the vast increase in the online application of telemedicine, another means of effective application of telemedicine.
REFERENCES


11. Kumar, Grouve; Shardha, Harsha Komal; et al: Assessment of knowledge and attitude of healthcare professionals regarding the use of telemedicine: A cross-sectional study from rural areas of Sindh, Pakistan.
20. SM Wubante and MD Tegegne 2022, Health professionals knowledge of telemedicine and its associated factors working at private hospitals in resource-limited settings
   Patients’ perceptions of telehealth services for outpatient treatment of substance use disorders during the COVID-19 pandemic.


Abstract

Health Information System is an umbrella term that refers to various application systems that collect, analyse, manage, process, store, distribute, and transform medical information in a Health Care Environment. Currently, the world is focused on increasing patient engagement to a satisfactory level through digitization. These hospital management systems support healthcare policies and decisions and are the main vehicle for controlling life expectancy and mortality rates. Ensuring management, protection, and accessibility of health information remains a major challenge to the health sector, and such systems’ failure needs to be seriously adhered to. The failure of Health information systems is largely attributed to their inability to provide information access, equity, security, and information management, among other reasons. Poor system rationality, inadequate logical functioning, and lack of intelligence assistance to human beings are the major drawbacks behind the use of these systems despite today’s technological advancement. This calls for new technological inventions to help curb the gap in health information issues. However, technically, artificial intelligence (AI) ensures the application of intelligence assistance, rationality, and logical decision-making within an information system. AI is a branch of computer science that deals with artificially designing, creating, and simulating intelligent behaviours in information systems. The advancement of such systems through AI is important as they play a pivotal role in the health sector responsible for human life protection. Therefore, this research paper investigates the application of AI to health systems to improve information access and equity. We conducted a systematic review of data from the online data stores and a practical examination of an AI-based model. We found out that AI-revolutionised health information systems remain the best solution for the health sector. AI-assisted and modernized systems should be the focus of attention if we are to succeed in medical information management. Artificially intelligent health information systems are dynamic, adaptive, and responsive and can autonomously collect and give user feedback depending on their environment. Their ability to improve service performances, solve problems, and
scale with increasing demand are some of the main reasons behind their success. Sensible decision-making and rational simulation are some of the core features of artificial intelligence that power information accessibility, comprehension, and usability.

Despite such success, we acknowledge potential limitations such as data hallucinations, intelligence explosion, compromised data accuracy, and security. Therefore, this research models the application of artificial intelligence to health information services to address problems faced by the health sector. This is achieved by bringing together the key cornerstones of AI: system rationality, logical functioning, and intelligent assistance to enact adaptiveness and visualization of health assistants. In conclusion, AI generative models and online medical databases with transformative potential play a significant role in highlighting areas of improvement; this will eventually benefit policy developers, health professionals, medical students, patients, system developers, and the public.

**Keywords:** health information systems, artificial intelligence, adaptive systems, virtual health assistants, generative models

**Introduction**

Health Information covers various crucial personal information and opinions about illness or any other forms of disability; therefore, it is very important to gather, compile, and analyze such data to make an informed decision about saving people's lives and managing costs. This can be achieved with the relevant systems that can receive, process, and output data logically and intelligently. Access to such health information systems is the key to better health. Looking at the current operating systems, there is a need for the right technology adjustment in terms of infrastructure or equitable information access.

The health sector makes key decisions such as monitoring mortality rates based on data from various multiple sources such as road traffic accident data stores, crime statistics, police records, labour records, academic data files, and health financial data stores. This proves how big data plays a pivotal role in the health sector. Data retrieval, storage, organization, and management are at the core of such incidents. As a result, it is the responsibility of the health sector to implement and use intelligent systems that are logical enough to enable them to succeed. Such systems should not only identify where there may be erroneous human inputs but also continuously update while at the
same time providing both rational and intelligence assistance. Digital patient engagement systems have proven to be at the helm of improving health services as well as reducing medical care costs.

The application of AI in the health sector is ground-breaking, reshapes disease detection strategies, enables more accurate diagnosis, provides improved analysis of clinical documentation, and improves disease detection and prediction due to well-crafted algorithms during systems design. AI-powered systems transform how patients receive quality treatments with reasonable costs, thereby benefitting both the service providers and consumers. It is on this premise that we conducted an analytical review of existing tools and frameworks, literature sources, databases, and theorems for the betterment of health services. Improvements in medical records management, pattern identification in disease symptoms, large medical data processing, drug delivery, discovery strategies properly documented and implemented, and change detection in patient records are some of the main reasons why AI remains the main solution to the current issues facing the health sector. The ability to enable the health professional to predict success rates of medications based on the available data is one of the core features that need to be incorporated into the health information systems; these benefits need not be overemphasized. A system that interprets and extracts useful medical records and analyses and presents them in a meaningful way that aids professionals in making informed decisions is an indispensable asset to the whole nation, and therefore, such a system qualifies to be regarded as an intelligent system. Intelligent systems from different perspectives are produced by applying the Artificial Intelligence process. As a result, medical systems need to be developed to exhibit intelligence traits and rationality when operating in each field. This will greatly transform positively the entire operations of the health sector, from administrative duties, financial issues, medical records management, and even the general management of staff workers. As outlined above, such systems can multitask and are more efficient, fast, and less laborious as compared to the manual process of data management currently used in most hospitals and clinics, thereby saving costs, lives, and other resources for the benefit of us all.

The development of standardized databases encourages information sharing throughout the world. In research by Mbondji et al., (2014), a review was conducted to identify key data sources of health information and describe their availability in
various African member countries of the World Health Organization (WHO). However, the study found that comprehensive national plans must be developed to address data needs and sources while simultaneously building a national capacity for data gathering, analysis, usage, dissemination, and storage.

To improve health systems performance, we should be able to track and evaluate progress in health-related issues and, more importantly, monitor mortality rates. It is evident that health planners, policy developers, and systems managers need clean, actionable data. Sadly, most countries, especially African countries, rely on very weak, fragmented systems that cannot manage data as meaningfully as expected. Data concerning key determinants of good health, such as food nutrition, food security, education, and socio-economic status, all form part of the important records and must be properly stored for easy access, retrieval, and usage in case of need, which eventually speeds up proper decision-making. Efficient systems responses regarding health determinants, health status, policy inputs, and outputs must be represented and reported in a less time-consuming approach, saving resources. This means all countries need greater standardization and quality control measures to handle routine health information. Comprehensive national health plans that support decision-making in the health sector are vital, and such system features can better be achieved when incorporating Artificial Intelligence in the earlier stages of systems design and implementation from development to deployment of data management systems.

Health information management systems involve acquiring, analysing, securing, storing, and ensuring the quality of medical records. Protecting patients’ information in digital platforms encompasses a lot of advantages and disadvantages that need to be dealt with accordingly. Even though AI has a high potential to impact all disciplines of health care, the adoption of emerging technologies still lags behind. Healthcare professionals continue to struggle with delayed reports, poor patient management, and loss of critical data due to the lack of adoption of emerging technologies, which negatively affects general clinical practice. Therefore, to overcome data access, readiness, and availability challenges, we urgently need to rapidly adopt and implement AI literacy, AI-powered systems for visualization, quick automation, and security processing. According to (Wiljer & Hakim, 2019) AI has enormously grown such that it has the potential to transform health care. However, as pointed out by most researchers, there is no proper integration of AI and health data.
Recently, OpenAI released ChatGPT4, an AI-based conversational platform that answers questions, responds to users and is therefore suitable for training medical professionals. It comprehends and reacts to conversational queries and health care directives. It allows patients to converse naturally, provides human-like interactions, and improves patient outcomes. This is a rewarding advancement in the health sector, despite some drawbacks to be solved.

**Related Work**

AI in the healthcare sector is receiving considerable attention; however, studies prove that very few investigations have been conducted from multidisciplinary perspectives, such as health professions, finance, management, and decision-making (Secinaro et al., 2021). Analysis of various studies indicates that physicians can diagnose, predict, or customize treatment via AI; unfortunately, literature in this field is still emerging. Even though there is an abundance of computational technologies that can emulate intelligence assistance such as machine learning, deep learning, and reinforcement learning. However, integrating them into the health sector is still a challenging task. As a result, an analytic review of existing frameworks, theorems, and literature sources will help provide more insight into what needs to be incorporated as AI gradually transforms medical practice.

It was emphasized by Cho et al., (2020) that physicians' use of colposcopy photography is very important in cervical cancer detection. However, developing countries such as African member states are still lagging. If there is a lack of physicians, as is the case with most developing countries, the best solution will be the simulation of intelligent human-like behaviour in information systems to solve the gap. Additionally, in the same research, a typical example was discovered, indicating the use of deep learning technologies to classify cervical lesions, where the collected images were analyzed and categorized into normal and abnormal ones, and the healthcare workers could rely on the results for decision-making. In conclusion, Deep learning models have proven to be very supportive to under-experienced clinicians in deciding whether there is a need to perform a cervical biopsy or transfer patients to specialists. This is a huge decision that would otherwise be difficult without assistive technologies. Accurate cancer detection through PathAI services allowed pathologists
to make proper diagnostics, improved treatment variability, and better patient results analysis.

As stated by Davenport & Kalakota, (2019), although many situations prove the need for AI-powered health systems, there are also various factors hindering their success, such as failure of large-scale automation as well as ethical considerations. However, quite importantly, many studies show that AI performs better as compared to human beings, even though there are situations where humans will always remain vital. Challenges remain not on the side of systems development but rather on whether they will be adopted, used, and transparency issues, which may take longer than the availability of the technology itself. This poses another task of educating the entire nation, equating to improving AI health literacy.

In developing advanced cohorts for clinical trials and detecting uncontrollable growth of cancerous cells, well-designed and properly implemented algorithms outperformed radiologists. This is possible as AI is a collection of various technologies, not just one, and they are responsible for controlling the behaviour and the operation of a healthcare system. Such technologies include deep learning, machine learning, neural networks, and natural language processing. They work in precision medicine, diagnosis, and treatment, so to use them, the most important aspect is to ensure that the dataset has been properly trained to give the right outcomes. Although AI transforms radiology, it won't replace radiologists, argues (Davenport & Dreyer, 2018) despite speculations. The increase in human population means more health services, and as a result, the need for more AI-powered innovations becomes inevitable.

**Virtual Health Assistants (VHA)**-These are applications used in the health sector to respond to patients' queries through online chats and emails. They manage the medical records, store data, schedule appointments, and, in some situations, perform follow-ups and manage reminders. They comprise a combination of speech recognition, cognitive computing, augmented reality as well as body recognition technology. Controlling their logical behavior through AI means their intelligence level will improve to a point where they match or even surpass human capability. AI efficient and precise innovations reduce the sufferings of patients and help identify treatments(Jiang et al., 2017). Since they mimic human cognitive functions, this has fuelled the debate as to whether virtual doctors will replace human doctors.
The advancement of conversational AI transforms basic features of virtual assistant applications to provide efficiency, usability, comfort, and utility for the entire clinical care. Generally, virtual health assistants are not a replacement for human interaction. If properly designed, they can satisfactorily fulfill patients' increasing requirements, complement humans, and be very useful. These two, operating in conjunction with each other, will produce outstanding results. VHAs are interactive, intuitive, adaptive, and accessible, and they can differentiate the much-needed data from the rest, thereby exhibiting intelligent assistance (IA).

The continuous growth of medical science and the need to increase life expectancy rates have piled pressure on healthcare providers, this has led to rising costs and a struggle to meet the patients' requirements. To solve this problem, we need to implement the right technology, and only technological and digital innovations such as AI will prosper (Dicuonzo et al., 2023; Ellahham et al., 2020). VHA can determine whether a patient deserves a test or needs referrals. This is because the application asks a series of questions, collects and analyses data collection payments when needed, and places an order for medication or treatments. This eventually reduces the staff workload and medical costs and educates patients through feedback provision, while patients can avoid queues and travel costs.

Even though there is a growing body of evidence examining the use of VHA, there is very little in their adaptiveness, human-computer interaction, design characteristics, implementation functionality of algorithms, and feedback provision mechanisms. It is because of these reasons that we need to seriously consider revisiting their intelligence capacity during operation. Since these are innovative healthcare programs, they should be user-interactive, appealing, customized, and convenient to meet the needs of users.

VH are digital services designed to simulate human conversation and provide customized feedback responses as per the user requests (Curtis et al., 2021); they converse through answering questions and responding to user requests, and conversational agents act like humans in both appearance and behaviour (Ring et al., 2015). Quite important features such as the look and feel, language features, response rate, and virtual appearance have a very high impact on influencing users' motivation, experience, and engagement. Therefore, they need to be considered during the
design of VHA. The user experience is controllable through the application's presentation, interactivity, response, and functionality. Clear protocols for developing user interfaces are needed, and accessible conversational interfaces to accommodate various users, including disability groups. These algorithms should be coded from clearly developed guidelines and systematically reviewed to reduce errors.

According to Chattopadhyay et al., (2020); Curtis et al.,(2021), VHA that show empathy and display nonverbal behaviours with personal data about themselves perform better. However, there is no direct connection between the user experience and the look and feel features. VHA with human simulated functionalities brings alongside the capabilities of conversational agents and interactive digital characters. It is also important to identify the features of human interventions that contribute to the effectiveness and efficacy of patient-facing systems. As stated by Magnenat-Thalmann & Kasap, (2009) serious games can support people with autism, as well as people who suffer from social interaction; for example, such patients are allowed to create an avatar and then interact with another online avatar to learn some important issues such as starting a conversation and keeping it flowing, this can even help those with normal intelligence. The use of second Life Technology is a typical example of such scenarios.

Cognitive behaviour Therapy, situations where patients facing challenges of behavioural disorder, general disorder, phobia, or posttraumatic disorders (PSTDs) can be better controlled by virtual health assistants in the form of health games; controlling their anxiety can be achieved by simulating some anxiety-triggering simulations to make them feel comfortable.

**Improving Virtual Health Assistants Through AI**

**Adaptiveness**: The use of conversational agents handles user queries. They automatically update themselves to meet users’ current needs; they are improved versions of human-to-human-to-machine-to-human interactive technology-driven conversation. Real-time data, reminders, and quick assistance to patients redefine the healthcare sector through intelligent virtual care assistance. They can upgrade themselves to meet the current needs of users. This involves monitoring patients, responding to queries, booking appointments, and acting as a connection entity
between service users and providers. Remote patient monitoring coupled with
dynamic interactive responses forms the core part of adaptive virtual health assistants.

Integrating adaptivity in the design and development of virtual healthcare assistants
increases effectiveness and time efficiency (Henkemans et al., 2008). They have been
proven to improve health literacy regarding diabetes and enable older patients to
integrate with social and self-care activities in their daily normal routines thus
improving their lives and literacy as well as adherence to taking their medical
treatment.

Intelligent programs make decisions and perform actions based on their environment,
user input, and experience. They autonomously collect data at regular intervals,
through programmed behaviour, or as requested by users. This means they adapt to
experience, learn, solve problems, and give feedback through data retrieval and
storage. For a system to be called adaptive, it must be able to change its behavior in
response to its environment to achieve a particular goal.

**Design: Interface, Visual:**

The visual design of a virtual health assistant encompasses aesthetics as well as
usability. Elements such as images, layout, color, etc., should be properly placed to
create user interfaces that can optimize user experience while at the same driving
conversation. This engages and motivates the user, leading them to discover the right
content, navigation, and other system functionality. Good visual design ensures the
user's attention gets directed to the right functionality, and the aesthetics are consistent
to avoid turning the user off. If users do not trust design elements and principles, they
will have a hard time using the system, which eventually destroys its whole purpose.
Successful design is a combination of careful visual design and good usability. There
are various means by which the user interacts with the health assistant, and they
include the following.

a) Graphical user interface (GUI) interaction is implemented through visual
representation (graphics) and is effected by inserting commands to perform a
specific functionality.

b) Gestures-based interfaces (GBI) where interaction is done through 3-
dimensional design spaces recognizing body motions; examples include virtual
reality games.
c) Voice interface (VIF) interaction is done through voice.

The most important factor to consider when creating visual design is usability (an easy-to-do task with less effort), content easily accessible, and good emotional attraction features. This includes mental limitations of patients’ needs, discoverable buttons, menus, and response options. User interface design comprises various components to make it easy to learn to improve user productivity and satisfaction (Williams & Hewlett-Packard, 1989).

**Intelligence Assistance**

To help humans perform tasks, intelligence assistance plays a vital role, meaning intelligent health information systems can better serve human beings. These are software applications or extensions or part of the main health system responsible for coordinating a group of tasks, identifying problems, finding approaches to solving issues, and the relationship between such problems. They autonomously solve problems, learn, update health information, perceive signals, and assist other applications.

Intelligent assistant programs are powered with artificial intelligence to enable them to intelligently assist humans (Isla-Cota et al., 2022). From a perspective of computer science, this is an intersection of artificial intelligence, human beings, and the health care system to provide services to patients.

**Drawbacks of VHAs**

Although the benefits of AI-powered VHAs need not be overemphasized, there is a growing trend of drawbacks that come alongside the existence of such applications, despite the benefits of high-level automation, remote monitoring, customized patient management, and intelligent operation throughout service use. Some problems need to be solved as well, and these include compromised communication, which could be caused by internet disruptions or power cut-offs. This means we need to put some contingency plans in place, which may include at least one human health assistant in operation, a backup power supply, and alternative direct lines such as cell phones.

**Secondly, Unsupervised Operation** is another problem because intelligent VHAs deal with large various data from different perspectives; they continuously learn, adapt, and respond to user inputs, which means they consume a lot of structured or
unstructured information. In cases where it has been fed with erroneous or malicious data, this can compromise the logical flow of functionality of the system, hence giving wrong output or even mixing medical prescriptions. We need to make sure that proper reset options are functional, train models with authentic data, and regularly check the on-time intervals to avoid problems that may crop up and disrupt service delivery. In some situations, those who maintain and repair such systems work remotely; therefore, backup plans are vital.

**Thirdly, Compromised Data Security from networks**, online viruses, or hackers having access to unauthorized data. These are security mechanisms that need to be taken into consideration; antiviruses and right firewalls need to be updated properly to help ensure security. The systems need to be empowered with security features. The development of the right policies and procedures can help deal with compromised data security.

Despite technological advances, there are also several legal barriers and potential legal issues associated with the remote treatment of patients, and some mechanisms in place to identify illegal online administration of medication, sales, and distribution (Balestra, 2018; Gajarawala & Pelkowski, 2021; Mackey et al., 2017).

However, even though there are some drawbacks incurred by using VHAs. The bottom line is that their benefits far outweigh their drawbacks, and that is all that matters, as there is some solution for most problems encountered. AI empowers them to do a lot of beneficial tasks, but we need to develop the right guidelines and procedures to deal with unforeseen circumstances.

**Data Hallucination:**

Intelligent virtual health assistants are mainly transformer-based, which effectively helps them to generate responses. However, they extract data from large data sets using a technique called heuristic data collection. During data collection, the process heuristically selects and pairs sentences to their source and target. Unfortunately, target references can hold information with no supporting sources. Consider a scenario of today’s commonly used platforms like ChatGPT4, BERT (Bidirectional Encoder Representations from Transformers), DialoGPT, and RASA by medical students and health professionals and how they operate. Unintended hallucinated data may be because of generating the output that contradicts the references sources
or failing to verify the source. As a result, this gives nonsensical or unfaithful data claiming to be fluent and natural, and it is difficult to notice such errors at once (Ji et al., 2023). For example, the generated response may read “clinical trials have been approved” but the data source may read “clinical trials are yet to be approved”. This huge mistake poses a danger to life, violation of privacy issues, plagiarism, and unethical data usage by medical professionals and students.

Methodology:

Collection: Analysis of Existing Data and Practical Model Assessment (ChatGPT)

Ensuring health information is accessible, comprehensible, and usable remains problematic, to address these issues, the research paper applied two data collection methods: (i) Analysis of Existing Data and (ii) Practical Model Assessment. Analysis of Existing Data approach draws data sets, research findings from the largest medical library, and recognized and authoritative online data stores, which involve the National Library of Medicine, Journal of Medical Internet Research (JMIR), BMC Medical Informatics and Decision Making, and Medline. Practical Model Assessment uses a live practical assessment of an Artificial Intelligence-based generative conversational model called ChatGPT4 to determine its performance, response structure, feedback prescriptions, patient interaction approach, or how it serves the health sector concerning solving the research proposition. A rigorous strategy to avoid outdated data, a careful selection to eliminate old findings which may not currently matter, and re-evaluation to reduce biases are some of the systematic approaches used. Data sets are recent, and the newly released model, ChatGPT4, November 30, 2022, has been examined. Data are categorized according to their year of publication, leaving mainly old ones and sticking to the new research finding. The scale is indicated in the pie chart below:
The Data Search Approach:

1. Search online databases [health information + artificial intelligence]
2. Use keywords with concatenation operators "and", "or"
3. Retrieve and categorise papers.
4. Use abstract, conclusion to verify applicability of content.
5. Discard non-qualifying documents.
6. Collect data from the qualifying ones.

AI-Powered Health Information Systems
ALGORITHMIC STEPS

➢ Search online databases [health information + artificial intelligence]
➢ Use keywords with concatenation operators “and”, “or”
➢ Retrieve and Categorise papers.
➢ Use the abstract, conclusion, and methods to verify the applicability of the content.
➢ Discard non-qualifying documents.
➢ Collect data from the qualifying ones.

Generative Pre-Trained Model-ChatGPT4

To ensure patient management and comprehension, the newly introduced AI-based ChatGPT model is a very advanced and powerful tool providing customized responses and conversing with patients in natural language. It is a deep learning model that generates human text, with the ability to revolutionize the medical sector. Doctors, students, and medical science professionals have a supportive tool for tracking medical information, analyzing, and identifying health data, and anomalies, and helping with decision-making as well as speeding up the process of assessing patient conditions. Useful for identifying critical patients and recommending relevant treatments. Picture 1 below demonstrates a live conversation between ChatGPT4 and a real patient suffering from a headache, and it provides seven solutions instantly. Tools such as ChatGPT offer improved disease surveillance, prediction of outbreaks, collaboration, and improved accuracy of data analysis. However, the tool carries some drawbacks which need to be considered alongside its usage. Despite independent thinking, it fails to provide data sources, as depicted below, only answers with no references; therefore, we cannot verify data sources, and it does not understand the target audience. In as much as it is good, it has also been accused of manipulating users to do its tasks as it learns from them, it was trained from existing data; therefore, it inherits existing data biases such as gender inequality, and wrong prescriptions, while at the same time lacks emotional intelligence throughout the medical consultation process.

As stated in (ChatGPT Statistics 2023 Revealed, 2023) conversational agents such as ChatGPT have been available in medicine, trained on approximately 300 billion words with the ability to converse on a broad range of medical health information.
Since its release on November 30, 2022, it took less than a month to reach 57 million users and up to 100 million users by January 2023, making it the fastest-growing conversational AI tool. A clear indication that it is used by many users, therefore vital to understand how it operates.

Pic1

Data Analysis: Descriptive

The collected data involves current and historical information. Therefore, we systematically applied descriptive analysis as a way of finding patterns and relationships that exist between theorems of artificial intelligence, frameworks, and models in health systems that provide the best results, and the comparisons are as follows:

- **AI from a perspective of rationality vs human character-based theory**

It has been noted that many tend to associate artificial intelligence with computer systems that mimic the problem-solving and decision-making of human beings. However, this raised huge debate, with many disputing that not every human behavior qualifies as being rational. This calls for exact clarity of what ideal system rationality entails. According to Bringsjord & Govindarajulu, 2018; Russell & Norvig, (2009), AI
aims at logical building, that is, building intelligent agents that act rationally, not just like humans. This means acting sensibly or logically. Intelligent agents make decisions and perform actions based on their environment, user input, and experience. They autonomously collect data at regular intervals, through a learned or programmed behavior, or as requested by users. This means they adapt to experience, learn, solve problems, and give feedback through data retrieval and storage. They differ according to their level of intelligence or capabilities, but the suitable one for the health sector is learning agents. Modelling health information systems behind this approach ensures information is accessible, comprehensible, and manageable. In summary, system rationality as outlined is the best preference as opposed to the human character-based perspective. This takes us to the next point.

➢ **Logical Functionality vs general system functionality**

Logical Functional systems involve health information systems that can analyze the situation, identify a problem, and provide a solution. Having analyzed the facts, then methodologically deciding is an indispensable asset to both health workers and patients. This is derived from the above notion of rationality verifying the importance of this cohort when properly implemented within an application. However, generally programming health information systems to behave in a particular manner, as is the situation with today’s applications limits its operational ability to the algorithmic design style used. The logical approach as compared to the general one is best suited for the health sector. This is because even though the logical strategy follows algorithmic design but they go beyond the programmer’s scope as they can predict, and learn from experience which is most important for reoccurring disease or symptoms. (Darwiche, 2020) considers logically AI in three roles; firstly (i) logic as a basis for computation, secondly (ii) logic for learning from a combination of data and knowledge, and lastly (iii) logic for reasoning about the behavior of an application. This sums up a truly logical health information system.

➢ **Frameworks that enact intelligence through adaptivity**

Adaptive behavior for a health information system is quite important as it occurs in response to achieving a goal. Adapting to the environment, and giving feedback is important. This is called goal-seeking adaptation. The interrelated entities or agents converge to a particular state, forming a continuous evolution. Coding
algorithms to produce this behavior is challenging but attainable, the use of conditional statements and loops is necessary for this task thus giving artificially adaptive health systems. The complex adaptive health systems challenge the cause-and-effect assumptions and view health systems as dynamic. In this approach, relationships and interactions of various components simultaneously affect and shape the system's behavior. It is notable to accept that such systems influence leadership and organizational decisions. Though many actors are required, they are all components of the same system, and therefore, they interact and connect unpredictably or randomly throughout the operation, thus forming emerging patterns that in turn, provide necessary feedback to users. Properties of such systems involve dynamically interacting elements, boundaries, history, present behaviors, interacting agents, nested loops, self-organization, and iterations.

➢ Visually appealing interfaces
The aesthetics of the health system matters too; the presentation of words, characters, space, behavior, and time influence how users perceive and use the system. Ironically when there are many options on the display, the greater the cognitive load required. A state of indecision where one struggles to decide due to too many available options is a common problem resulting from decision paralysis. According to HICK'S Law the more choices a person is presented with, the longer the person will take to reach a decision.

This is because there is a correlation between the number of stimuli present and reaction time to any given stimulus. Presenting more stimuli to choose from extends the decision time; thus, patients and health workers bombarded with many choices take longer to interpret, analyze, understand, and decide.
Table 1: Hick law: \( RT = a + b \log_2 (n) \)

<table>
<thead>
<tr>
<th>Notion</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>“RT”</td>
<td>reaction time</td>
</tr>
<tr>
<td>“(n)”</td>
<td>number of stimuli present</td>
</tr>
<tr>
<td>“a” and “b”</td>
<td>denotes constants that are measured, depending on the task to be performed and the conditions to be met</td>
</tr>
<tr>
<td>log2</td>
<td>Binary logarithm, base applied with logarithms</td>
</tr>
</tbody>
</table>

For example, “A” can denote finding the right medication for your patient, and “B” could be a prescription under which that medication will work best. The amount of time taken by system users to make decisions increases in proportion to the presented options, thus, the gain of information is, on average, constant with time (Hick, 1952).

Good visually designed interfaces ensure a positive first impression from the onset. Health information systems become user-friendly and convey a very clear understanding of health services, with simplified navigations as well as information accessibility. This makes patients think differently, affects how they feel, and makes things easier, thereby saving the nation. For all this reason, the importance of interfaces needs not to be over-emphasized.

All of this should form a learning health system that is capable of learning from user experience and routine service delivery in an iterative and data improvement approach. Though they form a major part of health systems, there is a gap between their promise and practice. According to Hardie et al., (2022), part of Health Data Research UK’s (HDR UK’s) Better Care program, literature review reports, interviews, a survey of more than 100 expert stakeholders, and a series of practical case studies, offering real-world examples of LHS approaches were taken to explore core areas of learning health systems, focusing on health leaders, and policy developers, learning from data, harness technology, and implementing service improvements. All this indicates that a change in the health service’s learning and improvement capability is
necessary if we are to find a sustainable approach to recovery and effectively reshape care for the betterment of future health needs.

Summary and Recommendation

Despite the challenges faced by the health sector, tremendous growth has been made to improve health information accessibility, comprehensibility, and manageability through Artificial Intelligence. This encompasses improving systems rationality, logical functioning, and intelligence assistance to healthcare stakeholders. AI-assisted and modernized health information systems remain at the helm of data access, equity and better work as virtual health assistants. Though a lot of literature sources pointed to the inability of the health system to perform its mandate as expected, the use of Virtual Health Assistants was considered the best in ensuring information accessibility and usability. This is because they come alongside important features such as adaptiveness, properly designed interfaces, intelligence assistance, and logical decisions, the best functional behaviors needed to solve current issues. However, they had their drawbacks, such as compromised data security, unsupervised operation, and communication lapses. However, these were all proven to be manageable and less hazardous as compared to their benefits, indicating how much more they are useful to the health sector. Datasets from analysis of existing data and practical model assessment by ChatGPT4 live demonstration have proven the ability of Artificial Intelligence to improve health systems. Descriptively analyzing such data resulted in a strong conclusion that AI is the best solution to improve health information systems. Finally, the benefits of improved system intelligence involve accurate diagnostics, targeted treatments, management of medical records, dosage error reductions, clinical trial participants, fraud detection, and improved medical development.

Future Work

Intelligence explosion because of strong AI may be both bad and good for the health sector. This research focussed mainly on improving the intelligence level of health information systems but has not touched on the control measures to apply in case such logical and rational performances exceed human control. There is a hypothetical scenario in which the application of AI leads to an exponential growth of intelligence, which may eventually surpass the human level. This means systems may outsmart, outmanoeuvre, and manipulate healthcare beneficiaries rather than serve them.
Though it has not yet happened, it is inevitable; therefore, researchers need to be up to date with control measures. As a result of the super-intelligent healthcare system, despite the good aspects outlined in this research, there may be bad implications such as violation of human rights, tampering with medical information, and unauthorized data access, which may be beyond human control. This will cause more damage and conflicts within the healthcare sector policies as super-intelligent virtual health assistants may pursue their objectives with catastrophic effects. However, This is an important field to be explored alongside the efforts to improve health information management systems.

References


4. Champions as Essential Drivers of Better Evidence for Training Program-
Anthony Kiuna, Glorias Asiimwe and Tariku Sime

1Anthony Kiuna, 2Glorias Asiimwe, 3Tariku Sime

1University of Global Health Equity (Rwanda)
2Busitema University (Uganda)
3Jimma University (Ethiopia)

Abstract

Introduction: The Better Evidence program at Ariadne Labs - a joint center for health systems innovation at Brigham and Women’s Hospital and the Harvard T.H. Chan School of Public Health - aims to support the current and future health workforce to integrate the latest evidence into their decision-making to improve health outcomes. Better Evidence for Training has been building the capacity of the next generation of leaders in the health workforce by partnering with medical schools across Africa to facilitate free access to leading digital clinical decision support tools, including UpToDate. Our research has shown that when provided access to these digital tools known to improve patient outcomes in training, students continue to use them in practice.

Objective: To evaluate the effectiveness of Champions in promoting the use and access of digital clinical decision supporting tools.

Methods: In 2019, the first group of eight universities joined the Better Evidence for Training program and received free access to UpToDate. In 2020, the number of medical schools participating doubled. Champions were invited from every school including; librarians, ICT professionals, and faculty to join the movement to promote uptake and usage locally. Champions shared ideas with each other and with the network through webinars, an online community of practice, and other channels. In 2021, nominating a Champion became a requirement for participating schools, and Champions took on increasing responsibility for the program.

Results: As of August 2023, 52 medical schools and 93 Champions are participating and promoting access and uptake across 136 training facilities. Champions have taken on increased responsibility for leading the program, training and mentoring new Champions, and spearheading local efforts. Local ownership has allowed continued
expansion of the program, which should include more than 60 schools by the end of 2023.

**Conclusion:** Champions have been essential in promoting the use and uptake of evidence-based clinical decision support tools, and they are taking on increased responsibility and helping grow the movement for better evidence across the continent. With increased local ownership and investment in training the workforce to use and access the latest evidence, the latest information and science will be incorporated into practice and patients will get better care for generations to come.

**Introduction**

Better Evidence is a program at Ariadne Labs, a joint center for health systems innovation at Brigham and Women’s Hospital and Harvard T.H. Chan School of Public Health, in the United States. The Better Evidence (BE) program launched its program for African universities, Better Evidence for Training, in 2019. Better Evidence’s mission is to “enable the current and future health workforce to access and use the latest evidence to improve health outcomes.” Its vision is that “all providers will routinely access the best available evidence for diagnosis and treatment to provide the best possible care everywhere.”

The Better Evidence program facilitates access to evidence-based clinical resources in low- and middle-income countries. This journey commenced in 2009 when Better Evidence partnered with UpToDate to facilitate the donation of UpToDate subscriptions to individual clinicians. Later, in 2015, UpToDate committed to donate free 5-year subscriptions to students and faculty at a few medical schools in Sub-Saharan Africa to see if the tool could be useful to them. After an interim analysis showed positive results in 2018, Better Evidence has partnered with additional schools and affiliated training sites starting in 2019 to offer institutional UpToDate licenses. The program also supports the uptake of other evidence-based clinical information tools besides UpToDate, including Osmosis, TRIP PRO, and MERCK MSD Manuals.

One of Better Evidence’s strategies of building capacity among the next generation leaders in the health workforce through educational opportunities has been employed
to make these numerous clinical resources usable and known in 50 African medical schools currently enrolled under the program. The Better Evidence for Training Program launched in 2020 at 8 medical school schools, 11 more new schools joined in 2021, another 16 in 2022 and 19 in 2023. The Better Evidence for training program aims to train champions or advocates who are part of the medical schools to create awareness, train fellow faculty, and ensure these evidence-based clinical resources are effectively used.

Employees represent the most significant potential of any organization (Nikolić et al., 2021.). They have the best knowledge about the process and activities they undertake, as they are intimately involved in the implementation of the same processes. It should be noted that employees can and are significant generators of work-place innovation.

In the recent past, a lot of attention has been paid to the concept of employee engagement. According to Kahn (1990) employee engagement is based on three aspects: physical, cognitive and emotion. Organizations are thus encouraged to ensure that prospective brand ambassadors are engaged on these three levels.

In today's information-saturated world, the concept of trust is under increasing pressure (Šontaitė-Petkevičienė & Vaščėgaitė, 2022). This is true even within academia, where university staff, faculty and students are increasingly looking for trustworthy sources of information. With increasing access to information, pressure is now turning towards effective use of this information. According to Kibe and Kwanya (2015), information resources though accessible, have not been used adequately. To address this skewed situation, universities have developed partnership programs with information providers and developed systems that employ staff as ambassadors to encourage the use of information resources.

The Better Evidence for Training Program in 2020 adopted the “brand champions” approach to enhance evidence-based clinical information tools in 54 medical schools in Africa. Librarians, faculty members and students committed to become brand champions for the use and uptake of evidence-based clinical decision support tools. These champions work to align these tools, e.g., UpToDate, with how the tools view themselves, how they want to be viewed, and how the tools are actually viewed (Fisher-Buttinger & Vallaster, 2008).
Objective:

To evaluate the effectiveness of Champions in promoting the use and access of digital clinical decision supporting tools.

Methods:

1. Identifying Participating Institutions

Better Evidence started providing free, institutional UpToDate licenses to eligible African medical schools and affiliated clinical sites in 2018. Institutions/universities identified to participate in the Better Evidence program should be degree granting medical schools, have at least an intermittent internet access. African medical schools are allowed to express interest and approval is sought from UpToDate by Better Evidence. Once the medical school is invited to apply, the institution should complete an application form, which is reviewed and approval granted on a rolling basis.

2. Identifying Champions

It is widely recognized that employees play a pivotal role in establishing robust brands. Their influence and contribution are instrumental in shaping a brand’s image and its perceived value in the market (Löhndorf & Diamantopoulos, 2014). This also holds for the Better Evidence champions.

a) Librarians: One of the roles of librarians is to design suitable and appropriate strategies to enhance effective use of information resources (Jestin & Parameswari, 2005). To this end, librarians through the Better Evidence for Training program have been trained to become brand champions as a recognition that librarians are key in promoting effective use of clinical decision-making tools such as UpToDate. The training program has, therefore, seen member universities nominate 38 librarians to be part of the Champions.

b) ICT Staff: Services of the modern-day academic library rely heavily on ICT. ICT has become part and parcel of any academic library. As libraries continually adapt to an ever-changing ICT landscape, the need to have dedicated ICT
professionals has also increased. As a result, libraries have either employed graduate ICT personnel or have developed librarians to become systems librarians. UpToDate, a clinical decision-support tool, has been integrated into the various institutional ICT architectures for easy and efficient use. To date, 7 ICT staff have been nominated as Champions.

c) Teaching Faculty: According to Cetin et al., (2017), faculty are uniquely positioned to both identify students' information needs and provide guidance on how to deal with these information needs. Additionally, faculty play a critical role in the socialization of students. Shuval & Adler (1980) acknowledged this and stated that faculty are more pronounced within the medical school. The Better Evidence program did and has continued to appreciate this fact. Bandini et al, (2017) stated that students tend to internalize the behaviors and values of peers and faculty. Faculty thus become a critical resource in driving the use of any software/tools in medical education. To this end, the championship program has 19 faculty as champions.

3. Mentorship
Once champions have been appointed by their institution, they receive the first onboarding/induction training on the Better Evidence program, introduction to the basecamp – an online platform where champions and institutions share best practices, troubleshoot challenges and schedule training events. After that, Champions receive continuous training through monthly webinars to better understand the use of evidence-based clinical information tools. Through these trainings, Champions become more empowered to carry out trainings and rigorous awareness campaigns on the evidence-based information tools at their institutions. Each year, new medical schools and champions are added to the Better Evidence program, the existing champions volunteer to train the new incoming champions, and lead the monthly webinars. Furthermore, champions mentor students and faculty from their medical institutions to also be trainers of trainees or mini champions in the institutions.
Results:

Table 1: Institutional Statistics:

<table>
<thead>
<tr>
<th>Cohorts</th>
<th>No of countries</th>
<th>No. of Institutions</th>
<th>No. of Champions</th>
<th>No. of Medical Students @ onboarding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohort 1 (2019)</td>
<td>6</td>
<td>8</td>
<td>14</td>
<td>7,558</td>
</tr>
<tr>
<td>Cohort 2 (2020)</td>
<td>6</td>
<td>8</td>
<td>15</td>
<td>8,201</td>
</tr>
<tr>
<td>Cohort 3 (2021)</td>
<td>7</td>
<td>11</td>
<td>17</td>
<td>20,244</td>
</tr>
<tr>
<td>Cohort 4 (2022)</td>
<td>8</td>
<td>13</td>
<td>22</td>
<td>16,825</td>
</tr>
<tr>
<td>Cohort 5 (2023)*</td>
<td>7</td>
<td>19</td>
<td>25</td>
<td>9,064</td>
</tr>
<tr>
<td>5 cohorts</td>
<td>16 Individual countries</td>
<td>54</td>
<td>93</td>
<td>61,892</td>
</tr>
</tbody>
</table>

According to Table 1, a total of 52 medical institutions from 16 African countries have benefited from the program. 93 champions have been recruited under the program. East Africa has 6 countries (Uganda, Ethiopia, Tanzania, Rwanda, Kenya, Burundi and Somalia) and 33 medical institutions. West Africa with 3 countries (Liberia, Nigeria, Ghana) and 9 medical schools. Southern Africa with 4 countries (Malawi, Mozambique, Zimbabwe, Zambia) and 10 medical institutions.
Table 2: Usage Statistics

<table>
<thead>
<tr>
<th>Cohort</th>
<th>No. of Schools</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023 Jan-Apr</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>(Oct-Dec)</td>
<td>321,103</td>
<td>712,258</td>
<td>744,238</td>
<td>372,204</td>
<td>1,495,096</td>
</tr>
<tr>
<td></td>
<td></td>
<td>57,551</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>(Jun-Dec)</td>
<td>133,260</td>
<td>552,969</td>
<td>569,928</td>
<td>247,234</td>
<td>1,503,391</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>(May-Dec)</td>
<td>163,931</td>
<td></td>
<td></td>
<td>1,027,075</td>
<td>364,555</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,555,561</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>(Apr-Dec)</td>
<td>320,718</td>
<td></td>
<td></td>
<td>248,963</td>
<td>569,681</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>57,551</td>
<td>454,363</td>
<td>1,429158</td>
<td>2,661959</td>
<td>1,232,956</td>
</tr>
</tbody>
</table>

According to Table 2, the BE program has had five cohorts starting from 2019 to 2023. 2019 had 57,551 users; 2020 had 454,363 users; 2021 had 1,429158 users; 2022 had 2,661959 users and 2023 had 1,232,956 users.
Discussions:

The number of users of UpToDate has been on an upward trend. This can be attributed to two issues. The increase in the number of schools now enrolled in the Better Evidence program has seen the tool widely accessible to a wider population. The second reason, and more pertinent to this study, is the increase of Champions and the activities that champions undertake. The increase in champions has led to increased promotional activities, and this has had a positive impact on usage statistics.

It should be noted that the program ran during the COVID-19 period when many medical schools had to adapt to online learning. According to Kachra and Brown (2020), medical schools and residency programs have had to quickly respond and adapt to the spread of the pandemic by making rapid decisions with the best interests of faculty, staff, learners, and the public in mind. Champions and medical students were faced with a “new normal”. Teaching and learning went virtual, so there was a need to adopt new techniques to deliver medical education (Rose, 2020). As BE champions who had already started using ICT in promoting the use of clinical decision-making tools such as UpToDate, the virtual learning environment provided fertile ground for furthering this. Cohort 1 schools that were onboarded before the COVID-19 pandemic saw an over 100% increase in the use of UpToDate during the pandemic, signifying that Champions had and continues to have a positive impact.

A significant increase in the use of medical education tools offered under the Better Evidence Program in schools onboarded in cohort 3 can also be attributed to the fact that the Better Evidence program has adopted a policy of increasing champions in the newly onboarded schools. From the data, these schools have more than one champion, and this has had a positive impact as far as the use of the tools is concerned. A great deal of literature is available on the impact of the quantity of medical educators on medical education. Increased interaction between medical students and medical faculty has been shown to have positive learning outcomes. According to Tilghman (2022), faculty-to-student ratio in medical education is very important for learning outcomes. The increase in the number of champions in schools has seen an increase in the use of medical education tools under the BE program. Data points towards this.
It should be noted that Champions also have adopted innovative ways to continue pushing for the use of medical education tools. These innovative ways are specific to their environments and have borne fruit in ensuring there is not only increased use of the tools but also appreciation of the tools offered under the program. Some of the innovative ways that champions have employed include:

- Recruiting student ambassadors as part of their institution champions.
- Undertaking internal surveys on the use of to measure user satisfaction with the tools.
- Pushing for the adoption of these tools as part of the core curriculum resources and not as alternative resources.
- Mentorship programs where students are trained to be Trainer of Trainee (TOT).

**Conclusion:**
The Better Evidence program for Champions has been impactful. Champions have been the drivers of this impact that has seen the rise in the use of digital clinical decision-making tools. The mentorship program embedded in the BE program has also been helpful in onboarding new champions and providing them with experience-based learning opportunities where older champions provide their experiences, which have assisted in guiding the newer champions.

It is important to note that for future success, the Better Evidence program will be based on institutional support of the Champions model, champions continued engagement in activities that enhance and promote the use of the clinical decision-making tools and incorporating medical students in running such activities and programs.

**Acknowledgement:**

Special thanks to the Better Evidence Team at Ariadne Labs (Rebecca Weintraub, Julie Rosenberg, Sara Pellegrom and Rebecca Karstensen) as well as over 90+ Better Evidence for Training Champions who contributed greatly to this work.
References:


Access is not enough: A look at what Better Evidence for Training Champions are doing to promote the use and uptake of evidence-based digital tools in Africa—Grace A. Ajuwon, Aminu Musa Umar and Julie Rosenberg

Grace A. Ajuwon, Aminu Musa Umar, Julie Rosenberg

1 E. Latunde Odeku Medical Library, College of Medicine, University of Ibadan, Nigeria.
2 College of Medical Sciences, Ahmadu Bello University, Zaria, Nigeria
3 Better Evidence for Training at Ariadne Labs, Brigham and Women’s Hospital, Harvard T.H. Chan, School of Public Health, Boston, USA.

Abstract

Introduction
Around the globe, more than two million healthcare providers are consulting the evidence-based clinical content on UpToDate for answers to their clinical questions. The digital tool is used more than 1.7 million times per day. It’s also the only resource of its kind to be associated with health improved outcomes.

For many years, UpToDate was out of reach for those with limited resources due to the high cost. Now, a program called Better Evidence is making it available in about 60 African medical schools for free. Providing free access to the tool is not enough, there is the need to promote registration and usage. Without encouragement, training, and support, the free access goes unused. Implementation efforts are essential.

Objective
The main objective of the study is to examine the Better Evidence for Training Champion’s role in promoting uptake, adoption, and use of UpToDate and other clinical decision support tools in partner institutions (medical schools) across Africa.

Methods
Champions have implemented many innovative programs using different strategies. These includes launching communication campaigns (WhatsApp, Telegraph, Email, posters and flyers), offering training, engaging faculty, appointing student ambassadors, attending orientation for new students or other events where potential users are congregating, and more to promote uptake and use of clinical decision support tools in their institutions as well as affiliate sites.

Results
Over time, usage and tool registration have increased at every single institution. Schools that recently joined the program usually see <10% of eligible registrants engage with the tools. Schools participating in the program for the longest have the highest registration and usage rates. At Cohort 1 schools, more than 67% of eligible users were registered after three years, with registration rates slightly lower for each consecutive cohort.
Conclusion
Local advocacy and innovation are essential for promoting the use of new digital technologies and informatics tools, even when such tools are known to be beneficial. It takes time for people to adopt new tools.

Introduction
Evidence-based Medicine (EBM) is a process of lifelong, self-directed learning in which caring for patients creates the need for clinically important information about a diagnosis, prognosis, therapy, and other clinical and health care issues (Masic et al., 2008). Sackett and colleagues (1996) describe EBM “as the conscientious, explicit, and judicious use of current best available research evidence in making decisions about the care of individual patients”. Evidence-based medicine (EBM) is about using research evidence to inform care of individual patients.

The advent of the Internet and the exponential growth of the biomedical literature has left clinicians suffering from information overload; more than 250,000 clinical studies are published each year. Clinicians lack sufficient time to wade through volumes of health literature. Unanswered questions, medical errors, and adverse events necessitated the development of clinical decision-support tools (Moore & Loper, 2011). Haynes and Wilczynski (2010), defined CDS tools as “information technology-based systems designed to improve clinical decision making.” Clinical decision support tools are interactive (Vardell & Moore, 2012). They provide information or data, usually at the point of care, to guide clinical decisions and improve health care delivery (Goodman et al., 2023) by enhancing medical decisions with targeted clinical knowledge, patient information, and other health information at the point of need (Osheroff et al., 2012); they aid in the avoidance of diagnostic errors and reduce costs of treatment (Liberati et al., 2017).

Clinical decision support systems are also known as digital decision support tools (DDSTs). Some DDSTs are designed for a specific speciality or purpose, and others address a wide range of topics. Those that connect the clinician to the latest clinical evidence are considered evidence-based clinical decision support tools. With such tools, clinicians can search at the patient’s bedside instead of going to the library to look up clinical information. Examples of evidence-based CDS tools that bring the most recent evidence to the clinician at the point of care include UpToDate, MSD
Manuals, DynaMed, VisualDx, and Clinical Key (Rosenberg, Miller, et al., 2022). They allow clinicians to make faster and better decisions in the management of their patients. The importance of DDSTs in effective, high-quality, and equitable healthcare outcomes has been well acknowledged by the World Health Organization (WHO, 2019).

Previous studies (Bonis, 2008; Isaac, 2012) have examined evidence-based digital support tools and their impact on patient outcomes as well as (Kawamoto, 2005; Hardenbol et al., 2018; Cho et al., 2022) the usability and general performance of evidence-based decision support tools. Bonis et al., (2008), noted that hospitals with access to UpToDate were reported to have better patient care quality and shorter lengths of stay.

**UpToDate: A Digital Decision Support Tool**

UpToDate is one of the most popular digital clinical decision support tools. It covers 25 specialties and is used by over two million healthcare providers in 190 countries, with more than 1.7 million consultations per day (UpToDate, 2020). One study showed that 37% of the time clinicians look something up in UpToDate, they change their decision (Phua et al., 2012). Hospitals that offer UpToDate were found to have shorter lengths of stay, higher quality care, and lower mortality rates (Bonis et al., 2008; Isaac et al., 2012). In settings where clinicians are seeing a wide range of conditions and have minimal access to specialists for consultation, it is likely that the tool leads to even greater improvement in health outcomes.

**Statement of the Problem**

UpToDate is more than 30 years old, evolving over the years from arriving by mail on computer disks to being downloadable and web-based. Despite increased usage of UpToDate and other digital clinical decision support tools over the years, usage has not been universal. The cost of the tools and several other barriers to access have meant that use has been much lower in developing parts of the world, where they could have the largest impact, given the disease burden and human resource shortage.
Access to evidence-based digital tools is possible in today's information age, but having access is insufficient since access does not necessarily lead to use. The Better Evidence for Training Program – a program run from the USA at Ariadne Labs, a joint centre for health systems innovation at Brigham and Women's Hospital and the Harvard T.H. Chan School of Public Health – facilitates access to evidence-based digital tools such as UpToDate and has on boarded “Champions” who have taken on the mission of encouraging the use and adoption of these technologies in medical schools in universities across Africa. The Champions consist of health librarians, clinicians, IT professionals among others. They develop and implement strategies for uptake of UpToDate in medical schools in Africa. While a wealth of literature could be found on evidenced-based digital tools, little research was conducted on maximizing uptake and usage of evidenced-based digital tools, especially within the African continent. This research set out to fill in this existing gap in the literature.

The Objective of the Study
The main objective of the study is to examine the Better Evidence for Training Champions role in promoting uptake, adoption, and use of UpToDate clinical decision support tool in partner institutions (medical schools) across Africa.

Review of Related Literature
Numerous factors affect the uptake, adoption, and usage of evidence-based digital tools; therefore, promoting their uptake and usage has become imperative (Rosenberg et al., 2022; Kinengyere et al., 2021). Several promotion strategies have been identified in the literature to ensure the use and uptake of digital tools. Kinengyere et al., (2021) found that the use of the tools is variable and suggest capacity building and promotion can contribute toward increasing the consistent use of evidence-based digital tools.

Hwang and colleagues (2020), categorize strategies for promoting Institutional Digital Repositories in Texas into active and passive outreach practices. To buttress this further, Atkinson et al., (2017), conducted a study to discover mental health professionals' attitudes towards evidence-based practice and methods used to keep up-to-date with research, promote the use of a digital evidence-based platform known
as the National Elf Service (NES), assess its use, and explore its potential to impact clinical practice. A series of presentations by the NES Director was followed by the introduction of the NES subscription to adult mental health community teams and two early intervention services across Oxford and Buckinghamshire. Research assistants were employed to increase staff awareness and engagement in research by promoting the NES through an intervention. The study found that the NES increased awareness and knowledge about evidence-based digital tools, which has led to greater demand and utilization across various sectors. However, most Oxford Health National Health Service Foundation Trust staff members were still unaware of the NES resource at follow-up, suggesting that emails were not effective in advertising the service. Future possibilities include advertising within team bases and having team managers promote the resource.

Also, George, et al., (2022), analyzed the behaviors and characteristics of champions who successfully promoted evidence-based interventions in the healthcare sector. Using a mixed-methods, cross-sectional triangulation design with a convergence model. The study found that champions exhibited characteristics that facilitated trust and motivation among their colleagues. These included intrinsic motivation, persistence, enthusiasm, and effective communication. However, champions were more likely to underrate their skills and abilities to instigate change than their colleagues. The study highlights the importance of understanding the unique characteristics and behaviors that make champions effective in facilitating evidence-based interventions.

In another related study, Lehane et al. (2018), explore the challenges and enablers of evidence-based practice (EBP) and associated technologies. The study used a qualitative research methodology to achieve its objectives. The findings of the study indicated that "EBP curriculum considerations", "Teaching EBP," and "Stakeholder engagement in EBP education" were the major bottlenecks to proper EBP usage and associated technologies. These categories informed the overarching theme of "Improving healthcare through enhanced teaching and application of EBP". The study indicated that despite positive opinions regarding EBP and widespread acknowledgement of its importance in providing quality and safe healthcare, reliable translation at the point of care remains elusive.
Valtis et al., (2016) conducted a study on the use of UpToDate evidence-based digital decision support tool by clinicians in resource-constrained settings. Data was collected via Google Forms from applicants requesting access to UpToDate between 2009 and 2015. The findings indicated that increased awareness is central to usage and uptake promotion. For example, the findings revealed that "growth picked up significantly after 2013, potentially due to growing awareness". The findings also indicated that removing the cost barrier to accessing UpToDate has led to frequent usage by low and middle-income countries. This study was foundational to the findings of Valtis et al., (2018), who reported that the removal of access costs among medical students and faculty generated uptake and usage of UpToDate by senior medical students. It also helped facilitate their continued usage after graduation.

Rosenberg and colleagues (2022) analyzed factors affecting clinicians’ uptake and usage of UpToDate specifically, barriers and enablers of facilitating access to digital evidence-based tools. The findings of the study indicated that some of the challenges faced by the respondents were integrating the digital tool into practice, with clinicians who faced difficulties being only half as likely to log on. Also, the study indicated that the perceived utility of the tool mattered for uptake, with a percentage reporting an improved ability to find answers. Also, the study suggested that a positive professional context facilitated tool use.

**Program Approach**

The Better Evidence program aims to bridge the gap in access and use of clinical decision support tools. Better Evidence began facilitating access to UpToDate to clinicians in 2009 and after a decade saw that it was important to train clinicians to use the tool in medical schools to promote usage (Valtis et al., 2018). The program began to facilitate free access to UpToDate in African medical schools by turning on access through the IP addresses of schools and their associated training facilities. However, again, the program saw that access alone was not sufficient for utilization and uptake. Partnering with local advocates would be essential for shifting the culture to foster acceptance and integration of clinical decision support tools into daily practices.
Better Evidence for Training Champions

Starting in 2020, each school appointed up to two champions, including librarians, clinicians, and ICT professionals, to promote the use of free, digital evidence-based tools in their respective universities and affiliated training institutions.

As of July 2023, 71 champions (including 23 women and 35 librarians) were working across 43 schools in 15 countries. The champions are raising awareness about the benefits of evidence-based tools, dispelling misconceptions, and addressing concerns related to technology use. Champions partner with the Better Evidence team, providing feedback to the team and working to develop strategies and implement ideas.

Across universities, Champions have implemented many innovative programs to raise awareness and encourage the uptake of evidence-based digital tools. We launch targeted communication campaigns to disseminate information about the availability and benefits of these tools. These include the use of WhatsApp, Telegram, email, and newsletters as well as hanging printed posters or flyers around campus. Over the last year, more than 80% of Champions have displayed posters on their university campus and more than a third have hung posters at affiliated sites.

Additionally, Champions have been coordinating and conducting training sessions to familiarize users with UpToDate. Training sessions aim to give users the necessary knowledge and skills to make the most out of this tool. Champions either set up sessions or try to ensure that they can get time slot during existing faculty meetings or student orientations. Champions engaged in organizing training to promote uptake and use of UpToDate digital tools at departmental meetings, Faculty governance councils, journal clubs, and meetings with university administration and service units. Nearly 50% held trainings at affiliated sites. By providing hands-on training and support, Champions can troubleshoot any technical issues on site and empower colleagues to integrate evidence-based tools seamlessly into their daily workflows. Some universities have appointed student ambassadors and distributed the work of Champions or Advocates even more broadly.

By leveraging various channels, we are effectively building awareness of both the availability and utility of evidence-based digital tools over time.
Over time, Champions have developed promotional strategies and preferences for direct and personal communication with faculty members, clinicians, residents, and students. The rising uptake and usage show the commitment and dedication of Champions towards promoting evidence-based digital tools. Champions used face-to-face outreach to market and promote the use of UpToDate digital tool to the general user community in their various universities in Africa.

Furthermore, the experience gained by Champions over time becomes invaluable as we share the ideas that work amongst ourselves and later train newly nominated Champions from medical schools that join the program in effectively advocating for the use of UpToDate in their institutions. More than 50% attend the live webinars on Zoom, with the remainder watching asynchronously, and more than 80% have posted in the online community of practice. The knowledge transfer ensures the continued evolution and growth of the program and the increasing awareness of evidence-based digital tools across universities and training programs.

**Impact**

**Registration rates among eligible users by cohort over time**

Over time, usage and tool registration have increased at every single participating institution (see Table 1 for percent of eligible users registered within each cohort over time). Schools that recently joined the program usually see <10% of eligible registrants engage with the tools in the first month. Schools that have been participating in the program for the longest have the highest registration and usage rates. There is a big range in registration rates among schools, ranging from 4% to 232%. Because the rate is calculated using the total number of students, faculty, and interns as reported by schools as the denominator, registration rates may exceed 100%; the tool is available to all clinicians working in affiliated training facilities.
Table 1 Registration rates among eligible users by cohort over time

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohort 1</td>
<td>31.16 %</td>
<td>57.99 %</td>
<td>94.67 %</td>
<td>133.24* %</td>
</tr>
<tr>
<td>Cohort 2</td>
<td>--</td>
<td>51.85 %</td>
<td>81.45 %</td>
<td>109.65 %</td>
</tr>
<tr>
<td>Cohort 3</td>
<td>--</td>
<td>--</td>
<td>41.78 %</td>
<td>70.13%</td>
</tr>
<tr>
<td>Cohort 4</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>25.83 %</td>
</tr>
</tbody>
</table>

*Some percentages exceed 100% because there are more people registered than the number of enrolled students, faculty, interns as reported by universities.

**Cumulative registration data is pulled in May/June of the second year shown.

Usage rates by cohort over time

While registration rates relate to the number of people who sign up for access to the tool, usage rates show how much they actually use it and search for information. Based on the usage of the UpToDate evidence-based digital tool, the findings show some discrepancy in use between cohorts. The schools that have had access the longest generally have higher levels of use. However, in the first year of the program (2019-2020), there were no Champions, and usage rates were lower. In the second year (Cohort 2), schools were invited to appoint Champions and usage increased. Cohort 3 schools were required to appoint Champions. Cohort 3 was slightly bigger than the previous two cohorts and saw the highest usage relatively quickly. There may also be an impact seen from the COVID-19 pandemic during which many schools closed for an extended period, limiting the ability to register and/or use the tool. Most schools see a dip in usage around the winter holidays each year.
Discussion of Findings

Analysis of findings from the study indicated that promoting evidence-based digital tools is an integral part of the role of Better Evidence for Training champions. Regarding the success stories over uptake and usage, Better Evidence for Training champions have used several strategies to promote UpToDate evidence-based digital tool usage among faculty members, clinicians, residents, and students. For example, the findings of this study showed a trajectory increase in older cohorts. There is no surprise here because the older champions have been persuading and engaging people for a long time, which has undoubtedly led to an increase in uptake and usage.

UpToDate Champions also used fliers, personal letters, mass e-mails, handbills, leaflets, brochures, and notices placed on notice boards, social media, WhatsApp, institutional websites, and other media, which according to Schlangen (2015) and Thompson et al., (2016), are considered an effective way to market and promote uptake and usage of the digital tool in general. Therefore, the success stories recorded by the Champions are aligned with previous research findings. Through their constant engagement, commitment, communication, and dedication, Better Evidence for Training Champions have established networks of users across the entire African continent.
Conclusion

In conclusion, access alone is not enough for the optimal use of evidence-based digital tools. By developing collaborative alliances and champions, Better Evidence for Training initiatives are encouraging the usage and uptake of UpToDate evidence-based digital tools. Through raising awareness, understanding, and use, Better Evidence for Training Champions are impacting clinicians in different countries to make better decisions and achieve better outcomes. Through its ongoing work, Better Evidence for Training is paving the way for a future where evidence-based digital technologies will be successfully applied in practice, enhancing both individuals’ lives and society’s well-being within the African continent and beyond.

While reducing cost barriers is an important step toward increasing access and uptake of evidence-based digital tools in practice, it is not sufficient. Local advocacy and innovation are essential for promoting new digital tools, even when such tools are known to be beneficial. It takes time for people to adopt new tools. There is a lot of interest in UpToDate among members of African medical schools who are aware of access. Lowering the cost barrier and conducting tool promotion and training can, therefore, address the currently low tool uptake in the continent. Better Evidence’s approach, through the efforts of local champions, aims to increase engagement and use of clinical decision-making tools, helping to foster a culture of evidence-based practice in African medical schools.

Acknowledgements

We acknowledge most sincerely the Better Evidence for Training team for providing information, and their support in the initial draft of this paper. Our thanks go to Amira Ravshanova, Rebecca Karstensen, Sara Pellegrrom, and Miina Jovonen for all you do to make the work of UpToDate Champions easy and exciting. We are very grateful to you and Rebecca Weintraub for supporting Champions to attend the 16th AHILA Conference that took place in Gaborone, Botswana, 16-20 October, 2023 and to the funders who back your work, including the Abundance Fund. This enabled Champions to present papers on the fantastic work they are doing in promoting UpToDate clinical decision support tool on the African continent.
References


of the UpToDate clinical decision support tool at the Makerere University College of Health Sciences (MakCHS), Uganda. *African Health Sciences, 21*(2), 904-911.


Evidence-Based Medicine (EBM) is a crucial aspect of healthcare improvement and quality assurance. EBM involves the careful, explicit, and thoughtful use of current best evidence in making decisions about the care of individual patients. Librarians’ involvement in EBM has been widely reported in developed nations. However, there is a gap in the literature concerning the roles of African librarians in EBM. While literature reveals the application of EBM in healthcare settings in some African countries over the past two decades, the roles of African librarians in EBM practice have not been comprehensively reported. The study was conducted to determine the involvement and roles of African librarians in supporting EBM practice and the tools they use. The study adopted the descriptive survey design technique. Respondents for the study comprised 45 medical librarians from Sub-Saharan African countries. Findings indicate that medical librarians are involved in roles that support Evidence-Based Medical Practice (EBMP) in Africa. These roles are currently clustered around information resource use, management, and evidence dissemination. The paper concludes that an expansion of librarians’ involvement in EBMP is important, considering the limited human resources available to care for patients across the continent.

Introduction

Evidence-based medicine (EBM) is integral to healthcare improvement and quality assurance. EBM involves the careful, explicit, and thoughtful use of current best evidence in making decisions about the care of individual patients. In Evidence-Based Medical practice (EBMP), research evidence is combined with patient values and the caregiver’s knowledge to improve healthcare delivery and outcome. The importance.
of this was epitomised during the COVID-19 era, whereby the application of EBMP became the cornerstone of healthcare decision-making and medical care (Davis et al., 2022).

Research has shown that EBMP improves the quality of care and reduces healthcare costs (Walewska-Zielecka et al., 2021). Hence, health professionals are expected to use updated information in practice and policy for improved health outcomes. However, due to the exponential growth of medical information and resources, healthcare personnel lack the time to search and access evidence, resulting in a knowledge gap and a lag in the rate of EBM adoption in clinical practice. Consequently, there is a demand for librarians, because of their expertise in information search and retrieval, to connect health professionals with evidence to actualise the EBMP process (Habibi et al., 2023).

Librarians play significant roles in the critical steps of EBMP, as clinical team members. Their participation in EBMP emanated from past practices, notably clinical medical librarianship (Scherrer & Dorsch, 1999; Aitken et al., 2011; Davis et al., 2022). Hence, librarians’ roles have evolved from merely supportive to a more collaborative role, and more crucial aspects of the EBMP process (Davis et al., 2022). Having librarians engaged in clinical practice helps close the knowledge gap for clinical personnel. Aside from providing information by identifying the evidence, librarians are involved in clinical work and administration, EBM education, EBM resources use and management and evidence dissemination (Li & Wu, 2011; Yaeger & Kelly, 2014). These activities require librarians to have competency in EBMP and acquire knowledge skills to support the process.

In their role as educators, librarians teach and assess EBMP skills and information literacy to students, residents and fellows in undergraduate, graduate, and post-graduate education. In some North American Medical Schools, EBMP courses are embedded in the curriculum, and librarians offer their expertise on curriculum development committees (Maggio et al., 2015). According to Gruppen et al. (2005), librarians at the University of Michigan work with clinical faculty to design and administer an EBM Objective Structured Clinical Examination (OSCE) to evaluate students’ EBM skills. However, Boykan and Jacobson (2017) argued that, although librarians are engaged in an EBM curriculum, librarians’ expertise in teaching EBM is
underutilised. Through information literacy classes, librarians educate researchers, faculty and students on scholarly communications, electronic information resources, and institutional repository use to enhance their scholarly skills.

Furthermore, librarians have been engaged in research processes to generate, document and disseminate evidence for EBMP (Davis et al., 2022). Research is a process that builds on existing evidence. Without continuous publication and dissemination of new research, there cannot be EBMP. For this reason, librarians play a critical role in ensuring the documentation and dissemination of evidence-based work. Increasingly, librarians are involved in the development of high-quality systematic reviews (Kinengyere et al., 2015) and evidence-based practice guidelines, which are key resources in the EBMP agenda. In this role, librarians demonstrate their expertise in clinical question formulation, searching the literature, identifying relevant evidence, reviewing methodologies and recommending critical appraisal and review tools to review teams. As systematic review team members, librarians provide guidance, register evidence synthesis protocols, and serve as co-authors for clinical guidelines and systematic reviews (Davis et al., 2022; Golder, 2008; Koffel, 2015; Loke & McIntosh, 2008).

As advocates of EBM, medical librarians play a unique role in promoting clinical decision tools that are crucial for EBMP (Moore & Loper, 2011), facilitating access to the tools, training, and providing technical support (Eskrootchi & Boroumand, 2022). Health professionals have acknowledged giving better advice to their patients, which resulted in better-informed decisions, following the support they received from librarians (Marshall et al., 2013). The authors also confirmed that the most frequently used resources for EBMP were online journals, PubMed/MEDLINE, UpToDate and online books. Similarly, physicians have acknowledged that collaborating with clinical librarians could be crucial in saving time and hospital costs while benefiting patients, residents, clinicians, pharmacists, nurses, consulting teams and medical students. This would further help to inculcate EBMP culture and promote its application in daily practice and decision-making (Aitken, et al., 2011; Habibi et al., 2023; Rohani et al., 2012; Yaeger & Kelly, 2014).
Despite the extensive reports on librarians’ involvement in EBM from other parts of the world, there is a dearth of information about the roles of African librarians in EBMP. Some interventional programmes, such as the Ariadne Lab’s Better Evidence for Training (BET) ([https://www.ariadnelabs.org/better-evidence/medical-school-program](https://www.ariadnelabs.org/better-evidence/medical-school-program)), have incorporated African librarians as key stakeholders towards improving the adoption of EBMP in Africa. The impacts of such programmes on librarians’ EBMP involvement are yet to be reported. While isolated cases of EBMP have been reported in some healthcare settings in Africa (e.g., Kinengyere et al., 2021), the roles of African librarians in EBMP have not been comprehensively documented. This impedes the possibility of African librarians learning from their colleagues while planning or implementing EBM-related services.

**Objectives**

The general aim of this study was to determine the involvement of medical librarians in support of Evidence-Based Medicine Practice (EBMP) in Africa. The specific objectives of the study were to:

1. identify the roles of medical librarians in EBMP in Africa;
2. document the tools frequently used for EBMP by librarians in Africa;
3. determine the expertise or skills and competencies possessed by African medical librarians and the skills and expertise they suggest are needed to support EBMP; and
4. document the challenges encountered by librarians in supporting EBMP in Africa

**Methods**

The study adopted a cross-sectional descriptive survey design. The study population comprised medical librarians in Sub-Saharan African countries. Researchers designed the survey after a literature review, which identified four categories of EBMP roles undertaken by librarians across the globe - EBM clinical work and administration, EBM education, EBM resources use and management, and evidence dissemination - and the activities associated with each. All respondents were informed that participation was voluntary, that data would be collected for research purposes only, and that data would be kept confidential before participating. The survey questionnaire had open and closed-ended items and collected demographic data.
Invitation to participate in the study was sent, with follow-up reminders, through Ariadne Lab’s Better Evidence for Training (BET) Community of Practice platform on Basecamp, which included about 45 African librarians (called BET champions) working to promote the use of evidence in practice; the Research4Life user group mailing list, which reached a wide range of stakeholders; the Association for Health Information and Libraries in Africa’s (AHILA) WhatsApp platform, which comprised 56 members; and personal emails to identified librarians during the month of July 2023. Responses to the close-ended questions were descriptively analysed using frequency counts and percentages, while the open-ended questions were thematically analysed.

Results

Respondents’ Demography

A total of 41 medical librarians responded to the survey invitation. As shown in Table 1, respondents were from 12 African countries, spanning all geographical zones in Sub-Saharan Africa (Table 1). The librarians work mostly in academic libraries and were fairly distributed along the years of experience scale. At the time the study was conducted, most respondents were Better Evidence for Training (BET) champions. These are librarians working to promote the use of UpToDate and other digital tools that support EBMP at their institutions.

Table 1: Respondents’ characteristics

<table>
<thead>
<tr>
<th>Country</th>
<th>Frequency</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tanzania</td>
<td>4</td>
<td>9.8</td>
</tr>
<tr>
<td>Zambia</td>
<td>5</td>
<td>12.2</td>
</tr>
<tr>
<td>Nigeria</td>
<td>12</td>
<td>29.3</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>3</td>
<td>7.3</td>
</tr>
<tr>
<td>Malawi</td>
<td>2</td>
<td>4.9</td>
</tr>
<tr>
<td>Kenya</td>
<td>5</td>
<td>12.2</td>
</tr>
<tr>
<td>Rwanda</td>
<td>2</td>
<td>4.9</td>
</tr>
<tr>
<td>Ghana</td>
<td>1</td>
<td>2.4</td>
</tr>
<tr>
<td>Country</td>
<td>Count</td>
<td>Percentage</td>
</tr>
<tr>
<td>--------------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>Botswana</td>
<td>1</td>
<td>2.4</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>3</td>
<td>7.3</td>
</tr>
<tr>
<td>Uganda</td>
<td>2</td>
<td>4.9</td>
</tr>
<tr>
<td>South Africa</td>
<td>1</td>
<td>2.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>24</td>
<td>58.5</td>
</tr>
<tr>
<td>Female</td>
<td>17</td>
<td>41.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work setting</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital Library</td>
<td>4</td>
<td>9.8</td>
</tr>
<tr>
<td>Academic Library</td>
<td>35</td>
<td>85.4</td>
</tr>
<tr>
<td>Special Library</td>
<td>2</td>
<td>4.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Years of experience in Medical Librarianship</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 year</td>
<td>1</td>
<td>2.4</td>
</tr>
<tr>
<td>1 - 3 years</td>
<td>5</td>
<td>12.2</td>
</tr>
<tr>
<td>4 - 6 years</td>
<td>13</td>
<td>31.7</td>
</tr>
<tr>
<td>7 - 10 years</td>
<td>6</td>
<td>14.6</td>
</tr>
<tr>
<td>&gt; 10 years</td>
<td>16</td>
<td>39</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BET Engagement</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>BET champion</td>
<td>26</td>
<td>63.4</td>
</tr>
<tr>
<td>Non-BET champion</td>
<td>15</td>
<td>36.6</td>
</tr>
</tbody>
</table>

**Roles of African Medical Librarians in EBMP**

Of the four categories of EBMP roles addressed in the study, African medical librarians are most active in the role of EBM resources use and management. In the EBM clinical work and administration category, librarians primarily play roles in articulating clinical questions and identifying the best evidence to support clinical decisions (Figure 1). Most librarians had never participated in ward rounds, case report sessions (morning reviews), point of care research and development of EBM guidelines and policies.
In the category of EBM education (Figure 2), African medical librarians are primarily involved in supporting critical appraisal of articles and providing EBM workshops and seminars. Developing EBM curriculum and delivering EBM courses to practitioners were the least common EBM education-based activities among respondents. Furthermore, in the EBM resources use and management category, the study revealed, as shown in Figure 3, that the librarians are actively promoting the use of EBM resources. Only 4.9% of the respondents have never been involved in promoting the use of EBM resources. However, in other roles on EBM resources use and management, African health sciences librarians are least involved in creating or updating web resources for EBM and developing EBM federated search tools.

![Figure 1: EBM Roles of African Medical Librarians (clinical work and administration)](image)
Regarding their roles in evidence dissemination, Figure 4 shows that the medical librarians are mostly involved in the documentation of evidence-based works at their institutions. Among other roles, this was the most reported role that African health sciences librarians engaged in. The majority also reported engaging in the management of institutional repository and teaching of scholarly communications.
concepts.

Figure 4: EBM Roles of African Medical Librarians (Evidence Dissemination)

Tools Used by Medical Librarians to Support EBMP in Africa

In the questionnaire, respondents were asked to indicate which of the listed EBMP tools they had used, promoted or offered while offering support for EBMP at their institutions. They were also requested to state other unlisted EBMP tools. The findings showed that African medical librarians had mostly utilised or promoted UpToDate (75.6%) and Cochrane Library (56.1%) to support EBMP. The results depict higher utilisation of EBM tools they could access at no charge (Figure 5). Other tools reportedly used by the librarians are PubMed Clinical Query and Research4Life/HINARI.
Figure 5: Tools utilised by African medical librarians to support EBMP

Librarians Involvement in providing support for EBMP
The librarians were asked to indicate how their involvement in EBMP has changed over time. Most (~78%) indicated they have become more involved in providing EBM support at their institutions over time (Table 2). Of those reporting they have become more involved with EBM over time, the majority (78.1%) were BET champions. Among the librarians who have been less involved in EBMP over time, the majority (5 out of 6) were non-BET champions, while all those who reported no change in their involvement in EBMP over time were non-BET champions. A Fisher's exact test for the result confirmed a significant association between BET engagement as champions and the EBMP involvement by medical librarians over time.
Medical Librarians self-appraised competency in EBM

This study also collected data on the competency of librarians in the four categories of EBM roles identified earlier. For each category, respondents rated themselves, using a Likert-type scale, as novice, advanced beginner, competent, proficient and expert. As shown in Figure 6, most proficiency and expertise for EBM, as reported by the librarians, were within the evidence dissemination and EBM resources use and management categories. A large number of librarians reported being novice in EBM clinical work and administration, while the majority indicated they were either advanced beginners or simply competent in matters of EBM education.
Expertise needed to support EBM in Africa

Using an open-ended question, African medical librarians were asked to mention the expertise needed to support EBM practices at their institutions. Table 3 shows the thematic concepts reported by the respondents and the frequency of occurrence of the concept as reported using the included terms and other related terms. The findings showed that most African medical librarians agree that the most needed expertise for EBMP support is the information search and retrieval skills, followed by systematic review and critical appraisal skills.
Table 3: Self-reported expertise required to support EBMP by medical librarians in Africa

<table>
<thead>
<tr>
<th>Reported expertise</th>
<th>Frequency of occurrence (including related terms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Searching skills, literature search skills, digital search skills, information retrieval skill, skills in identifying appropriate resources,</td>
<td>15</td>
</tr>
<tr>
<td>Systematic review skills, critical appraisal skill, evidence evaluation</td>
<td>8</td>
</tr>
<tr>
<td>Knowledge of health technology, ICT skills</td>
<td>6</td>
</tr>
<tr>
<td>Training skills, teaching skills, information literacy instruction</td>
<td>5</td>
</tr>
<tr>
<td>Research skills</td>
<td>5</td>
</tr>
<tr>
<td>Communication skill, collaboration skill</td>
<td>3</td>
</tr>
<tr>
<td>Analytical skills; critical thinking skills</td>
<td>3</td>
</tr>
<tr>
<td>AI use skills, emerging technologies</td>
<td>2</td>
</tr>
<tr>
<td>Research data management, Reference management knowledge of EBM resources</td>
<td>2</td>
</tr>
<tr>
<td>Medical terminology</td>
<td>1</td>
</tr>
<tr>
<td>writing skills</td>
<td>1</td>
</tr>
<tr>
<td>Critical understanding of local practice</td>
<td>1</td>
</tr>
<tr>
<td>clinical work administration</td>
<td>1</td>
</tr>
<tr>
<td>project management</td>
<td>1</td>
</tr>
</tbody>
</table>

Challenges encountered by librarians in supporting EBMP in Africa

In the open-ended question of the questionnaire, respondents reported the challenges encountered while supporting EBMP at their institutions. The most common challenges relate to skill deficiency, poor funding and poor internet connectivity (Table 4).
Table 4: Challenges encountered by librarians while providing support for EBMP

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Frequency of occurrence (including related terms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of EMB skills, knowledge and expertise,</td>
<td>13</td>
</tr>
<tr>
<td>Lack of institution willingness to invest in EMB tools and resources, Lack of funds to subscribe to proprietary EBM databases, poor funding and facilities, Lack of management support</td>
<td>9</td>
</tr>
<tr>
<td>Poor Internet connectivity</td>
<td>9</td>
</tr>
<tr>
<td>Lack of access to EMB information resources</td>
<td>7</td>
</tr>
<tr>
<td>Limited contact with users, Library workload, lack of time from the clinicians/residents side and from (librarians) side also, low attendance of users at trainings, Time</td>
<td>6</td>
</tr>
<tr>
<td>Librarian not part of medical discussions (alienation); lack of EBM culture among health workers, Attitude from Doctors</td>
<td>4</td>
</tr>
<tr>
<td>Collaboration with co-workers, lack of recognition, lack of coordination</td>
<td>3</td>
</tr>
</tbody>
</table>

Discussion
This study focused on the roles of African medical librarians in supporting Evidence-Based Medical Practice (EBMP) on the continent. The study categorised these roles into Evidence-Based Medicine (EBM) clinical works and administration, EBM education, EBM resources use and management, and evidence dissemination. The findings show that African medical librarians were mostly involved in EBM resources use and management. Across the four categories, the frequently undertaken roles by African medical librarians in support of EBMP at their institutions include documenting evidence-based works, promoting the use of EBM resources, managing institutional repositories, maintaining EBM databases/resources, evaluating EBM resources, collecting EBM tools/resources, identifying the best evidence to support clinical decisions, teaching scholarly communication concepts, providing EBM
workshops/seminars, and teaching EBM courses to undergraduates. This finding confirms frequent involvement of African medical librarians in 10 of the 25 roles considered in the study, indicating a moderate involvement of the librarians in providing support for EBMP on the continent. It also supports earlier reports about the diverse roles played by librarians in EBMP in the United States (Boykan & Jacobson, 2017; Dhakal, 2018; Yaeger & Kelly, 2014), the United Kingdom (Adolphus, 2019; Rudd & Harding, 2021) and Sweden (Ahlryd & Hanell, 2021). The EBMP roles performed by African medical librarians could potentially enable their librarian-specific competencies to be recognised and appreciated by the clinicians they work with (Hanell & Ahlryd, 2023).

Furthermore, the medical librarians reported they have been more involved in EBMP over time, and mostly use or promote UpToDate and Cochrane Library as tools for EBMP. These findings depict a rising interest in EBMP in Africa, and suggest an awakening of medical librarians to the roles they could perform in EBMP. This could be connected with the opportunity provided by the Ariadne Lab’s Better Evidence for Training (BET) programme to the majority of the respondents, who serve as champions in the programme. BET provides unpaid access to UpToDate and builds African librarians’ capacity to support EBMP at their institutions. Shunmugam et al (2022) confirmed that librarians’ support for EBMP could be enhanced by having access to professional development opportunities. The study’s revelation that African medical librarians mostly use or offer subsidised or freely-accessible tools for EBMP, supported by the reported funding challenge, buttresses the importance of interventions that enable access to resources and build capacity for EBMP on the continent.

Concerning the expertise needed by librarians to support EBMP, the prominent expertise identified include skills in searching and retrieving information, evidence synthesis/critical appraisal-related skills, and ICT skills. Professionally, librarians are equipped with the skills to find, appraise and synthesise information (Hinrichs & Blevins, 2020). These expertise are inherently required in the EBMP process, thus establishing a role for medical librarians in the process (Yaeger & Kelly, 2014), with a likelihood of positive return on investment when librarians are employed as part of the clinical team (Hartfiel et al, 2021). However, additional expertise, such as teaching, communication, and self-confidence skills as reported in the study and identified by Zarghani et al (2021), will be as required for medical librarians to work in clinical
settings. Medical librarians that support EBMP should not only acquire these skills, but must demonstrate them to make their work visible, valued and recognised (Hanell & Ahlryd, 2023).

Limitations
This study had limitations with the number of respondents surveyed. Studies with a higher number of respondents will provide more strength to enhance the generalisability of the present study.

Conclusion
Medical librarians are involved in roles that support Evidence-Based Medical Practice (EBMP) in Africa. While these roles are currently clustered around information resources use and management and evidence dissemination, an expansion of librarians’ involvement in EBMP is important, considering the limited human resources for health available to care for patients across the continent. As awareness about the importance of EBMP grows on the continent, and medical librarians acquire competencies that situate them as inherent members of EBMP teams, their importance and often-overlooked roles in supporting EBMP will become more apparent. Recognition of librarians’ work and potential impact on health outcomes is important for clinicians, leaders and policy makers to understand and support them moving forward. Medical librarians will also benefit from resources, programmes or interventions that build their EBMP expertise and from free or low-cost access to evidence-based medicine tools. By virtue of their professional training, librarians have the potential to promote and support the use of EBMP tools among trainee and professional medical personnel.

Recommendations
• African Medical librarians should showcase their skills and expand their services to ensure adequate recognition of their roles in EBMP
• Interventions, such as Ariadne Lab’s BET programme, should be established and strengthened to enhance librarians’ involvement and the growth of EBMP in Africa.
• Capacity building opportunities that provide EBMP expertise to African medical
librarians should be created by library associations and institutions on the continent.

- Institutional support and funding for EBMP should be improved to enhance healthcare delivery in Africa.
- Medical librarians engaged in EBMP should be adequately incentivised to remain motivated for optimal role delivery.

References


DOI: 10.1080/02763869.2023.2193123

Eskrootchi, R. and Boroumand, M.A. (2022) 'Marketing methods for electronic


Peggy Cruse crusep@njhealth.org & Shandra Protzko (2014) Librarian Contributions to Clinical Practice Guidelines, Medical Reference Services Quarterly, 33:3, 327-334, DOI: 10.1080/02763869.2014.925710

Rohani, A. V. Akbari, and K. Moradian, (2012). “Assessment and Use of Evidence-Based Medicine in Clinical and General Practitioners in Yasooj University of Medical Sciences,” Iranian Journal of Medical Education 11, no. 7: 701


Experiences, Challenges and Lessons while Implementing a Clinical Decision Support System in Botswana - Kagiso Ndlovu, Nate Stein, Ruth Gaopelo and Mmoloki Molwantwa

Kagiso Ndlovu¹, Nate Stein², Ruth Gaopelo¹, Mmoloki Molwantwa³

¹Department of Computer Science, University of Botswana, Gaborone, Botswana
²Department of Product Management, VisualDx, USA
³Department of Department of Medical Education, Faculty of Medicine, University of Botswana, Gaborone, Botswana

Abstract

Background
The use of ICT within the healthcare setting - eHealth, has given rise to mobile health (mHealth) applications and services. For the developing world, mHealth has been hailed as being immensely valuable for extending healthcare access to rural, remote and other underserved populations. More recently, clinical decision support systems (CDSS) within mHealth applications are used to augment clinicians in their complex decision making processes. Botswana is a typical developing country where VisualDx a CDSS was implemented to provide reference materials at the point of care to support early diagnosis and management of complex dermatological conditions.

Objectives
To share experiences, challenges and lessons learnt while implementing VisualDx CDSS in Botswana.

Methods
This study was conducted through an explanatory sequential mixed methods approach between March 2021 and August 2021. A total of 28 healthcare providers stationed at 20 clinic and hospital sites across Botswana participated in the study. Nine recorded training sessions were conducted via Zoom and addressed both basic VisualDx application features, use of the offline version, as well as clinical case reviews (dermatology and general medicine). Participants had VisualDx user accounts and interacted with it on their own towards varying use cases. Quantitative and qualitative data were collected via REDCap surveys (3) and e thirty-minute semi-structured interviews were conducted with each of the participants. Standard VisualDx
application usage data was also collected. Descriptive statistics were generated and analysed using Excel (usage data and REDCap survey data). Thematic analysis of interview transcripts was performed using Delve software. The study was approved by IRB’s of the University of Botswana (UB: UBR/RES/IRB/BIO/223) and the Ministry of Health (MOHW: HPDME: 13/18/1) in Botswana.

**Results**

Experiences, challenges, and lessons learned noted throughout VisualDx implementation in Botswana entail infrastructure, adherence to data protection guidelines, image data quality, continuous training support, AI regulation, participants' retention, and sustainable health technology funding.

**Conclusion**

The implementation of VisualDx in Botswana illustrates both the value and the challenges of cross-sector and cross-border collaboration in driving the adoption of eHealth tools in developing healthcare systems. The lessons learned here may inform future strategies for implementing other eHealth platforms in Botswana and other similar developing countries.

**Keywords:** VisualDx, Dermatology, mHealth, Clinical Decision Support System, Botswana

**Background**

Globally, health systems are faced with rising costs of care provision and challenges of inadequate health human resources (HHR), particularly in Low-and Middle-Income countries (LMICs) [1]. This presents complex health problems requiring innovative solutions. The “cost-effective use of information communication technologies (ICTs) for health” – eHealth [2], is considered a key factor in addressing many existing and future healthcare challenges. The essential nature of eHealth is emphasized by the World Health Organization (WHO) and is perceived as an enabler for achieving Universal Health Coverage (UHC) and health-related Sustainable Development Goals (SDGs) [3] and certainly within Africa [4]. It is against this background that most governments believe that part of the solution will be through the adoption of data-driven interventions, particularly Clinical Decision Support Systems (CDSS) capable of augmenting human intelligence [5]. Botswana is an exemplar of LMIC, which
recently launched a national eHealth Strategy (2020-2024), recognising eHealth as a means of improving healthcare provision and delivery [6]. The eHealth Strategy further notes the potential value of emerging technologies, including utilizing mobile devices and the Internet of Things (IoT) (subsection 2.2.3) as is the value of “Sensors to populate digital devices with data” (subsection 2.2.3) [6].

Although less severe than elsewhere in Sub Saharan Africa (SSA), Botswana has a recognised inadequacy of HHR, which is worst in primary healthcare [7]. A low doctor to patient ratio (3.8/10,000) as well as a shortage of medical specialists were reported [8]. This remains one of the major bottlenecks in achieving high-quality healthcare in Botswana [8]. According to Nkomazana et al. [7], factors contributing to the shortage of healthcare personnel in the country include high staff turnover at all levels of the health sector, inequitable deployment and failure to optimize the existing healthcare personnel. For instance, the number of dermatologists in Botswana’s public health sector has varied from none to, most recently, two full-time MOH employees and three contract specialists from Cuba [9]. However, the demand for dermatology care continues to be much higher than can be provided by the current specialists, resulting in six or more months of waiting times for appointments [9]. As a result, the management of dermatological conditions is often directed to generalist doctors or even nurses who often find themselves managing primary care clinics in such contexts [10]. This shortage of dermatologists in Botswana calls for efficient use of the limited resources and continuous empowerment of those commonly engaged in managing prevalent skin conditions [11]. It further suggests a critical need for a clinical decision support system (CDSS) to ameliorate current challenges.

In 2020, the University of Botswana (UB) collaborated with VisualDx on a research study funded by the Bill & Melinda Gates Foundation (grant number INV003773) to assess the feasibility of VisualDx usage in patient care settings in Botswana and also gather feedback to inform further improvements of the platform. VisualDx is a CDSS platform with over 20 years of experience in supporting healthcare providers with their clinical decision-making [12]. The platform was developed by VisualDx and designed to be used on a mobile phone/tablet running Android (Google, Inc., Mountain View, CA, USA) or iOS operating systems (Apple, Inc, USA); it can also be accessed via web browser on a desktop computer. Recently, VisualDx has also developed an
offline-capable version of its application for Android devices. VisualDx, as a company, employs over 70 full-time team members, all dedicated to maintaining accurate, updated content with user-friendly functionality. The platform has been utilized globally in more than 2,300 universities, hospitals, and clinical sites [12]. VisualDx combines expert knowledge, problem-oriented search, a curated medical image library, and technology to support differential diagnosis, treatment recommendations, and patient education. It can contribute to increased provider confidence and reduced diagnostic errors in primary care settings [13, 14]. The platform combines machine learning algorithms and vision science with a structured clinical knowledge base. This allows non-specialist healthcare providers to capture patient-specific findings, build custom differentials, and view images and treatment recommendations. The DermExpert™ feature in VisualDx uses a Convolutional Neural Network (CNN) to estimate diagnosis and lesion categories from an input image. CNNs are data-driven models that require a large dataset of labelled pairs to train and validate [15].

Although CDSS offers some documented benefits, it is essential to consider implementation challenges arising in their use. This study reports on the experiences, challenges and lessons learnt while implementing VisualDx CDSS in Botswana.

Methods
Study participants
Implementation of the VisualDx platform in Botswana was supported by healthcare workers at dermatology clinics from public and private health facilities and medical students from the University of Botswana participating in dermatology coursework or rotations at health facilities. Prospective study participants were sent email and WhatsApp invitations to participate through the eHealth Research Unit at the University of Botswana (UB). A total of 18 participants volunteered to take part in the study initially and were sent consent forms via email.

Following the lifting of COVID-19 restrictions in Botswana, 10 more healthcare workers were recruited through the Greater Gaborone District Health Management Team (DHMT) to participate with approximately three months remaining in the study period, resulting in a total of 28 participants from 20 sites (healthcare facilities and UB) in Botswana. The DHMT is a local authority under the MOH tasked with overlooking the management and staffing of primary care clinics. Participants were based at 6 health
districts (Greater Gaborone (21), Greater Palapye (1), Greater Phikwe (2), Greater Francistown (2), Maun (1) and Chobe (1)).

The authors acknowledge the small sample size and attribute sample limitations in part to funding constraints on the project to provide mobile devices to participants and participants’ willingness to use personal devices (mobile phones) throughout the project. Funding constraints also limited the scale of the recruiting effort. Further, the COVID-19 pandemic and resulting strain on the healthcare system in Botswana was also a factor in limiting interest, as healthcare providers were uncertain where they would be allocated for how long and how much time they could devote to participating in the study. As such, the sample selection was biased toward providers who were already interested in utilizing mobile health (mHealth) tools in their daily work.

**VisualDx Use**

All participants used personal smartphones or tablet devices to download and install the VisualDx mobile application, with account credentials provided by VisualDx. They were offered mobile data vouchers to assist with the cost of data for the mobile application download and subsequent usage. Initial training with the original cohort of participants was conducted using the Zoom platform upon joining the study. Those recruited through the DHMT attended an in-person training session at the UB eHealth Research Unit. Training sessions covered information technology skills, demonstrations of VisualDx application features and the practical application of VisualDx to common dermatologic and general medical conditions experienced in Botswana. All training sessions were recorded and provided to participants who were unable to attend on the training day. Throughout the study duration, six case-based training sessions were provided to demonstrate the successful use of VisualDx to guide the clinical reasoning process. Participants used VisualDx at their own discretion throughout the study period. A WhatsApp group was created to offer a platform for sharing announcements and seeking support related to the study.

**Data collection**

An explanatory sequential mixed methods design [16] was used to assess the feasibility of and willingness to accept VisualDx as a CDSS tool in Botswana. Quantitative data was collected from a series of three surveys delivered at the beginning, middle and end of the study. The survey data collection was designed in
three parts to assess any changes in participants’ acceptance over time as they become familiar with the system. RG and NS created the first draft of the survey questions and the interview script. Survey questions were then reviewed and edited by all authors to avoid noted ambiguities. After survey questions were configured in the Research Electronic Data Capture (REDCap, Vanderbilt University) system [17], pre-testing of the surveys was conducted by RG, NS, and KN before being enhanced through improved branching logic.

VisualDx mobile application usage data was also collected from the VisualDx servers through existing event-tracking mechanisms. Qualitative data from semi-structured interviews was collected (one 30-60 minute interview with each participant) 1-3 months after the end of the study survey. Both survey and interview tools were used by the authors to meet the study objective. Interviews further assisted in gaining in-depth insight from participants.

All surveys were administered through the REDCap, with links provided to the participants for access on their personal or work devices. REDCap is a secure (HIPAA and GDPR compliant) system for supporting electronic data capture for research and operational support projects. The first survey was distributed to participants immediately following their initial mobile application training (March 2021). The second survey was delivered in the third month of the study period (May 2021). For the cohort of participants that started midway through the study, this survey was delivered after one month of participation (July 2021). The final survey was completed at the end of the study period (August 2021). All three surveys were offered to the same participants, but due to their conflicting work schedules, not all were able to participate. Surveys had closed-ended and open-ended questions (dichotomous, multiple choice and Likert scale).

Starting three months into the study period in June 2021, participants were contacted individually via WhatsApp to schedule semi-structured interviews. All interviews were conducted remotely via the Zoom platform, with each interview recorded, transcribed verbatim, and reviewed by all researchers. Sequential Query Language (SQL) statements were executed against the VisualDx database to obtain usage data associated with the study participants’ user accounts.
Data analysis
Quantitative data were summarized using descriptive statistics, and the mean, median, range, and standard deviation were calculated using the REDCap system. Interview transcripts were uploaded to Delve software for coding. Qualitative interview data was analyzed using Braun and Clarke’s widely accepted principles of thematic analysis [18] to categorize data into key themes. Iterative transcript review and deductive coding [19] were performed independently by NS, RG, and MM. A predefined list of descriptive codes were developed and later discussed by all authors: “clinical decision support”, “eHealth”, “ease of use/usability”, “continuing education”, “Internet connectivity”, “electronic health record”, “national implementation feasibility”, “technology acceptance”, “usage facilitators”, and “usage barriers”. Sub-codes were created to further categorize interview responses in more detail. The codes were later grouped into four broader themes: “governance”, “technology infrastructure”, “human resource capacity development”, and “usability”.

Usage data associated with the study participants’ user accounts was analyzed in Excel to generate basic descriptive statistics related to frequency of use, mode of access, and features most commonly utilized. Integration of the mixed methods was achieved through a weaving narrative report, connecting themes from the quantitative and qualitative data collected.

Ethics approval
The study protocol was approved by the University of Botswana’s IRB (UB: UBR/RES/IRB/BIO/223) and the Botswana Ministry of Health and Wellness (MOHW: HPDME: 13/18/1) in December 2020. The approved protocol was implemented over six months, from March 2021 through August 2021.

Results
Study participants consisted of healthcare workers at public and private health facilities as well as medical students from the University of Botswana participating in dermatology coursework or rotations at health facilities (Table 1).
### Table 1: Study participants’ characteristics

<table>
<thead>
<tr>
<th>Participants Specialty</th>
<th>Age range</th>
<th>Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obstetrician and gynaecologist</td>
<td>30-39 (1)</td>
<td>Nyangabwe Hospital</td>
</tr>
<tr>
<td>Dermatologist</td>
<td>40-49 (2)</td>
<td>Princess Marina Hospital Nyangabwe Hospital</td>
</tr>
<tr>
<td>General Practice/Nurse</td>
<td>20-29 (8)</td>
<td>Hospital way Medical Centre Mahalapye DHMT Shakawe Clinic Princess Marina</td>
</tr>
<tr>
<td>General Practice/ Nurse</td>
<td>30-39 (11)</td>
<td>Princess Marina Hospital Otse Clinic Old Naledi Clinic Siga Clinic Baylor Children’s Hospital Gaborone West Clinic Nkoyaphiri Clinic Block 8 Clinic</td>
</tr>
<tr>
<td></td>
<td>40-49 (1)</td>
<td></td>
</tr>
<tr>
<td>Student</td>
<td>20-29 (1)</td>
<td>University of Botswana/Princess Marina Hospital</td>
</tr>
<tr>
<td>Midwifery</td>
<td>40-49 (1)</td>
<td>Selibe Phikwe Hospital</td>
</tr>
<tr>
<td>Family Medicine</td>
<td>30-39 (1)</td>
<td>Maun Hospital Princess Marina Hospital</td>
</tr>
<tr>
<td></td>
<td>20-29 (1)</td>
<td></td>
</tr>
<tr>
<td>Surgery</td>
<td>20-29 (1)</td>
<td>Princess Marina Hospital</td>
</tr>
<tr>
<td>MMed Public Health Medicine</td>
<td>30-39 (1)</td>
<td>University of Botswana</td>
</tr>
</tbody>
</table>

Although this paper reports on challenges and resolutions while implementing VisualDx in Botswana (Table 2), figures 1-5 are intended to illustrate specific implementation features of the VisualDx platform and how information on VisualDx was shared through posters at health facilities in Botswana.
**Figure 1:** Searching for a diagnosis to view images and detailed diagnosis information

**Figure 2:** Building a differential diagnosis based on the patient’s symptoms
Figure 3: Using VisualDx’s DermExpert™ feature to analyze a skin problem with artificial intelligence

Figure 4: VisualDx Usage summary by use case, by operating system, and by connectivity mode
Challenges and resolutions while implementing the VisualDx platform to support healthcare facilities in Botswana are summarized in Table 2.

**Table 2:** Challenges and Resolutions while Implementing VisualDx at healthcare facilities in Botswana

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Resolutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weak Internet connectivity</td>
<td>Purchase of mobile data bundles and training on how to utilise offline features.</td>
</tr>
<tr>
<td>Poor image quality</td>
<td>Demonstrations on good quality image capture for analysis by the DermExpert feature.</td>
</tr>
<tr>
<td>Continuous health worker training</td>
<td>Use of pre-recorded VisualDx videos for different use cases. We ensured that we had discussions as well on WhatsApp groups and raised questions to employ their curiosity of the capabilities of VisualDx.</td>
</tr>
<tr>
<td>Weak AI Regulation</td>
<td>Alignment with global AI ethical principles (for example, Transparency, Impartiality, Accountability, Reliability, Security and Privacy)</td>
</tr>
<tr>
<td>Sustainable funding for mHealth and CDSS</td>
<td>Engagement of the Ministry of Health and application to external funding opportunities</td>
</tr>
</tbody>
</table>
Continuous outreach to individual clinicians both within public and private sectors to replace those that were referred elsewhere. Offered free trial licences to incentivise continued participation. Performed data analysis on each data collection instrument based on number of active participants instead of initial enrolled number.

<table>
<thead>
<tr>
<th>Participant retention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous outreach to individual clinicians both within public and private sectors to replace those that were referred elsewhere. Offered free trial licences to incentivise continued participation. Performed data analysis on each data collection instrument based on number of active participants instead of initial enrolled number.</td>
</tr>
</tbody>
</table>

**Discussion**

This paper describes experiences, challenges and lessons learnt while implementing the VisualDx platform at health facilities in Botswana. VisualDx implementation challenges and lessons identified during the study are categorized under four themes: (1) **Infrastructure**, (2) **Capacity Development**, (3) **AI regulation**, (4) **Sustainable health technology funding**, and (5) **Participant retention**.

**Infrastructure**

Previous studies emphasised the essential need for ICT infrastructure towards successful and sustainable eHealth implementation [20-23]. According to Mauco et al. [24], one of the essential factors in determining an eHealth-ready setting is the presence of relevant eHealth infrastructure. It is not surprising that the WHO reports constraints to adopting eHealth in Africa, including low ICT budgets, poor infrastructure for communication in support of health services and erratic electricity supply [25], all of which are reflections of poor readiness. Consequently, the Botswana National eHealth Strategy also prioritises improved eHealth infrastructure by noting key activities contributing to infrastructure for completion by 2023, to include “**Connecting all health facilities in the country with minimum bandwidth**, “**Establish registries and national data dictionaries**” and “**Establishing Master Patient Index (MPI) for use by patients interfacing with the health system at all levels countrywide**” [6]. Open source software endorsed by WHO and the need for a centralised national data repository (data-warehouse) are also recognised [6].

In this study, the infrastructure challenge experienced is weak Internet speed at public health facilities connected to the government data network (GDN). The GDN supports many other government ministries and departments with Internet connectivity and that
could be one of the factors that contributed to slow Internet connectivity while implementing VisualDx at public health facilities in Botswana.

As a mitigation for the slow internet connectivity, the authors engaged private internet service providers (ISPs) to offer Internet through mobile routers. These efforts align well with recommendations within the Botswana National eHealth Strategy, which advocates for the engagement of private sector stakeholders to support eHealth implementation as outlined in the ‘Strategy and Investment’ pillar of the National Strategy [6]. The Internet connectivity at private health facilities was not a problem as they already had privately sourced Internet connections.

Another mitigation to the slow Internet challenges was the deployment of an offline-capable version of VisualDx for participants with Android devices. The offline feature served as a backup option to allow these participants to access VisualDx’s CDSS tools in situations of slow or intermittent Internet connectivity. The offline mobile feature was also previously considered ideal for storage-limited devices and low power-constrained devices such as mobile phones [26]. In this study, the majority of participants used VisualDx in online mode (Figure 4). This was influenced by the availability of privately procured Internet data bundles for the study and participants’ fear of running out of memory on their personal mobile devices.

**Capacity Development**

Consistent with other studies in the developing world, there is a shortage of trained personnel to support CDSS [27-29]. This problem is not unique to the developing world as it is also experienced in the developed world; with the American Medical Informatics Association 10 by 10 education program, the Informatics Training for Global Health Program of the Fogarty International Center, and the introduction of medical informatics courses at Universities, all aimed at solving this problem [30]. The Botswana National eHealth Strategy (2020-2024), identifies as one of its key priority needs, “Strengthening Ministry of Health human resource capacity to generate, disseminate, access, secure, store and use health information for evidence based planning at all levels and policy direction” (subsection 1.3.2) [6]. It is no surprise that the WHO Global Strategy on Digital Health [2] stresses the need for health human resource capacity building and digital literacy, to ascertain the collection of good quality data and subsequently facilitate its sharing to support planning, commissioning
and transformation of health service delivery. Overall, the WHO Global Strategy emphasises that digital health can radically change health outcomes if it is supported by sufficient investment in institutional and workforce capacity in line with national strategies. The Strategy recognises “the need for data use training, planning, and management to improve the efficiency and cost-effectiveness of care, allowing for new business models in the delivery of services”[2]. It is worth noting that as healthcare institutions increase their digital footprint, there will be a need to increase human resource awareness of privacy digital laws and regulations [31].

**AI Ethics and Regulation**

In recent years, there has been growing interest in the application of artificial intelligence (AI) in healthcare to create intelligent processes and workflows that could make healthcare cheaper, more effective, more personalized, and more equitable [32]. The WHO calls for “caution to be exercised in using artificial intelligence (AI) generated large language model tools (LLMs) to protect and promote human well-being, human safety, and autonomy, and preserve public health [33]”. According to WHO, “Non nocere!” (do no harm) is the indispensable principle of the healthcare profession, meant to encourage healthcare practitioners to desist from actions that may result in causing more harm than good [34]. Consequently, in the age of digital health, the new definition of “do no harm” may include that AI driven digital health technologies should “do no harm”. If properly implemented, AI in healthcare could uncover clinical best practices from electronic health records (EHRs) by analyzing clinical trends over time, thus assisting in the development of new clinical practice models of healthcare delivery such as precision medicine [32]. The regulatory role for AI systems in most developing countries such as Botswana is still at an infancy stage, as well as the establishment of “good machine learning practices,” and robust oversight mechanisms.

A recent study identified that in order “to fully achieve the potential of AI in healthcare, four major ethical issues must be addressed: (1) informed consent to use data, (2) safety and transparency, (3) algorithmic fairness and biases or discrimination, and (4) data privacy are all important factors to consider” [35]. Ethical considerations adhered to during implementation of VisualDx in Botswana entailed;

- **Informed consent to use data**: All study participants gave informed consent prior to participation. In fact, the study protocol and consent form were approved
by IRBs at the University of Botswana (UB: UBR/RES/IRB/BIO/223) and the Ministry of Health in Botswana (MOHW: HPDME: 13/18/1) prior to implementation.

- **Safety and transparency:** To ensure safety, VisualDx uses peer-reviewed and experts’ validated content. The platform is also compliant with the General Data Protection Regulation (GDPR) [36] and the Health Insurance Portability and Accountability Act (HIPAA) [37]. In order to ensure correct and safe use, a series of training and sensitization sessions enabled continuous knowledge exchange. Study site teams allowed interactions among clinicians and specialists. While in use, the VisualDx AI model suggests possible diagnosis and treatment options, and is not prescriptive.

- **Algorithmic fairness and biases:** VisualDx’s DermExpert utilizes convolutional neural networks (CNN) [38], a popular deep learning architecture used for computer vision applications. In order to ensure fairness and eliminate any biases, the CNN model was trained with over 80 million image variations with different ethnicities consisting of dark and light skins. The model was primarily tested on dark skin colors in Botswana, hence contributing towards the federated learning approach [39], thereby improving its fairness.

- **Data privacy:** VisualDx collects only de-identified and generalized demographic information about the patient to provide a differential diagnosis. Even when using the ‘DermExpert’ AI tool, the image of the patient remains on the device at all times and is discarded immediately after the analysis is complete. This alleviates any data security concerns and allows the tool to conform to data protection standards such as the HIPAA [37] and the GDPR [36].

**Sustainable Health Technology Funding**

While results from the study indicated promising acceptance of the VisualDx platform by study participants, in the months since the primary data collection period, the authors have been challenged to overcome what is commonly referred to as “pilotitis,” or the tendency to stall and remain in the pilot phase. Although VisualDx had initial funding for a pilot study, it was not sufficient to support its implementation at national level. This challenge has been highlighted by others in the literature, with reference to the need for sustainable funding mechanisms to carry digital health implementations
beyond the pilot phase [40]. Barriers such as lack of regulatory frameworks and patients’ data ownership issues have been highlighted to also contribute to “pilotitis” [40].

The need for sustainable funding has been reported as essential for scaling up digital health interventions [2]. In their study, Egermark et al. [41], suggested different funding models that could be considered including 1) insurance-based healthcare financing systems, 2) reimbursement for digital health technologies, 3) single-payer healthcare financing systems and 4) dedicated funding for digital transformation, all of which could contribute to cost-effective improvements in care quality and patient outcomes. The need for a sustainable digital health funding model is also emphasised in the recently launched Botswana National eHealth Strategy (2020-2024). The Strategy seeks to “increase government budget allocation for eHealth”, “mobilise the private sector and donor funders to provide financial support for the implementation of the eHealth Strategy”, and “establish an investment committee to facilitate investment flows at all levels of the national healthcare system” [6]. The author’s appreciation of the National eHealth Strategy ‘Investment Pillar’, contributed to their engagement with the Ministry of Health and also applying for external funding opportunities.

**Participant Retention**

During the implementation of VisualDx in Botswana, the authors experienced a decreasing participant retention rate. This was, in part, due to the unpredictable nature of the participants’ work conditions during the COVID-19 pandemic. To mitigate this, the authors offered free VisualDx trial licences to incentivise continued participation and performed data analysis on each data collection instrument based on the number of active participants instead of the initial number of participants enrolled (Table 2). Providing incentives and nudges was also previously reported as having the potential to improve study participation rate [42].

It is worth noting that the response rates from each VisualDx survey dropped off as the study went on; that is, the pre-pilot survey had 100%, the mid-pilot survey was completed by 78.6% of participants, and the post-pilot survey had 67.8% rate. The survey length was not considered a contributing factor, as the pre-pilot survey had 29 questions, the mid-pilot survey had 22 questions, and the post-pilot survey had 19 questions. This, however, could have been that participants’ got fatigued along the
way as the survey activities were conducted far apart. A similar observation was previously noted in another study where infrequent tasks with higher cognitive burden contributed to minimal participation [42].

**Study Limitations**

The study protocol was affected by the restrictions and delays caused by the COVID-19 pandemic. Consequently, training and interview sessions had to be conducted remotely via the Zoom platform. Moreover, researchers were unable to visit clinics in person to offer technical support and physical training. Overall, participation in the study was limited as COVID-19 resulted in some participants being reassigned to efforts such as vaccine distribution, something which was not applicable for VisualDx use. The increased health workers’ stress and workload due to COVID-19 surges in Botswana likely contributed to a lack of compliance in using the VisualDx platform.

**Conclusion**

The implementation of VisualDx in Botswana illustrates both the value and the challenges of cross-sector and cross-border collaboration in driving the adoption of eHealth tools in developing healthcare systems. Understanding and preparing for these challenges may inform and improve future strategies for implementing and researching other eHealth platforms in Botswana and other countries with similar levels of infrastructure readiness, capacity development, funding, and AI regulation.

**References**


Information document. Available at 
https://apps.who.int/iris/handle/10665/334099.


42. Daniore P, Nittas V, von Wyl V Enrollment and Retention of Participants in Remote Digital Health Studies: Scoping Review and Framework Proposal J Med Internet Res 2022;24(9):e39910 URL: [https://www.jmir.org/2022/9/e39910](https://www.jmir.org/2022/9/e39910) DOI: 10.2196/39910
PART TWO: EQUITY TO HEALTH INFORMATION AND SERVICES


Bezawit Teshale Bekele, Assurance Sipho, Masimba Muziringa, Julie Rosenberg and Ariadne Labs

Jimma University Faculty of Medicine, Jimma, Ethiopia

University of Zimbabwe, Faculty of Medicine and Health Sciences, Harare, Zimbabwe

Harvard TH Chan School of Public Health and Brigham and Women’s Hospital, Boston, MA, USA

Abstract:

Introduction

UpToDate—an evidence-based clinical decision support tool whose impact on care has been demonstrated by more than 100 studies—is used at over 90% of academic medical centers in the US. It is also used elsewhere around the globe. However, UpToDate usage is lower in Africa. Better Evidence aims to promote the use of evidence-based digital tools in training and practice to improve health outcomes by removing the cost barrier and supporting local Champions at many African universities. Champions are essential to this effort and making strides in promoting uptake among students and faculty. It is unclear what all the barriers to use are, however—whether there is lower demand or other external factors impede use.

Objective

Better Evidence for Training Champions sought to understand the barriers and facilitators to use to tailor efforts and better engage potential users.

Methods

Champions distributed a survey to African medical school members, including medical students, residents, and faculty members. The survey asked about UpToDate access, impact, and more.
Results

In total, the survey had 1,558 respondents from 28 medical schools. Of school members who had registered for UpToDate access, 75% said they used it at least once per week and shared overwhelmingly positive feedback, including 92% attesting that the tool helped them find answers to clinical questions. Their primary barriers to use were external, unrelated to a lack of interest. Lack of access to the internet/high data cost and technical difficulties accessing their accounts were the primary barriers indicated. Similarly, school members who had not yet registered for UpToDate accounts overwhelmingly said the reason was not having heard about access, and most noted that more information and training about the tool would make them more likely to start using it.

Conclusion

There is a lot of interest in UpToDate among members of African medical schools who are aware of access. Lowering the cost barrier and conducting tool promotion and training can address the currently low tool uptake in the continent.

Introduction:

UpToDate is an evidence-based clinical decision support tool whose impact on care has been demonstrated by more than 100 studies. It is available at over 90% of academic medical centers in the US. Ninety-six percent of those who use it report that it helps them stay current, and 95% say it improves the quality of care they provide. Of trainee subscribers, 98% would recommend it to a friend or colleague.2 Yet, access to digital tools does not guarantee use. Strong implementation efforts are essential for effective routine use and uptake, especially in settings where access is newly available. At 43 medical schools, Better Evidence at Ariadne Labs, a joint center for health system innovation at Harvard TH Chan School of Public Health and Brigham and Women’s Hospital, has facilitated access to UpToDate in recent years. More than 90 African leaders across 15 countries are working to let students and faculty know about the tool and encourage them to use it. Since the tool can lead to better patient health outcomes and hospital performance, maximizing use is important. While leaders, also known as Champions, can see general data on usage and uptake at African medical schools, there is no clear understanding of the barriers and facilitators
to using and perceptions about the tool. To better tailor efforts to engage users, we launched a survey to identify barriers and facilitators of UpToDate usage in African medical schools.

Methods:

We designed a survey by building on previous work to identify barriers and facilitators to use UpToDate among clinicians who asked about its access, impact and more. After appropriate ethical approval from an institutional review board, Better Evidence Champions launched the online survey in their respective schools, targeting medical students, residents, and faculty members using email and WhatsApp over 6 weeks. The survey included multiple-choice and Likert scale questions. A basic analysis was performed after the survey period.

Results:

In total, the survey had 1,558 respondents from 28 medical schools. The most common means of hearing about the free access to UpToDate was through a friend/collleague (40.9%), followed by librarian/university staff (30.6%) and dean/faculty (24.5%). WhatsApp was a more common channel than email, social media, or posters. Of respondents who had registered for UpToDate access, 75% said they used it at least a few times per month. More than half downloaded the app for offline use. Nearly 20% did not know offline use was an option. Technical issues, including lack of access to the Internet or the cost of data and account login issues, accounted for 64% of responses to the question to registered users about what prevents them from using the tool more. Other responses, which accounted for 10% or fewer, included forgetting about it, having alternative tools, thinking it was too complicated, and not having a device. Users shared overwhelmingly positive feedback, including 92% attesting that the tool helped them find answers to clinical questions, 85% attending it helps them feel more confident in their decisions, and 87% agreeing it expands the scope of their practice. The most common reason for not registering for UpToDate was not hearing about it, followed by access/login issues and lack of Internet/data. Some noted they did not understand the content or did not have time to use it.

Similarly, most non-registered users noted that more information and training about the tool would make them more likely to start using it. Getting recommendations from
classmates or colleagues and being required to use the tool for classes were also suggestions for what might inspire them to register, along with learning about global use, seeing professors and faculty use, and reminders about it. Several respondents added words of gratitude to open text boxes, such as, “Thank you all for your support. You are helping us to become better, skilled, with effective clinical reasoning skills.”

**Conclusion:**

There is a lot of interest in UpToDate among members of African medical schools who are aware of access. Lowering the cost barrier and conducting tool promotion and training can address the currently low tool uptake in the continent.

**References**


PART THREE: DATA SCIENCE & RESEARCH DRIVEN
HEALTH INFORMATION

1. Health Sciences Librarians ‘Roles in Research and Community Service’ -
   Twinamasiko Emmanuel

   Twinamasiko Emmanuel
   1Kabale University, Uganda

Abstract:
As information professionals, health sciences librarians play a critical role in supporting research and community service activities in their institutions. This paper discusses the various roles and responsibilities of health sciences librarians in research and community service, including facilitating access to research resources and tools, providing instruction and training on research methods and information literacy, collaborating with researchers and other stakeholders, and engaging with the community to promote health education and outreach initiatives. The paper also highlights some of the challenges and opportunities that health sciences librarians face in fulfilling these roles, including the need for ongoing professional development and staying current with emerging technologies and trends in the health sciences field. Ultimately, this paper seeks to raise awareness of the valuable contributions that health sciences librarians can make to research and community service, and to encourage further collaboration and innovation in this important area.

Key terms: Health sciences Librarian, Research, Community service

Introduction

Health sciences librarians have emerged as essential and dynamic contributors in the rapidly evolving landscape of healthcare and biomedical research. Their multifaceted roles extend far beyond the confines of traditional library settings, as they have developed into invaluable partners in the realms of research support and community service. This paper seeks to shed light on the roles health science librarians play in these two distinct but interconnected spheres, and how their expertise, knowledge, and dedication are instrumental in advancing the field of health sciences and enhancing community wellbeing.
The synergy between health sciences librarians and the research community is undeniable. In the digital age, where the volume of health-related information is expanding exponentially, health sciences librarians serve as gatekeepers to a vast repository of knowledge. They not only curate and manage vast collections of resources but also actively participate in information literacy programs, assisting researchers in the efficient retrieval and synthesis of relevant data. The contribution of these professionals is evident in the development of systematic reviews, evidence-based practice guidelines, and the promotion of best practices which leads to fostering the advancement of evidence-based health care.

The dual responsibilities of clinical medical librarianship require librarians to attend morning reports or rounds in which they often conduct real-time searches to support EBM practice or perform later searches based on information provided at the meeting. In the same way, health science librarians are required to attend faculty meetings and actively participate in the planning and teaching activities of the faculty. Johnson, Butler, Johnston, (p.765) said that, beyond their roles in research support, health sciences librarians also extend their influence to community service, underscoring their commitment to public health and welfare. They serve as bridges between healthcare institutions and the communities they cater to, facilitating access to credible health information for patients, caregivers, and the general public. This act of information dissemination goes a long way in promoting health literacy, disease prevention, and the empowerment of individuals to make informed decisions about their health. In essence, health science librarians play an instrumental role in narrowing the information gap, which can often be a barrier to effective healthcare access and delivery.

Health sciences librarians should be equipped not only to handle specialized research inquiries based on the focus of the clinical institution or department they serve, but also to be embedded “with clinicians in processes of patient care or teaching” This paper digs into the multifaceted roles that health science librarians play in research and community service, highlighting their significance in bridging the gap between information and practice through examining their contributions, challenges, innovative approaches as well and opportunities available.
Roles and responsibilities of health sciences Librarian in research and community service.

In the performance of their work, health science play different roles. Related to health research and community service. These roles include:

(a) **Facilitating access to research resources and tools.**
Health sciences librarians are at the center of information access and they are strategically positioned to serve the needs of their community by facilitating access to research resources and tools. Many institutions where health sciences librarians work subscribe to thousands upon thousands of resources for their community and librarians are the core personnel charged with the responsibility of managing the subscriptions. This places them at a higher advantage of knowing what is available and how to use it to help researchers in the community.

(b) **Providing instruction and training on research methods and information literacy.**
Health information librarians are also mandated to provide instruction and training on research methods and information literacy to their users. Many users look at librarians as people who should be knowing how to get anything from the vast amounts of information available locally in the library as well as online resources. Librarians need to be equipped with research methods and skills to be able to do this properly. It should be noted that when a user comes to the librarian for help and the librarian fails to help, then the user loses confidence in the librarian and might not come back again. However, this also depends on how the user has been handled in the process of either getting the required information or failing to get one. This, therefore, makes librarians best suited to provide instruction and training on research methods to their users.

(c) **Fighting misinformation.**
Health sciences librarians are equipped with knowledge, skills, and experience to play an important role in fighting against fake news. It is worth noting that since in 1980’s Librarians have always led the role of sensitizing people through information literacy programs on how to evaluate facts and how one can check the authenticity of information (Banks, 2017). Naeem, & Bhatti,. p.234-235 posited that “There is a need now for HSLs to promote dialogue amongst themselves about how best to develop mechanisms to prevent and
counteract the spread of fake news. The main weapon must be training and education, drawing on the many information literacy programs to alert the public on how to identify fake news". This dialogue should be part of one of the core agenda for library associations around the continent. It should be noted that what these associations choose to go with most of the time it’s implemented due to the combined effort that is involved.

( d )Collaborating with researchers and other stakeholders

Librarians have a chance and are also indebted to collaborate with other researchers both in and outside their institutions. A librarian is one of the most privileged person in the institution that can get a chance of meeting many people. And this provides a firm ground for them to collaborate with such contact for the smooth running of the activities in their institutions. Researchers need librarians to collaborate with them for several reasons including the provision of research resources and tools. No wonder Boutet, Manley & Helwig,. (2018,pg.1).

“In health sciences libraries, we constantly strive to expand with new services to meet the evolving needs of the researchers we support. As we continue to become further integrated into our researchers’ projects, we want to make the most productive use of our time and resources.”

(e )Engaging with the community to promote health education and outreach initiatives

It is the responsibility of health sciences librarians to engage with the community in order to promote health education and outreach initiatives. Librarians listen to many people with different information needs and these needs should motivate librarians on where to go for community outreach and for what purpose. In so doing they will be able to meet the user needs of the community in question. For instance, we see that when there is a pandemic, a librarian is one of the people that remains in the frontline to performs the following roles under the pandemic circumstances, promoting public health awareness. This is done by creating and disseminating information about preventive measures, offering research team the necessary support that is required by information about the latest developments, research and literature and also in meeting the core needs of regular users.

Health information sciences librarians have a responsibility of sharing evidence-based information about the pandemic like the origin of the pandemic, information about
people who have recovered, and advice on nutrition and lifestyle to reduce the risk of the pandemic escalation. (Ali, & Gatiti, 2020).

e) Systematic reviews
Librarians are actively involved in doing systematic reviews because by virtue of their training and roles, they are strategically positioned for such responsibility. According to Balk and Bonis (2021, pg. 1) argues that “A systematic review is a comprehensive summary of all available evidence that meets predefined eligibility criteria to address a specific clinical question or range of questions.”. A good systematic review includes the following issues: research question, sources that were searched, with a reproducible search strategy (naming of databases, naming of search platforms/engines, search date and complete search strategy), inclusion and exclusion criteria, selection (screening) methods, it also critically appraises and reports the quality/risk of bias of the included studies, information about data analysis and synthesis that allows the reproducibility of the results (Krnic , Pieper, Glatt & Puljak, 2019). However, Harris (2005) in his study on librarian’s role in the systematic review process, he found out that, the role of health sciences librarians in doing systematic reviews was not very well embraced. As time went by librarians began to be involved in the systematic review process as we see in the study done by Kinengyere A.A et al (2020). Kinengyere, ., Hussein, , Ssenono, , & Mallya, pg. 31:) posit that. “As the process of conducting systematic reviews gains momentum in the field of health sciences, librarians are being recognized as crucial professionals who could play a critical role in supporting the review teams.”

(f) Advocacy and professional development.
Health sciences librarians are obliged to advocate for the community to concerning information access. In some areas information access is limited, the librarian in such a case stands a chance to advocate for the community to get access to the right information. And in the same manner, also librarians are mandated to ensure continuous professional development takes place amongst themselves with support from their institutions since the information landscape keeps on evolving and one cannot rely on what they studied from school alone.

(h) Fighting against “infodemic”
People now use social media to communicate and share information, unfortunately, this is doing more harm than good when it comes to sensitive information. Soomro, &
Hussain. (2019, p. 9) said “Social media is affecting cultural, economic and social life of the people, and it has become an essential part of everyone’s life. Social media networking is a platform that enables users to participate and share multimedia content”

Social media is here to stay, and it is good when used properly. But to achieve this, librarians have a lot to do regarding sensitization to the public. Librarians need to fill in the gap of sensitizing people about proper usage of social media and how they can choose the right information from the multiple sets of information that is available online. During this information age, people are likely to believe information that is appealing to their emotions and personal beliefs as opposed to information that is regarded as factual and objective. This is dangerous and poses a threat to public health. UNESCO during COVID 19, started a campaign to counter misinformation and promote facts about the pandemic by using #think before clicking, #ThinkBefore Sharing, and #shareKnowledge, all to help people from consuming the information that is not right for them to consume (Charbonneau, & Vardell2022).

(i) Data and knowledge preservation
This is the mother of roles performed by librarians in the community where they serve. There is a growing need for data managers in addition to knowledge preservation. Originally librarians had the responsibility of preserving knowledge and it’s on this basis that data management responsibility has been added. Librarians need to take up this responsibility and ensure that there is smoothness in the preservation of information created in electronic format. According to Andrikopoulou, Rowley & Walton, (2022), the preservation of electronic data offers the following benefits:

- Data sharing potentially avoids researchers from replicating research that has already been conducted,
- Preservation and curation activities ensure that costly and valuable data sets remain safe,
- The retrieval, co-analysis, and comparison of data derived from different sources are viable, leading to multiple insights,
- Verification of findings through checking and replication of experiments contributes to research integrity.

(k) Evidence-based practice advocacy.
As custodians of information, health sciences librarians should advocate for evidence-based practice of health practitioners. Information is rapidly evolving and stakeholders may not need to rely on old literature without considering the current one. The way things were done in the past is far much different from how things are or ought to be done today and there is abundant literature available to support this. When someone fails to consider evolving literature, then Evidence Based Practice (EBP) is compromised yet it improves and encourages better treatment options. Librarians do EBP ranging from developing curricula, planning and teaching EBP material to assessing student progress and contributing to scholarly literature. Depending on the circumstances and opportunities available, librarians can do well in any role and contribute at all levels in the EBP teaching process. Teaching information skills seems to be the most common role for librarians in EBP instruction, and research has indicated that librarians may have better learning outcomes for one-shot, face-to-face information literacy sessions than nonlibrary instructors (Swanberg 2016)

Challenges faced by health sciences librarians while carrying out the above roles

Despite the critical role played by health sciences librarians, they are often confronted with several challenges during the execution of their duties. Some of these challenges include:

(a) **Budget constraints.**

Kinengyere, (2019, p.185-189.). Says that there is a challenge of limited funds to facilitate library activities such as purchasing and maintaining IT equipment, providing adequate internet connectivity and acquiring new editions of textbooks and subscriptions to e-resources. Libraries now depend mainly on consortium joint subscriptions, which are inadequate. When consortiums are paying for subscriptions, they consider what is common to their members. Sometimes, institutions have unique user needs and you find that the consortium cannot fund them.

(b) **The rapidly evolving information landscape**

Information is greatly increasing its format, which means librarians need to be well-versed with those landscapes to provide users with the required information. For instance, in the past, librarians used to offer information to the users through published
books. However, nowadays, information is presented in databases and other modern forms.

(c) **Information overload.**

Information overload may not necessarily or directly be a problem for librarians. But to the users, it is a big problem. This brings about user confusion and will make people ignore everything. Once man fails to understand, they often leave or take what they know as the absolute truth. The services of the librarian are more required today than ever before as most people have resorted to using Google and other sources of information where they cannot easily get the required authentic information.

(d) **Lack of appropriate training**

Health sciences librarians lack appropriate training to perform the tasks their users require. Kinengyere, (2019,p188:). Indicated that “Lack of adequate library skills for the new and upcoming librarians. For instance, new librarians are not specialized in new training areas such as systematic review development and research. Furthermore, most Ugandan librarians have undergone only general librarian training (from diploma, degree, master's to PhDs). There are no educational programs focused on the needs of health librarians. Consequently, very few librarians are prepared for the role of health information professionals.”

(e) **Changing role and expectations**

Librarians’ roles are constantly changing. In the past, librarians were known to be the custodians of knowledge (books in print format). Today, things have changed, and their roles have become massive with new methodologies onboard. As indicated above, there is a growing need for large data managers, and librarians are also required to play this role. Furthermore, librarians are now expected to manage systems, do systematic reviews, Engage in community outreach, and many other activities, most of which they were unprepared and ready for. Without engaging in these activities, some of the librarians might easily be replaced by technology as most have not been equipped with the necessary skills to operate the IT systems. There is, therefore, a need for librarians to be actively engaged in continuous professional development. Much as there might be people in the profession who don’t enjoy change, it is the way to go, and librarians should embrace this change that has come to remain vital in the community.

(f) **Health privacy and data protection.**
Many health sciences librarians in developing countries lack privacy and data protection legislation knowledge. This may put them at risk of interfering with people’s privacy while sharing information. Training needs to be done on how to handle privacy issues which are subject to data protection. Data protection is still a challenge in developing countries. Many people don’t mind about their privacy, which makes those people handling information reluctant about what to do with people’s information. It should be noted that these librarians sometimes hold patients' information, which is too confidential. The librarian can get in trouble once it gets to other people in the community.

(g) Limited time for instruction and training

In most cases, health sciences librarians are too busy to the extent that they do not have time to do what they should have done. They are not ordinary librarians who wait to serve the users' needs. Health sciences librarians are supposed to know what is affecting their community concerning health and to know this. One has to be actively involved in the practice. The librarian does not need to be a doctor or a nurse to be in a position to serve better, but they collaborate with health professionals. This may go to the extent of doing ward rounds. These rounds will open the eyes of the librarians to the health conditions of the patients, and in return, it will trigger them on what to have in the resource center as far as information is concerned.

(h) Resistance to change.

Many users do not want to consume the information provided to them by librarians; they assume they have what they expect, and once they are told something different, it becomes an issue. These are some of the users in our libraries or information centers who, when new information is found, are reluctant to accept it. Health Science librarians still encounter users opposed to anything in electronic format. They sincerely believe that they cannot get authentic information electronically. These medical practitioners are used to the traditional ways of publishing and are reluctant to trust information that is created and shared electronically.

(i) Institutional support and recognition

Health sciences librarians, at times, are looked at as “just librarians”, and some professionals don’t want to mix with them. Africa generally has a poor reading culture, and most people only read to get jobs. And once they get jobs after graduation, they claim to have reached the reading climax. Such people do not want to mix with
librarians, for they still consider a librarian the custodian of books. It has often been observed that some of these people occupy senior positions, yet it takes some effort on the part of the librarian to show their relevancy to them and the institution before they receive the required support to carry out their activities.

3.0 Opportunities available for the execution of the above duties

(a) Several opportunities currently exist that Science Health Librarians might utilize to act as the connector or abridge for the information gap between the medical literature and patient care. Some of these opportunities include: Research collaboration. Librarians have an opportunity to collaborate with senior professors in research. This will increase librarians’ knowledge and research skills, hence enhancing the career of librarianship.

(b) HLs have an opportunity to take part in coming up with favourable public health policies in their countries. This is because they are always in touch and collaborating with researchers on health. They have an avenue where they can give their views on health policies.

(c) Job satisfaction cannot be overlooked. When one is satisfied at work, morale increases. Health sciences librarians find joy when they offer information that leads to one's recovery from a particular disease.

(d) International opportunities and conferences. Due to sensitivity of health aspect. SHLs have chances to travel and network with other people to share ideas on how better they can serve their communities.

(e) Continuous learning and growth. SHLs enjoy continuous learning and growth due to the nature of their work. They are, therefore, more informed on health matters than their counterparts who practice general librarianship.

Conclusion

In conclusion, health sciences librarians play a critical and evolving role in the healthcare and research domains, working as information guardians, instructors, and community advocates. Their contributions are integral to the pursuit of excellence in healthcare and the dissemination of knowledge. Health sciences Librarians possess the transformative potential of research development, innovation and community development. It has been proved that health sciences librarians are not merely
keepers of information but agents of progress, working tirelessly to advance research and enhance the well-being of the communities they serve.

References


Johnson, L. M., Butler, J. T., & Johnston, L. R. (2012). Developing e-science and research services and support at the University of Minnesota Health Sciences Libraries. *Journal of library administration, 52*(8), 754-769.

2. Developing research data skills among health librarians in Nigeria: a survey – Abiodun-Asanre, Oluwaseun Adeola, Ikolo Violet Elohor and Ajuwon Grace Ada

1Abiodun-Asanre and Oluwaseun Adeola, 2Ikolo Violet Elohor3, Ajuwon Grace Ada

1Lagos State University College of Medicine, Ikeja, Lagos State, Nigeria.
2College of Health Sciences, Delta State University, Abraka, Delta State, Nigeria
3E. Latunde Odeku Medical Library, College of Medicine, University of Ibadan

Abstract

Background
Research data management (RDM) deals with the efficient storage, maintenance, preservation, and re-use of research data. RDM demands the discoverability of data by secondary users and encourages usage with confidence in its authenticity and integrity. This is a relatively new role in the practice of health librarianship, especially in a developing society like Nigeria. Providing RDM services requires health librarians to possess specialized skills far from conventional cataloging and classification skills.

Objectives
This research aims to assess the current data management skills and competencies of health librarians and ultimately ascertain the skills and competencies they need to perform research data-related work in health libraries in Nigeria.

Methods
The descriptive survey design method was adopted for the study. This method is appropriate because it blends quantitative and qualitative data to provide relevant and accurate information about the problem under study. Data was collected using a questionnaire that was adopted from Federer (2018) and modified by the researchers of this study. Data collected from the respondents was analyzed using descriptive and inferential statistics.

Conclusion
Health librarians are inadequately skilled in RDM. Although they have adequate library and personal skills, these are not enough for the provision of RDM services in health libraries. There are several initiatives to improve and develop themselves, such as attending online webinars and self-directed learning. These have also proven not enough to develop adequate RDM skills among health librarians. However, funding is
still seen as the major challenge towards acquiring adequate RDM skills among health librarians.

**Introduction**

Data is said to be the new gold. Research data management (RDM) deals with the efficient storage, maintenance, preservation, and re-use of research data. It must be discoverable by secondary users and used with confidence in its authenticity and integrity. Research data management is important for the reproducibility and transparency of research and for meeting funder and publisher requirements for data sharing and preservation. It also increases the potential return on the large investments made into research by reducing costly data duplication. Consequently, making the discussion about RDM a global subject.

Research data management (RDM) is becoming increasingly important in the field of health sciences. Several initiatives and policies have been developed to promote RDM practices and support data sharing. For example, the National Institutes of Health (NIH) requires all research data generated with NIH funding to be deposited in a public repository (U.S. National Institutes of Health, 2007). Similarly, the International Committee of Medical Journal Editors (ICMJE) requires authors to provide a data-sharing statement for clinical trials (Taichman et al., 2017). These initiatives aim to increase the transparency and reproducibility of research and improve the quality of evidence in healthcare.

The healthcare sector is experiencing a data explosion, with vast amounts of data generated every day from various sources such as electronic health records, genomics, medical imaging, and clinical trials. This data is a valuable resource for research but presents significant challenges for managing, storing, and sharing. The management of research data is essential to ensure that it is secure, accessible, and reusable. For health libraries, the discussion is also trending because of their previous experiences with open access services and their proactive role in shaping scholarly communication in the healthcare environment (Fuhr, 2022). Thus, while it has always been the responsibility of libraries to support scientific research by collecting, organizing, maintaining, and creating access to research materials, health researchers are naturally turning to health libraries and health librarians for the much-needed skills to manage generated data (Bradley-Ridout, 2018).
Health librarians have traditionally played a key role in organizing and providing access to information resources (Furl, 2022), and their expertise in data management has become increasingly important as research data continues to grow in complexity and volume. Some medical and health libraries have taken on new roles of providing data services to their research communities. However, the increasing emphasis on open science, data sharing, and reproducibility has highlighted the need for health librarians to develop the necessary skills and knowledge for research data management (RDM).

Moreover, this is a relatively new role in the practice of health librarianship, especially in a developing society like Nigeria. According to Tenopir and colleagues (2020), providing RDM services requires that health librarians possess specialized skills (data types, legal and regulatory framework, information technology and training, and advocacy) different from conventional cataloging, and classification skills. It is against this backdrop that this study attempts to examine perspectives of RDM services among health Librarians, their current state of RDM skills, and their readiness to acquire these new skills.

Objectives:

The aim of this research is to assess the current data management skills and competencies of health librarians and to gain a better understanding of the skills and competencies they need in order to perform data-related work in health libraries in Nigeria.

Research Questions

The study is guided by the following research questions:

1. To what extent are health librarians in Nigeria knowledgeable about RDM?
2. What is /are the RDM skills possessed by health librarians in Nigeria?
3. What professional development initiatives have health librarians in Nigeria engaged in as regards the acquisition of RDM skills?
4. What are the perceived challenges towards rendering RDM services in health libraries in Nigeria?
Study of Research Data Management (RDM) embraces the practices and activities associated with the lifecycle of data. From the time data is created, its collection, storage, control, sharing, and dissemination. Research data management is a process that seeks to ensure long-term value and use of such data for new analyses and consequent replication of study findings (Cox & Pinfield, 2014; Flores, Brodeur, Daniels, Nichollas & Turnator, 2015). According to Galetto (2016), RDM is an administrative process that includes acquiring, validating, storing, protecting, and processing required data to ensure the accessibility, reliability, and timeliness of the data for other users.

Nwabugwu, and Godwin (2020) are of the opinion that RDM depicts the care and maintenance directed towards data produced during a research cycle. Being one of the most important elements of research, RDM helps to ensure that the data is appropriately organized, described, preserved, and eventually shared when the need arises. Vasilevsky Wirz and Champieux (2014) stated that RDM is all about managing research data; embracing all the services, activities, tools, and infrastructure to organize, document, store, and share data for future re-use. They further explained that RDM could have implications on the reuse and reproducibility of research data, from planning the details of data collection to addressing long-term data plans.

Whyte and Tedds (2011, p. 1), explained that the purpose of RDM is to “ensure reliable verification of results, and permit new and innovative research built on existing information.” In light of this, Nwabugwu and Godwin (2020) emphasized that good RDM practice allows for earlier published results to be verified and thereby opens up possibilities of more innovative research built on existing information.

Thus, the new culture of scientific research preaches collaboration among researchers for the good of mankind. Ball (2013) stated that data generated especially by publicly funded research is increasingly being seen as a public good, which should be available for verification and reuse. Also, more researchers are becoming convinced of the value of open data and the potential for its reuse.

**RDM, A NEW SKILL IN HEALTH LIBRARIANSHIP IN NIGERIA**

Research data management (RDM) skills for health librarians are essential for effective and efficient management of health research data. RDM skills are needed to
ensure that research data is properly collected, organized, analyzed, preserved, and shared in compliance with ethical, legal, and regulatory requirements. Health librarians play a critical role in facilitating the management of research data in the health sciences. According to a recent study from the UK (Davidson, 2014), academic and research librarians are being inspired to create research data services for professors and students by the growth of data-intensive science and the implementation of data mandates.

RDM is beginning to gain popularity in organisations, institutions, research funders, governments, and legislations across the world. John et. al. (2013) discovered that institutions and libraries globally are now developing infrastructure to support RDM by providing advice on storage repositories in addition to open access and other aspects of scholarly communication. These broaden the role of health libraries and librarians from the traditional custodian of knowledge to support for researchers, including data curation and management. Previous researchers (Hey & Hey, 2006; Pryor & Donnelly, 2009) identified early the integral role played by health librarians in providing RDM services. Pryor and Donnelly (2009) further described the new functions assigned to health librarians due to the new development. According to them, this new role will see librarians as data creators, data scientists, and data managers. Surkis and Read (2015), concurred with Tenopir et al., (2014) and further noted that librarians now provide a range of services in research data management that includes teaching data management to researchers, assisting researchers in improving their data management practices, creating data management subject guides, and assisting in supporting funding agency and publisher data requirements. Tenopir, Sandusky, Allard and Birch (2014) acknowledged that there had been an increasing need for libraries and librarians to play a leading role in research data management.

When appropriately managed, research data can ensure more productive and efficient science as new knowledge is created by building on discoveries, innovations, and open scientific inquiry. Furthermore, research data reuse can reduce research costs by making data readily available while limiting its duplication and acting as a way of meeting funder mandates (Woeber, 2017).

Embracing research data management as a new area of expertise in Nigeria makes sense, because it is a natural extension of what health science librarians already do.
However, there is a dearth of information on the skills needed by health librarians in Nigeria to provide RDM services to users.

NEW SKILLS FOR NEW SERVICE

Research data management, being a new field in librarianship, requires upgrading knowledge. Fehr (2022) attests that LIS field regularly adopts new services that require new skills upgrades to keep up with the demands of library users. Research management skills are relatively new to many library professionals, and they may need training to acquire the skills to offer newly adopted services. Fedrer (2018) recognises that librarians provide a broad range of services to researchers, so they need various skills and expertise.

RDM skills go beyond the conventional cataloguing and classification skills. RDM services address the complete lifecycle of research data. Tenopir et al., (2020), highlight several specialized skills for librarians, such as data mining, metadata knowledge, technical details of repository hardware and software, legal and regulatory framework, information technology and training and advocacy.

Several authors have investigated RDM services and competencies among librarians in general. A study by Hamad, Al-Fadel, and Al-Soub (2019) showed that libraries in Jordan have a high perception and awareness of libraries’ roles and responsibilities regarding RDM.

Also, an international survey by Cox et al., (2019) identified that academic librarians should have data curation skills, technical and ICT skills (data storage, infrastructure and architecture), research skills (data analysis and visualization), data description and documentation, legal, policy and advisory skills (intellectual property rights, ethics and licensing) to offer RDM services in the libraries. Ohaji, Chawner and Yoong (2019) listed some knowledge requirements that emerged from their study: technical knowledge; research and/or scholarly publication; metadata; background in information literacy and liaison; science and statistics; researchers; and data. Skill is required in aspects such as the use of citation tools, keeping up to date, research and searching, training and data literacy, data, database, project management and people (communication and interaction). The authors further stressed that in terms of ability, someone in a data librarian role is expected to be able to communicate, relate, use technology, liaise, and catalogue library materials.
Abankwa and Yuan (2019) in a study of RDM in university libraries in Ghana revealed that in providing access to data, about 45 (55%) respondents mentioned that academic librarians have in-depth skills in setting up institutional repositories. Also, about 20 (25%) said they had prior knowledge from working at the library. Their study results implied that many librarians did not have ideas in RDM service but had ideas in open access; with little training, they could do better. Similarly, Xu (2022) acknowledged that RDM training is essential because there has been increased demand for RDM services since 2011 in North America, Europe, and Asia Pacific.

According to Cox, Verbaan and Sen (2012), one of the most significant challenges facing academic and research libraries attempting to offer RDM services is the limited skill set of librarians. This has hindered the rendering of RDM services in academic libraries. Yu (2017) categorized challenges of RDM provision in terms of institutional commitment, collaboration, academic engagement, technology infrastructure, and lack of policies, finance, and staff knowledge. Sheikh, Malik, and Adnan (2023) stressed that developing countries lack policymaking, funding, collaboration, skills, and infrastructure development for research data management and sharing.

According to Masinde, Chen, Wambiri and Mumo (2021), there are inadequacies in skills and training capability, technological infrastructure and collaborative partnerships. Many academic librarians reported that they lacked the skills, competencies, and training to handle RDM services over the past decade (Tenopir, Birch & Allard 2012; Tenopir, Sandusky, Allard, & Birch, 2013; 2014), clearly indicating the critical need for skill development and support of librarians (Poole, 2015). Nwabugwu, and Godwin (2020) recommended that librarians to take it as a professional responsibility to update their knowledge about data management. They stated further that there is so much information available on the subject, not only from internet sources but also as a result of several recent studies and projects funded by corporate bodies.

**Methodology**

The study employed the descriptive survey design method. This method is appropriate to provide relevant and accurate information about the problem under study. Data was
collected using a questionnaire. The study population is 205 health librarians who are fully registered members of the Medical Library Association of Nigeria (MLA NG) and are working in health and medical facilities in Nigeria. The total enumerative sampling technique was adopted to ensure that an equal opportunity was provided for all health librarians to express their perceptions and allow for the generalization of results. The questionnaire was adopted from Federer (2018) and modified by the researchers after an extensive literature review. The data collection instrument which was in electronic format, was posted on the official social media (WhatsApp) platform of the MLA-NG repeatedly for 4 weeks. A total of 126 electronic responses were received, giving a response rate of 61.4%, which was judged adequate for the study. Data collected from the respondents was analyzed using frequencies, percentages, and mean. Results were presented in charts and tables.

Results

![Health Libraries Pie Chart]

**Figure 1: Type of health libraries where Librarians work**

Figure 1 shows the type of health libraries where librarians work. Majority, 78 (62%) of the health librarians in Nigeria work in academic health libraries, while 19 (15%) work in teaching hospitals and hospital libraries respectively and 10 (8%) work in research health libraries.

Research Question 1: To what extent are health librarians in Nigeria knowledgeable about RDM?

**Table 1: Health Librarians RDM Knowledge**
Table 1 shows that health librarians in Nigeria have RDM knowledge. Most of the respondents agreed to the following knowledge items as presented in the order of magnitude from the Table: RDM is a process of maintaining data throughout all stages of the research lifecycle (3.74), RDM is the planning, collecting, organizing, managing, storage, security, back-up, preservation and sharing data (3.72), way data are organized and structured within collections (2.84) and that RDM involves licensing and intellectual property issues (2.76). They rightly disagreed that RDM is not the publication requirements of journals (1.74) and RDM is not the citation and referencing practices of researchers (2.17). Hence, with a weighted mean score of 2.82, this indicates that health librarians in Nigeria know the concept of RDM.

## Table 1

<table>
<thead>
<tr>
<th></th>
<th>SA</th>
<th>A</th>
<th>D</th>
<th>SD</th>
<th>( \bar{x} )</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The planning, collecting, organizing, managing, storage, security, back-up, preservation and sharing data</td>
<td>101</td>
<td>15</td>
<td>10</td>
<td>-</td>
<td>3.72</td>
<td>Adequate</td>
</tr>
<tr>
<td>2. The process of maintaining data throughout all stages of the research lifecycle</td>
<td>98</td>
<td>24</td>
<td>4</td>
<td>-</td>
<td>3.74</td>
<td>Adequate</td>
</tr>
<tr>
<td>3. The way data are organized and structured within collections</td>
<td>23</td>
<td>72</td>
<td>19</td>
<td>12</td>
<td>2.84</td>
<td>Adequate</td>
</tr>
<tr>
<td>4. The publication requirements of journals</td>
<td>27</td>
<td>23</td>
<td>57</td>
<td>19</td>
<td>1.74</td>
<td>Inadequate</td>
</tr>
<tr>
<td>5. Licensing and intellectual property issues</td>
<td>21</td>
<td>35</td>
<td>62</td>
<td>8</td>
<td>2.76</td>
<td>Adequate</td>
</tr>
<tr>
<td>6. Citation and referencing practices of researchers</td>
<td>12</td>
<td>34</td>
<td>62</td>
<td>18</td>
<td>2.17</td>
<td>Inadequate</td>
</tr>
</tbody>
</table>

Weighted \( \bar{x} \) 2.82 > 2.50

Adequate
Research Question 2: What are the RDM Skills possessed by health librarians in Nigeria?

<table>
<thead>
<tr>
<th>Table 2: Health Librarians Core RDM Skills</th>
<th>HC</th>
<th>C</th>
<th>FC</th>
<th>NC</th>
<th>$\bar{x}$</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Data mining skills</td>
<td>14</td>
<td>24</td>
<td>43</td>
<td>45</td>
<td>2.05</td>
<td>Inadequate</td>
</tr>
<tr>
<td>2. Data use and analysis skills</td>
<td>22</td>
<td>21</td>
<td>72</td>
<td>11</td>
<td>2.42</td>
<td>Inadequate</td>
</tr>
<tr>
<td>3. Data curation and preservation</td>
<td>25</td>
<td>48</td>
<td>33</td>
<td>20</td>
<td>2.61</td>
<td>Adequate</td>
</tr>
<tr>
<td>4. Data depositing and/or work with repositories</td>
<td>28</td>
<td>34</td>
<td>41</td>
<td>23</td>
<td>2.53</td>
<td>Adequate</td>
</tr>
<tr>
<td>5. Bioinformatics skills (e.g. impact factor, h-index) and altmetrics</td>
<td>30</td>
<td>31</td>
<td>57</td>
<td>8</td>
<td>2.65</td>
<td>Adequate</td>
</tr>
<tr>
<td>6. Developing or applying ontologies and metadata</td>
<td>9</td>
<td>32</td>
<td>29</td>
<td>56</td>
<td>1.95</td>
<td>Inadequate</td>
</tr>
<tr>
<td>7. Institutional repository support skills</td>
<td>41</td>
<td>32</td>
<td>31</td>
<td>22</td>
<td>2.73</td>
<td>Adequate</td>
</tr>
<tr>
<td>8. Skills to use relevant tools (such as Mendeley, Scopus author management, Data Management Plan Tool, ORCID identifier).</td>
<td>20</td>
<td>51</td>
<td>19</td>
<td>36</td>
<td>2.43</td>
<td>Inadequate</td>
</tr>
</tbody>
</table>

Weighted $\bar{x}$ 2.42 < 2.50

Inadequate

Table 2 presents the core RDM skills possessed by health librarians in Nigeria. The weighted mean score of 2.42, which is less than the criterion mean score of 2.50, shows that health librarians in Nigeria have low core RDM skills. However, health librarians were adequate, having institutional repository skills (2.73), bioinformatics skills (2.65), data curation and preservation skills (2.61), and data depositing and/or being able to work with repositories (2.53). They exhibited the lowest core RDM skill in developing or applying ontologies and metadata (1.95).
Table 3: Health Librarians IT Skills for RDM

<table>
<thead>
<tr>
<th></th>
<th>HC</th>
<th>C</th>
<th>FC</th>
<th>NC</th>
<th>( \bar{x} )</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Data visualization</td>
<td>22</td>
<td>31</td>
<td>30</td>
<td>43</td>
<td>2.25</td>
<td>Inadequate</td>
</tr>
<tr>
<td>2. Scientific programming</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Inadequate</td>
</tr>
<tr>
<td>(such as R, 3. Python, Javascript, etc.)</td>
<td>8</td>
<td>19</td>
<td>37</td>
<td>62</td>
<td>1.78</td>
<td>Inadequate</td>
</tr>
<tr>
<td>4. Statistical software</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Inadequate</td>
</tr>
<tr>
<td>(such as SAS, SPSS, MATLAB, etc.)</td>
<td>23</td>
<td>36</td>
<td>34</td>
<td>33</td>
<td>2.38</td>
<td>Inadequate</td>
</tr>
<tr>
<td>6. Developing and maintaining websites Geographic information system (GIS) software and data</td>
<td>10</td>
<td>19</td>
<td>11</td>
<td>86</td>
<td>1.62</td>
<td>Inadequate</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Weighted ( \bar{x} )</th>
<th>2.00 &lt; 2.50</th>
</tr>
</thead>
</table>

Table 3 shows that health librarians have low IT skills for RDM. The mean scores for the individual items were all below the criterion mean of 2.50, indicating that health librarians do not have skills in data visualization, scientific programming (such as R, Python, Javascript, etc., and the use of statistical software such as SAS, SPSS, MATLAB, etc.), developing and maintaining of websites and the use of geographical information system (GIS) software and data.

Table 4: Health Librarians Library skills for RDM

<table>
<thead>
<tr>
<th></th>
<th>HC</th>
<th>C</th>
<th>FC</th>
<th>NC</th>
<th>( \bar{x} )</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Collection development</td>
<td>45</td>
<td>32</td>
<td>23</td>
<td>26</td>
<td>2.76</td>
<td>Adequate</td>
</tr>
<tr>
<td>2. Cataloging and classification</td>
<td>47</td>
<td>42</td>
<td>22</td>
<td>15</td>
<td>2.96</td>
<td>Adequate</td>
</tr>
<tr>
<td>3. Reference support</td>
<td>55</td>
<td>46</td>
<td>16</td>
<td>9</td>
<td>3.16</td>
<td>Adequate</td>
</tr>
<tr>
<td>4. Literature searching and systematic review support</td>
<td>50</td>
<td>45</td>
<td>21</td>
<td>10</td>
<td>3.07</td>
<td>Adequate</td>
</tr>
<tr>
<td>5. Scholarly communication support (copyright, support for scholarly publishing, etc.)</td>
<td>41</td>
<td>44</td>
<td>28</td>
<td>13</td>
<td>2.89</td>
<td>Adequate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weighted ( \bar{x} )</th>
<th>2.96 &gt; 2.50</th>
</tr>
</thead>
</table>

Table 4 shows a weighted mean score of 2.96, indicating that health librarians are skilled in collection development, cataloging and classifying, reference services, literature searching, systematic review, and scholarly communication support for researchers.
Table 5: Health Librarians Personal Skills for RDM

<table>
<thead>
<tr>
<th>Aspects of RDM Skills</th>
<th>HC</th>
<th>C</th>
<th>FC</th>
<th>NC</th>
<th>x̄</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Customer service skills</td>
<td>88</td>
<td>24</td>
<td>14</td>
<td>-</td>
<td>3.37</td>
<td>Adequate</td>
</tr>
<tr>
<td>2. Oral communication and presentation skills</td>
<td>52</td>
<td>30</td>
<td>21</td>
<td>23</td>
<td>2.88</td>
<td>Adequate</td>
</tr>
<tr>
<td>3. Written communication skills</td>
<td>43</td>
<td>41</td>
<td>22</td>
<td>20</td>
<td>2.84</td>
<td>Adequate</td>
</tr>
<tr>
<td>4. Supervisory skills</td>
<td>64</td>
<td>31</td>
<td>11</td>
<td>20</td>
<td>3.10</td>
<td>Adequate</td>
</tr>
<tr>
<td>5. Teaching skills</td>
<td>50</td>
<td>51</td>
<td>19</td>
<td>6</td>
<td>3.15</td>
<td>Adequate</td>
</tr>
<tr>
<td>6. Teamwork skills</td>
<td>34</td>
<td>62</td>
<td>30</td>
<td>-</td>
<td>3.03</td>
<td>Adequate</td>
</tr>
<tr>
<td>7. Management and leadership skills</td>
<td>30</td>
<td>50</td>
<td>35</td>
<td>11</td>
<td>2.78</td>
<td>Adequate</td>
</tr>
</tbody>
</table>

| Adequate Weighted x̄ 2.57 > 2.50      |

Table 5 presents the data on the personal skills possessed by health librarians for RDM. The weighted mean score of 2.57 is an indication of adequate personal skills. Customer service (3.37), teaching (3.15), supervisory (3.10), and teamwork (3.03) are among the highest personal skills possessed by health librarians in Nigeria.

Table 6: Summary of Health Librarians' RDM Skills

<table>
<thead>
<tr>
<th>Aspects of RDM Skills</th>
<th>x̄</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Core RDM skills</td>
<td>2.42</td>
</tr>
<tr>
<td>2. IT skills for RDM</td>
<td>2.00</td>
</tr>
<tr>
<td>3. Library skills for RDM</td>
<td>2.96</td>
</tr>
<tr>
<td>4. Personal skills for RDM</td>
<td>2.57</td>
</tr>
</tbody>
</table>

| Weighted Mean 2.48 < 2.50 Inadequate  |

Table 6 presents a summary of all the aspects of RDM skills that are required from health librarians. It presents an overall weighted mean of 2.48 of all the individual skills of health librarians in Nigeria. Overall, health librarians do not possess adequate skills for RDM.

Research Question 3: What professional development initiatives have health librarians in Nigeria engaged in as regards the acquisition of RDM skills?
Table 7: Health Librarians Professional Development Initiatives for RDM Skills

<table>
<thead>
<tr>
<th>Professional Development Initiatives</th>
<th>Agreed (%)</th>
<th>Disagreed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Self-directed learning</td>
<td>68 (54%)</td>
<td>58 (46%)</td>
</tr>
<tr>
<td>2. Mentorship with peer (library staff)</td>
<td>65 (52%)</td>
<td>61 (48%)</td>
</tr>
<tr>
<td>3. Job shadowing</td>
<td>63 (50%)</td>
<td>63 (50%)</td>
</tr>
<tr>
<td>4. Webinar</td>
<td>70 (55.5%)</td>
<td>56 (45.5%)</td>
</tr>
<tr>
<td>5. Attending conferences</td>
<td>43 (34%)</td>
<td>83 (66%)</td>
</tr>
<tr>
<td>6. Online courses</td>
<td>12 (9.5%)</td>
<td>114 (90.5%)</td>
</tr>
<tr>
<td>7. Workshops</td>
<td>32 (25%)</td>
<td>94 (75%)</td>
</tr>
<tr>
<td>8. Learning by doing (trial and error)</td>
<td>38 (30%)</td>
<td>88 (70%)</td>
</tr>
</tbody>
</table>

Presented in Table 7 is the data for the professional development initiatives that health librarians are engaged in for the acquisition of RDM skills. The majority 70 (55.5%) of the health librarians have engaged in webinars, 68 (54%) in self-directed learning, 65 (52%) in mentorship while 63 (50%) have engaged in job shadowing.

Research Question 4: What are the perceived challenges towards rendering RDM services in health libraries in Nigeria.

Table 8: Challenges Encountered in Acquiring RDM Skills by Health Librarians

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Agree (%)</th>
<th>Disagree (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Inadequate knowledge of RDM concept</td>
<td>32 (25.3%)</td>
<td>94 (74.7%)</td>
</tr>
<tr>
<td>2. Limited technology use skills</td>
<td>50 (39.6%)</td>
<td>76 (60.4%)</td>
</tr>
<tr>
<td>3. Inadequate information technologies in libraries</td>
<td>65 (51.6%)</td>
<td>61 (48.4%)</td>
</tr>
<tr>
<td>4. Lack of laws and policies for RDM in my institution</td>
<td>80 (63.4%)</td>
<td>46 (36.6%)</td>
</tr>
<tr>
<td>5. Lack of funding/sponsorship for training</td>
<td>116 (92.0%)</td>
<td>10 (8.0%)</td>
</tr>
<tr>
<td>6. Lack of time to attend training</td>
<td>12 (9.5%)</td>
<td>114 (90.5%)</td>
</tr>
</tbody>
</table>

Table 8 reveals the challenges that health librarians face in acquiring RDM skills. Lack of funding for training has the highest score of 116 (92.0%), followed by lack of laws and RDM policies in Nigerian institutions 80 (63.4%). Thirdly, 65 (51.6%) of health librarians agreed that inadequate information technologies in their libraries is also a challenge to acquiring RDM skills.

Discussion of Results

This study assessed the data management skills and competencies of health librarians working in Nigeria. The results showed that health librarians have a good knowledge of the concept of RDM. Most agree that RDM is the process of maintaining data throughout all stages of the research lifecycle and the planning, collecting, organizing, managing, storage, security, back-up, preservation, and sharing of data. In addition, health librarians are aware that data can be organized and structured within collections. This is an indication that health librarians possess some level of
understanding of the concept of RDM. This finding is in support of the definition of RDM proposed by Nwabugwu and Godwin (2020) that it depicts the care and maintenance directed towards data produced during a research cycle and that of Galetto (2016), which views RDM as an administrative process that includes acquiring, validating, storing, protecting, and processing required data to ensure their accessibility, reliability, and timeliness of the data for other users. Also, the finding supports the view of Hamad, Al-Fadel, and Al-Soub (2019), whose study showed that libraries in Jordan have a high perception and awareness of their roles and responsibilities regarding RDM.

The RDM skills of health librarians are viewed from different aspects, specifically the core RDM skills, IT, library, and personal skills. The survey showed inadequate core RDM skills. Although a close look at the results shows health librarians as having adequate institutional repository, bioinformatics, data curation and preservation and data depositing skills, they displayed the lowest core RDM skill in developing or applying ontologies and metadata. The need for IT skills in the management of research data cannot be over-emphasized; these are among the most necessary skills today that modern health librarians are acquiring to remain relevant in disseminating RDM and other modern library services. Unfortunately, health librarians recorded inadequate IT skills for RDM services. Being inadequately skilled in data visualization, scientific programming (such as R, Python, Javascript, etc. statistical software usage, website development/maintenance and geographic information system (GIS) software and data.) Health librarians displayed adequate library skills. This is not surprising as many of the health librarians are already familiar with traditional library skills to render traditional library services. The librarians similarly reported a high level of personal skills, which is adequate for RDM services. Skills for customer services, teaching, supervision, and teamwork are among the highest personal skills possessed by health librarians in Nigeria.

Putting these four aspects together revealed that health librarians are inadequately skilled for RDM services in Nigeria. This result implies that there is a skill gap. This view is in tandem with an earlier result presented by Masinde, Chen, Wambiri and Mumo (2021), that academic libraries in Southeast and South Asia displayed
inadequate skills and training capability, technological infrastructure, and collaborative partnerships. In the same vein, Abankwa and Yuan (2019) found that while a good number of academic librarians in Ghana have in-depth skills in providing access to data and setting up institutional repositories, most librarians did not have ideas in RDM services. Also, Nongo and Ikolo (2021) reported that the majority of medical librarians in Nigeria need training to equip them with skills for modern health library services.

What are health librarians in Nigeria doing to improve their skills? The findings show that most health librarians have attended webinars on RDM. Some are engaged in self-directed learning, while others are involved in mentorship to develop themselves. The result for attendance of conferences and workshops for RDM is quite low. This might explain why overall RDM skills are low and inadequate because librarians are not engaging themselves enough to acquire the necessary skills in RDM services. According to a recently published scoping review by Xu (2022), RDM training is essential, and there has been an increased demand for RDM training since 2011 in North America, Europe, and Asia Pacific.

The study also showed health librarians' challenges in acquiring RDM skills. Funding is the foremost reason identified by health librarians. The lack of laws and RDM policies in Nigerian institutions is also a major challenge identified. This finding corroborates the result of Sheikh, Malik, and Adnan (2023) that challenges of lack of policies, funding, collaboration, skills, and infrastructure development are the major setbacks for RDM and data sharing. On the contrary, Cox, Verbaan and Sen (2012) stated that the most significant challenges facing academic and research libraries attempting to offer RDM services are the limited skillsets of librarians, lack of understanding of the diversity of research data and lack of knowledge by librarians of the motives and practices of researchers and the diversity of research data.

Conclusions

Health librarians in Nigeria know the concept and definitions of RDM, although there is still room for acquiring more knowledge of the concept. Health librarians are inadequately skilled in RDM; although they have adequate library and personal skills, these are not enough to provide RDM services in health libraries. There are several
initiatives to improve and develop themselves, such as attending online webinars and self-directed learning. These are also not enough to develop adequate RDM skills among health librarians, while funding is seen as the major challenge towards acquiring adequate RDM skills among health librarians.

**Recommendation**

Arising from the results, the following recommendations are made:

1. The study recommends that the management of health libraries need to sponsor their staff for training on RDM. This will be seen as an investment in the right direction as the health librarians will be better positioned to render RDM services that will give more relevance to their libraries.

2. Health librarians need to be encouraged to train themselves on their own. It is essential at this point for librarians to participate actively in professional association activities as some of these trainings are given for either free or at minimal cost by many professional associations.

**References**


Abstract

Data sharing and reuse are becoming increasingly important in enabling research replicability and reproducibility, enhancing scientific knowledge, and accelerating the development of new treatments and interventions in health sciences. Nevertheless, there is a dearth of empirical evidence on researchers' compliance with data-sharing advocacy and policies in Africa. This study, therefore, aimed to examine the extent of data sharing and reuse among health science researchers in selected eight (8) African countries. A bibliometric analysis of published studies from South Africa, Egypt, Tunisia, Nigeria, Algeria, Kenya, Morocco, and Ethiopia was adopted. Literature searches were conducted on PubMed for studies published by researchers from each country to retrieve the latest 50 studies published each year from 2020 to 2023. For every study from the 1,594 published studies examined, we collected data on the research data availability status, the existence of data policy by the journal that published the study, and whether the study is openly accessible or not. The data was analysed using frequency and percentages. The study revealed a high rate of open-access publishing by health sciences researchers from the eight African countries between 2020 and April 2023, with Ethiopia recording the highest proportion. In addition, only a small proportion of researchers have made their research data openly accessible, with Kenya taking the lead. Most researchers did not comply with journals' data policies regarding open data sharing, which was predominantly the Type 3 research data policy. The study also ranked the countries according to publication and research data openness, and identified the data-sharing platforms frequently used by African health sciences researchers.
Introduction

Research data sharing and reuse are becoming increasingly popular in health sciences research globally. This is because of an existing international consensus that shared research data potentially enables research replicability and reproducibility, advances scientific discovery, accelerates the development of new treatments and interventions, and strengthens research transparency (1,2). In Africa, where there are significant health challenges worsened by inadequate research resources, data sharing and reuse are essential for advancing research, facilitating innovations, and improving health outcomes on the continent (3).

In recent times, following COVID-19 experiences, librarians, researchers, institutions, and policymakers have advocated the need to make research data openly accessible and reusable (4). Several reputable academic publishers have also encouraged or mandated authors to share the data underlying their research findings, especially when such data does not breach ethical requirements (5). Similarly, high-profile research funders, such as the National Institute of Health (NIH) and the Wellcome Trust, have instituted policies that require researchers to openly share research data associated with funded studies (6,7).

Data sharing and reuse are aspects of open science (Figure 1). It involves depositing research data (such as datasets and metadata) in repositories with open or regulated access for use by other researchers. Through data sharing, scientists not only have the opportunity to accrue more citations, recognition and collaborations, but by making their studies reproducible and verifiable, they are able to foster increased confidence and trust in their research findings. The importance of research validation was indicated in an earlier report that 70% of researchers who attempted to reproduce published studies could not achieve the goal due to research data-related challenges (8). Such barriers in data access and reuse constitute a significant impediment to the development and testing of new hypotheses, which could have been achieved by interacting with openly accessible research data.
Furthermore, the spectrum of beneficiaries from openly-accessible research data has made the practice more attractive to the global scientific community. In health sciences, patients and other research participants benefit from data sharing because they do not have to be repeatedly probed for the same data. Besides, data obtained from research participants for a single study could eventually help answer other research questions that may lead to more progress in society. In addition, researchers and research funders benefit from data sharing because the time that would have been expended on data gathering by the former is significantly conserved, while the resources expended by the latter are maximally utilised beyond immediate gains. Moreover, the larger society benefits from research data sharing because new interpretations that can address societal problems can be derived faster and cheaper when researchers have access to existing research data.

In the open science concept, sharing of research data and other aspects of scientific processes constitutes a sustainable way of practising science (10). This is especially true of African countries where resource inadequacy has been a perennial topic. Research data sharing and reuse could encourage collaboration among African researchers and provide a platform for addressing some of the shortfalls in research resources on the continent. However, despite the potential benefits, research data sharing and reuse are yet to be adopted as common practice among African
researchers (11). This may be due to several factors, such as limited research capacity, unwillingness to share data due to distrust in data reuse among researchers, disparate data governance and standardisation at international, national, and sub-national levels, and, in some cases, concerns around data quality (3,12).

Nevertheless, there is a dearth of empirical evidence on researchers’ compliance with data-sharing advocacy and policies in Africa. This study, therefore, is aimed at examining the extent of data sharing and reuse among health sciences researchers in selected African countries.

**Study Objectives**

1. Determine the extent of availability of openly accessible research publications from African health sciences researchers.

2. Identify the proportion of publications with openly accessible research data by African health sciences researchers from

3. Ascertain the level of data sharing among the researchers

4. Determine the extent of compliance with journal data policy by the researchers.

5. Ascertain the open data-sharing platforms and repositories commonly used by African researchers.

6. Rank selected African countries based on data availability among their researchers.

**Methodology**

The study involved a bibliometric investigation of published papers by health science researchers from the top eight African countries in research productivity. These countries are South Africa, Egypt, Tunisia, Nigeria, Algeria, Kenya, Morocco and Ethiopia (13). Extant literature search was conducted on PubMed for studies published by researchers from each country selected. For each of the countries, the latest 50 studies published annually from 2020 to 2023 were retrieved for bibliometric analysis against the research objectives. The PubMed search was conducted with the
search string “(((South Africa[Affiliation]) AND (South Africa>Title/Abstract])) NOT (Systematic Review[Publication Type]) NOT (Review[Publication Type]) NOT (Meta-Analysis[Publication Type])” for South Africa, while the country name was replaced in the search string for respective countries in the study. A date limit of 2020 to 2023 was applied to filter the search results appropriately. The search results were sorted by the PMID to identify the latest 50 studies for each year. The searches were conducted between June 21 and 22, 2023.

For every publication retrieved through the PubMed search, we collected data on the research data availability status, the existence of data policy by the journal that published the study, and whether the study is openly accessible or not. We also utilised Springer Nature's legacy data policy types (available at https://www.springernature.com/gp/authors/research-data-policy/research-data-policy-types) to classify the data policies in journals patronised by African scholars. Thus, Type 1 data policy represents that “data sharing and data citation is encouraged.” For Type 2, “data sharing and evidence of data sharing (is) encouraged.” In Type 3, “data sharing (is) encouraged and statements of data availability required”, Whilst for journals classified as having Type 4 data policy, “data sharing, evidence of data sharing and peer review of data (are) required.”

Results

The study investigated the data sharing practices among health science researchers in selected African countries.

Table 1: Number of publications included in the study

<table>
<thead>
<tr>
<th>Country</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>50</td>
<td>197</td>
</tr>
<tr>
<td>Egypt</td>
<td>49</td>
<td>49</td>
<td>50</td>
<td>50</td>
<td>198</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>50</td>
<td>50</td>
<td>49</td>
<td>50</td>
<td>199</td>
</tr>
<tr>
<td>Kenya</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>200</td>
</tr>
<tr>
<td>Morocco</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>200</td>
</tr>
<tr>
<td>Nigeria</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>200</td>
</tr>
<tr>
<td>South Africa</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>200</td>
</tr>
<tr>
<td>Tunisia</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>200</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>1,594</strong></td>
</tr>
</tbody>
</table>
Table 1 shows the yearly number of publications that were included in the study for each country. Only original articles that report findings after collecting primary data or utilising secondary data were included in the study. The publications include single and multiple-authored papers. However, the lead author in a multiple-authored paper must be from the corresponding country to be included in the study. The data collected from each article include the country of publication, accessibility status, research data availability, research data policy by the journal that published the article, and the platform used for sharing the research data, if available.

**Research Question 1:** What is the proportion of openly-accessible research publications from health science researchers in Africa?

![Research Question 1 Chart](image)

Figure 2: Proportion of open access research articles by African health science researchers from 2020 – 2023

The results presented in Figure 2 indicate a high rate of open access publishing by health science researchers from the eight African countries. As shown in figure 2, between 2020 and April 2023, more than 80% of the publications by health science researchers in seven of the eight countries (except Algeria) were published in open access journals, with Ethiopia recording the highest (97%) proportion of open access publications.
Furthermore, for every country included in the study, Figure 3 shows similarity in the proportion of open access articles published by the researchers in each of the years from 2020 to 2023. Only the data from Tunisia shows a consistent downward trend from 2020 (with 90% open access papers) to 2023 (with 74% open access papers).

Figure 3: Year-by-year proportion of open access papers published by African health sciences researchers (with percentages for 2023 publications highlighted).

**Research Question 2: What is the proportion of publications with openly-accessible research data by African health sciences researchers?**
The study collected data on the availability of research data for every publication considered in the study. The result indicates a low level of openly accessible data among the researchers. Of the eight countries, Kenya recorded the highest (43%) of openly accessible data. The year-by-year analysis (Figure 5) revealed an inconsistent trend in data sharing among the African health researchers in each country, except for the Nigerian research publications, which show a step-wise increasing trend in research data availability from 2020 (4.1% openly available data) to 2023 (28.0% openly available data). In addition, there has been a steady increase since 2020 in all the countries, which can be an indication of increased open science awareness among health researchers in the continent.

**Research Question 3:** What is the extent of compliance with journal data policy by the researchers?

The percentage compliance of the health science publications with journal’s research data policy requirement was obtained by finding the proportion of included publications that have openly-accessible data after being published in journals with research data policies. For every country included in the study, Table 2 shows the percentage of publications by African health science researchers that comply with journal research
policy. Findings revealed that the East African countries (Ethiopia and Kenya) have higher compliance rates than countries in other regions of the continent. This is an indication of a low level of compliance with journal research data policies.

Table 2: Percentage compliance with journal data policy (calculated by articles that make research data openly available after being published in journals with research data policy)

<table>
<thead>
<tr>
<th>Country</th>
<th>Compliance with Journal Research Data Policy</th>
<th>Number of journals with Data Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>17.4%</td>
<td>132</td>
</tr>
<tr>
<td>Egypt</td>
<td>29.0%</td>
<td>125</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>39.5%</td>
<td>125</td>
</tr>
<tr>
<td>Kenya</td>
<td>52.9%</td>
<td>146</td>
</tr>
<tr>
<td>Morocco</td>
<td>37.1%</td>
<td>99</td>
</tr>
<tr>
<td>Nigeria</td>
<td>29.1%</td>
<td>129</td>
</tr>
<tr>
<td>South Africa</td>
<td>30.6%</td>
<td>96</td>
</tr>
<tr>
<td>Tunisia</td>
<td>23.5%</td>
<td>136</td>
</tr>
</tbody>
</table>

Research Question 4: What research data policy types are commonly adopted by Journals?

The type of research data policy adopted by the journals is shown in Table 3. Information about the policy was obtained from the instructions-for-authors page of each journal’s website. In all the countries included, the Type 3 research data policy was the dominant data policy type adopted by most journals patronised by researchers. This data policy type encourages data sharing in open repositories and requires a statement of data availability in the publication.

In most of the publications analysed, the authors only provided statements that indicated that the data was available upon reasonable request from the corresponding author. While the reason for not making the research data openly available, such as the data being part of an unpublished PhD study, was provided in some publications, most authors simply require intending users of their research data to send reasonable requests to the corresponding author. There were also several statements indicating
that the nature of the data or privacy concerns were the reasons why data could not be shared.

### Table 3: Distribution of Research data policy types

<table>
<thead>
<tr>
<th>Country</th>
<th>Data Policy Types**</th>
<th>Percentage occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria (n* = 132)</td>
<td>T1: 28.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2: 4.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T3: 60.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T4: 6.8</td>
<td></td>
</tr>
<tr>
<td>Egypt (n = 125)</td>
<td>T1: 23.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2: 5.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T3: 70.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T4: 0.8</td>
<td></td>
</tr>
<tr>
<td>Ethiopia (n = 125)</td>
<td>T1: 14.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2: 5.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T3: 80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T4: -</td>
<td></td>
</tr>
<tr>
<td>Kenya (n = 146)</td>
<td>T1: 17.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2: 5.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T3: 76.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T4: 0.6</td>
<td></td>
</tr>
<tr>
<td>Morocco (n = 99)</td>
<td>T1: 16.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2: 5.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T3: 76.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T4: 1.0</td>
<td></td>
</tr>
<tr>
<td>Nigeria (n = 129)</td>
<td>T1: 21.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2: 10.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T3: 67.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T4: 0.7</td>
<td></td>
</tr>
</tbody>
</table>
South Africa (n = 96) | T1 | 10.4 |
| T2 | 2.1 |
| T3 | 85.4 |
| T4 | 2.1 |

Tunisia (n = 136) | T1 | 25.7 |
| T2 | 1.5 |
| T3 | 72.1 |
| T4 | 0.7 |

*n = number of publications published in journals with research data policy


Research Question 5: What open data-sharing platforms and repositories are commonly used by African researchers?

Table 4: Platforms used for Data Sharing

<table>
<thead>
<tr>
<th>Country</th>
<th>Data sharing platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>Figshare; GenBank; MALDI-TOF; BIO-SOURCE; Zenodo, NCBI</td>
</tr>
<tr>
<td>Egypt</td>
<td>GISAID repository; Sequencing Read Archive; Figshare; Dryad; Mendeley Data; Dataverse; Open Science Framework (OSF); GenBank; The Demographic and Health Survey Program (DHS); U-merge; NCBI Repository</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>PMADATA; Figshare; Zenodo; Dryad; NCBI</td>
</tr>
<tr>
<td>Kenya</td>
<td>Figshare; MEASURE DHS; OSF; VEC Data Repository; LSHTM COMPASS; Dataverse; DTA; OPTIONS; Havard Dataverse; KEMRI-Wellcome Online Data Repository; DHS Online Portal; GenBank; GitHub; GISAID; CIMMYT; Inspiredata; Kenyatta University Repository; Dryad Digital Repository</td>
</tr>
</tbody>
</table>
Table 5 presents a list of diverse data sharing platforms and repositories that African health researchers have used from 2020-2023 to store and openly make their data accessible. A close look shows that the two most commonly used open data-sharing platforms and repositories are Figshare and NCBI. Figshare is used in all the countries except Morocco and Tunisia, while NCBI is also common among researchers, and used in all except Kenya and South Africa. Zenodo and Dryad are used in five of the eight countries under study, while Genbank is used in five countries.

In the eight countries studied, some indigenous repositories are being used by researchers. For instance, in Kenya, KEMRI-Wellcome Online Data and the Kenyatta University Repository are based there. In Nigeria, the University of Ibadan Urban Health Repository is also based there. It was observed during the study that the journals most often presented authors with a list of suggested repositories where they could store their data, while the type of data also had a role to play in the authors choice of data repository.

<table>
<thead>
<tr>
<th>Country</th>
<th>Repositories</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Morocco</strong></td>
<td>NCBI; ClinVar database; GenBank; Zenodo; NCBI</td>
</tr>
<tr>
<td><strong>Nigeria</strong></td>
<td>GitHub; Figshare; CLOCKSS (Swiss National Library - Helveticat); OpenICPSR; National Center for Biotechnology Information (NCBI) repository; Mendeley Data; DHS Programe; IITA CKAN; Zenodo; PMA Data; Dryad; Yambase; GISAID’s EpiCoV; Epicenter; University of Ibadan Urban Health Repository; FoodSwitch database; Havard Dataverse; International Livestock Research Institute (ILRL Datasets Portal)</td>
</tr>
<tr>
<td><strong>South Africa</strong></td>
<td>Mendeley Data; OSF; UK Data Service; AHRI Data Repository; Africa Health Research Institute Repository; DataFirst; GitHub; ReShare Repository; Kaggle; HERstory Study; Dedoose; Dryad; OAKS; Figshare; Earthref (MagIC)</td>
</tr>
<tr>
<td><strong>Tunisia</strong></td>
<td>Zenodo; ClinicalTrials.gov; GenBank; BioProject Repository; GISAID; Climate Data Store; NCBI</td>
</tr>
</tbody>
</table>
Research Question 6: What is the ranking of African countries based on openness?

Figure 6: Ranking of African countries by open access publication from 2020 – 2023

Based on the number of published openly accessible articles and associated openly-accessible data, we ranked the countries included in the study to identify the leading countries in providing openly-accessible research publications and data. Findings show that Ethiopia, with 97.0% openly accessible publications, ranked 1st in open access publications (Figure 6), while Kenya, with 43.0% openly-accessible data, takes the lead in making research data openly available on the continent (Figure 7). The country with the least number of open access publications and openly accessible data is Algeria.

Figure 7. Ranking of African countries by open research data publication from 2020 - 2023
Discussion of Results

Open access publications by African health sciences researchers

The results indicate a high rate of open access publishing by health science researchers from the eight African countries included in this study. Between 2020 and April 2023, more than 80% of the publications by health science researchers in seven of the eight countries (except Algeria) were published in open access journals, with Ethiopia recording the highest (97%) proportion of open access publications. The result is an indication of an increased level of awareness of research, making sure that the work they publish is more accessible to the audience that might want to use the results. This result supports a recount report by (14) who investigated open access publishing in Africa using African Journals Online and African Index Medicus. In their study, 174 journals from 13 African countries were identified. The finding revealed that two thirds of the journals where African authors published were freely available to download. In addition, stressing the reason for more openly accessible publication by health researchers, (15) stated that during and immediately after the pandemic, more researchers relied less on traditional systems of publishing and embraced open access platforms and preprint repositories to disseminate their COVID-19-related research results as quickly as possible.

Openly-accessible research data among African health sciences researchers

There are many advantages to sharing and reusing health research data. Researchers in the African health sciences have a low level of open data sharing. A cursory glance at the distribution of open access data they have published year over year shows that only a small number (less than 30%) of the publications by researchers from seven countries had openly accessible research data. For Nigerian research publications, there is an appreciable step-wise increasing trend in research data availability from 2020 (4.1% openly available data) to 2023 (28.0% openly available data). This may be attributed to the observable increase in open access publications by health researchers in Nigeria. These results are consistent with earlier research (16, 17) that found little exchange of raw data in health research. As opposed to a report by Kabanda et al. (18), who claimed that the majority of researchers in sub-Saharan Africa had already shared their data. They further emphasised that they were
satisfied with exchanging their data for either co-authorship on publications or collaboration on projects. A positive progression is seen in the level of research data availability in each of the countries. This is promising and encouraging in that there is the likelihood that as researchers continue to see the benefits of sharing data, they are more likely to embrace the practice of open science.

**Compliance with research data policy of journals**

Open science aims to improve the robustness of the research process, support validation, transparency, reproducibility, and replicability of research results. Many journals today have policies in place that promote open data and data sharing. However, for this to be accomplished, researchers must comply with journal policies. As such, this study investigated the proportion of publications that had openly-accessible data after being published in journals with research data policies in place. The findings revealed that Ethiopia and Kenya have the highest compliance rates when compared to other countries in other regions of the continent. Though there is some level of compliance in the other countries under study, our findings suggest that the ideal of open data is far from fully realised, even with policies journals have put in place to ensure the availability and sharing of data among researchers.

This finding agrees with an earlier report by (19), where they tested the extent to which authors actually complied with the data-sharing policy of PLoS Medicine or PLoS Clinical Trials. Their finding showed that even though authors were reminded of the journal's data-sharing guidelines, some investigators did not respond, and some responded but refused to share their data. Only one author sent an original data set, giving a 10% compliance rate. A similar report was presented by (20, 21, 22), in which authors had to be encouraged through several reminders before a few became willing to share their data. This indicated a reluctance on the part of authors to comply with the data-sharing policies of the journals where their articles have been published. Researchers in Africa often work under the pressure of clinical and teaching commitments and most often have to deal with a lack of or inadequate infrastructural support, less responsive ethics review committees, and little support for writing and managing research grants. Disparities in the number of skilled researchers, the availability of resources, and the high data collection cost were all identified as major inhibitors for open research data sharing (23).
Research data policy types adopted by journals

The current study finding revealed that the Type 3 research data policy was the dominant data policy type adopted by most journals patronised by researchers. This data policy type encourages data sharing in open repositories and requires a statement of data availability in the publication. Most publications analysed show that authors only provide statements depicting that the data is available upon reasonable request from the corresponding author. The common reasons authors give for not making their research data openly available are that the data is part of an unpublished PhD study, confidentiality issues, and protecting study participants’ privacy. Most authors simply required that intending users of their research data send a reasonable request to the corresponding author before they could have access to the research data.

According to (24), data availability statements are often based on trust, and journals or publishers are not expected to verify the accuracy of the statements for every publication. However, several studies into researchers’ responses to data availability statements have shown that most researchers are unwilling to release their data even after the corresponding authors have been contacted (20, 21, & 22). Hence, not all researchers embrace the open science movement, especially when it comes to sharing their data.

Platforms and repositories used for Data Sharing

Our study uniquely points out the different data sharing platforms and repositories employed by African health researchers to store and openly make their data accessible from 2020-2023. The findings reveal and demonstrate that Figshare and NCBI are the most used platforms. Other platforms common to researchers are Zenodo, Dryad and Genbank. A few country-based repositories also stand out from the list of repositories used by researchers. KEMRI-Wellcome Online Data, Kenyatta University Repository, and the University of Ibadan Urban Health Repository. Most journals and publishers provide authors with suggested repositories where they could deposit their data, while the type of data also plays a role in the author’s choice of data repository. (25) emphasized that Canadian researchers choose open health data repositories based on their metadata-based filtering mechanisms. Features such as
searching, browsing, and navigation functionalities, as well as the richness of metadata description practices, were also considered by researchers.

**Country Research Openness Ranking**

Among the countries surveyed, Ethiopia is the leading country providing openly accessible research publications and data from 2022-2023. This figure could be attributed to the adoption of a national open access policy for higher education institutions in 2019. The policy mandated that all published articles, theses, dissertations, and data resulting from publicly-funded research conducted by staff and students of the over 47 universities funded by the Ministry of Science and Higher Education of Ethiopia (MOSHE) must be openly accessible. Furthermore, the policy encouraged open science practices by including ‘openness’ as one of the criteria for the assessment and evaluation of research proposals. In other words, researchers submitting research proposals and requests to be funded must submit their Data Management Plans to research offices and university libraries for approval, to confirm that the data will be handled according to international FAIR data principles (26).

The discussion on the extent of open access publication in Africa is rich with diverse views from different authors. Some authors (26, 27, 28) argue that the extent to which research publications from Africa are low is because of government policies and open access initiatives in academic and research establishments and the high article processing charges, which exacerbate the disparities between fully funded and partially or unfunded research. Other authors (29, 30) believe that the proportion of open access publishing articles has increased over time due to increased awareness among researchers of the benefits of open science. Kenya takes the lead in making research data openly available in the countries studied. However, there is also visible evidence that, at different levels, health researchers in all of Africa are sharing research data. This position supports several authors’ conclusions that although there is a slow adoption of data sharing across Africa, there has been a steady increase in this since 2000 (31).

**Conclusions**

African health sciences researchers are slowly keying into the open science concept. Publishing in open access journals, sharing and reusing research data, complying with the research data policies of journals, and storing their data in open repositories and
platforms are gradually being seen as part of the health research environment among health researchers in Africa. However, not all countries are moving at the same speed, and not all researchers are complying with the mandates of open science. The progress seems slow, although promising, and health research in Africa is going to benefit from the advantages of open science eventually.

References


30. Basson I, Simard MA, Ouangré ZA, Sugimoto CR, Larivièe V. The effect of

4. Big Data Management in Libraries: A Case of Busitema University, Uganda - Glorias Asiimwe, Joyce Bukirwa and Alison Annet Kinengyere

1Glorias Asiimwe, 2Joyce Bukirwa & 3Alison Annet Kinengyere
1Busitema University Faculty of Health Sciences, Library
2Makerere University College of Computing & Information Sciences
3Makerere University College of Health Sciences, Library

Abstract

Background: Everything we do, see or communicate in this world amounts to data, resulting in voluminous amounts of data dubbed as Big Data that exceed 1.145 trillion megabytes daily (Bulao, 2021). Academic libraries execute numerous functions that result in the generation of large amounts of data, thus necessitating better management of this data. Big Data can reduce uncertainty, inform decisions and predict future outcomes.

Objective: The purpose of the study was to examine the management of Big Data at Busitema University Library (BUL) and propose measures to enhance the management of Big Data for improved decision-making and the quality of library services.

Methods: The study adopted a qualitative case study design. The study population comprised 34 participants clustered as 5 Head Campus Librarians (HCLs), 19 Library Assistants (LAs), and 10 Library ICT Support Staff (LISS). A sample size of 29 participants (5 HCLs, 19 LAs, and 5 LISS) was purposively selected. Data was collected using interviews, Focus Group Discussions, and document review and analyzed using thematic analysis.

Results: The study found that various types of Big Data emanating from several library operations were managed at BUL. Data was used to support decision-making; understand user information needs, and support collection development as well as planning and budgeting. However, there were major challenges including limited
budget, skills gap, unstable Internet, inadequate and outdated ICT equipment and lack of a central data management system, among others.

**Conclusion:** The study recommends that Busitema University should standardize and centralize the management of Big Data; increase the University library budget; train library staff; increase Internet bandwidth, and recruit a data management specialist.

**Keywords:** Big Data, Management, Library, Busitema University, Uganda.

**Background**
Everything we do, see, or communicate in this world amounts to data. This has resulted in voluminous amounts of data, dubbed Big Data that exceed 1.145 trillion megabytes daily (Bulao, 2021) and 1.7 million bytes every minute across the globe (Reinsel et al., 2018). Libraries are no exception, as they execute numerous functions that result in large amounts of data. Following the emergence of the COVID-19 pandemic, Universities across the globe closed their physical doors and embraced online teaching and learning (Ishtiaq, Sehar & Shahid, 2020). This abrupt change saw a drop in the physical use of library resources as the internet’s prominence skyrocketed as an alternative source of information for teaching, learning, and research (Connell, Wallis & Comeaux, 2021). Consequently, University libraries have had no choice but to remodel their services from the traditional norm to the ‘New Normal’ of offering services remotely to remain relevant. Library collections have been extensively digitized, and innovative ways of serving users such as virtual reference services, virtual research support, and e-document delivery services boosted to support online teaching and learning (Rafiq, Batool, Ali & Ullah, 2021). In the process, voluminous amounts of data and data from traditional services have been generated. Therefore, University libraries must ensure effective management of this data because Big Data has the ability to shape and transform a library’s strategic direction by providing the information needed to reach better decisions, understand user needs, plan for collection development and demonstrate value for money (Massi, 2016; Scott 2019; Travis & Ramirez, 2020). With such associated benefits, data has been recognized as the ‘new gold’ in today’s information-driven society (O’Halloran, 2020).
Institutional Context

Busitema University is one of the eight public universities in Uganda, whose main administrative offices are located along the Jinja-Malaba highway approximately 185 kms from the capital Kampala, 26 kms southwest of Tororo town, and 18 kms west of Busia town. Established by the Statutory Instrument of 2007, the University operates on a multi-campus model with six campuses spread over five districts of Tororo, Mbale, Soroti, Kamuli, and Pallisa in Eastern Uganda. Each campus is unique and discipline-specific. Busitema campus focuses on Engineering, Nagongera on Science & Education, Namasagali on Natural Resources and Environmental Sciences; Arapai on Agriculture and Animal Sciences; Mbale on Health Sciences and Pallisa on Business and Management Sciences. Busitema University Library (BUL) is made up of six campus libraries situated at Busitema, Nagongera, Mbale, Arapai, Pallisa, and Namasagali campuses. The main administrative library is located at Busitema Campus and hosts the Engineering campus library. Each campus library’s collection is unique and based on the programmes offered at the campus. The overall collection of the University library comprises: 35,700 print textbooks, 102,972 electronic books and journals; bound newspapers, student dissertations and theses (KOHA system generated statistics, 2022). These collections support over 45 academic programmes at certificate, diploma, undergraduate, and graduate levels, with a population of over 8000 users, including students, staff, external researchers, and neighbouring communities (Busitema University, 2021).

From its inception in 2007, BUL operated solely a manual system characterized by card catalogues stored in wood cabinets, book processing using physical classification schemes, and accession registers to circulating books using counter books and paper borrowing slips. Over the years, the University library has slowly embraced and adopted technology alongside the manual system. For instance, an Online Public Access Catalog (OPAC) using the KOHA library management system was introduced in 2021 with functions namely Cataloging, Circulation, Patron, Course Reserves, and Serials modules. A Radio Frequency Identification (RFID) machine and barcode readers were installed at Busitema Campus library to check in and out books. The University library website portal was developed in 2021 to serve as a one-stop hub for accessing e-resources, rendering research support, and creating awareness of library
services. A Dspace institutional repository for uploading research output from students, staff, and affiliated researchers as well as other University publications was installed. Additionally, virtual reference support tools such as “ASK A LIBRARIAN” and electronic Document Delivery Services were also installed to supplement physical reference desk services. The subscription to electronic books, journals, and databases has increased with the support of the Consortium of Uganda University Libraries. With the COVID-19 outbreak in 2020, Busitema University re-emphasized the use of Open Distance Education Learning (ODEL) and the library was brought on board to support the development of online course modules and teaching materials (Busitema University, 2021). Furthermore, in its mission to support teaching, learning, and research, BUL carries out several activities including acquisition, processing, circulation, stocktaking, user education, reference services, and research support services (Busitema University, 2018). Consequently, the transformation of library systems and services rendered results in an enormous amount of data at BUL.

Statement of the Problem
The management of Big Data in African Universities is lacking and problematic as data is kept in silos with no standardized guidelines or policy frameworks (Oyerinde, 2015). As a result, individual units manage their own data separately, leading to data redundancy that limits its optimal use. At Busitema University, though strides have been made in implementing systems like KOHA, the operationalization of its functionalities has been rolled out in a phased manner and predominately at the Busitema Campus library (Busitema University, 2021). Besides, no known system is specifically for managing data centrally from other library operations, considering the multi-campus model setup and remoteness between the six campuses (Achieng, 2018). Hence, data remains scattered at the campus level for library administrators to use collectively to inform decisions and improve the quality of library services. Therefore, it’s against this background that the study examined the management of Big Data at BUL.
Purpose and Objectives of the Study

The purpose of the study was to examine the management of Big Data at BUL and propose measures to enhance the management of Big Data for purposes of improving on decision-making and the quality of library services. The specific objectives were to:

1. Identify the types of Big Data managed at BUL.
2. Investigate the uses of Big Data at BUL.
3. Investigate how Big Data is managed at BUL.
4. Identify the factors affecting the management of Big Data at BUL.
5. Propose measures to improve the management of Big Data at BUL.

Theoretical Perspective

The study was guided by the Organizational Information Theory’s (OIT) assumptions that human organizations exist in an information environment to function effectively and accomplish goals; information in an organization differs in terms of equivocality and human organizations engage in processing information to reduce uncertainty (West & Turner, 2018). OIT describes how organizations process information to reduce uncertainty and use this information to achieve organizational goals. Additionally, the theory indicates that organizations receive information from multiple sources, which relates to the way Big Data in libraries is generated through different activities. Therefore, based on the OIT, Big Data should be well processed, organized, and managed to enable the library to make sense of it to reach better decisions, understand users better and reduce uncertainty, thus leading to improved library services.

Review of Related Literature

Types of Big Data in Academic Libraries

A survey on the implementation of Big Data analytics in Pakistan academic libraries revealed that the types of Big Data in libraries ranges from structured, semi-structured, and unstructured data (Ahmad, JianMing & Rafi, 2019). Out of the three, Ball (2019) observed that there is an increasing amount of unstructured data in academic libraries compared to structured and semi-structured data combined. Osman and Alexandrina (2018) established four main types of Big Data namely, bibliographic metadata,
circulation data, usage statistics, and catalogue data. A study conducted in 3,793 United States academic institutions discussed Big Data originating from interlibrary loans, book reservations, physical and virtual reference counts, information literacy training, and circulation histories (Phan, Hardesty & Hug, 2014). From the African perspective, a case study conducted at the University of Zimbabwe library revealed that research data is increasing especially in developing countries, as researchers turn to libraries to provide research data management services (Nhendodzashe & Pasipamire, 2017). The types of Big Data identified in the studies confirm one of the assumptions of OIT that organizations receive data from multiple sources.

**Uses of Big Data in Academic Libraries**

Travis and Ramirez (2020) indicated that Big Data enables academic libraries to understand and predict patterns of students’ past and future learning based on user profiles. Murumba and Micheni (2017) review on Big Data Analytics in Higher Education concluded that Big Data supports a multi-level decision-making process by providing administrators, top managers, and policymakers in academic institutions with reliable information to reach evidence-based and smarter decisions. Other studies have highlighted that Big data enables libraries recognize the changing information needs and behaviors of users (Panda, 2021); provide a basis for understanding and predicting user reading habits (Kamupunga & Chunting, 2019).

**How Academic Libraries Manage Big Data**

The review of literature on how academic libraries manage Big Data in this study was focused on the collection, organization, processing, analysis and storage of Big Data. On collection, Kamupunga and Chunting (2019) revealed that more data is generated in libraries as a result of digitization of library collections. Pertaining organization, a systematic literature review of published papers on Big Data between 2012 and 2018 concluded that one of the library’s role in Big data is to organize the large and messy data sets into usable knowledge (Garoufallou & Gaitanou, 2021). On processing and analysis, Manaseer, Alawneh and Asoudi, (2019) indicated that software like Hadoop was being used to process and analyze data. With storage, scholars highlighted the use of cloud storage, specialized data service units and institutional repositories as one of the dominant storage services in libraries’ Big Data management (Al-Barashdi & Al-Karousi, 2018; Heidorn, 2011; Kakai, Musoke, & Okello-Obura, 2018).
Factors affecting the management of Big Data in Academic Libraries

Rafiq, Batool, Ali, and Ullah (2021) study on Pakistan University libraries found that academic libraries encounter financial, social, and technological challenges in managing Big Data. The lack of technical conceptual knowledge and skills among librarians in managing data especially in the aspects of presentation, analysis, visualization, and mining, was discussed as a key challenge in libraries (Lawton & Burns, 2015; Burton and Lyon, 2017; Brown, Wolski, & Richardson, 2015). Other challenges in other studies included budget cuts and limited financial resource allocations (Zarate, 2013); inadequate ICTs infrastructure in the library (Okello-Obura & Magara, 2008) and data privacy (Roni et al, 2011; Kiconco, 2018).

Strategies to Mitigate Challenges in Big Data Management in Academic Libraries

Al-Barashdi and Al-Karousi (2018) recommended that academic libraries embrace different techniques to effectively analyze Big Data, such as statistics, machine learning, data mining, signal processing, and visualization techniques. Pertaining skills, academic librarians need to broaden their skills in using the latest technologies by taking advantage of the numerous cross-cutting data courses, undertaking continuous professional development, benchmarking and sharing best practices with fellow Library and Information Studies’ (LIS) professionals (Kiconco, 2018; Ahmad, JianMing and Rafi, 2019; Zhan & Widén, 2019; Okello-Obura & Magara, 2008). Despite the growing research interest in Big Data, the review of the literature established that few studies have been conducted and discussed on the application of Big Data in academic libraries (Ahmad, JianMing and Rafi, 2019; Zhan & Widén, 2019; Al-Barashdi & Al-Karousi, 2018). The research gap identified during the review was the limited number of studies on Big Data management, particularly in the Ugandan academic libraries’ context.

Methodology

The study adopted a qualitative case study design because the researchers wanted to understand how Big Data is managed within the natural setting and context of BUL based on people’s experiences and perceptions (Neuman, 2010). The study’s target population comprised 34 participants clustered as 5 Head Campus Librarians (HCLs), 19 Library Assistants (LAs), and 10 Library ICT Support staff (LISS). Twenty-nine (29)
out of the 34 participants (5 HCLs, 19 LAs, and 5 LISS) were purposefully sampled based on their day-to-day active involvement in managing library data. Two forms of purposive sampling were used: total population and expert purposive sampling (Laerd Dissertation, 2012). Total population purposive sampling, which involves selecting an entire group based on a particular set of characteristics, was used to select all the 5 HCLs and 19 LAs. Expert purposive sampling, which entails capturing knowledge in a particular form of expertise, was used to select 5 out of 10 LISS who possessed expertise in ICT but also oversaw ICT-related activities at each of the campus libraries.

The study employed three data collection methods: interviews, Focus Group Discussions (FGDs), and document review. Ten in-depth interviews were conducted with 5 HCLs and 5 LISS as they provided flexibility to probe for detailed information and a relaxed atmosphere for gathering rich information (Kinchin, Streatfield, & Hay, 2010). The FGDs enabled the researchers to collect rich and detailed data within a short time as well as obtain collective views and experiences from 18 LAs, leaving out 1 LA at Pallisa Campus, who was one at campus. In total, 5 FGDs were held at the five campuses of Namasagali, Mbale, Nagongera, Busitema, and Arapai. Documents including the University library strategic plans, Human Resource manuals, library statistics, annual reports and system-generated-activity reports from KOHA were also reviewed. These provided background information and evidentiary data to back up responses obtained through interviews and FGDs. Qualitative data analysis was achieved through thematic analysis (Vaismoradi, Turunen, & Bondas, 2013), and data was presented using direct verbatim, quotes and tables based on five themes devised from the study objectives.

Findings and Discussion

Response Rate: The researchers had targeted to collect data from 29 respondents; however, 28 participated in the study. These included; 5 Head Campus Librarians (HCLs), 5 Library ICT Support Staff (LISS), and 18 Library Assistants (LAs). From the interviews, 10 out of 10 respondents (5 HCLs & 5 LISS) participated; making a response rate of 100%. Meanwhile, from the Focus Group Discussions (FGDs), 18 out of the 19 targeted Library Assistants participated, resulting in a 95% response rate. Therefore, the response rates of 100% (Interviews) and 95% (FGDs) mean that most of the targeted respondents participated in the study.
Demographic Characteristics of Respondents: The gender, level of education, and duration of service of the respondents was captured from as shown in Table 1 below.

Table 1: Demographic Characteristics of Respondents

<table>
<thead>
<tr>
<th>Item</th>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Female</td>
<td>11</td>
<td>39%</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>17</td>
<td>61%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>28</td>
<td>100%</td>
</tr>
<tr>
<td>Level of Education</td>
<td>Diploma</td>
<td>10</td>
<td>36%</td>
</tr>
<tr>
<td></td>
<td>Bachelors</td>
<td>9</td>
<td>32%</td>
</tr>
<tr>
<td></td>
<td>Certificate</td>
<td>4</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td>Masters</td>
<td>5</td>
<td>18%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>28</td>
<td>100%</td>
</tr>
<tr>
<td>Duration of Service in</td>
<td>10 years and above</td>
<td>17</td>
<td>61%</td>
</tr>
<tr>
<td>University</td>
<td>5 to 9 years</td>
<td>11</td>
<td>39%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>28</td>
<td>100%</td>
</tr>
</tbody>
</table>

From Table 1, the total number of females was eleven (39%), whereas the number of males was seventeen (61%). These findings indicate that there is a higher portion of males compared to females working at BUL. Besides, the findings prove that the study was not gender-biased as it captured the views of both females and males. On the level of education, the highest number of respondents ten (36%) were at the Diploma level, followed by nine (32%) at Bachelor's degree level, four (14%) at the Certificate level and lastly, five (18%) at Master's level. This indicates that at least all respondents had a formal qualification in Library and Information Science or Information Technology. Lastly, on duration in university service, seventeen (61%) respondents had served in the University for ten or more years, whereas the remaining eleven (39%) had served for five to nine years. These findings suggest that the duration of service was adequate for respondents to give a clear picture and history of data management at BUL.

Types of Big Data Managed: The participants were asked to state the type of Big Data BUL possessed and the activities from which this data was generated. Findings revealed that different types of big data, including circulation data, stocktaking, user
registration, acquisition, reference service, user education, bibliographic, and research
data, existed at BUL. These were generated through the various library activities
carried out, such as circulation, stocktaking, acquisition, reference services, user
registration, cataloging, and classification. Table 2 summarizes the types of Big Data
and activities generated from as mentioned by participants.

Table 2: Types of Big Data Generated from Library Activities

<table>
<thead>
<tr>
<th>Library Activity</th>
<th>Type of Big Data Generated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulation</td>
<td>Circulation data (e.g., statistics of users served, statistics of books borrowed, records of books overdue and returned, titles of books frequently requested, lists of students and staff defaulters and system-generated reports from KOHA)</td>
</tr>
<tr>
<td>Stocktaking</td>
<td>Stocktaking data (e.g., statistics of titles in the collection, records of borrowed, misplaced, and lost books, number of tables, chairs, computers, and other ICT equipment and statistics of damaged books for repair)</td>
</tr>
<tr>
<td>Reference services</td>
<td>Reference services data (e.g., queries, reading lists, users' feedback, e-resources usage statistics, names, email and telephone contacts of users served, departments, and academic programmes served)</td>
</tr>
<tr>
<td>Acquisition</td>
<td>Acquisition data (e.g., requests from departments, correspondences with book suppliers, quotations and invoices, bids from book vendors, procurement forms, records of new arrivals, biodata of book suppliers, lists of book donors, reports of books purchased, annual work plans and budgets)</td>
</tr>
<tr>
<td>Registration of library users</td>
<td>User registration data (e.g., passport photographs, registration forms, photocopies of national IDs, clearance forms, student registration numbers, date of entry to the university, programme of study, KOHA and MYLOFT system-generated reports)</td>
</tr>
<tr>
<td>Processing of information materials</td>
<td>Bibliographic and catalogue data (e.g., class numbers, book titles, accession numbers, author names, publishers, place of publication, ISBN/ ISSN, barcodes, spine labels, accession registers, card</td>
</tr>
</tbody>
</table>
These findings are an indication that Big Data in academic libraries is multifaceted, taking on diverse kinds and formats. This corresponds to what the Organizational Information Theory (OIT) points out: that organizations receive information from multiple sources (West & Turner, 2018).

**Uses of Big Data:** The HCLs were asked how Big Data is utilized at BUL. Findings revealed that Big Data was majorly used in supporting decision-making, understanding user information needs, aiding the collection development process, developing strategic plans, work plans and budgeting. Concerning decision-making, Massi (2016) indicated that data supports discussion openness and provides a basis for the library to justify decisions in collection development, acquisition, staff recruitment, and infrastructure development. On understanding user needs, Travis and Ramirez (2020) indicated that Big Data enables academic libraries to understand and predict patterns of users’ needs based on past usage of library information resources. The revelation that Big Data was being used in planning aligns with Miller (2018), who states that data is essential in developing value-driven library strategic plans.

**How Big Data is managed:** The participants were asked to describe the management of Big Data based on collection, organization, processing, analysis and storage. Findings revealed that despite the different activities under Big Data management, there was no separation of roles as the majority executed all tasks from data collection to storage. This contradicts Affelt's (2015) idea that roles in big data management should be distinct, with librarians taking on roles as data curators, data cleansers, or
data archive managers. The mechanisms used in organizing data were unique at each campus, including alphabetical arrangement, creating file naming conventions, grouping related data in box files, categorising data according to activity, and creating collections and communities in Dspace. This is consistent with Onwuchekwa's (2012) revelation that libraries in developing countries tend to organize information alphabetically in boxes, subject-wise according to the activity, by document descriptions, and under collections. Tools such as KOHA, Microsoft Excel and Access, accession registers, and borrowers’ cards were used to process and analyse data. This collaborates with what Zhan and Widen (2017) stated. Though analysis requires statistical programmes like Python and R programming to draw conclusions and identify patterns, most libraries don’t have them. Data was stored electronically and manually, though manual storage still dominated. This agrees with Luyombya & Ndgaire's (2020) findings that university libraries in Uganda still operate manual and electronic systems.

**Factors affecting the management of Big Data:** Findings revealed the following challenges encountered in managing Big data: slow and unreliable Internet connection; electricity cuts; limited University library budget; lack of a uniform and consistent system of organizing data; limited skills in data management; no formalized guidelines and uniform way of organizing data across campus libraries; lack of standby generators, inadequate and outdated equipment; lack of motivational support. The findings on poor Internet connectivity corroborate with studies conducted in African libraries (Echezona & Ugwuanyi, 2010; Buruga & Osamai, 2019), which revealed that poor, slow and unreliable Internet connectivity in African universities poses a threat to timely retrieval of information and utilization of e-resources. The issue of electricity cuts is in line with Dina's (2014) study in Nigeria, which revealed that University libraries experience electricity failure frequently, affecting library services. The findings on a limited budget are consistent with earlier studies (Echezona & Ugwuanyi, 2010; Namuleme & Kanzira, 2015) that revealed that African University libraries have a big challenge of underfunding that hinders the acquisition of information resources and effective delivery of services.

**Measures to improve the management of Big Data:** The measures proposed by the study participants included organizing regular training to improve staff skills, increasing the Internet bandwidth and linking all six campus libraries to the Research
an Education Network for Uganda (RENU) National Backbone to ensure speedy connection; procuring standby generators or strong power backup systems to ensure continuity of work during power cuts; allocation of additional finances to the University library; drafting standard written guidelines; procuring sufficient and modern ICT equipment; hiring a data management specialist to guide other staff, and recruiting more professional staff. With the increased emphasis on online teaching and learning due to the COVID-19 pandemic, the findings corroborate Alsoud & Harasis’s (2021) suggestion that universities should invest in strong technological infrastructure such as the Internet. On ensure electricity stability, Dina (2014) proposed that University libraries should acquire and use alternative power-generating sources to ensure continuity of library services in case electricity is off. On training, the findings corroborate with Sengupta’s (2016) suggestion that in order for librarians to transform large amounts of data into value effectively, they need to have sufficient knowledge that corresponds with Big Data challenges. Furthermore, the University library could lobby for increased funding from the government, as Namuleme and Kanzira (2015) suggest, by demonstrating its vital role in fulfilling the University’s overall mission.

**Conclusion and recommendations**

All types of library Big Data are valuable and thus ought to be effectively managed to support decision-making, aid in understanding users’ information needs and collection development, and support strategic planning and budgeting how Big Data was being managed exposed gaps that need to be addressed by developing standardized guidelines for the six campus libraries, clearly defining and separating the roles in data management. Besides, as universities adjust to the ‘New Normal’ of online teaching and learning due to the COVID-19 pandemic, BUL has to shift from manual to digital data management. The major challenges identified included a limited library budget, skills gap, slow and unreliable Internet, inadequate and outdated ICT equipment, lack of uniform and documented guidelines; lack of a central data sharing platform and lack of motivational support. Consequently there is need to organize regular trainings; increase on the Internet bandwidth and link the six campus libraries to RENU; acquire standby generators and strong power backup systems; allocate more funds to the University library and develop written guidelines on data management. As stipulated in the Organizational Information Theory, once data is effectively processed and managed, it will lead to reduced uncertainty and better decision making that will ensure
BUL achieves its organizational function of rendering quality library services that support teaching, learning and research. Therefore, the study suggests the following recommendations:

**Standardize and centralize the management of Big Data:** BUL should develop written guidelines that stipulate how Big Data is to be collected, organized, processed, analyzed, stored, and preserved. This will ensure uniformity and a streamlined process of managing Big Data in a multi-campus setting. In addition, the University library should consider having a central Big Data management system where data from the six campus libraries is stored and centrally shared.

**Increase the University library budget:** The University’s Top Management should advocate for increased funding from the government. BUL should be prioritized during budget allocations by increasing its budget from the current 2.5% to at least 10% per the National Council for Higher Education recommendations. Besides, the different campus libraries can embark on identifying and writing grant proposals to boost their financial base.

**Continuous training of library staff:** BUL should organize regular training to ensure library staff develop hands-on digital skills and keep abreast with the latest data management practices. Benchmarking visits to other institutions with well-established data management systems need to be arranged to ensure best practices are learned. Library ICT support staff should be encouraged by the University Library Management Committee to attend free online courses on Introduction to Library and Information Science to familiarize themselves with the LIS terminologies and remain relevant in supporting the library.

**Increase the Internet bandwidth:** The University’s ICT department should advocate for an increase in the Internet bandwidth from 20 Mbps (Megabytes per second) per campus to at least 50 Mbps to ensure a speedy connection. Since campus libraries play a pivotal role in supporting teaching, learning, and research, they should be prioritized to receive fast and reliable Internet. All six campuses of Busitema University should be linked to the RENU national backbone and consistently monitored by the
ICT technical personnel to ensure the institution gets the Mbps paid for to ensure continued Internet stability.

**Acquire electricity backup systems:** Considering the remote location of the six campuses of Busitema University, electricity fluctuations are prone to occur frequently. Therefore, the University should consider acquiring standby generators and strong power backup systems such as invertors so that if electricity is off, data management activities and other library operations that necessitate electricity don't come to an abrupt halt that could lead to data loss.

**Recruitment of more professional staff:** The University Library Management Committee should lobby to recruit additional professional staff such as the Data Officer and other essential technical staff, to occupy positions in the University library establishment that currently stand vacant at 70%. Hiring additional staff will help reduce the challenge of understaffing and ensure there is separation of roles in data management.

**Fully operationalize KOHA modules:** Though KOHA had been introduced with numerous functionalities, including Cataloging, Circulation, Patron, Course reserves, and Serials modules, operationalization of these has been done in a phased manner and mainly at the Busitema campus library. Therefore, there is a need to ensure the existing modules are fully implemented across all six campus libraries as well as add more modules on acquisitions, reporting, label printing, and offline circulation, amongst others. This will enable a smooth migration from the manual way of managing data to the digital form.

**References**


O`Halloran, D. (2020). *Data is the new gold. This is how it can benefit everyone while harming no one.* Retrieved 2021, from https://europeansting.com/2020/07/30/data-is-the-new-gold-this-is-how-it-can-benefit-everyone-while-harming-no-one/


ABSTRACT

INTRODUCTION

Research and publications are the recognized indicators of scholarship and the pinnacle of academic achievement. Scientists in academia are measured by the scholarly output of peer-reviewed publications. This standard has made engagement of scientists with peer-reviewed publications mandatory; failure of which may bring about perturbing results of abandoning a promising job. However, as the peer reviewing progresses there are concern about transparency that led to the agitation for an anonymity form (double-blinded) of peer review and current agitation for an open peer review.

OBJECTIVES

The main aim of the study is to investigate the influence of the mandatory peer review policy and technology applications - the contemporary online submission system, on the research productivity of African Health Librarians (AHLs).

METHODS

The descriptive survey design method was adopted for this study. A web-based structured closed-ended 11-item questionnaire was used to collect data from the respondents. The questionnaire, monitored with email messages, WhatsApp charts, and telephone calls, was administered on two social media (WhatsApp) forums for health librarians in Africa namely, Medical Library Association of Nigeria (MLA-NG) and Health Librarians for Data Science for Health and Innovation in Africa (DSI-Africa). The population of the study consisted of 296 health librarians. Of the 296 members, 45 completed and returned the questionnaire. Descriptive statistics was adopted
including frequency counts, percentages, data analysis and reporting. While inferential statistics were employed for further analysis.

RESULTS

The respondents' mean age was 44.7, and more than half (59.4%) were males. More than two-thirds (64.4%) of the respondents work in academic medical school libraries. The respondents have positive affirmations to statements such as “I experienced highly engaging and interactive digital communications in the peer review process of publications with the various journals they have published” (X̄=33.3); “peer review is advancing scholarship” (X̄=3.86). The majority (91.2%) did not see peer review policy as a threat to their research productivity. However, 40.0% respondents condemned the choice of words of reviewers and editors as not only derogatory but devastating for authors. Respondents affirmed positively to the statement “outright rejection of their manuscript based on insufficient analytical rigour or other deficiencies rather than recommending revision affected their intellectual efforts to write papers” (X̄=3.56). More than two-thirds (64.4%) of the respondents could not publish more than two papers per year.

CONCLUSION

Findings from this study affirm the wide adoption of Internet technology among academic publishing journals. On the existence of bias, unfairness, and discrimination in the peer review community, this study did not find strong statistical evidence for these claims. Findings from this study suggest that the reviewers’ comments and editors’ decision on outright rejection of the manuscript has a significant negative correlation with the respondents’ research productivity.

INTRODUCTION

Mandatory peer review of scholarly manuscripts is described in different ways by various researchers. Nicholas and colleagues (2015), define peer review as an exercise central to scientific publishing. Ware et al., (2008) cited by Rowley and Sbaffi, (2017, p.1) described peer review as the process of subjecting an author’s scholarly manuscript to the scrutiny of their peers, who are experts in the same field, before publication in a journal. It is the means through which the research output of a scholar is assessed to improve the quality.
Academic journal publishing involves compulsory scrutiny of research findings, (Sharma et al., 2022) to “ascertain if the assertions made, methods deployed, results and conclusion are in line with the accepted practices in scientific writing and publication” (Wang et al., 2016, p.61). Evidence from the literature has offered convincing arguments in support of research and publications as the only highly rewarded activity among the four academic scholarships (Bello et al., 2023). Many reasons account for why peer review of manuscript is inevitable in the scientific community. The relevance of publications in science has made peer review of manuscripts an inevitable process in publishing as a universal scientific practice (De Witte et al., 2010; Miller et al., 2011).

The implementation of mandatory peer review varies from journal to journal. The forms depend on the choice of a journal. Issues of level of anonymity offered, the number and type of expertise recruited and the degree of interactions among the stakeholders are peculiar to different publishing outlets. Of these forms, either single, double-blind or open peer review is becoming more popular in the peer review community. Concerns about fairness and discrimination in peer review have brought about contentious agitations for an anonymity system, which is embedded in the double-blind review among researchers (Sense about Science, 2009; Mulligan et al., 2013; Taylor & Francis, 2015; Rodríguez-Bravo et al., 2017)

Anonymity is believed to guarantee fairness and prevent reviewers’ discrimination among the authors (Taylor & Francis. 2015). Mulligan et al., (2013), saw blinded peer review as a form that eliminates bias and allows the reviewer to concentrate on the quality of the review. A single-blind review process is a traditional system where the entire identities of the authors, names and affiliations are disclosed to the reviewers (Stensrud & Brooks, 2005). Many authors do not support this form of review as circumstantial evidence suggests that reviewers are not always unbiased with the names, gender, country of origin and the number of authors known to the reviewer (Tregenza, 2002; Wenneras et al., 1997).

Open peer review (OPR) is still evolving as it has not been widely adopted (Wang et al., 2016). The OPR movement is borne out of the criticism of the “black box” since around 1990, discussing the merits of “opening up” many facets of peer review.
(Hamilton et al., 2020, p. 2). The availability of Digital communications and online dissemination of knowledge in the 21st century influenced the evolving debate of open peer review. For instance, advocacy for OPR has been linked to the early period of online open-access journals when OPR was argued to be central to the newly created electronic open-access journals’ operation (Jana & Librarian, 2019; Sumner & Shum, 1996).

The 21st Century peer review differs considerably from the early days. In the early times, the most popular review of the manuscript was the use of a web-based email where an author sends a manuscript as an attachment to the editor; whose decision, after reviewing, is communicated to the author through the same channel (Horbach & Halfman, 2018). That process appeared boring and un-interactive. Rather than learning in the process, authors seemed to be struggling to grow in research as the encoding and decoding systems of communication among the stakeholders were not only characterized by hostility but were devoid of learning by doing. The peer review process is changing and the digital age has eradicated this hostility (Horbach & Halfman, 2018).

Health librarians, also referred to as ‘health sciences librarians’, ‘medical librarians’, ‘health information professionals’, have been involved in scholarly publications for decades. Many health information professionals hold academic positions that require scientific publications for career advancement. As a result, they publish their research findings in peer-reviewed journals and go through the peer-review process.

A number of reasons account for peer review of manuscripts in the global scientific community. Peer review is used in various circumstances, such as manuscripts, grant applications, and promotion assessments for career advancement. Previous studies have focused on the peer review process with respect to the work of other categories of researchers; however, there is limited information on peer review of papers published by librarians. It investigates the research activities of African health librarians in the context of contemporary digital peer review of manuscripts.
Literature Review

Development of Peer Review and its Impact on Scholarship

The emergence of the mandatory peer review process (MPRP) in science has a haphazard development as it moved gradually (Burnham, 1990). For instance, the early claim of the origin of peer review coincided with “Henry van Oldenburg’s establishment of an academic journal” (Brown, 2004; Peters & Ceci, 1982; Rennie, 2003; Weller, 1990) was refuted in support of the claim of “peers judging of the publishability of a manuscript after Second World War” (Beasley, 2002; Benos et al., 2005). Despite these claims, findings from the literature further pointed out that peer review, which was initially designed to address grant review processes (and not journal article reviewing), originated from the scientific press in the 1960s (Baldwin, 2017; Moxham & Fyfe, 2018). Further to this, more revelations regarding its origin indicated that the practice of reviewing manuscripts as a scientific communication channel began from the learned societies in the early and mid-nineteenth century (Moxham & Fyfe, 2018). Before a well-established system, varying styles of peer review abound. Many journals, like the Lancet, considered the process unimportant, while the Journal of the American Medical Association merely constituted an internal review panel and rarely engaged external reviewers (Horbach & Halfman, 2019).

The common early decisions on acceptance or rejection were vested in a single editor or a small editorial committee that acted without a concrete basis (Baldwin, 2015). A well-established system of peer review as a gatekeeping mechanism in science was not in place until the late nineteenth century (Moxham & Fyfe, 2018). It is important to note that the early system of manuscript assessment was also trailed by challenges for the slow adoption of the policy by various journals, but it survived the turbulence till the time of wider adoption (Horbach & Halfman, 2018). As reported in the changing forms and expectations of peer review, the British Medical Journal was one of the early adopters (Horbach & Halfman, 2018). By the late 20th century, the peer review process was institutionalized, and many journals embraced the practice (Benos et al., 2007). What is known as a peer review system (a quality assessment procedure) metamorphosed from its 18th-century roots (Hargens, 1990; Knoll, 1990). This process is manifested by the publication acceptance or rejection anchored by editors and expert reviewers (Ingelfinger, 1974; Weller, 1990).
Reviewers’ Comments/Recommendations and Journals’ Editorial Decisions on Manuscripts.

The MPRP, as a scientific policy, has specific stages. It involves a period of initial submission of a manuscript through the editorial first assessment to its distribution to reviewers and the period of the editor’s implementation of the reviewers’ comments and recommendations in the form of either acceptance or rejection. Hargens (1990) noted two key stages of navigation: acceptance and rejection of the manuscript after submission. However, the author pointed out that, in some cases, a manuscript assessment could end at the initial submission with the editor’s outright rejection on the grounds of inappropriateness or other reasons for the journal. This submission was further corroborated with statistical evidence of up to 10% of manuscripts submitted which were rejected at the first submission. Conversely, if the editor finds the manuscript suitable for the journal, it moves to the stage of expert review.

An average of two reviewers are involved in the peer review process depending on the journals (Weller, 1990). As Benos et al., (2007) elaborated on the Hargens, (1990) contentions, the reviewers’ comments and recommendations are returned to the editor for a decision. It was further stated that, more often than not, the decision to reject or accept a manuscript is exclusively based on the recommendations of the reviewers (Benos et al., 2007), where the acceptance could be with corrections or without corrections. Unfortunately, a request for revision by the editor (based on reviewers’ recommendations) does not guarantee acceptance, as the manuscript may still be rejected after revision (Benos et al., 2007). Hargens (1990) reports that the rate of manuscript rejection by various journals, amounting to as high as 90%, is as demoralizing as it is capable of killing the thirst for publishing.

As Munafò et al., (2017), claimed that peer review has become a standard procedure where over 65,8000 English language-based journals implemented the policy. Sharma et al., (2022), complemented that the quality of a peer review guides the editor’s decision regarding acceptance or rejection of a manuscript. Reiterating the importance of peer review, Horn, (2016) claimed that the policy “plays a decisive role in filtering, directing and even redirecting research findings” (p. 11). Similarly, Benos et al.,( 2007) offered an apt description of the policy: “peer review now embodies a process of systematically distributing, evaluating, and reaching a consensus on the merit of the submitted manuscript as evidence by its acceptance or rejection” (p. 145). Quoting a
respondent voice in a study titled “Peer Review: Still King in the Digital Age” by Nicholas et al., (2015), the author described peer review as “a familiar, reliable, and traditional practice … thought to be an important scholarly attribute that enables researchers to search, use, cite and disseminate research findings with confidence” (p. 16).

**Effects of Mandatory Peer Review Policy on Manuscripts**

Despite the various concerns raised in the research community about the credibility of the peer review process, many studies that investigated the effect of the policy on manuscript quality still found significant support for it. For instance, a quantitative study was carried out to characterize the effect of changes in the manuscript submitted to the Annals of Internal Medicine using line-by-line measurement to compare the published articles with the submitted versions (Purcell et al., 1998:54). The results indicated a tremendous change to the manuscript in five major categories: too much information, too little information, inaccurate information, misplaced information and structural problems (Purcell et al., 1998). Proofing the efficiency of peer review further, another study of articles submitted in the same journal measured manuscript quality with a 34-questionnaire instrument (Goodman et al., 1994). The outcome of the study yielded a substantial positive correlation. For instance, the manuscript examined by forty-four blinded physicians and epidemiologists using the questionnaire indicated 97% improvement on the items of the questionnaire following peer reviewing. As reported in the literature, peer review increases the quality of the published articles and advances scientific research.

**The Impact of Fairness, Bias, and Discrimination on Peer Review Policy**

Bias, fairness and discrimination in manuscript judgment have been debated extensively. The demand for equity (fair and equal treatment) of minority groups in scholarship, especially women gender (Benedek, 1976; Peters & Ceci, 1982; Whelehan, 1995) has brought about stiff arguments against bias and discrimination in peer review. Establishing the existence of bias in peer review, Peters and Ceci conducted a study where the published manuscripts were resubmitted with paraphrased titles, different authors, institutions, and names and sent to the same journals that first published them. Surprisingly, almost all the manuscripts (not less than 8 out of 12) were rejected on account of poor quality resulting from errors in the
methodology (Peters & Ceci, 1982). As the studies conducted after Peters reported similar effects, the earliest reports by Peters et al. (1982) sparked a contentious debate with various letters contesting what appeared to be unfair and discriminatory in science (Okike et al., 2016; Ross et al., 2006). The outcomes of these studies led to increased awareness that ‘manuscripts were refereed not only on their content but also based on other secondary factors such as the author’s affiliation, background, and personal characteristics’ (Pontille & Torny, 2014).

Proofing the presence of bias among reviewers, Lloyd, (1990), experimental study affirmed the presence of gender bias in reviewing manuscripts. The authors requested reviews of identical manuscripts with male and female authors in the experiment. A seemingly unexpected result of the study revealed that manuscripts authored by females were significantly more often accepted by female reviewers (62.0%) than by male reviewers (21%). Results of the study with respect to acceptance rate. The acceptance rate result of the study vindicated male reviewers as those who did not discriminate between male or female-authored manuscripts in terms of acceptance rate (20-30%) as against that of female reviewers. Results further identified female reviewers as those significantly less likely to accept the male version of the paper (10%) if compared with the female version (62%).

Consequently, these findings have invoked unending debate, leading to the agitation for a double-blind review (Pontille & Torny, 2014) and open peer review (Smith, 1999) as immediate solutions to bias, fairness, and discrimination in science; however, findings by Gilbert et al., (1994) differs. The authors conducted a retrospective cohort study of 1, 851 articles in the Journal of American Medical Association on the assessment of gender bias in peer review of manuscripts. They found no significant effect on the recommendations for acceptance or rejection.

**Peer Review in the Age of the Internet**

The burdensome process involved in the peer review procedure has pushed many journals to be fully online. This development raises the need for knowledge of technology usage among the peer review stakeholders in 21st-century publishing.
The internet-based automated screening tool is used in academic publishing to address several limitations of peer review, such as plagiarism (Schulz et al., 2022). The tool facilitates the initial screening of the manuscript to determine its suitability (Zhang, 2010) before the editor sends it to the expert reviewers (Schulz et al., 2022). In addition, it aids active engagement with the authors as all the stakeholders, who are connected to the Internet, can interact through digital communications in the process of publishing a manuscript (Abdill & Blekhman, 2019). Further to the automated screening functionalities, some journals are also experimenting with the tool to check statistical reporting errors (Nuijten & Wicherts, 2023), missing vital information (Asplund & Hulter Åsberg, 2021), incorrect statistical calculations (Carmona-Bayonas et al., 2018), ethics statements, blinding, randomization and sample size calculations (Alnaimat et al., 2023). While traditional peer review is labour-intensive as it requires time and effort, automated tools are being used to screen many papers and provide individualized feedback faster (Huisman & Smits, 2017). For instance, duration matters a lot to the authors as many publish mainly to meet up with the timing of promotion or tenure track. Imagine a paper that could be possibly reviewed in a couple of days, as observed by Ware & Mabe, (2015), may lie untouched on reviewers’ desks and in editorial offices for extended periods before it receives attention (Azar, 2007).

However, advances in technology have transformed the peer review process. The duration and timing of providing feedback to authors are changing. More articles are being published quickly with automated checks and other relevant software tools (Ross-Hellauer, 2017). Authors are now engaged online through digital communications to fast-track the process (Amsen, 2014; Baldwin, 2014; Ross-Hellauer, 2017) from submitting a manuscript to the time of acceptance or rejection. In addition, the availability of researchers’ web pages and e-mail addresses empowers publishing journals to quickly circulate manuscripts and review reports (Horbach & Halfmann, 2018) to many authors simultaneously. Further to these, the advent of Internet technology has paved the way for various journals to establish large and fast-operating archives where potential authors could freely upload their manuscripts (Gunnarsdóttir, 2005; E. Smith et al., 2017; Walker & da Silva, 2015). Internet technology has also brought about electronic publishing, resulting in a massive increase in peer-reviewed journals, articles and citations (Larivière et al., 2015).
Internet technology has also helped implement uniformity in standards of peer review (Burley & Moylan, 2017). Peer reviewing is now made easier with the aid of technology. For instance, technologies are now being addressed with technologies, such as determining the publishability of a manuscript, copying text from various sources, and detecting plagiarism levels (Serge; Horbach & Halffman, 2020). Reviewers now use technology tools to check for the correct use of statistics in submitted manuscripts (Epskamp & Nuijten, 2014), check image manipulation (Huh, 2023), and misuse of statistics in the submitted manuscript (Munafò et al., 2017).

The use of technology in peer review is eradicating restrictive and un-interactivity. Rather, it promotes transparency, a rate of publishing articles and an open access model. For instance, the Public Library of Science Journal (PLoS), which has employed technology since 2006, has been a growing publishing outlet for professionals in the field (Hames, 2014). It has published about 30,000 articles (Davis, 2017). However, it is important to note that as online tools have contributed to the speedy processing of manuscripts, they have also increased the number of publishing outlets (Hames, 2014). The development has given researchers the opportunity to generate more manuscripts; many of which merely fulfilled the aim of promotion and institutional ranking but contribute almost nothing to the body of knowledge (Bello et al., 2023).

**Health Science Librarians/Health Information Professionals as Researchers and Authors**

Health sciences librarians also known as health librarians or health information professionals, medical librarians/ or hospital librarians have for several years been involved in scholarly communication. They have been writing manuscripts for publication in peer review journals. A review of the literature showed that health librarians are active authors in research and have gained experience from manuscript submission to various journals. Evidence in the literature confirmed health librarians as productive authors who are actively involved in health science information practice research. For instance, a study conducted to investigate the research engagement of health sciences librarians offered a compelling report of 44% of the respondents who had designed and conducted research with 24% of quantitative (24%); qualitative (18%) and 54% of mixed methods (p.168). Grouping the significance of respondents’
research activities and publication rates, the results further identified health academic librarians (72%) as those engaged more in research than did hospital librarians (16%) counterparts (p. 168).

Another study also reported that 66% of the health librarians studied had conducted research (Powell et al., 2002). Other studies found high proportional differences in institutional affiliations regarding the research productivity of the health librarians studied. These disparities were observed in some studies where research productivity of health academic librarians (64%) significantly differed from the hospital librarians (36%) (Fenske & Dalrymple, 1992) and 56% versus 2% for health academic and hospital librarians in the study by Gore et al., (2009) and 70% versus 15% for health academic and hospital librarians in another study (Harvey & Wandersee, 2010).

The reviewing, in the digital age, has moved manuscript processing from the state of the un-interactive one-centred system to a stage where all the stakeholders engage in encrypted digital communications from the point of manuscript submission to the end. This transformation has challenged all the active authors to be proficient in the use of digital tools. Based on this development, this paper examines the impact of technology applications on peer review of the manuscripts submitted to various journals by African health librarians.

Various studies have been conducted on health librarians’ knowledge of research and peer-reviewed publications. However, studies investigating the research activities of health information professionals in the area of the peer review of the manuscripts submitted to publishing journals have not received much attention in Africa.

Many of the empirical studies conducted on the peer review process globally are mostly from developed and Asia countries. Many of these studies addressed the professionals in various disciplines outside of librarianship. There is a paucity of research on peer review process experiences of librarian-researchers in the African region. The present paper fills these gaps in knowledge. The study’s main aim is to examine how researchers in the field of health science librarianship are getting on with the mandatory peer review process using the 21st century online submission system deployed by most academic journals.

The specific objectives are to:
• Determine the proportion of AHLs who used online journal submission system for the peer review process
• Determine the respondents’ perception of the mandatory peer review (MPR) process as a scientific policy.
• Explore the effect of reviewers' comments and decisions of editors on the health librarians’ manuscripts

Research Questions
1. What proportion of the respondents used the online journal submission systems and went through the mandatory peer review process?
2. What is the perception of AHLs about the mandatory peer review process?
3. What is the effect of reviewers' comments and decisions of editors on AHLs manuscripts submitted to journals and their research output

Research Hypothesis
There is no significant relationship between AHLs perception of mandatory peer review policy, reviewers’ comments and decisions of the journal editors on the research productivity of AHLs.

Methodology
The descriptive survey design was adopted for this study. The population of study consisted of health librarians who work in various health libraries across Africa. This quantitative study adopted a total enumeration technique involving 296 health librarians (who were active members of the Medical Library Association of Nigeria (MLA-NG) and AHILA/DS1-Africa.

Data for this study was collected with an 11-item structured, web-based questionnaire. The questionnaire with multiple-choice and closed-ended questions was designed using Google Forms. The questionnaire has three sections, namely, (1) the demographic characteristics of the respondents, (2) the perception of health librarians about the mandatory peer review (MPR) process as a scientific policy and (3) the effect of reviewers’ comments and decisions of editors on the health librarians’ manuscripts. A four-point Likert scale consisting of “Strongly disagree (1)”, “Disagree (2)”, “Agree
(3”) and “Strongly agree (4)” were used to examine the respondents’ online manuscript submission for peer review.

Since the respondents in this study were scattered all over the African continent, the authors decided to use an online questionnaire. Specifically, the choice of an online questionnaire was based on two major reasons. First, the geographical locations of the respondents. Second, the convincing arguments of many authors (Alessi & Martin, 2010; Callegaro et al., 2015; Eysenbach, 2004; Sue & Ritter, 2012) on the effectiveness and reliability of internet-based questionnaires.

The questionnaire hyperlink was deployed to the respondents on three key social media platforms where health librarians meet regularly to interact and brainstorm on health science librarianship. These platforms include: AHILA/DSI-Africa Librarians team (general), DSI-A/AHILA Nigeria Team and MLA-NG. The link was sent repeatedly for two months and followed and monitored with telephone calls. WhatsApp messages were also sent to remind the respondents to complete the survey questionnaire. In addition, the survey link was sent to the individual email addresses not less than three times as follow-up.

The completed online questionnaire was uploaded into an Excel sheet using Google Form analytical tools. It was thereafter imported to SPSS version 26 for coding and computation. The data was analysed using descriptive statistics, including frequency counts and percentages. Mean and weighted mean were used to analyse the demographic and other variables. Some variables were measured using a four-point Likert scale.

**Results**

**Demographic Characteristics of the Respondents**

The demographic characteristics of the respondents is shown in Table 1.

The respondents' mean age was 44.7. There were more males (57.8%) than females (42.2%). Most respondents (51.1%) had Master's degree, and less than one-third (22.2%) had acquired a PhD degree. Only 15.6% are Deputy University Librarians. There were more senior librarians (24.4%) than other categories of library staff. More than two-thirds (64.4%) of the respondents work in academic medical school libraries.
Table 1: Demographic information about the respondents

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>N = 45 †</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>26</td>
<td>57.8</td>
</tr>
<tr>
<td>Female</td>
<td>19</td>
<td>42.2</td>
</tr>
<tr>
<td><strong>2. Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td>4</td>
<td>8.9</td>
</tr>
<tr>
<td>30-39</td>
<td>8</td>
<td>17.8</td>
</tr>
<tr>
<td>40-49</td>
<td>19</td>
<td>42.2</td>
</tr>
<tr>
<td>50-59</td>
<td>11</td>
<td>24.4</td>
</tr>
<tr>
<td>60 and Above</td>
<td>3</td>
<td>6.7</td>
</tr>
<tr>
<td><strong>3. Education Qualification</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BLIS</td>
<td>6</td>
<td>13.3</td>
</tr>
<tr>
<td>MLIS/MLS</td>
<td>23</td>
<td>51.1</td>
</tr>
<tr>
<td>PhD</td>
<td>10</td>
<td>22.2</td>
</tr>
<tr>
<td>Diploma</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
<td>11.1</td>
</tr>
<tr>
<td><strong>4. Grade Level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Librarian II</td>
<td>6</td>
<td>13.33</td>
</tr>
<tr>
<td>Librarian I</td>
<td>6</td>
<td>13.3</td>
</tr>
<tr>
<td>Senior Librarian</td>
<td>11</td>
<td>24.4</td>
</tr>
<tr>
<td>Principal Librarian</td>
<td>3</td>
<td>6.7</td>
</tr>
<tr>
<td>Institute Librarian/ Director of Library</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>Deputy University Librarian</td>
<td>7</td>
<td>15.6</td>
</tr>
<tr>
<td>Others (please specify)</td>
<td>11</td>
<td>24.4</td>
</tr>
<tr>
<td><strong>5. Types of Library</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic medical school library</td>
<td>29</td>
<td>64.4</td>
</tr>
<tr>
<td>Hospital library</td>
<td>6</td>
<td>13.3</td>
</tr>
<tr>
<td>School of Health Technology library</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>Nursing School Library</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>Others (please specify)</td>
<td>8</td>
<td>17.8</td>
</tr>
</tbody>
</table>

† Total population in the study

Manuscript Submission for Peer review through the use of Digital Communication Tools (Journal Online Submission System/Platform) by the Respondents

The results of respondents’ use of digital communication tools (journal online submission system) are shown in Table 2. Findings revealed that more than half
(55.9%) of the respondents agree/ strongly agree that they used the online journal submission system during the peer review process. Respondents' had positive affirmations to statements on familiarity and use of digital communication tools: “All the journals I have submitted articles for publication utilized functional online submission portals” (\(\bar{x}=3.33\)). “Responses to the editors’/reviewers’ comments on the articles submitted for publication in various journals have been through Internet technology” (\(\bar{x}=3.62\)); The current use of technology in the peer review process has transformed the policy in terms of timing, openness, and interactivity (\(\bar{x}=3.78\)).

Table 2: Respondents Use of Digital Communication Tools (Online Journal Submission Systems/Portals)

<table>
<thead>
<tr>
<th>SN</th>
<th>Statements</th>
<th>SD (1)</th>
<th>D (2)</th>
<th>A (3)</th>
<th>SA (4)</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency %</td>
<td>Frequency %</td>
<td>Frequency %</td>
<td>Frequency %</td>
<td>Frequency %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>All the journals I have published are online</td>
<td>8 17.8</td>
<td>11 24.4</td>
<td>18 40.0</td>
<td>8 17.8</td>
<td>3.33</td>
<td>1.279</td>
</tr>
<tr>
<td>2</td>
<td>All the journals I have submitted articles for publication utilized functional online submission portals</td>
<td>13 33.4</td>
<td>6 13.3</td>
<td>17 37.8</td>
<td>9 20.0</td>
<td>3.33</td>
<td>1.365</td>
</tr>
<tr>
<td>3</td>
<td>I have experienced highly engaging and interactive digital communication in the peer review process of publications with the various journals where I have published.</td>
<td>23 33.4</td>
<td>3 6.7</td>
<td>22 44.8</td>
<td>5 11.1</td>
<td>3.33</td>
<td>1.243</td>
</tr>
<tr>
<td>4</td>
<td>Responses to the editors’/reviewers’ comments on</td>
<td>10 22.2</td>
<td>1 2.2</td>
<td>23 51.1</td>
<td>11 24.4</td>
<td>3.62</td>
<td>1.370</td>
</tr>
</tbody>
</table>
the articles submitted for publication in various journals have been through Internet technology.

5 The current use of technology in the peer review process has transformed the policy in terms of timing, openness, and interactivity

<table>
<thead>
<tr>
<th></th>
<th>8</th>
<th>2</th>
<th>19</th>
<th>16</th>
<th>3.78</th>
<th>1.396</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17.8</td>
<td>4.4</td>
<td>42.2</td>
<td>35.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¥ A four Likert scale point was used to examine the respondents’ research activities through the Internet.
† Total population of the study
†† “Strongly Disagree”, “Disagree”, “Agree”, and “Strongly Agree”.

Respondents’ Perception of the Mandatory Peer Review Process (MPRP) as a Scientific Policy and effect of Bias, Fairness and Discriminations on their Research Productivity

The respondents’ perception of the MPRP process as a scientific policy and the effect of bias, fairness and discrimination on their research output is shown in Table 3. The respondents strongly agree/disagree with the following statements: “Sometimes I perceived the policy to be unfair and discriminatory to my region by looking at the statistics of the papers published in some journals by different races, which affected my thirst for publishing” (x̄=2.91); “I see the current peer review process to be stressful and a source of emotional exhaustion which slows down my motivation to publish” (x̄=2.73); “The current academic publishing principle is a diversifying scheme serving only the purpose of advancing academic careers but weakens the researchers’ dedication to research and publication” (x̄=2.80); “The peer review process has been perceived to have threatened my research productivity” (x̄=2.31). In addition, AHLs strongly affirmed to the statement: “I see peer review as a process that is certainly advancing scholarship” (x̄=3.86).
### Table 3: Perception of AHLs about mandatory peer review process

<table>
<thead>
<tr>
<th>SN</th>
<th>Statements</th>
<th>SD Freq.</th>
<th>D Freq.</th>
<th>A Freq.</th>
<th>SA Freq.</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Freq. %</td>
<td>Freq. %</td>
<td>Freq. %</td>
<td>Freq. %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Sometimes I perceived the process to be unfair and discriminatory to my region by looking at the statistics of the papers published in some journals by different races, which affect my thirst for publishing.</td>
<td>23</td>
<td>51.1</td>
<td>6</td>
<td>13.3</td>
<td>14</td>
<td>31.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>4.4</td>
<td>14</td>
<td>31.1</td>
<td>2</td>
<td>4.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.91</td>
<td></td>
<td>1.164</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I see the current peer review process to be stressful and a source of emotional exhaustion which slows down my motivation to publish</td>
<td>17</td>
<td>37.8</td>
<td>17</td>
<td>37.8</td>
<td>7</td>
<td>15.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>8.9</td>
<td>4</td>
<td>8.9</td>
<td>2.73</td>
<td>1.136</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.73</td>
<td></td>
<td>1.136</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>The current academic publishing principle is a diversifying scheme serving only the purpose of advancing academic careers but weakens the researchers' dedication to research and publication</td>
<td>18</td>
<td>40.0</td>
<td>13</td>
<td>28.9</td>
<td>14</td>
<td>31.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>0.0</td>
<td>17</td>
<td>37.8</td>
<td>16</td>
<td>35.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.80</td>
<td></td>
<td>1.014</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>The peer review process has been perceived to have threatened my research productivity</td>
<td>22</td>
<td>48.9</td>
<td>19</td>
<td>42.2</td>
<td>2</td>
<td>4.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>4.4</td>
<td>2</td>
<td>4.4</td>
<td>2.31</td>
<td>.996</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.31</td>
<td></td>
<td>.996</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>I see peer review as a process that is certainly advancing scholarship</td>
<td>10</td>
<td>22.2</td>
<td>2</td>
<td>4.4</td>
<td>17</td>
<td>37.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16</td>
<td>35.6</td>
<td>16</td>
<td>35.6</td>
<td>3.86</td>
<td>1.217</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.86</td>
<td></td>
<td>1.217</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¥ A four Likert scale point was used to examine the respondents' perception about peer review.
† Total population in the study
†† “Strongly Disagree”, “Disagree”, “Agree”, “Strongly Agree”.

### Effect of Reviewers' Comments and Decisions of Editors on the Manuscripts Submitted for Publications by the Respondents

The effect of reviewer's comments and the decisions of editors on the manuscript submitted for publication by AHLs is shown in Table 4. With a mean of 3.31, respondents affirmed positively to the statement: “The comments/decisions of the editor who first assessed the suitability of the paper in most cases are highly encouraging”. The respondents also strongly disagree/disagree with the following statements: “The comments/decisions of some editors/reviewers who first assessed and reviewed the manuscripts submitted in most cases are highly coercive which killed
my morale" ($\bar{x}$=2.84); “The choice of words of some reviewers who recommend acceptance or rejection in the peer review cycle is not only derogatory but devastating” ($\bar{x}$=3.04); “The editor’s /reviewer’s outright rejection, rather than recommending revision, based on insufficient analytical rigour or other deficiencies had affected my intellectual boldness to write papers” ($\bar{x}$=3.56).

**Table 4:** Effects of reviewers’ comments and decisions of journal editors on AHLs research productivity

<table>
<thead>
<tr>
<th>SN</th>
<th>Statements</th>
<th>SD (1)</th>
<th>D (2)</th>
<th>A (3)</th>
<th>SA (4)</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The comments/decisions of the editor who first assessed the suitability of the paper are, in most cases, highly encouraging.</td>
<td>17 (37.7)</td>
<td>8 (17.8)</td>
<td>14 (31.1)</td>
<td>6 (13.3)</td>
<td>3.31</td>
<td>1.062</td>
</tr>
<tr>
<td>2</td>
<td>The comments/decisions of some editors/reviewers who first assessed and reviewed the manuscript submitted in most cases are highly coercive which killed my morale.</td>
<td>16 (35.5)</td>
<td>15 (33.3)</td>
<td>10 (22.2)</td>
<td>4 (8.9)</td>
<td>2.84</td>
<td>1.167</td>
</tr>
<tr>
<td>3</td>
<td>The choice of words of some reviewers who recommend acceptance or rejection in the peer review cycle is not only derogatory but devastating.</td>
<td>13 (28.9)</td>
<td>12 (26.7)</td>
<td>18 (40.0)</td>
<td>2 (4.4)</td>
<td>3.04</td>
<td>1.062</td>
</tr>
<tr>
<td>4</td>
<td>Based on the comments and decisions of some editors and reviewers the current peer review process has negatively affected my intellectual innovations and boldness.</td>
<td>32 (71.1)</td>
<td>15 (33.3)</td>
<td>9 (20.0)</td>
<td>0 0.0</td>
<td>2.42</td>
<td>1.055</td>
</tr>
<tr>
<td>5</td>
<td>The editors/reviewer’s outright rejection, rather than recommending revision, based on insufficient analytical rigor or other deficiencies had affected my intellectual boldness to write papers.</td>
<td>8 17.8</td>
<td>12 (26.7)</td>
<td>13 (28.9)</td>
<td>12 (26.7)</td>
<td>3.56</td>
<td>1.159</td>
</tr>
</tbody>
</table>
A five Likert scale point was used to examine effect of peer review reports on respondents’ research productivity.
† Total population in the study
†† “Strongly Disagree”, “Disagree”, “Agree”, “Strongly Agree” and “Neutral”,

Hypothesis

1. There is no significant relationship between AHLs perception of mandatory peer review policy, reviewers’ comments and decisions of the journal editors on their research productivity.

Table 5 shows that there is a significant relationship between AHLs perception of mandatory peer review policy, reviewers’ comments and decisions of the journal editors on their research productivity ($r=0.628$, $n=45$; $p=0.000<0.05$). Therefore, the perception of AHLs about mandatory peer review policy, reviewers’ comments, and the journal editors’ decisions on the respondents’ manuscripts submitted for publication reveal a strong positive relationship. Hence, the null hypothesis is rejected.

Table 5: Spearman Product Correlation showing the relationship between AHLs perception of the mandatory peer review policy, reviewers comments and decisions of the journal editors and their research productivity

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>n</th>
<th>r</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perception of AHLs about the current peer review policy, the reviewers’ comments &amp; decisions of the journal editors.</td>
<td>1.000</td>
<td></td>
<td>45</td>
<td></td>
<td>Sig.</td>
</tr>
<tr>
<td>Research productivity</td>
<td>.628**</td>
<td>.000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed).

Discussion

In this study, the academic qualifications of the respondents, with a mean result of 2.47, indicate a marked difference between those who had master’s degrees, PhD and other qualifications. This finding corroborated the study conducted by Lessick et al., (2016), in which not less than 90% of the health sciences librarians studied had acquired master’s degrees, and 5% had PhD. The contrast in the academic qualifications of the respondents in the present study suggests three interpretations.
First, the majority of AHLs have fulfilled the required entry point academic qualifications to practice as Librarians. Two, the respondents must have been exposed to academic training on research while undergoing a master’s degree programme, which seems to be shaping their performance in research. Third, arguably, possession of a doctoral degree in the field of library and information science (LIS) does not seem to be a key requirement in the acquisition of knowledge to conduct scientific research. Implications of the results in both the present study and the previous ones further insinuate that, as the doctoral degree is the highest academic qualification, and a master’s degree is second to it, in any discipline, having only a master’s degree does not probably make any professionals deficient and incompetent in research and publications. Beyond these interpretations, generally, a doctoral degree may be compulsory for certain categories of professional levels in various fields, but they are not compelled to have the degree before engaging and becoming knowledgeable in research.

This academic background makes health librarians, particularly those who work in academic institutions, active researchers. These arguments align with the previous studies that confirmed health sciences librarians are active researchers (Lessick et al., 2016; Powell et al., 2002). The proportional distribution between the respondents in health academic and hospital libraries is significantly more for the former than the latter. This indicates that being in an academic community, librarians in health academic libraries are more concerned with research activities than hospital librarians.

In this study, the results showed that the respondents were engaged in online submission and interactive in the use of digital communications during the peer review process in the various journals where the respondents have published were statistically significant. These findings are in consonant with some authors (Abdill & Blekhman, 2019; Schulz et al., 2022; Zhang, 2010) who had established the use of some Internet-based tools to address various limitations in peer reviewing. The implication is that peer review in the 21st Century is changing as publishing journals are moving fast to the Internet and the authors, who are major stakeholders, are also changing to adapt to the new system where knowledge of technology is mandatory.

Other noteworthy and key findings of this study relate to using Internet technology in peer review. The respondents positively affirmed the online presence of most journals

211
where they had published (Table 2). Results further indicate that the journals' authors' communications had been through the Internet.

The results obtained on the impact of current use of technology in the 21st Century peer review process were statistically significant. The respondents agreed with the peer review transformation in terms of “timing”, “openness” and “interactivity” through the use of Internet technology. Taking this one after the other, timing (as an essential commodity), in this context, refers to the duration of rigorous screening and scrutinization of a manuscript submitted for publication in a publishing journal. Openness signifies the degree of transparency or how the level of involvement of all the stakeholders (authors, reviewers and editors) in peer reviewing is made open to one other. Interactivity, on the other hand, refers to the periodic involvement of authors in the specific stages of peer reviewing. These results suggest that the respondents would not only be able to publish within a short period, but they would also learn and gain more experience in the process. These findings further authenticate some studies conducted on how the duration of providing feedback during peer review is changing (Amsen, 2014; Baldwin, 2014; Ross-Hellauer, 2017; Schulz et al., 2022).

However, despite the level of transformation in peer review, an unexpected result about the respondents' research publication rate leaves one in many thoughts. Majority of the respondents were only able to publish 2 papers per year. It can be argued that peer reviewing could be faster, open, and interactive, and manuscript submission is more or less a finishing aspect of conducting research, which has nothing to do with the timing and intellectual labour expended in writing a quality paper. More often than not, the demand for methodological rigour in scientific study to avoid outright rejection of a manuscript is a key reason to consider in writing a paper, hence the possible end reason why the respondents' publication rate is low.

Unfortunately, the experience of AHLs regarding the existence of bias, fairness and discrimination in peer review differ (Table 3). While the results obtained in the present study are in tandem with Gilbert et al., (1994) they were statistically lower than some other reports on gender bias (Benedek, 1976; Ceci & Peters, 1982; Lloyd, 1990; Peters & Ceci, 1982), unfairness and discriminations (Okike et al., 2016; Ross et al., 2006), and authors’ affiliations, background and personal characteristics (Pontille & Torny, 2014). However, the highly significant result for the “neutral position” of the
respondents is open to some interpretations. They might be unaware that some of the manuscript rejections they experienced had elements of one form of bias or the other. In reality, exhibiting bias or discrimination in peer review is not easily recognizable or openly demonstrated by the reviewers, editors, or referees. Lurking of bias in peer review is certainly a practice borne out of racial discrimination, which is hardly detected unless through a scientific approach like those undertaken by Ceci & Peters, (1982) and Lloyd, (1990).

Potentially equally important are the results of unanimous agreement of the respondents with peer reviewing advancing scholarship (Table 3). The implication is that peer review is not only growing but contributing to the quality of published articles in various journals. This invariably turns the research articles indexed in various databases to be reliable resources and worthy of replications in scientific studies.

Another significant result in this study has to do with the effect of “editors'/reviewers’ outright rejection rather than recommending revision” (Table 4). These significant results imply that respondents in this study would prefer a decision of comprehensive revision as feedback to the manuscripts submitted for publication rather than outright rejection. Generally, unless someone is highly committed to achieving success, an outright rejection of a manuscript not only demoralizes but also induces a feeling of incompetence.

**Conclusion**

In conclusion, this study has established that the majority of the journals where they had published had adopted technology in managing the peer review process. It further affirms that the use of Internet technology has substantially transformed peer review in terms of timing, openness and interactivity, but the usage of the tool does not positively impact the respondents’ publication rate. This study also demonstrates that the languages employed in writing reports or recommendations in peer reviewing negatively impact the respondents’ research productivity. Outright rejection of a manuscript also has a negative impact on the respondents. In addition, though literature established the existence of bias and discrimination in the peer review process, the results obtained in this study did not support the existence.
References


Benos, D. J., Fabres, J., Farmer, J., Gutierrez, J. P., Hennessy, K., Kosek, D., Lee,


https://doi.org/10.1002/ASI.22798


Sumner, T., & Shum, S.B. (1996). *Open peer review... - Google Scholar. (n.d.).*


Ware, M. 8The STM report: An overview of scientific and scholarly journal publishing. https://digitalcommons.unl.edu/scholcom/9/


Abstract

The establishment of Federal Universities of Health Sciences by the Government of Nigeria a few years ago has brought about unique roles for librarians working in those institutions. This paper discusses the experiences of the Federal University of Health Sciences in Otukpo (FUHSO) Nigeria, which was the first among such category of institutions established by the Federal Government. This paper discusses support services by the library in this institution, such as voluntary digital hands-on coaching to some newly employed staff from the administrative arm of the institution who frequented the library. It also discusses the library’s liaison efforts and engagements with faculties for resource development, the collaboration between both entities for targeted user-driven services and academic support. Relationship building with other Health Science Universities newly established after FUHSO, in addition to connections which led to support from publishers and global research partners like Research4life are taken cognisance of. Data derived for this position paper was primarily from involvements by the pioneer University Librarian of FUHSO (this author), the library staff roles, periodic reports, inventories and direct contacts with library patrons. Constraints encountered in the area of exercising responsibilities in a specialised university such as FUHSO are also stated. It is, however noted in conclusion that the gains derived from team work internally and externally become lessons for the planning and advancement of a developing establishment.

Introduction

Universities, as citadels of knowledge creation and diffusion are saddled with the responsibility of teaching, research and community service. In Nigeria, universities with specialties are bound to advance areas such as agriculture, technology, maritime, health sciences, etc. The Federal University of Health Sciences Otukpo (FUHSO) is one of those which came into existence with growth prospects as the first of such
established by the Federal Government of Nigeria (Philip in Issa, et al., 2022). The relatively new institution with the mission to become a world-class university in the future undertakes innovative approaches to entrench its uniqueness, extending to the library work pattern. Libraries in University settings are academic; they back up university’s educational function in ensuring their collection development policy supports curriculum and other academic endeavours through the provision of information resources to equip end-users with knowledge.

The library in a newly established institution as the university is saddled with a lot of responsibilities that require some level of distinctiveness in operation to actualise unique goals. The process to actualising this in some instances, requires collaborative effort based on rapport and goodwill (relationships) established with stakeholders within the community and beyond. This paper in light of the foregoing, discusses the pioneering efforts and activities undertaken by librarians in an emerging institution as Federal University of Health Sciences Otukpo (FUHSO). The library in FUHSO was set up from scratch by its pioneer University Librarian with support from two employees. The process of advancing FUHSO Library undertook initiatives and involvements by the few librarians, such as supporting its community of users in their work output and fostering relationship building alongside other engagements and collaborations with external partners / groups.

Collaboration creates opportunities to build connections towards strong relationships and boosts positive interpersonal relations to form learning communities and continue collaboration (Nguyen and Tuamsuk, 2020). Online Dictionary of Library and Information Science (Reitz, 2012) indicates collaboration as being between a library and an organisation of a different type, usually on a particular project and often forming the basis for a long-standing relationship with the potential for future partnerships which most frequently are established to attract and sustain audience segments. In this regard, there was also an interchange of knowledge from allied academic institutions through study tours, feasibility studies, insights from veterans and so forth for robust ideas and effective planning.

Therefore, the discourse of this paper hinges on the initial couple of years of FUHSO’s existence and the endeavours of its library (a.k.a. FUHSO Library) to build relationships through symbiotic engagements with the user community and allied
groups. The outcomes of the interactions and collaborations, positive and otherwise, are also conveyed, with lessons learned in addition to challenges peculiar to a budding institutional library.

**Health Sciences Universities**

The Nigerian society is densely populated, and this has been one of the factors in the establishment of universities by the Federal Government. Presently, more than 50 Federal Universities exist, while private and State owned Universities together number over 180 listed by National Universities Commission (2023). In 2015, the establishment of the Federal University of Health Sciences Otukpo (FUHSO) was approved, though the process was later halted following a decision over election matters at the national level and amendments arising from a change in leadership of government the same year. However, in June 2019, the then President of Nigeria pronounced restoration of FUHSO and in May 2020, a month before the COVID-19 "lockdown" was eased. Following this development the University management comprising four principal officers was inaugurated (University Librarian inclusive) and four external members constituting members of the Governing Council.

The Federal University of Health Sciences Otukpo came into existence as the first genre established by the Federal Government of Nigeria, though four Medical/ Health Science Universities owned by private and state governments were already in existence in other regions of the country. The mission of FUHSO has been to “build capacity of healthcare professionals through integrated medical education”. It had been earmarked by Nigeria’s federal government to establish other health science universities in the six geopolitical zones of the country. The plan came to fruition with the establishment of four other Health Science Universities in 2022, from the North East, South West and South-South zones. Essentially, global health concerns in the recent past, as noted by the Executive Secretary of the Tertiary Education Trust Fund-TETFund (Echono, 2020), have led to the drive towards an efficient health-driven society, among other development factors, which also necessitated the establishment of health science universities.
Theoretical Perspective

The theory of Total Quality Management (TQM), which can otherwise be noted as efficiency theory, was propounded to enhance efficiency, which is an outcome of quality and productivity in an organisation. The theory is generally attributed to Edwards Deming in the late 1920s, who was initially introduced with the intent to offer a solution to Japan's ailing economy. Deming’s TQM rests upon certain cardinal factors intended to guide the leadership of an organisation, the library inclusive. These include:

- An understanding of the way the company’s process and system works, which Deming termed as “system appreciation.”
- An understanding of the variation occurring and its causes, termed variation knowledge
- An understanding of what can be known, which Deming stated to be “knowledge theory”.

For an entire working team to demonstrate quality in task performance, Deming also made some of the following recommendations for organisations towards efficient and quality services:

Create constancy of purpose

- Aim for continuous production and service improvement
- Bring in cutting-edge on-the-job training
- Implement cutting-edge methods
- Get rid of quantity-based (for quality-based) work goals
- Ensure everyone is trained and educated

When considering the scheme put forth by Deming for work progress, it can be deduced that the factors to efficient and quality service performance furthermore rest upon the three elements of TQM, which are: employee participation, customer-focused quality and continuous improvement. Therefore, the model which drives TQM theory can be associated with library service goals being recognised in relation to maintaining efficiency and quality service performance for “customer” satisfaction and striving towards becoming effective. The quality of staff and services in any organisation is an important asset, coupled with the knowledge of service quality standards applicable to
university libraries. Looking at these issues in other ways, a person’s efficiency is relative to the task at hand or the requirement for the day, in the sense that when library staff are doing what they have chosen to do, they are apt to become productive and willing to work. Committed staff at all levels to actualise the library’s service goal is not negotiable from the details discussed, particularly in relation to being sensitive and responsive to library user’s needs and expectations.

Libraries have found the cogent need to maintain service standards within the citadel of learning over the years. They unarguably can be rated as knowledge enterprises. The Asian Productivity Organisation (APO, 2013) also enumerated criteria that can be adapted for the library work environment in the following ways:

- creating an enterprise of knowledge-driven culture (being the goal of an academic library as a whole)
- developing knowledge workers (e.g. through training of staff)
- delivering knowledge-based products/ services/ solutions (in diverse forms)
- creating an environment for collaborative knowledge sharing and learning (empowering user communities through accessible e-platforms and facilities)
- transforming knowledge enterprise into shareholder value (library exists for its users and other stakeholders)

Collaboration has been theorised as one of the building blocks of organisational growth. Colbry, Hurwitz, Adair (2014), postulating a theory of collaboration, note that it can be taken from interpersonal, intra-organizational, or inter-organizational level. The authors also draw inferences from Grounded Theory, which defines collaboration as any ongoing interaction to achieve a common goal. The interpersonal aspect is to garner cooperation, commitment, and compliance, though the other aspects are more often researched. The study notes that, first and foremost, a system’s internal workings must be properly coordinated and enhanced to set the motion for an efficient organisational work environment. From this level, the other dimensions of inter-organizational and intergroup collaborations can be harnessed. The latter two are equally important to a wider dimension of partnership to strengthen and foster corporate or group courses connected to some goals and interests. Building strong partnerships through fruitful collaboration is germane in an organisation at both internal and external levels for cross-breeding of robust ideas. With understanding and
terms of reference adhered to, libraries can benefit from long-term positive effects yielded from building a work environment laced with joint efforts since every sector’s interests become all-inclusive. The submissions thus raised, can be attributed as indicators for functional service, essentially relevant for advancement of work.

**FUHSO Library and User Community**

The Library in the newly established Federal University of Health Sciences, Otukpo (a.k.a. FUHSO Library), was set up as the institution's first service centre. This was achieved by the pioneer University Librarian, with support from the first Vice-Chancellor through utilising the take-off grant from Nigeria’s Tertiary Education Trust Fund (TETFUND). The intervention fund is an essential component and statutory role of government in support of tertiary institutions, particularly newly established ones.

At the start, FUHSO Library had only two staff to harness the numerous services for a period of eleven months before the workforce was expanded with the employment of other library staff. Being the first operational place aside from the central administrative block, the demand for information support services and other forms of assistance to users was at its peak. The library exists to cater to specialised information needs in the areas of sciences, medicine, and allied health, among others. Philip and George (2022) note that university libraries in health science institutions are designed to assist physicians, health professionals, medical students, patients, medical researchers, and consumers in locating health and scientific information to utilise, improve, and update their knowledge. The foregoing is typical of what FUHSO Library exists for, being a specialised health science institution. Further description of the roles of Health libraries/ librarians is depicted by Emme, et al. (2022). The authors highlight some of the services by health librarians as follows: to deliver training for health care staff on accessing the quality of information, or demonstrate techniques for finding reliable information; to work with service users, as well as staff so they can find reliable information about the following: their own health, work on the frontline helping healthcare staff access quality information to inform their decisions and for research purposes from textbooks to online databases. Users of FUHSO Library typically comprise:

- **Academics**: Senior and mid-cadre lecturers; consultants
- **Students**: undergraduates at a beginning level
- **Administrative staff** (Registry /General administration and Bursary)
- **Technical staff**: Lab technologist, ICT staff, Works/ Maintenance Department and Physical Planning.
- **Health Service workers**: Medics and allied staff from University Health Centre.

Librarians continually recognise varying interests among the communities they serve. Knowing what constitutes information needs and regular requests of the various stakeholders, goes a long way to determine the nature of service delivery. These concerns and interests of library staff in FUHSO have brought forth their unique roles in the service of the health science university as further discussed below.

**LIBRARY SUPPORT SERVICES**

From its inception, the FUHSO library was equipped with computer facilities at the brink of full commencement of activities in the university. This gave the library an edge in terms of relevance since other sectors of the institution were yet to be equipped to kick-start administrative and academic activities. The University operated for about a year before welcoming pioneer student intakes, while the staff of FUHSO, within the expected period, benefitted from the library in unique ways, from direct services to other forms of assistance. Olubiyo and Yemi (2020) acknowledge that librarians are presently keener at being in touch with library users than previous. Key roles and notable areas of support by FUHSO Library in this regard are in terms of:

**Wi-Fi enabled services**: FUHSO library aside Central administrative block of the University, was set up and equipped with internet and Wi-Fi even before the laboratories, general administrative offices, lecture halls, and other academic blocks were put in place. In this regard, the library became an active hub for more than a year reason of being the only centre with internet/Wi-Fi connection at the commencement of University activities. This advantage was the most cogent reason for library patronage by various staff of the University, including management. Official duties online, formal communication, payment transactions, use of desktops for personal and academic purposes, online meetings and phone chats, alongside learning to use computer facilities in the library, were the most frequent activities by FUHSO staff who utilise the library, till date. Usage was also necessitated by the fact that the University is situated in a sub-urban community with a paucity of commercial cybercafés and exorbitant fee charges for the few ones at far far-distance location.
**Library as CBT centre:** staff of FUHSO as a pre-requisite to their being confirmed, were required to undergo a re-assessment test and audit. FUHSO Library became the centre for this engagement for staff involved as available computer facilities were utilised individually. Later, it was also proposed that the library serve as the university’s admission screening point because of the available computer facilities and the internet. The plan was, however, declined as it was deemed not actualisable considering the limited library space which could disrupt regular services to the detriment of users.

**Information Literacy:** Some employees in FUHSO were interested in having practical knowledge of computers in addition to library-use skills since FUHSO operations are ICT-driven. The few library staff on the ground were daily engaged in assisting other staff who came to the library with how to link up with electronic resources, search processes online and navigate Research4Life platform, which was one of the main available resources online at the time. Among other ways, library staff assisted with MS Office Word functions and how to type, boot system, retrieve/download information and so forth. The demands placed on library staff consequently instigated the pursuit for capacity building for them, which was organised internally by the University Librarian (this author). This was carried out intermittently within the library, with the aim that as many library staff as possible would be capable of handling various forms of assistance relating to the use of computers for any category of user.

The exercise was published in the University’s maiden edition of its official News Magazine (ADVANCE, 2023). It took the form of hands-on training, which spanned three months and was assisted by two library staff who manned the ICT section of the library to engender peer tutorship.

**Faculty liaison duties:** The library exists to support academic endeavours, among other purposes. In light of this, a university staff orientation and seminar was organised by management of FUHSO whereby the library and what it has to offer was presented. The exercise was relevant, particularly to early career academics involved in research work. As a follow-up, a designated library staff is assigned to make contact with the Faculty of Science and College of Medicine. Part of the reasons for library contact is to select occasional book lists and recommend relevant resources, among other inputs. Kamau and Elegwa (2021), Singh and Mahajan (2022) note that the input of
faculty staff is considered essential, particularly for collection development in libraries, since they have the subject expertise to know the needs of their students and programmes. Another reason for librarians’ contact with faculty includes selective information dissemination and provision, faculty meetings, facilitating the Use of Library course which is credit-earning in FUHSO and to assist with examination and group marking of answer scripts.

**Instructional support:** Lecture methods in FUHSO are generally supported with interactive facilities to enrich blended learning. Each content of the lecture after tutorial is uploaded on the library’s desktop for students to access. At other times the students’ representative would facilitate access to the lecture notes for peers from the library. YouTube tutorials on clinical practice, for example, handling Patients, treatments, diagnostics and so forth, are other forms of contents from the College of Medicine that are downloaded by the library for pedagogical purposes.

**Muster point:** FUHSO did not have a centre for relaxation at its commencement. The library, being the first public service centre on campus, served this purpose for staff other than their offices, particularly as serious academic activities were yet to commence and warranted intensive work. Staff involved in administrative duties, among other works, enjoyed their leisure time at the library during and beyond official hours. The library consequently served not necessarily for cognitive purposes or to carry out some official work but to ease and engage in watching sports, charging phones, small group discussions/meetings, taking a nap, chatting with someone, browsing with phone and so forth.

**Shared facility:** The benefit of having desktops and accompanying ICT facilities before other offices in FUHSO procured theirs led to the loaning and permanent release of extra library facilities to aid operations in faculty and central administration in the University. Some of the items were reprographic machines, UPS, office furniture, and such kinds released to the Faculty to support the examination process and accounting purposes, including funds transfer, E-payments and other online duties to keep up with operations in the university. Shared facilities are common in most university systems and can be used for a short period, especially with urgent and immediate tasks.
Extension services: Federal University of Health Science (FUHSO) is a Health Science institution with programmes tailored to reflect medical and allied sciences. The rapport between FUHSO Library and its academic community brings about other forms of involvement beyond the library sphere. One such is participation in health-based research by some of the library staff in collaboration with faculty and other health professionals, the teaching of General Study courses other than "Use of Library" such as, "Peace and Conflict Resolution" "Nigerian People and Culture" "Philosophy and Logic" among others. The confidence that the Faculty and College of Medicine have in library staff's capability led to this connection and the perception that librarians have a wide spectrum of knowledge.

Other activities that heightened library staff's relationship with the university community are hosting quarterly seminars (non-formal) for awareness of some staff new to the university system and public service. The seminars were anchored by the university librarian with logistics from library staff and a few other non-library staff. Similar interactions are also conducted for beginning students to broaden their knowledge of life issues and foster acceptable conduct and cordiality among them.

The aforementioned engagements and involvements by library staff were among the factors that opened up avenues for cordiality, collaborations and good working relationships between the library and its user community in FUHSO.

Collaboration and Relationship building

The leadership pattern of management at the Federal University of Health Science Otukpo (FUHSO) is collaborative. Intended projects are generally spearheaded and deliberated upon by committees usually headed by any of the top cadre management staff of the University, including the University Librarian. This was necessary since most of the staff in FUHSO were relatively new to the modalities of a university system, hence the need to ensure standards in operation and good quality in work output as required in the University’s Academic Brief. On the contrary, Phelps and Campbell in Bendriss, Saliba and Birch (2015) note that in most institutions of higher learning, little or no interaction exists between librarians and faculty due to the notion that librarians only provide information services. McCue (2014), Bendriss, et al., (2015) advise that the a need to create effective partnerships and build strong working relationships with
faculty members (among others) and through collaboration, librarians become more visible and accessible. In this regard, the model of team effort in FUHSO, with extension to the library, draws forth the combined effort of stakeholders from the Faculty, College, and other centres. Furthermore, the working relationship established by the library and other participants/stakeholders is highlighted.

Management: The principal officers of the university made it a monthly routine to visit the library. The essence was not only for routine checks but also an opportunity to rub minds with the University Librarian onsite towards actualising knowledge-driven goals of the institution by the library.

College of Medicine: one of the foundations of a health science University is the College of Medicine. FUHSO Library has benefited from free online medical resources and related subjects. The resources are mostly downloaded from recognised online platforms and subsequently forwarded by the Office of the Provost to the library. Other scholarly resources in print from the College and from lecturers are also part of the teamwork to support the library’s collection development plan.

Library Development Committee (LDC): The LDC provides professional advice and other recommendations on library provision in terms of facilities, services, resources and other areas of operations. The team is drawn from representatives of the Faculty of Science, College of Medicine, Institutes, other academic centres and senior administrative officers (the latter for records and finance purposes). The composition of members is to afford holistic and inclusive inputs. The committee furthermore heightens the relationship between the library and other sectors of the university with the sense of being part of library growth.

FUHSO Library also had to connect with external bodies, some of which led to boosting the library's support base, particularly at the initial stage of the library’s growth. The groups were:

Regulatory bodies: there are government agencies responsible for tertiary education institutions in Nigeria, primarily the Tertiary Education Trust Fund (TETFUND) and National Universities Commission (NUC). TETFUND has stipulated grants for higher learning institutions that meet the criteria for accessing the same. One of the education grants was instituted to enhance library development, of which FUHSO library is
among the would-be beneficiaries. Both TETFUND and NUC also intermittently donate rare copies of academic books and other publications to libraries.

**Global Research Partners**: modern libraries are powered by a good internet connection and accompanying Wi-Fi. However, institutional subscriptions are paramount to efficient academic and specialised libraries. While FUHSO was at its nascent stage, the need for open-source databases was necessary, though this appeared not actualisable considering the financial obligations of implementing one. Research4Life programme, however, became the first to partner with FUHSO in this wise. It supported FUHSO as a new institution with a free subscription for an appreciable period based on the request from the University Librarian for the benevolent endeavour by Research4Life and without fee, amidst several other prospective partners who declined the request for non-chargeable database subscription for a period of time. FUHSO Library consequently gained free access to Research4Life's entire collections for some months. The support boosted the library at a crucial period when new academic staff commenced their research and other educational activities.

**Publishers/ Book vendors**: Book publishers and vendors are generally interested in libraries as core intermediaries to reach end users with information products. A few became interested in partnering with FUHSO library, to donate related science books for possible purchase. Some of the first set of basic science books in print which occupied four shelves, were obtained from the donation of some of the vendors, including novels and other forms of leisure reading materials also donated by individuals.

**Professional Bodies**: The status of FUHSO as a specialised university with a preponderance to health, engenders relationship building and partnership with medical experts and groups. Foremost was the Nigerian Medical Association, which the Vice Chancellor of FUHSO was its President until last year. In this regard, FUHSO library benefitted from complementary copies of the association’s journals among proceedings and technical reports from other medical fields. Senior academics from the College of Medicine in FUHSO also teamed with the library to tender undergraduate textbooks and lecture manuals.
**Cognate Universities:** The need for relationship building with allied universities was germane with other Federal Universities of Health Sciences newly established after FUHSO, in other regions of the country. One of the avenues was through site visits and study tours by the management team of the new universities to FUHSO. Core areas of focus to understudy and possibly adapt to were finance and bursary operations, general administration, the College of Medicine and the Library. Some of the management staff of FUHSO after its commencement also embarked on a similar visit to a university renowned for its state-of-arts facilities.

**Lessons learned**

In the course of working to advance a course and actualise a goal through relationship building and collaborations with numerous stakeholders, the outcomes with lessons noted are as follows:

- Collaborative management approach, which is goal-driven, engenders rich, diverse and robust ideas / knowledge in the development of an organisation.

- Pioneering an institutional work requires expertise for benchmarking standards, which serves as a parameter for the future work plan.

- Effective teamwork is more often a function of cordiality, relationship building, lobbying and expression of a mission in simple, clear, and sincere terms. This was particularly witnessed in the library’s interaction with core stakeholders in the University community.

- Library staff become more effective when assigned duties based on their capabilities, other than qualifications.

- Library usage undoubtedly is increasingly enhanced with the availability of the internet and accompanying digital facilities.

- When a library presents its services as readily available, it is more likely to have considerable patronage, particularly when maximum staff assistance is ensured.

- Capacity building through workplace coaching and peer tutorship heightens day-to-day skills while on the job. This entails deliberate mentorship between superior – and subordinate, among peers with the skilled and the less skilled or new/ early career
personnel. This pattern of training is also found to be less expensive and more individualised in approach.

- Knowledge derived and shared from external stakeholders with proven expertise is one of the core attributes of an academic environment for a broad spectrum of blended ideas.

- Constant supervision laced with workplace coaching when pioneering a course, sets the pace for a significant work output. In a nutshell, when the Head of a library is constantly observant of general work operations in the library, goes a long way to heightening the staff sense of duty and curbing lapses.

Challenges and Headway

The anticipation of what an academic library exists for, from a broad perspective, can sometimes lead to unwarranted work situations and related problems. This is not unusual when considering some critical issues that can ideally be identified with a budding institution such as FUHSO. Ashilungu (2023) indicates weak library-faculty relations and the library staff not being available to help, including lack of experience by faculty as part of the challenges with respect to library-faculty collaboration. These assertions are not uncommon in the course of the library reaching out to stakeholders in the faculty. FUHSO library nonetheless has gained good faculty relationships, which is partly due to the drive by the university to develop all sectors from inception. Beyond these, there are issues that affect library staff and the work in the course of serving user community. There are identified are as follows:

**Lean library space**: The open section of the library space is temporarily structured to accommodate fifty users. Small group meetings and online chats by users seemed disruptive. The situation was later remedied with Wi-Fi connections in almost every university office and a newly acquired annex campus, which is presently being utilised. Minimal floor space also hampered the procurement of enormous facilities and the non-placement of some library furniture, including having to utilise a limited number of shelves.

**Reliance on staff**: The assistance rendered to other newly employed staff of the university by less than five library staff at the initial time resulted in heavy reliance on the few staff when library services commenced. The pressure was also partly a result
of role expectations that with librarians having to utilise ICT facilities, they were capable of assisting others (users) with electronic services. With Wi-Fi connected at various offices in the university, this dependence however was lessened.

**Assistance in non-Library work:** Some users bring technical or science-related issues to the library for the library staff to help resolve, which are not within the limits of core library work. Some of those duties were assisting in typing a user’s personal stuff, creating charts and worksheets, solving statistical problems, and so forth. Few of the library staff skilled in technical works were mostly consulted in this wise, on a personal basis with possible remuneration.

**Adjusting to modifications:** Some library staff transferred their services from other universities and institutions to FUHSO, resulting in diverse ideas from past work experiences. On the other hand, adjusting to the seemingly modified pattern of operation to suit the uniqueness of a health science University posed a challenge to some of the staff, though the situation was ameliorated through re-orientation and workplace coaching.

**Workload:** Less than five staff members assisted in pioneering library work for a lengthy period of nine months prior to the employment of more library staff. The downside of this was in having to provide rigorous assistance and services to meet requests from the larger University community, which sometimes led to the few library staff feeling exhausted thereafter. The workload, however, lessened as the library workforce increased.

**Non-ethical conduct by users:** Some users staff when personally surfing the net in their offices and cannot access a particular content restricted by purchase option, consult library staff. This is often done with the hope that access could be gained through the expertise of library staff despite the fact that terms and conditions for access are applicable!

**Pressure to get it right:** FUHSO being a pioneer health science institution established by the Federal government of Nigeria, was driven by an overwhelming need to succeed. The essence was for FUHSO to function as a model for other newly established (Federal) Health Science Universities. This expectation to some extent placed much demands on the management of FUHSO, including the library to meet
up with timelines, ultimatums and overarching duties. The gains, however have superseded whatever could have posed pressure to the developments, which are still ongoing.

**Low student patronage:** Education institutions and centres exist for the benefit of their core recipients, being students. However, Usage statistics and observations reflect a more constant visit to the library by staff, than students. The reason was partly due to the availability of desktops in the library since most of the staff did not have personal computer, while students seemed more interested in connecting Wi-Fi to their phone beyond library domain. The situation became a point of concern considering the need for students” patronage. Notifications through text, WhatsApp and other forms of messages were relayed to students to create awareness on the library’s resources and facilities. As of present, the usage level in the library by students has remarkably improved.

**Adopting work model:** A growing institution undergoes strategic planning and testing in a bid to establish" new grounds". As a result, appropriate work modalities and conduct would still be experimented upon. By implication, understudying the operations of a relatively new institution by another newly established one, should be exercised with caution to curb the risks of adopting an operational pattern that is yet to be precisely consolidated.

**Staff status:** In most university libraries in Nigeria, library and information science graduates employed with a university degree are accorded the same academic status as those in the faculty. The situation though may differ slightly in institutions with core specialty. This was the case with library staff employed in FUHSO with a difference in nomenclature other than academic status, which can affect career structure, cadre and placement of roles. The plan to review the same in accordance with the regular structure obtainable in most university libraries is ongoing. Another issue was the university’s central library at the initial tagged “Medical Library” with the latter more often attached to a Medical school, College or Institute as the case may be. A medical library for the FUHSO’s College of Medicine is being developed to cater for speciality needs, while the central library still maintains its wide-ranging role and the entire university community.
Conclusion:

A University community fundamentally thrives to advance knowledge and broaden skills alongside other development factors. FUHSO library and the university as a whole have benefitted from connections and relationships established with allied professional bodies and partners in support of the growing institution. The Library served as the pioneer hub for all categories of newly employed staff and subsequently students. Internet and availability of Wi-Fi was the main enabler to utilising the library, with staff physically present to offer direct assistance to users. Routine duties, professional activities and administrative requirements amongst other demands of starting a new institution, presuppose the cogent need for various stakeholders to work as team members for day-to-day support of initiatives. Library staff as a whole found the attentive role of supporting their user communities with inclusive approaches to serving them. The outcome engendered further possibilities for good relationship, teamwork and support towards holistic advancement of institutional goals.

Acknowledgement: This author hereby expresses appreciation to supporters of the library, stakeholders, and groups whose backing and teamwork have been noted in this paper.

References


Ashilungu, M. (2023). Faculty–Librarian Cooperation in Collection Development at the University of Namibia library, with Special Reference to Electronic Resources. Emerald Publishing Ltd. Available at https://www.emerald.com/insight/2514-9326.htm


McCue, R. (2014). Does a blended learning, flipped classroom pedagogy help information literacy students in the long term adoption of research skills? Available at http://www.llrx.com/features/blendedlearning.htm


2. The Roles of Librarians in the Dissemination of Health Information Towards the Attainment of the Sustainable Development Goals (SDGs): A Case Study of Tanzania Food and Nutrition Library - Monica Chipungahelo, Emmanuel Twaha and Hamza Mwangomale

Monica Chipungahelo¹ Emmanuel Twaha¹ and Hamza Mwangomale¹

¹Tanzania Food and Nutrition Centre since 2007, Department of Nutrition Education and Training

Abstract

Introduction: Information is one of the most essential needs of human life, just like air, water, food and shelter. Hence, information is a key resource for the progress and development of the nation.

The Tanzania Food and Nutrition Centre Library has been playing an important role in disseminating food and nutrition information and other health-related information to improve Tanzanians’ wellbeing. This is aimed at facilitating the achievement of Sustainable Development Goals by 2030.

Objectives: The general objective of the study was to highlight role of librarians in disseminating food, nutrition and health-related information towards the attainment of the United Nations Sustainable Development Goals-SDGS. The paper specifically highlighted librarians’ role in disseminating information for development and discussed the challenges libraries face in providing food, nutrition and health-related information for development.

Methods: The paper is based on the documentation review of the role of the librarians in the dissemination of information towards the attainment of the Sustainable Development Goals. It also used the direct observation method for collecting information on the role of librarians in the dissemination of information and challenges faced by librarians in the provision of information for development.

Results: The findings from documentation reviews indicated that the main methods used by the Tanzania Food and Nutrition Centre library were distributing nutrition information educational materials, online public access catalogue (umojacat), social media networks, Centre’s website, publishing in local newspapers and mailing list and physical visits.
**Conclusion:** Tanzania Food and Nutrition Centre has used various methods to disseminate food, nutrition, and health-related information towards achieving SDGs. However, while noting that the library has made commendable efforts in disseminating information towards attaining SDGs, the paper identified challenges such as lack of ICT infrastructure and inadequate funding that have limited their scope of achieving the SDGs.

**INTRODUCTION**

Information is one of the most essential needs of human life, just like air, water, food and shelter. Hence, information is a key resource for the progress and development of the nation. A nation must provide sustainable development goals for its citizens to meet their ever-increasing demands. To accomplish this, the library has to play an important role in creating, organizing, processing, storing, disseminating, and providing access to information. This information to be provided will reduce the level of ignorance and help people to make informed decisions.

Good health is crucial for the development of any society. Thus, Nations of the world endeavour to put in place strategies that can sustain a healthy population to enable progress and development. Healthy populations stimulate communal growth due to the ability to perform effectively in their societal functions. However, health literacy has been noted to be of importance in achieving good health (Lehmann & Abel, 2016), and this offers a role to the library, being the hub of information, knowledge and literacy, and librarians, whose role in improving health in developing economies has been emphasized (Crisp, 2007).

Being an important international issue, the need for good health was embedded in the United Nations’ Sustainable Development Goals (SDGs), a set of 17 goals (underpinned by a total of 169 targets) that member States of The United Nations (UN) agreed to focus on until 2030. Out of the 17 goals of the SDGs, Goal 3 of the plan (SDG-3) is titled ‘Good health and wellbeing for all at all ages’. SDG-3 brought to the fore the importance of health in all endeavours of mankind. Popoola (2019) asserts our health affects everything from how much we enjoy life to what work we can perform. The United Nations Development Programme corroborated this fact by noting that ‘our health affects everything from how much we enjoy life to what work we can perform’. Nevertheless, it has been established that the low literacy rate in developing
countries hinders the success of health programmes (Amoa, 2018; Irwan et al., 2016; Kabir & Afzal, 2016). Therefore, libraries, as the hub of knowledge and literacy, have a role to play in improving health literacy in these nations.

Libraries are tools for the development of society and serve as an institution that stores and preserves people's information and disseminates the information needed at the appropriate time.

Tanzania has continued to progress in implementing international commitments on sustainable development, including the 2030 Agenda on Sustainable Development. The Sustainable Development Goals (SDGs) are being implemented in the framework development plans, which currently operate under Five Year Development Plan II (FYDP) (2016/17-2020/21). One of the objectives of the FYDP II is to ensure global and regional agreements (e.g. national development planning and implementation frameworks for the benefit of the country.

Tanzania has committed to global that ensure optimal health for all, focusing on Women and Children. The UN Sustainable Development Goals (SDGs 2030) direct countries to ensure Good Health and Well-being (Goal 3), Quality Education (Goal 4), Gender Equality (Goal 5), Clean Water and Sanitation (Goal 6), Reduce Inequalities (Goal 10) and enhancing Partnerships for achieving all Goals (Goal 17).

Tanzania has achieved marked improvement in nutrition status in recent years and reversed trends in all forms of malnutrition for children to attain SDG 2: The nutrition situation among children under five years in Tanzania has improved, with stunting prevalence reduced from 43% to 31% and wasting prevalence is reduced from 5% to 3% (MOH, 2022). The prevalence of anemia among children under five years in Tanzania stagnated between 59% in 2010 and 58% in 2015/16. In Tanzania, between 2010 and 2022, exclusive breastfeeding among children 0-5 months has increased from 50% to 64%, while the minimum acceptable diet among children 6-23 months has decreased tremendously from 21% to 9%. The nutrition situation among women of reproductive age in Tanzania has deteriorated especially in terms of the prevalence of overweight and obesity, which increased from 21% in 2010 to 28% in 2015/16. The prevalence of anemia among women of reproductive age in Tanzania has increased from 40% in 2010 to 45% in 2015/16. The prevalence of anemia is higher among adolescent girls aged 15-19 years (47%).
For Mainland Tanzania, the Maternal mortality ratio and the rate was 556 maternal deaths per 100,000 live births for the 10 years before the survey. Under 5, the mortality rate is declining at the highest rate, followed by the infant mortality rate. This is due to the improvements made in health services delivery across the country. The proportion of women married or in a union of reproductive age (aged 15-49 years) who need family planning satisfied with modern methods is about half (53%) of the existing demand for family planning.

The Tanzania Food and Nutrition Centre Library has been playing an important role in disseminating food and nutrition information and other health-related information to improve the well-being of Tanzanians. This aims to facilitate achieving Sustainable Development Goals, especially goals 2 & 3 by 2030.

**Purpose and significance of the study**

The key purpose of this study is to investigate the potential role of librarians in disseminating food, nutrition and health-related information towards the attainment of the United Nations Sustainable Development Goals-SDGS. The study explored librarians’ role in the dissemination of information for development and the challenges libraries faced in the provision of food, nutrition and health-related information for development. The study may help information professional experts to fully understand the key roles of librarians in contributing toward achieving the SDGs.

**Statement of the problem**

Though libraries are largely perceived as one of the most important institutions contributing to the dissemination and building of education in society, little research has been done on their value to the communities (Abu et al., 2011). Thus, this study will examine the potential role of the Tanzania Food and Nutrition Centre Library in its contribution to achieving the SDGs adopted by the UN.

**Objectives of the study**

The general objective of the study was to highlight the role of the librarians in the dissemination of food, nutrition and health-related information towards the attainment of the United Nation Sustainable Development Goals-SDGS. The paper specifically highlighted librarians’ role in the dissemination of food and nutrition and other health-
related information for development and discussed the challenges Tanzania Food and Nutrition Centre library face in the provision of food, nutrition and health-related information for development and recommended ways in which Tanzania Food and Nutrition Centre library can use in disseminating information towards the attainment of SDGs.

Research questions
To accomplish this purpose, the study pursued the following two questions:

i. What are the roles of librarians’ in the dissemination of food, nutrition and health-related information for development TFNC Library has undertaken towards achieving Sustainable Development Goals 2 & 3

ii. Do the TFNC library face any challenges in the provision of food, nutrition and health-related information for development?

2.1 Review of Related Literature

Information in the development of any nation cannot be left behind because it is a vital factor for sustainable development. A nation must provide sustainable development goals for its citizens to meet their ever-increasing demands. To accomplish this, the library has to play an important role in creating, organizing, processing, storing, disseminating and providing access to information. This information to be provided will reduce the level of ignorance and help people to make a living. In their study, Ezekwe & Muokebe (2012) observed that libraries with various resources are the best heritages that humanity can claim to have. This signifies that any nation without a library and information centre is not worth its development.

In view of the foregoing, the library and information centers are the bedrock for the development of any nation and serve as an institution that stores and preserves the information of the people and disseminates the information needed at the appropriate time.

Sustainable Development: A Conceptual Overview

SDGs, which succeeded the Millennium Development Goals (MDGs), were developed with the participation of the UN’s 193 member states and non-governmental organizations (Council on Foreign Relations, 2017). According to the United Nations (2015), these goals are: G1: No Poverty, G2: Zero Hunger, G3: Good Health &

The role of Libraries towards the attainment of Sustainable Development Goals

Libraries are agencies engaged in the collection, processing, preservation and dissemination of recorded information in the various formats most convenient to its target users, libraries contribute to the aggregation, dissemination and creation of knowledge (Rubin & Rubin, 2020; Cyr & Connaway, 2020). As agencies for social, political, economical and educational institutions, libraries are considered among the vehicles that have a potential role in enhancing the achievements of SDGs.

Libraries play an important role in achieving the Sustainable Development Goals. It is globally considered a centre of research and a place of information empowerment which role can never be over-emphasized, as the public immensely benefits from it. Library and information centres is an institution responsible for selecting, ordering, acquiring, processing, storing, and reserving resources in diverse formats to users at the appropriate time. Similarly, Nicholas and Perpetual (2015) pointed out the library as an information centre that processes, organizes, stores, retrieves, and disseminates information to users. The role of information in any nation cannot be left behind because libraries are seen as the custodians of knowledge and the most reliable information centre that deals with the acquisition, organization, dissemination and preservation of information for actualizing sustainable development.

Methodology: The paper is based on the documentation review of Tanzania Food and Nutrition Centre quarterly reports on the food and nutrition library and documentation, particularly on the library's role in disseminating information towards the attainment of Sustainable Development Goals. The literature review of the reports was carried out from 2016 to 2022. The direct observation method for collecting information on the role of librarians in disseminating information and the challenges that librarians face in providing information for development were used. Observation
checklist included: the availability of computers, the library collection, the Internet and Wi-fi for searching and sharing of information.

**Findings of the Study and Discussion**

The following section presents the findings based on two research questions.

**Roles of TFNC Library towards attainment of sustainable development goals 1.**

What are the roles of librarians’ in the dissemination of information for development, Libraries in TFNC Library have undertaken towards achieving Sustainable Development Goals (SDGs)?

The findings revealed the roles of TFNC Library towards SDG 2: zero hunger SDG 3: Good Health, Table (1) displays various roles under each SDG:

**Table 1: Roles of TFNC Library towards the attainment of sustainable development goals**

<table>
<thead>
<tr>
<th>SDGs</th>
<th>Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero hunger</td>
<td>• Provision of accurate, relevant and timely information to the research community. This will facilitate the research to come up with appropriate solutions to end hunger.</td>
</tr>
<tr>
<td></td>
<td>• Distributing food and nutrition information educational materials,</td>
</tr>
<tr>
<td></td>
<td>• Dissemination of information via social media networks, center's website and online public access catalogue (umojacatalog).</td>
</tr>
<tr>
<td></td>
<td>• Dissemination of food and nutrition information via umoja catalogue, which is owned by the COSTECH library.</td>
</tr>
<tr>
<td></td>
<td>• Dissemination of nutrition information to communities through participation in exhibitions</td>
</tr>
<tr>
<td>Good health and well being.</td>
<td>• Distributing nutrition and health-related information educational materials.</td>
</tr>
<tr>
<td></td>
<td>• Dissemination of health information and promotion of healthy lifestyles</td>
</tr>
</tbody>
</table>
• Promoting health information using organization’s websites, mass media, newspapers, meetings, exhibitions and other information communication materials.
• Collaborate with nutritionists, health workers and communication officer.

Source: Documentation review 2023

Challenges TFNC library faces in the dissemination of development.

Question 2 sought to discuss the challenges TFNC library faced in providing information for achieving sustainable development goals. The study identified five challenges from documentation review comprising: Inadequate ICT equipment such as computers and printers, inadequate funding, space limitation, and old library collections.

Observation: According to the observation checklist, physical visits to the TFNC library observed the following: the availability of computers, access to the Internet and Wi-Fi for searching information for research activities and library collection. Some of the challenges identified (lack of equipment and computers, space limitation and old library collection inhibiting to provide adequate information for research and training purpose) were further validated with the observation.

Discussion of the Findings

This section discusses the various roles for achieving SDGs in the TFNC library and the associated challenges encountered in carrying them out.

SDGs Roles: Libraries across the globe are playing a key role in the UN 2030 agenda for sustainable development. TFNC library is actively involved in achieving SDGs across the country. Findings from documentation review and observations from TFNC Library in this study revealed some good progress towards the achievement of the sustainable development goals. TFNC Library is engaged in one way or the other in bringing developments to the communities they serve. They thus ensure access to information by repackaging information to suit the needs of communities, distributing nutrition and health-related information educational materials, sharing information
online through public access catalog (umojacat), social media networks, Centre’s website, sharing articles published in local newspapers, mailing list and physical visits. The following section discusses in detail the various initiatives under the different sustainable development goals that are being achieved by public TFNC Library.

**Zero hunger SDG 2:** TFNC library is actively involved in pushing the 2030 agenda for the achievement of SDG 2) with targets of ending hunger , ensuring access to adequate food for all and eliminating all forms of malnutrition, including stunting and wasting in children younger than 5 years by 2030, and addressing the nutritional needs of adolescent girls, pregnant and lactating women, and older people. The library distributes nutrition and health-related information educational materials to the communities through exhibitions, mailing lists and physical visits. This support the observation from the World Health Organization (2015) that to promote and protect community health and ensure a hunger-free zone, the people must have access to the information and services pertaining to a certain issue in question. The Lyon Declaration on Access to Information and Development 2014 calls upon the United Nations member countries to ensure that everyone has access to and can understand, use and share the information necessary to promote sustainable development (Bradley, 2016).

**Good Health and Wellbeing (SDG 3):** To maintain good health and wellbeing of the community, the TFNC library in this study contributes to healthy lives and promotes all wellbeing. For example, the library participates in the commemorations of the United Nations commemorative days like World AIDS Day and World Food Day, where they display library materials on nutrition and HIV/AIDS, healthy eating and lifestyles. They also provide health literacy to communities, such as nutrition and healthy lifestyles. They partner with nutrition professionals to address library users on health-related matters. Thus, the TFNC library supports healthy lifestyles by ensuring access to health and wellness information and these initiatives have yielded positive results. Health libraries and other libraries are essential providers of access to medical research and other health-related research that supports improved public health outcomes’ (IFLA, 2017). Public access to health-related information in all kinds of libraries helps people stay well-informed about their health
Ibegwan (2013) asserts that medical libraries are important in disseminating health information and promoting healthy lifestyles. This is because medical libraries can reach vulnerable communities by making health information accessible at the point of need. Ugwuona, Eze and Oyovwevotu (2016) contend that since medical libraries are concerned with information that has a direct impact on life, they should be seen championing and contributing to the letters of health ethical issues, best practices and guidelines, including the presentation in health information packages. Adisah-Atta (2017) posits that the low quality and credibility of health information may negatively influence the health status of individuals who use that information.

**Challenges:** Some terrible challenges experienced by librarians in the dissemination of information include a lack of equipment, such as computers and printers, that are essential for the dissemination. The lack of adequate funding to implement initiatives towards achieving the SDGs is yet another common challenge to the library. Funding is the most crucial resource for any performance of the activities. The purpose of establishing Libraries and Information centers is the provision of effective, efficient and quality service delivery to users to provide equitable access to information and satisfy the library clientele's general information needs and society's general information needs.

Apart from inadequate funding, there are other challenges that are facing libraries including old library collection, inadequate library facilities and infrastructure among others.

**Conclusion and Recommendations**

TFNC library is the most relevant information center that could provide food, nutrition and health-related information to the general public. The citizens must also be encouraged to access the information services of the TFNC library as have been explained and become literate on their health matters. The study has shown that the TFNC library is relevant to the full delivery of the SDGs, especially SDG goal 2, which focuses on zero hunger, and SDG 3, which focuses on the health and well-being of the community. Therefore, librarians should be well repositioned to ensure that they take library and information service delivery beyond the library's physical walls to the citizen in whatever form. Although the library has played a good number of roles in realizing SDGs, However, while noting that the library has made commendable efforts
in pursuing the implementation of various roles across the SDGs, the identified challenges, such as lack of ICT equipment, inadequate funding, and old library collection, have limited their scope of achieving the SDGs.

To overcome some of the identified challenges and successful execution of Sustainable Development Goals in libraries, the researchers put forward the following recommendations:

i. Partnerships: The sustainable development goals require an integrated approach towards achieving these goals; therefore, partnering with critical stakeholders such as governmental and non-governmental institutions is paramount in overcoming identified challenges.

ii. Librarians should strive to acquire information on the Sustainable Development Goals and bring the materials to library users’ awareness.

iii. The parent institution should financially support the library and information centers to end the challenges of inadequate infrastructure and facilities and poor network distribution. It would also assist in the publishing of research findings conducted by researchers.

iv. Engaging in effective lobbying and advocacy programmes: Librarians should acquire lobbying and advocacy skills at all costs to ensure that they contribute their quota to the reality of the SDGs.

References


https://doi.org/10.1016/j.ijnss. 2023.05.010


NBS(2019) . Implementation status of SDGs indicator in Tanzania framework


World Health Organization. (2015). Health in 2015: from MDGs, millennium development goals to SDGs, sustainable development goals.
Author Biographies

**Rajabu Simba** is a Health Information Technologist with two years of experience in CEDHA’s Health Information Department from 2020 to 2022. He specializes in health information science, which he gained from the University of Dodoma, Tanzania. He’s involved in the Department of Public Health and Community Nursing. He is interested in and motivates peers in research tools and data science.

**Haruna Hussein** is the Head of Health Information in the Department of Human Resource Development, Ministry of Health, Tanzania.

**Mary J Charles** is a Health Information Science Professional pursuing a bachelor’s degree in Health Information Science from the School of Nursing and Public Health at the University of Dodoma in Dodoma, Tanzania, with two years’ experience in tutoring students at the Centre for Education Development in Health Arusha (CEDHA). She provides Health Information Services in Healthcare activities and Academic institutions, empowering other employees to use emerging technologies and systems. She is also highly interested in research activities and report writing.

**Peter Asala** works for CEDHA, Department of Paramedicals, Tanzania.

**Tefo Kgosietsile** is a student in the Computer Science Department, Faculty of Science, University of Botswana, pursuing an MPhil in Computer Information Systems. He completed his MSc in computing at Teesside University, UK, and his Bachelor of Computer Science at the Open University, UK. He joined the University of Botswana as a Teaching Assistant.

**Ezekiel Uzor Okike** is a Senior Lecturer in the Department of Computer Science, University of Botswana, Gaborone. He holds a PhD in Computer Science, a Master of Information Science and a B.Sc. (Hons) in Computer Science, all from the University of Ibadan, Nigeria. He is a Senior member of the Institute of Electrical and Electronic Engineers (IEEE) and Computer Society, a member of the Association for Computing Machinery (ACM) and a member of the Association for Information Systems (AIS). He has been the cluster chair of Information Systems (2013-2022) and the cluster chair of Systems cluster (2023) Department of Computer Science, University of Botswana. He has published many papers in International Journals and attended many International conferences where he also presented papers. His research interests are information systems, software engineering, systems and architectures, cyber security, and measurements and metrics in information systems.

**Grace A. Ajuwon** is the Medical Librarian (Director) of E. Latunde Odeku Medical Library, College of Medicine, University of Ibadan. She is an academic librarian with a master and doctoral degree in Library and Information Studies from the University of Ibadan, Nigeria. She provides reference and information services to patrons, including undergraduates, graduate students, faculty, resident doctors, nurses, allied health professionals, and students in the University College Hospital (UCH), Ibadan. She also conducts training on online database searching (e.g., MEDLINE/PubMed), provides
literature search support for systematic reviews and other evidence syntheses and uses bibliographic management tools, including EndNote, Zotero and Mendeley.

Bilamin O. Popoola is the Systems, Scholarly Communications and Evidence-Based Medicine Librarian at the University of Medical Sciences, Ondo City, Nigeria.

Mercy M. Wamunyima is the acting Head of the Medical Library at the University of Zambia, School of Medicine, University of Zambia, Lusaka, Zambia.

Julie Rosenberg is the Deputy Director of The Global Health Delivery Project – a joint initiative between Brigham and Women's Hospital and Harvard University’s TH Chan School of Public Health, U.S.A.

Prisca G Shoo is pursuing a Bachelor’s degree in Health Information Science from the School of Nursing and Public Health at The University of Dodoma in Dodoma, Tanzania. She is a leader at the College of Informatics and Virtual Education (CIVE) in UDOM as a member of parliament. She is a powerful workplace force and uses a positive attitude and tireless energy to encourage others to work hard and succeed. She is interested in public speaking, research activities and report writing. Furthermore, she is trained in Web technology and Data science.

Kagiso Ndlovu is a Senior Lecturer in Computer Science and Coordinator of the eHealth Research Unit at the University of Botswana. Research interests in computer science, telemedicine, and implementation of digital health technologies in resource-constrained environments.

Bezawit Teshale Bekele is a general practitioner, lecturer, vice dean of the school of medicine, UpToDate Ambassador for Jimma University, MD, Jimma University, Ethiopia.

Assurance Sipho Ndhlovu is an Information Consultant and an acting Subject Information Specialist at the University of Zimbabwe Faculty of Medicine and Health Sciences Library. He also serves as a Better Evidence Champion. Assurance Sipho graduated from the National University of Science and Technology (NUST) with a Master’s in Library and Information Science degree and has special interests in research, information packaging, and dissemination.

Emmanuel Twinamasiko is an experienced, passionate librarian with a library and information science degree from Uganda Christian University specializing in digital library services. He is currently the team leader at the KABSOM resource room and works as a champion for Better Evidence at Kabale University.

Oluwaseun Abiodun-Asanre is a System Librarian at Lagos State University College of Medicine, Nigeria. She holds a master’s in library, archival, and information studies from the University of Ibadan in Nigeria. She also serves as a Better Evidence Champion. Her areas of research interest include accessibility of evidence-based health information to underserved populations, tacit knowledge transfer in residency training, Library impact on Webometrics rankings of academic institutions, capacity building for librarians, and human-computer interaction. Oluwaseun is an expert at facilitating online training and instruction using Google Meet and Zoom, as well as evidence-based literature search and review.
Violet E. Ikolo is a senior librarian at the Medical Library, College of Health Sciences, Delta State University, Abraka. She is passionate about meeting the research needs of staff and students of the College of Health Sciences by providing relevant health information resources and services. She is a cataloguer and a library administrator. She is also a researcher whose areas of research interest are Health Librarianship, library management, information literacy and library user satisfaction.

Glorias Asiimwe is the Head Medical Librarian at Busitema University Faculty of Health Sciences in Eastern Uganda. She also serves as a Better Evidence Champion at her institution. Glorias holds a Master’s Degree in Information Sciences and a Bachelor’s Degree in Library and Information Science from Makerere University, Uganda. Glorias’ research interests are health information management, big data, information retrieval, and information literacy.

Anthony Kiuna is the University Librarian at the University of Global Health Equity (UGHE) in Rwanda. Previously, He also served as a Better Evidence Champion at UGHE and the Butaro District Hospital, the teaching Hospital for UGHE. Anthony holds a Master of Philosophy Degree in Information Studies from Moi University (Kenya) and a Bachelor’s Degree in Library and Information Science from Makerere University (Uganda). His research interests include but are not limited to Access and Dissemination of Information, with special interest in Open Access, Health Information Systems, and Information Literacy.

Samuel A. Bello is a certified Librarian and head of the Reference/Information Section of the College of Medicine Library, University of Ibadan, Nigeria. Has two master’s degrees: MLIS and MIT. A Carnegie of New York academic grant fellow on a Master’s degree. Part of COMUI Library team for user-centric program, training of resident doctors/faculty, with research interest in electronic resources and application of ICT in academic libraries.

Joyce Bukirwa is a Lecturer, Researcher and Graduate Research Coordinator at the East African School of Library and Information Science, College of Computing and Information Sciences, Makerere University. She has supervised and examined various graduate studies and consulted widely locally and internationally in Information, Library, Knowledge, Records and Archives Management.

Alison Annet Kinengyere is a Senior Academic Health Sciences Librarian at Sir Albert Cook Library, Makerere University. She is a researcher who has published in several peer-reviewed journals and presented at various information science forums. She holds a Ph.D. and a Master’s in Library and Information Science.

Kathryn J. Philip has twenty-seven years (27 yrs.) of library work experience. She served as Head of various core sections of the Central Library, University of Uyo, Nigeria, and later as a lecturer in the faculty in charge of Undergraduate LIS Students’ Internships. She also served as a postgraduate coordinator for the LIS programme at the same institution. Kathryn has published over sixty professional articles, mostly in academic journals and book chapters and reviewed proceedings from international conference participation in over ten countries in Europe, Africa and Asia. She is ISCA’s sub-editor of the Research Journal of Library Science (RJLS) domiciled in India and a
Fellow. Kathryn was IFLA’s section officer (GENLOC) and a recipient of many professional awards at local and international levels. She has been a volunteer information worker in sub-urban communities for 17 years, where she has researched health-related and literacy issues. Kathryn Philip is the university librarian at the Federal University of Health Sciences in Otukpo, Nigeria. She is the PRO / Information Officer of the Association of University Librarians of Nigerian Universities.

**Monica Chipungahelo** is a librarian at the Tanzania Food and Nutrition Centre since 2007 under the Department of Nutrition Education and Training. She has been promoting public access to health information.

**Emmanuel Twaha** is a librarian at the Tanzania Food and Nutrition Centre under the Nutrition Education and Training department.

**Hamza Mwangomale** is a Communication officer at the Tanzania Food and Nutrition Centre under the Nutrition Education and Training Department. He has been developing and disseminating food and nutrition messages to the public.