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# Utilization and Uptake of the UpToDate Clinical Decision Support Tool in Five Medical Schools in Uganda (August 2022-August 2023): A Partnership with the Better Evidence Program

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## Abstract

**Background:** Clinical decision support tools provide suggestions to support healthcare providers and clinicians, as they attend to patients. Clinicians use these tools to rapidly consult the evidence at the point of care, a practice which has been found to reduce the time patients spend in hospitals, promote the quality of care and improve healthcare outcomes. Such tools include Medscape, VisualDx, Clinical Key, DynaMed, BMJ Best Practice and UpToDate. However, use of such tools has not yet been fully embraced in low-resource settings such as Uganda. **Objective:** This paper intends to collate data on the use and uptake of one such tool, UpToDate, which was provided at no cost to five medical schools in Uganda. **Methods:** Free access to UpToDate was granted through the IP addresses of five medical schools in Uganda in collaboration with Better Evidence at The Global Health Delivery Project at Harvard and Brigham and Women's Hospital and Wolters Kluwer Health. Following the donation, medical librarians in the respective institutions conducted training sessions and created awareness of the tool. Usage data was aggregated, based on logins and content views, presented and analyzed using Excel tables and graphs. **Results:** The data shows similar trends in increased usage over the

period of August 2022 to August 2023 across the five medical schools. The most common topics viewed, mode of access (using either the computer or the mobile app), total usage by institution, ratio of uses to eligible users by institution and ratio of uses to students by institution are shared. **Conclusion:** The study revealed that the tool was used by various user categories across the institutions with similar steady improved usage over the year. These results can inform the librarians as they encourage their respective institutions to continue using the tool to support uptake of point-of-care tools in clinical practice.

## Keywords

UpToDate, Clinical Decision Support Tool, Medical Schools, Uganda, Digital Health, Medical Education, Evidence-Based Medicine

## 1. Introduction

UpToDate is a widely used clinical decision support tool among healthcare professionals in many parts of the world. However, it has not been used as widely in the Global South. It has been slower to spread due to its cost and other issues related to lack of access, cultural shifts, and habit formation [1].

While others may be using other clinical decision support tools, uptake and use of these tools is very limited. A 2019 study on the use and uptake of the UpToDate clinical decision support tool found that usage of such tools in low-resource settings is still very low [2] as compared to high-resource settings where medical students are introduced to these tools early in their careers [3].

There are few existing studies on the use and impact of UpToDate in Uganda. Those studies have reported on the use of the UpToDate tool in Uganda [2] and other African countries such as Rwanda, Malawi and Tanzania [4]. A study by Valtis *et al.* evaluated the use of UpToDate among 2000 individual health workers receiving free access through Better Evidence and found the majority used it relatively regularly. Users from Africa were responsible for 54% of the usage. Specifically, users from Rwanda accounted for 19%, from Tanzania for 5%, and from Uganda for 2% [5]. The study suggested users feel that clinical decision support tools such as UpToDate have the potential to improve diagnostic and therapeutic accuracy at the point of care. The tools may also improve outcomes, reduce errors, and enhance care quality [2].

Uganda is one of the low-income countries that have greatly benefited from the UpToDate donation program offered by Better Evidence. Better Evidence is a program at The Global Health Delivery Project at Harvard and Brigham and Women's Hospital in the United States [6]. The Better Evidence for Training program was launched in 2019 to facilitate access to evidence-based clinical resources in low- and middle-income countries.

Five medical schools in Uganda registered with Better Evidence for the donation program (with Makerere University School of Medicine as the first recipient). Uganda has over 60 universities and other training institutes offering health sciences-related programs ranging from certificates to degrees (including PhDs).

## 2. About UpToDate

UpToDate is a widely used clinical decision support tool that provides evidence-based information to healthcare professionals. 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 [7]. It offers a vast array of medical topics, including diseases, conditions, treatment options and drug information based on evidence from clinical studies and research papers. The content is regularly updated by a team of physicians and experts in various medical fields, ensuring that the information remains current and reliable [7]. It is often utilized at the point of care to gather quick insights into diagnosis, treatment guidelines, drug interaction, and patient management. UpToDate can bridge the gap between the latest medical research and its application in real-world clinical settings. Research studies have shown that UpToDate leads to improved clinical decisions, shorter hospital stays and reduced mortality rates [8] [9].

The users' ability to download the UpToDate application on mobile phones to be used at the point of care makes it more accessible offline [10]. Its global reach due to its availability in multiple languages makes it accessible to healthcare providers worldwide, increasing its utilisation.

Overall, UpToDate serves as a valuable tool for healthcare professionals by providing them with reliable, current, and practical information to support their clinical decisions and improve patient care.

## 3. UpToDate Content

UpToDate covers a wide range of medical content across various specialties and sub-specialties. The content covers the following:

**Diseases and Conditions:** Detailed articles covering the aetiology, pathophysiology, clinical manifestations, diagnosis, and management of various medical conditions.

**Drug Information:** In-depth drug monographs covering prescription medications, over-the-counter drugs, herbal supplements, and their uses, dosages, adverse effects, interactions, and contraindications.

**Guidelines and Recommendations:** Summaries and explanations of clinical guidelines from leading medical societies and organizations to assist healthcare providers in applying the most current standards of care.

**Diagnostic Tools:** Information on diagnostic tests, interpretation of results, and their clinical implications.

**Treatment Options:** Comprehensive reviews of treatment strategies, including

pharmacological and non-pharmacological interventions, along with evidence-based recommendations.

**Patient Education Materials:** Resources designed to help healthcare professionals explain medical conditions, treatments, and procedures to patients in a clear and understandable manner.

**Graphics, Algorithms, and Calculators:** Visual aids, flowcharts, pathways, algorithms, and calculators that assist in decision-making, diagnosis, and treatment planning.

## 4. Access to UpToDate

UpToDate is a commercial product available for purchase. Accessing it typically requires a subscription, which is commonly provided through institutions like hospitals, medical schools, or healthcare organizations. Individuals can directly purchase a basic annual subscription for $599 in the US. This price puts it out of reach for many.

Free access to UpToDate by the five institutions was introduced by Better Evidence which supports the current and future health workforce to integrate the latest evidence into their decision-making to improve health outcomes [11]. The program facilitates access to evidence-based clinical resources to health providers serving vulnerable populations who couldn't otherwise afford them. The donation project was piloted at the University of Rwanda among medical students [4]. Seeing that students not only used the tool during their training but went on to continue using it in clinical practice gave birth to an expanded program. The Better Evidence for Training program facilitates five-year, in-kind donations of UpToDate licenses to medical schools across Africa. So far, 65 medical schools in Africa are benefiting from the program, with new schools added annually. Participating schools and their affiliated training sites access UpToDate via the institutional local area network (LAN). Registering for an account while on LAN for an individual account allows users access outside the LAN and to download the content through the mobile app for offline use [2]. Registration also allows users to bookmark pages, collect CME credits where relevant, and personalize settings. Each school appoints up to two individuals who are designated to facilitate access to the tool and promote its use across campus and affiliated training sites, deemed Better Evidence Champions.

## 5. Study Sites

In October 2024, 65 medical schools from 17 African countries had joined the UpToDate donation program through Better Evidence. Figure 1 is a map of Africa showing the countries that joined the program.

In Uganda, five participating medical schools were Busitema University, Gulu University, Kabale University, Makerere University, and Mbarara University of Science and Technology. These schools were all overseen by the national accrediting body that ensures consistency between the curricula [12].

## Participating schools as of October 2024
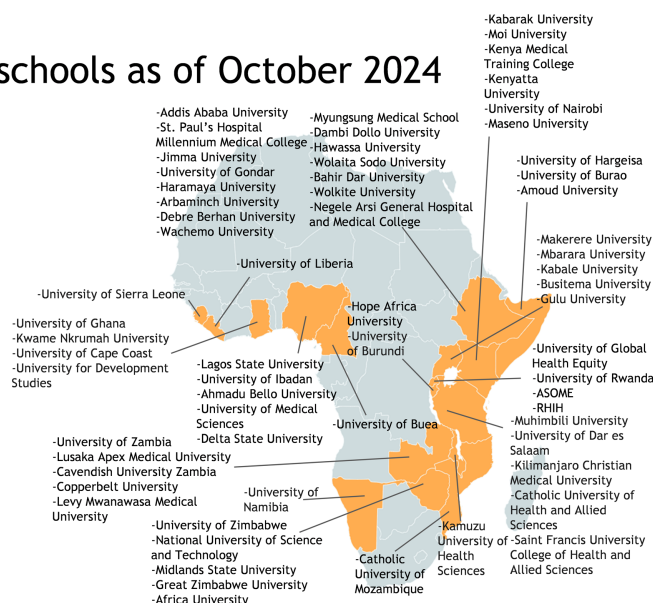


**Figure 1.** Countries and institutions in Africa that joined the UpToDate donation program by October 2024. Source: Better Evidence at: https://www.better-evidence.org/.

Busitema University is a multi-campus public University whose main administrative offices are located approximately 185 kms from the capital Kampala. Established by Statutory Instrument in 2007, the University has seven campuses spread in six districts of Tororo, Mbale, Soroti, Kamuli, Pallisa and Butebo districts in Eastern Uganda. Each campus is unique and discipline-specific focusing on critical study programs in Engineering, Science Education, Health Sciences, Natural Resources and Environmental Sciences, Agriculture and Animal Sciences and Management Sciences [13]. The Faculty of Health Sciences runs seven academic programs including the Bachelor of Medicine and Surgery, Bachelor of Nursing, Bachelor of Anaesthesia, Masters of Public Health, Masters of Internal Medicine, Masters of Pediatrics and Child Health as well as Masters of Obstetrics and Gynaecology. It hosts 550 students and 80 faculty and is affiliated to Mbale Regional Referral Hospital as the teaching hospital. Busitema University Faculty of Health Sciences (BUFHS) joined Better Evidence in 2021.

Gulu University was established by Act 7 of 2001 of the Parliament of Uganda and commenced teaching activities in September 2002 [14]. During the fifth annual graduation ceremony on 23 January 2010, Gulu University awarded degrees to 1050 graduates, including 40 medical doctors, the first graduating class of the Gulu University School of Medicine. In 2016, the University started postgraduate programmes in medicine: Master of Medicine in Surgery and Master of Medical Anthropology [15]. Gulu University joined in 2023.

Kabale University was established as a not-for-profit community institution, owned by the people of Kigezi. First admitting 42 students in 2002, the institution has grown to an enrolment of about 6000, coming from all parts of Uganda, and the neighbouring countries of Kenya, Tanzania, Rwanda, Burundi, Congo (DRC) and

South Sudan. In 2015, Kabale University was transformed from a private to a public University under Statutory Instrument No. 36 of 16th July 2015, the first institution of its kind to do so. Kabale University School of Medicine (KABSOM) opened in September 2016 for teaching, learning, research, and community service [16]. KABSOM joined the Better Evidence program in 2020.

Makerere University, established in 1922 is one of the oldest universities in Africa. It became a center for higher education in East Africa in 1935 and an independent national university of the Republic of Uganda in 1970, offering undergraduate and postgraduate courses. The university transitioned from the faculty-based to the collegiate system in 2011. As of 2024, it includes 10 constituent colleges, all operating as semi-autonomous units with a student body of 40,000 undergraduates and 3,000 postgraduates (both Ugandan and foreign).

Makerere University College of Health Sciences (MakCHS) was established in 1924 as Makerere University Medical School. It is the oldest medical training University unit in East Africa [17]. MakCHS includes 4 schools (School of Medicine, School of Biomedical Sciences, School of Public Health and School of Health Sciences). It hosts 3018 students and 249 staff or faculty who hold clinical roles primarily at the Mulago National Referral and Teaching Hospital, the Kiruddu Hospital and the Kawempe Hospital. The University joined Better Evidence in 2019 [2].

Mbarara University of Science and Technology (MUST) is a public university located in South-Western Uganda. It was established in 1989 by the Mbarara University of Science and Technology Statue of 1989, resulting from the government's realization that higher education was a critical asset for nation building, and that science and technology were the most realistic drivers to lead this initiative.

The University has contributed to the country's development, adopting a community-based curriculum to enable the students better understand the health problems of the rural and peri-urban areas where 70% of Ugandans live. During training, students are exposed and introduced to rural and peri-urban community settings.

The University has grown from a single medical and health sciences faculty with an undergraduate student population of 43 to 6 faculties and 2 institutes with a population of over 5,000; comprising undergraduates and postgraduate students. The university staff has also increased from the original six to 538 as of June 2023. The university operates two campuses: Kihumuro main campus located 7 km on the Mbarara-Bushenyi highway and the Mbarara City campus. MUST joined the program in 2021.

Table 1 shows a summary of when each of the five institutions joined the UpToDate donation program and the number of eligible users.

## 6. Objective

This paper explores the uptake and use of UpToDate among students and faculty at five medical schools in Uganda from August 2022 to August 2023.

Table 1. Year when institutions joined the program.

| Institution/Medical School | Year Joined | Total Eligible Users |
|---|---|---|
| Busitema University | 2021 | 730 |
| Gulu University | 2023 | 735 |
| Kabale University | 2020 | 460 |
| Makerere University | 2019 | 3575 |
| Mbarara University of Science & Technology | 2021 | 5061 |

## 7. Methodology

After being approved for participation in the Better Evidence for Training program, each of the five medical schools entered into a contract with UpToDate. UpToDate established access to the product through the local area network at the universities and the approved affiliated training facilities. The Better Evidence team aided librarians, students, and faculty at the schools in learning how to access, register for, and use the tool in 2019. The program appointed Better Evidence Champions starting in 2020 during the pandemic to help train potential users and promote access locally. The champions then communicated about and built awareness of the tool in their respective institutions through training sessions, creating awareness during school functions, such as dissemination seminars, administrative and academic board meetings, messaging and word-of-mouth.

The study included all the five medical schools in Uganda supported by the Better Evidence for Training program in accessing UpToDate. Data was extracted from bimonthly engagement reports of the five medical schools covering a period of August 2022 to August 2023. From each engagement report, we looked at the following areas:

1) Trending topics sorted by most views: these are topics that increased in popularity from the prior two-month period.

2) Methods used to access the topics: This is whether users accessed UpToDate via the website on a computer or via the UpToDate app on their smartphones, tablets or iPads.

3) Roles of the users that accessed topics in UpToDate.

4) Top five medical topics by views showing the most frequently visited topic cards during each two-month period.

5) Top five medical specialties viewed showing what specialties the topics viewed fall into.

6) Total usage by month showing how many searches were done.

7) Ratio of uses to eligible users by institution.

8) Ratio of uses to students by institution.

UpToDate remotely tracked usage and searches by registered, logged-in users or users on campus and shared aggregate data with the medical schools through

the Better Evidence for Training program every two months. The data was captured through various technical methods that track user activity while adhering to privacy and data protection standards [2]. These methods included user authentication that requires users to log in with credentials, which allows them to track individual usage patterns, such as which articles or topics are accessed, for how long, and how frequently; web analytics tools such as cookies and session identifiers that monitor how users interact with the platform. These tools collected data about page views, search queries and clicks. In addition, server logs that capture data such as IP addresses, timestamps, browser type, operating system, and request details were used. They helped to track usage trends and optimize their services. Data was also collected using user feedback and surveys, which were sent to the individual institutions [2].

For qualitative data, a Google survey form was designed by Better Evidence and sent by email to all medical schools. Quantitative data was tracked from user logins remotely captured by Wolters Kluwer. Bi-monthly usage reports sent to the five medical schools provided this data, which was then analysed.

There were no institutional review board (IRB) approvals that were needed given the nature of this work and the aggregate nature of the data that did not allow any individuals to be directly involved or identified and permissions that were granted by the institutions themselves.

## 8. Data Analysis

We used Excel (Ver. 2019) to organize the data into tables to enable us to look at the trends and usage patterns over time, across the institutions. We then grouped the relevant data based on trending topics, access methods, user roles, top five medical topics by views, top five medical specialties by views and total usage of the tool by institution and month of reporting. Reporting periods are labeled by when the report was received. UpToDate provided reports every two months.

## 9. Results

### 9.1. Trending Topics

Table 2 shows the trending topics sorted by increase in views for each two-month reporting period. The trends show various topics that were viewed across the five medical schools over the 1-year period.

Trending topics from the five medical schools show no similarity, apart from a few topics related to pregnancy, cancer and sickle cell disease.

### 9.2. Access Methods

Table 3 shows the number of times the tool was accessed by registered users via the website or the app for each two-month period being reported in the months of August 2022 and August 2023. The table also shows unregistered UpToDate.com usage.

Makerere University and MUST saw the highest use of the tool, while Busitema,

Gulu and Kabale, which had relatively low usage over the period under study, saw similar trends in a preference for using the mobile app more than the website. Accessing the tool via mobile app was more popular than accessing the tool via UpToDate.com and unregistered UpToDate.com usage across all schools.

**Table 2.** Trending topics.

| Month | Topic Viewed-MUK | Topic Viewed-Busitema |
|---|---|---|
| Aug-22 | Cerebral palsy: Evaluation and diagnosis | Overview of the management of type 1 diabetes mellitus in children and adolescents |
| | Cerebral palsy: Epidemiology, etiology, & prevention | Malaria in pregnancy: Prevention and treatment |
| | Paediatric HIV infection: Classification, clinical manifestation and outcome | Overview of the clinical manifestations of sickle cell disease |
| Oct-22 | Eyelid lesions | Ectopic pregnancy: Clinical manifestations and diagnosis |
| | Twin pregnancy: Labour and delivery | Management of early-stage cervical cancer |
| | Morphine: Paediatrics drug information | Preeclampsia: Clinical features and diagnosis |
| Dec-22 | Management of ST-elevation myocardial infarction | Advanced cardiac life support (ACLS) in adults |
| | Overview of community-acquired pneumonia in adults | Pathogenesis of malaria |
| | Phenytoin: Drug information | Overview of cancer pain syndromes |
| Feb-23 | Congenital syphilis: Clinical manifestations, evaluation, and diagnosis | Clinical features, diagnosis, and treatment of neonatal encephalopathy |
| | Clinical manifestations and evaluation of edema in adults | Moderate and severe thermal burns in children: Emergency management |
| | Urethritis in adult males | Venous thromboembolism: Initiation of anticoagulation |
| Apr-23 | Approach to the child with recurrent infections | Treatment of idiopathic nephrotic syndrome in children |
| | Subdural hematoma in adults: Aetiology, clinical features, and diagnosis | Syphilis: Treatment and monitoring |
| | Caesarean birth: Surgical technique | Urinary tract infections and asymptomatic bacteriuria in pregnancy |
| Jun-23 | Breast pain | Overview of postpartum hemorrhage |
| | Uterine fibroids (leiomyomas): Histology and pathogenesis | Glomerular disease: Evaluation and differential diagnosis in adults |
| | Advanced cardiac life support (ACLS) in adults | Peptic ulcer disease: Treatment and secondary prevention |
| Aug-23 | Abnormal uterine bleeding in non-pregnant reproductive-age patients: Terminology, evaluation, & approach to diagnosis | Overview of the clinical presentation and diagnosis of acute lympho1blastic leukemia/lymphoma in children |
| | Dermatophyte (tinea) infections 100% | Overview of the pathogenesis and causes of glomerulonephritis in children |
| | Overview of the management and prognosis of sickle cell disease | Diagnostic approach to the adult with jaundice or asymptomatic hyperbilirubinemia |

Continued

| Month | Topic Viewed-MUST | Topic Viewed-Kabale |
|---|---|---|
| Aug-22 | Glucagon-like peptide 1-based therapies for the treatment of type 2 diabetes mellitus | Ascites in adults with cirrhosis: Initial therapy |
| | Non-vertebral osteomyelitis in adults: Clinical manifestations and diagnosis | Alcohol-induced cardiomyopathy |
| | Sodium-glucose co-transporter 2 inhibitors for the treatment of hyperglycaemia in type 2 diabetes mellitus | Heart failure: Clinical manifestations and diagnosis in adults |
| Oct-22 | Management of symptomatic carotid atherosclerotic disease | Initial assessment and management of acute stroke |
| | Ileostomy or colostomy care & complications | Stroke: Etiology, classification, and epidemiology |
| | Preterm prelabour rupture of membranes: Management and outcome | Clinical features, evaluation and diagnosis of sepsis in term and late preterm neonates |
| Dec-22 | Antenatal corticosteroid therapy for reduction of neonatal respiratory morbidity & mortality from preterm delivery | Neonatal, necrotizing entercolitis: Management |
| | Overview of endometrial carcinoma | Treatment and prevention of hyperkalemia in adults |
| | Overview of the treatment of newly diagnosed, invasive, non-metastatic breast cancer | Aminophylline: Pediatric drug information |
| Feb-23 | Acute chest syndrome (ACS) in sickle cell disease (adults and children) | Malaria: Epidemiology, prevention and control |
| | Pathophysiology and treatment of fever in adults | Patient education: Scabies (The basics) |
| | Oral lesions | Urinary tract infections and asymptomatic bacteriuria in pregnancy |
| Apr-23 | Snakebites worldwide: Management | Bronchiolitis in infants and children: Treatment, outcome and prevention |
| | ECG tutorial: Basic principles of ECG analysis | Overview of pregnancy termination |
| | Mumps | Community-acquired pneumonia in children: Clinical features and diagnosis |
| Jun-23 | Diabetic ketoacidosis & hyperosmolar hyperglycaemic state in adults: Clinical features, evaluation, and diagnosis | Clinical manifestations, diagnosis, & staging of exocrine pancreatic cancer |
| | Clinical manifestations, diagnosis, & evaluation of nephrotic syndrome in children | Overview of the management of acute kidney injury in adults |
| | Aetiology and evaluation of haematuria in adults | Treatment of rabies |
| Aug-23 | Evaluation of adults with ascites | Diabetic ketoacidosis in children: Treatment & complications |
| | Acute asthma exacerbations in children younger than 12 years: Emergency department management | Clinical manifestations, diagnosis, and staging of esophageal cancer |
| | Overview of the clinical manifestations of sickle cell disease | Inguinal hernia in children |

Continued

| Month | Topic Viewed-Gulu | |
|-------|-------------------|---|
| Jun-23 | Depression, mania, and schizophrenia in HIV-infected patients | Abnormal uterine bleeding in nonpregnant reproductive-age patients: Terminology, evaluation, & approach to diagnosis |
| | An overview of asthma management | Dermatophyte (tinea) infections |
| | Treatment of severe malaria | Overview of the management and prognosis of sickle cell disease |
| Aug-23 | Abnormal uterine bleeding in nonpregnant reproductive-age patients: Terminology, evaluation, and approach to diagnosis | |
| | Dermatophyte (tinea) infections | |
| | Overview of the management and prognosis of sickle cell disease | |

**Table 3.** Access methods.

| Institution/Report Month | Registered Mobile App Usage | Registered UpToDate.com Usage | Unregistered UpToDate.com Usage |
|--------------------------|------------------------------|-------------------------------|----------------------------------|
| **MUK** | | | |
| Aug-22 | 8863 | 2488 | 5 |
| Oct-22 | 3541 | 1192 | 2 |
| Dec-22 | 6397 | 2372 | 6 |
| Feb-23 | 6433 | 1673 | 7 |
| Apr-23 | 4761 | 2848 | 2 |
| Jun-23 | 3199 | 1934 | 1 |
| Aug-23 | 2954 | 1758 | 2 |
| **MUST** | | | |
| Aug-22 | 4328 | 1605 | 0 |
| Oct-22 | 4324 | 1256 | 1 |
| Dec-22 | 2329 | 613 | 0 |
| Feb-23 | 5319 | 1718 | 2 |
| Apr-23 | 4198 | 1465 | 0 |
| Jun-23 | 3022 | 1466 | 1 |
| Aug-23 | 5373 | 2607 | 2 |
| **BUSITEMA** | | | |
| Aug-22 | 843 | 182 | 0 |

**Continued**

| | | | |
|---|---|---|---|
| Oct-22 | 1163 | 282 | 0 |
| Dec-22 | 1048 | 388 | 0 |
| Feb-23 | 624 | 198 | 0 |
| Apr-23 | 460 | 111 | 0 |
| Jun-23 | 748 | 598 | 0 |
| Aug-23 | 868 | 796 | 0 |
| **GULU** | | | |
| Jun-23 | 15 | 13 | 0 |
| Aug-23 | 60 | 57 | 1 |
| **KABALE** | | | |
| Aug-22 | 2006 | 1316 | 0 |
| Oct-22 | 1833 | 1273 | 3 |
| Dec-22 | 601 | 67 | 0 |
| Feb-23 | 2647 | 1021 | 1 |
| Apr-23 | 2319 | 736 | 2 |
| Jun-23 | 664 | 570 | 2 |
| Aug-23 | 1002 | 819 | 0 |

## 9.3. User Roles

Table 4 shows the roles of users who accessed the topics across the institutions by month. Generally, the main users included medical students, residents, librarians, nurses and physicians. However, there are other users such as pharmacists, physician assistants and unregistered workflow access users who are combined as other users.

**Table 4.** User roles.

| Institution | User Role | Aug-22 | Oct-22 | Dec-22 | Feb-23 | Apr-23 | Jun-23 | Aug-23 | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Medical Student | 171 | 109 | 182 | 210 | 200 | 157 | 86 | **1029** |
| | Resident | 125 | 80 | 113 | 113 | 131 | 109 | 7 | **671** |
| | Other | 41 | 11 | 14 | 18 | 22 | 14 | 5 | **120** |
| MUK | Medical Librarian | 9 | 0 | 0 | 1 | 1 | 0 | 2 | **11** |
| | Nurse | 2 | 2 | 6 | 0 | 2 | 2 | 2 | **14** |
| | Physician | 2 | 31 | 37 | 33 | 44 | 43 | 3 | **190** |

**Continued**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Medical Student | 28 | 31 | 57 | 42 | 38 | 55 | 71 | **251** |
| | Resident | 7 | 5 | 2 | 15 | 10 | 5 | 13 | **44** |
| BUSITEMA | Other | 1 | 10 | 4 | 1 | 3 | 4 | 3 | **23** |
| | Medical Librarian | 1 | 2 | 1 | 1 | 0 | 2 | 1 | **7** |
| | Nurse | 1 | 2 | 4 | 2 | 1 | 2 | 1 | **12** |
| | Physician | 13 | 12 | 11 | 11 | 9 | 8 | 13 | **64** |
| | Medical Student | 113 | 119 | 72 | 121 | 106 | 104 | 147 | **635** |
| | Resident | 48 | 47 | 37 | 83 | 72 | 79 | 85 | **366** |
| MUST | Other | 13 | 14 | 1 | 12 | 11 | 10 | 21 | **61** |
| | Medical Librarian | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| | Nurse | 4 | 5 | 5 | 9 | 9 | 7 | 5 | **39** |
| | Physician | 7 | 12 | 10 | 14 | 15 | 9 | 15 | **67** |
| | Medical Student | 93 | 95 | 41 | 108 | 102 | 76 | 86 | **515** |
| | Resident | 6 | 5 | 4 | 6 | 6 | 5 | 7 | **32** |
| KABALE | Other | 3 | 2 | 1 | 5 | 3 | 2 | 5 | **16** |
| | Medical Librarian | 2 | 1 | 0 | 0 | 2 | 1 | 2 | **6** |
| | Nurse | 1 | 1 | 0 | 1 | 7 | 1 | 2 | **11** |
| | Physician | 1 | 2 | 1 | 1 | 1 | 2 | 3 | **8** |
| | Medical Student | | | | | | 12 | 19 | **12** |
| | Resident | | | | | | 0 | 0 | **0** |
| GULU | Other | | | | | | 0 | 1 | **0** |
| | Medical Librarian | | | | | | 0 | 1 | **0** |
| | Nurse | | | | | | 0 | 0 | **0** |
| | Physician | | | | | | 1 | 0 | **1** |

Throughout the year, medical students accessed the tool more than the other categories. Makerere University and MUST again show higher usage than the other three universities. Medical students in Kabale University, which is relatively a new University, and with a smaller population seems to be utilizing the tool appropriately. The table shows that the librarians use the tool very minimally.

### 9.4. Top Five Specialties by Views

Table 5 shows the most topic specialties that were viewed during the reporting period.

**Table 5.** Top 5 topic specialties.

| Topic | Aug-22 | Oct-22 | Dec-22 | Feb-23 | Apr-23 | Jun-23 | Aug-23 |
|---|---|---|---|---|---|---|---|
| **MAK** | | | | | | | |
| Obstetrics, Gynecology & Women's Health | 1449 | 845 | 1134 | 936 | 947 | 772 | 487 |
| Pediatrics | 1263 | 472 | 729 | 1000 | 1000 | 531 | 404 |
| Neurology | 781 | 295 | | 366 | 477 | 324 | |
| Infectious Diseases | 779 | 572 | 733 | 625 | 625 | 492 | 411 |
| Hematology | 525 | | 585 | | | | |
| Drug Information | | 715 | 844 | 573 | 444 | 333 | 418 |
| Pulmonary & Critical Care | | | | | | | 294 |
| **MUST** | | | | | | | |
| Obstetrics, Gynecology & Women's Health | 468 | 619 | 251 | 767 | 494 | 334 | 878 |
| Pediatrics | 785 | 733 | 309 | 1008 | 500 | 345 | 1105 |
| Drug Information | 567 | 747 | 327 | 656 | 688 | 447 | 572 |
| Infectious Diseases | 462 | 761 | 276 | 800 | 470 | 360 | 862 |
| Gastroenterology & Hepatology, Pulmonary & Critical Care Medicine, Cardio, Nephrology & Hypertension | 335 | 319 | 168 | 449 | 304 | 377 | |
| Hematology | | | | | | | 540 |
| **BUSITEMA** | | | | | | | |
| Pediatrics | 225 | 200 | 113 | 61 | 86 | 91 | 363 |
| Infectious Diseases | 102 | 178 | 141 | 61 | 64 | 156 | 121 |
| Obstetrics, Gynaecology & Women Health | 80 | 355 | 137 | | | 205 | 315 |
| Haematology | 84 | 119 | | | | | 169 |
| Nephrology & Hypertension | 55 | | 76 | | 35 | 89 | |
| Others | | 148 | 83 | 179 | 51 | 82 | |
| Neurology | | | | | | | 79 |
| **GULU** | | | | | | | |
| Infectious Diseases | | | | | | 5 | |
| Nephrology and Hypertension | | | | | | 4 | |
| Obstetrics, Gynaecology and Women's Health | | | | | | 3 | 18 |
| Pulmonary & Critical Care Medicine | | | | | | 2 | |
| Oncology | | | | | | 2 | 8 |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pediatrics | | | | | | | 18 |
| Dermatology | | | | | | | 10 |
| Neurology | | | | | | | 6 |
| **KABALE** | | | | | | | |
| Gastroenterology & Hepatology | 450 | 258 | 33 | | | | 156 |
| Pediatrics | 447 | 594 | 143 | 504 | 716 | 164 | 261 |
| Infectious Diseases | 352 | 459 | 50 | 469 | 388 | 158 | 172 |
| Obstetrics, Gynaecology and Women's Health | 263 | | | 310 | 168 | | |
| Nephrology and Hypertension | | 236 | 41 | | 211 | 80 | |
| Drug Information | | | 80 | | 190 | | |
| Oncology | | | | | | 86 | 130 |
| Pulmonary and Critical Care Medicine | | | | 207 | | 81 | |
| Cardiovascular Medicine | 220 | | | | | | |
| Haematology | | 260 | | 357 | | | 117 |

Note: Others included other specialties not indicated in the table, such as endocrinology & diabetes.

For all the specialties that viewed the topics, the month of August shows the highest number of views across the institutions. Furthermore, topics like obstetrics and gynecology were most viewed by four out of the five institutions, followed by paediatrics and infectious diseases.

### 9.5. Top Five Medical Topics by Views

Table 6 shows the top five most viewed medical topics by reporting.

**Table 6.** Top five most viewed medical topics by reporting.

| Month of Report | Institution | Five Most Viewed Topics |
|---|---|---|
| Aug-22 | Muk | Cerebral palsy: Clinical features and classification (81) |
| | | Calculator: Estimated Date of Delivery (EDD) (52) |
| | | Uterine fibroids (leiomyomas): Treatment overview (46) |
| | | Cerebral palsy: Epidemiology, aetiology, and prevention (41) |
| | | Dermatophyte (tinea) infections (41) |
| | Busitema | Malaria: Clinical manifestations & diagnosis in non-pregnant adults and children (17) |
| | | Overview of the clinical manifestations of sickle cell disease (14) |
| | | Post term pregnancy (11) |

**Continued**

| | | |
|---|---|---|
| | | The common cold in children: Clinical features & diagnosis (11) |
| | | Pathogenesis of malaria (9) |
| | MUST | Myxoedema coma (46) |
| | | Clinical features, evaluation, and diagnosis of sepsis in term and late preterm infants (42) |
| | | Glucagon-like peptide 1-based therapies for the treatment of type 2 diabetes mellitus (42) |
| | | Dipeptidyl peptidase 4 (DPP-4) inhibitors for the treatment of type 2 diabetes mellitus (31) |
| | | Organophosphate and carbamate poisoning (29) |
| | Kabale | Peptic ulcer disease: Epidemiology, aetiology, and pathogenesis (81) |
| | | Evaluation of the patient with HIV and diarrhoea (47) |
| | | Heart failure: Clinical manifestations and diagnosis in adults (43) |
| | | Acute liver failure in adults: Aetiology, clinical manifestations, & diagnosis (29) |
| | | Mechanism of action of diuretics (26) |
| Oct-22 | MUK | Preeclampsia: Clinical features and diagnosis (36) |
| | | Clinical manifestations and diagnosis of Ebola virus disease (35) |
| | | Calculator: Estimated Date of Delivery (EDD) (34) |
| | | Diabetic ketoacidosis and hyperosmolar hyperglycaemic state in adults: Treatment (33) |
| | | Overview of dermatitis (eczematous dermatoses) (28) |
| | Busitema | Preeclampsia: Clinical features and diagnosis (24) |
| | | Invasive cervical cancer: Epidemiology, risk factors, clinical manifestations, and diagnosis (17) |
| | | Ectopic pregnancy: Clinical manifestations and diagnosis (16) |
| | | Diagnosis & management of glucose-6-phosphate dehydrogenase deficiency (15) |
| | | Sickle cell disease: Pregnancy considerations (15) |
| | MUST | Diabetic ketoacidosis & hyperosmolar hyperglycaemic state in adults: Treatment (46) |
| | | Preeclampsia: Clinical features and diagnosis (35) |
| | | Clinical manifestations & diagnosis of Ebola virus disease (31) |
| | | Overview of the treatment of lower extremity deep vein thrombosis (25) |
| | | Seizures & epilepsy in children: Classification, aetiology, & clinical features (25) |
| | Kabale | Overview of the treatment of hyponatremia in adults (29) |
| | | Clinical presentation & diagnosis of classic Hodgkin lymphoma in adults (27) |
| | | Clinical presentation and initial evaluation of non-Hodgkin lymphoma (23) |
| | | Uterine fibroids (leiomyomas): Epidemiology, clinical features, diagnosis, & natural history (21) |
| | | Etiology and pathogenesis of neonatal unconjugated hyperbilirubinemia (20) |

**Continued**

| | | |
|---|---|---|
| Dec-22 | MUK | Pathophysiology of sickle cell disease (40) |
| | | Prevention of malaria infection in travellers (35) |
| | | Overview of the clinical manifestations of sickle cell disease (34) |
| | | Supracondylar fractures in children (33) |
| | | Causes and diagnosis of iron deficiency and iron deficiency anaemia in adults (31) |
| | Busitema | Elevated intracranial pressure (ICP) in children: Clinical manifestations & diagnosis (23) |
| | | Diabetic ketoacidosis and hyperosmolar hyperglycemic state in adults: Treatment (12) |
| | | Advanced cardiac life support (ACLS) in adults (10) |
| | | Approach to acute upper gastrointestinal bleeding in adults (10) |
| | | Epilepsy syndromes in children (10) |
| | MUST | Antenatal corticosteroid therapy for reduction of neonatal respiratory morbidity and mortality from preterm delivery (24) |
| | | Thoracic paravertebral block procedure guide (18) |
| | | Calculator: Estimated Date of Delivery (EDD) (15) |
| | | Acute rheumatic fever: Treatment and prevention (14) |
| | | Mumps (14) |
| | Kabale | Approach to the child with anaemia (12) |
| | | Initial management of trauma in adults (7) |
| | | Isolated ventricular septal defects (VSDs) in infants and children: Anatomy, clinical features, & diagnosis (7) |
| | | Neonatal necrotizing enterocolitis: Management (7) |
| | | Peripartum cardiomyopathy: Etiology, clinical manifestations, and diagnosis (6) |
| Feb-23 | MUK | Malaria: Clinical manifestations & diagnosis in nonpregnant adults & children (59) |
| | | Preeclampsia: Clinical features and diagnosis (49) |
| | | Overview of the clinical manifestations of sickle cell disease (40) |
| | | Calculator: Estimated Date of Delivery (EDD) (37) |
| | | Labour: Overview of normal and abnormal progression (36) |
| | Busitema | Cardiovascular medicine (10) |
| | | Pruritus: Therapies for generalized pruritus (9) |
| | | Overview of the acute management of non-ST-elevation acute coronary syndromes (8) |
| | | Shoulder dislocation and reduction (8) |
| | | Local anaesthetic systemic toxicity (7) |

**Continued**

| | | |
|---|---|---|
| | MUST | Preeclampsia: Clinical features and diagnosis (62) |
| | | Overview of hypertension in adults (36) |
| | | Perinatal asphyxia in term and late preterm infants (35) |
| | | Oral lesions (33) |
| | | Seizures and epilepsy in children: Classification, aetiology, and clinical features (33) |
| | Kabale | Atopic dermatitis (eczema): Pathogenesis, clinical manifestations, and diagnosis (38) |
| | | Scabies: Epidemiology, clinical features, and diagnosis (33) |
| | | Anaemia in pregnancy (31) |
| | | Pneumonia in children: Epidemiology, pathogenesis, and aetiology (31) |
| | | Multiple myeloma: Clinical features, laboratory manifestations, and diagnosis (29) |
| Apr-23 | MUK | Approach to the child with recurrent infections (31) |
| | | Clinical features, evaluation, & diagnosis of sepsis in term & late preterm neonates (30) |
| | | Treatment of polycystic ovary syndrome in adults (30) |
| | | Sepsis syndromes in adults: Epidemiology, definitions, clinical presentation, diagnosis, and prognosis (29) |
| | | Malaria: Clinical manifestations and diagnosis in nonpregnant adults and children (28) |
| | Busitema | Aetiology, clinical manifestations, and diagnosis of nephrotic syndrome in children (17) |
| | | Postpartum blues (16) |
| | | Erythroderma in adults (11) |
| | | Overview of heavy proteinuria and the nephrotic syndrome (8) |
| | | Priapism (7) |
| | MUST | Overview of hypertension in adults (38) |
| | | Overview of benign lesions of the skin (33) |
| | | Diabetic ketoacidosis and hyperosmolar hyperglycaemic state in adults: Treatment (32) |
| | | ECG tutorial: Basic principles of ECG analysis (22) |
| | | Fever without a source in children 3 to 36 months of age: Evaluation and management (22) |
| | Kabale | Bronchiolitis in infants and children: Treatment, outcome, and prevention (212) |
| | | Overview of pregnancy termination (55) |
| | | General principles of fracture management: Bone healing and fracture description (32) |
| | | Organophosphate and carbamate poisoning (32) |
| | | Initial assessment and management of acute stroke (28) |

**Continued**

| | | |
|---|---|---|
| | | Infective endocarditis in children (54) |
| | | Overview of hypertension in adults (34) |
| | MUK | Acute rheumatic fever: Treatment and prevention (30) |
| | | Advanced cardiac life support (ACLS) in adults (30) |
| | | Tetanus (26) |
| | | Enterocutaneous and enter atmospheric fistulas (14) |
| | | Pathophysiology of sickle cell disease (14) |
| | Busitema | Diabetic ketoacidosis and hyperosmolar hyperglycemic state in adults: Treatment (12) |
| | | Spontaneous preterm birth: Pathogenesis (11) |
| | | Abdominal tuberculosis (10) |
| | | Diabetic ketoacidosis and hyperosmolar hyperglycemic state in adults: Treatment (22) |
| | | Diabetic ketoacidosis and hyperosmolar hyperglycaemic state in adults: Clinical features, evaluation, and (22) |
| Jun-23 | MUST | Clinical manifestations, diagnosis, and evaluation of nephrotic syndrome in children (21) |
| | | Clinical manifestations and diagnosis of rheumatic heart disease (20) |
| | | Chemotherapy nephrotoxicity and dose modification in patients with kidney impairment: conventional (20) |
| | | Risk factors for gastric cancer (22) |
| | | Overview of the management of acute kidney injury (AKI) in adults (15) |
| | Kabale | Approach to the child with acute diarrhoea in resource-limited settings (14) |
| | | Treatment of rabies (13) |
| | | Ludwig angina 10 |
| | | Hepatorenal syndrome (2) |
| | | COVID-19: Clinical features (2) |
| | Gulu | Shoulder dislocation and reduction (1) |
| | | Subacute and chronic low back pain: Nonpharmacologic and pharmacologic treatment (1) |
| | | Chemotherapy and radiation therapy in the management of osteosarcoma (1) |
| | | Epidemiology and pathogenesis of acute pulmonary embolism in adults (56) |
| | | Management of acute moderate and severe traumatic brain injury (36) |
| Aug-23 | MUK | Overview of the clinical manifestations of sickle cell disease (29) |
| | | Traumatic brain injury: Epidemiology, classification, & pathophysiology (25) |
| | | Overview of hypertension in adults (25) |

**Continued**

| | | |
|---|---|---|
| Busitema | Pathophysiology of sickle cell disease (25) | |
| | Overview of the clinical presentation and diagnosis of acute lymphoblastic leukaemia/lymphoma in children (15) | |
| | Perinatal asphyxia in term and late preterm infants (14) | |
| | Clinical manifestations, diagnosis, and evaluation of nephrotic syndrome in children (14) | |
| | Acute kidney injury in children: Clinical features, aetiology, evaluation, and diagnosis (14) | |
| MUST | Overview of the clinical manifestations of sickle cell disease (44) | |
| | Necrotizing soft tissue infections (42) | |
| | Diabetic ketoacidosis & hyperosmolar hyperglycaemic state in adults: Treatment (40) | |
| | Malaria: Clinical manifestations & diagnosis in nonpregnant adults & children (39) | |
| | Overview of the management & prognosis of sickle cell disease (37) | |
| Kabale | Overview of the clinical manifestations of sickle cell disease (22) | |
| | Diabetic ketoacidosis in children: Treatment & complications (17) | |
| | Pneumonia in children: Epidemiology, pathogenesis, & etiology (16) | |
| | Overview of abdominal wall hernias in adults (13) | |
| | Hepatic encephalopathy in adults: Clinical manifestations & diagnosis 13 | |
| Gulu | Hydatidiform mole: Epidemiology, clinical features, and diagnosis (7) | |
| | Placenta previa: Epidemiology, clinical features, diagnosis, morbidity and mortality (7) | |
| | Abdominal pregnancy (3) | |
| | Photo-sensitivity disorders (photodermatoses): Clinical manifestations, diagnosis, and treatment (3) | |
| | Overview of the management & prognosis of sickle cell disease (3) | |

The top five most viewed medical topics by reporting were all different across the institutions, each viewing different topics.
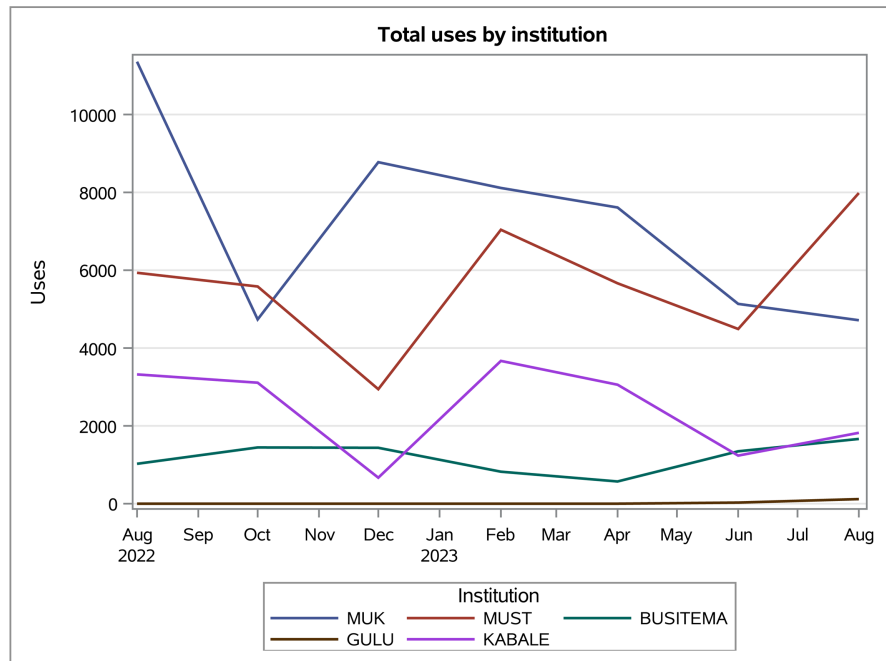
### 9.6. Total Usage by Institution

Figure 2 shows total usage of the tool at each of the five institutions over time.

The usage trend in Figure 2 shows similar highs and lows across the institutions, decreasing between October and November, increasing from December to April, and decreasing again from May to June.

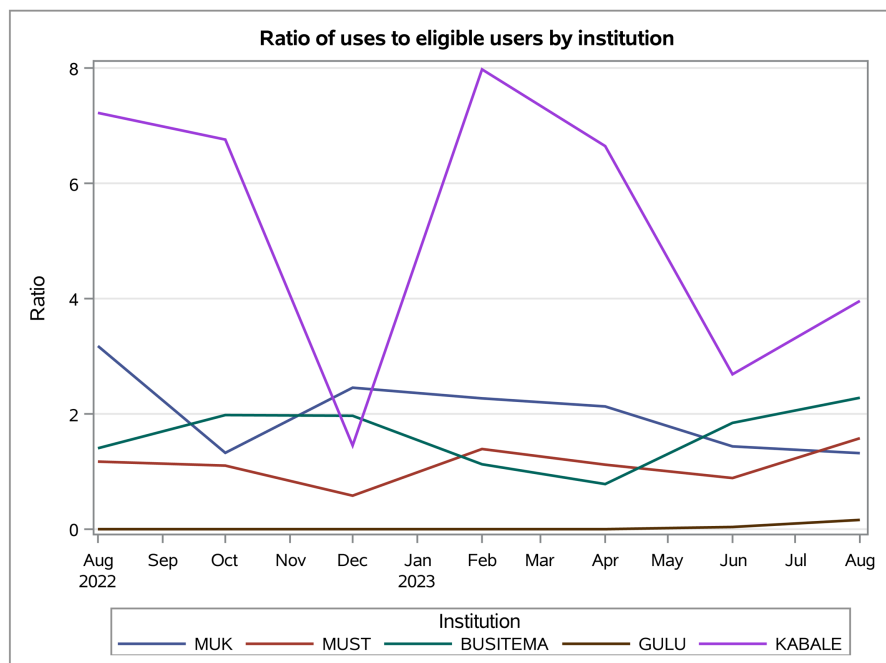### 9.7. Ratio of Uses to Eligible Users by Institution

Figure 3 shows the ratio of users to eligible users by institution.

The ratio of users to eligible users by institution refers to the comparison between the number of times UpToDate is utilized within an institution and the total number of individuals who are eligible to use it within the same institution.

The ratio of uses to eligible users also fluctuates across the institutions. However, Kabale University registered a sharp decrease in December 2022, and a sharp increase in January and February 2023. The rest of the universities had average fluctuations.



Note: Gulu University joined the Better Evidence for Training program in mid-2023, and hence usage data available is from June 2023.
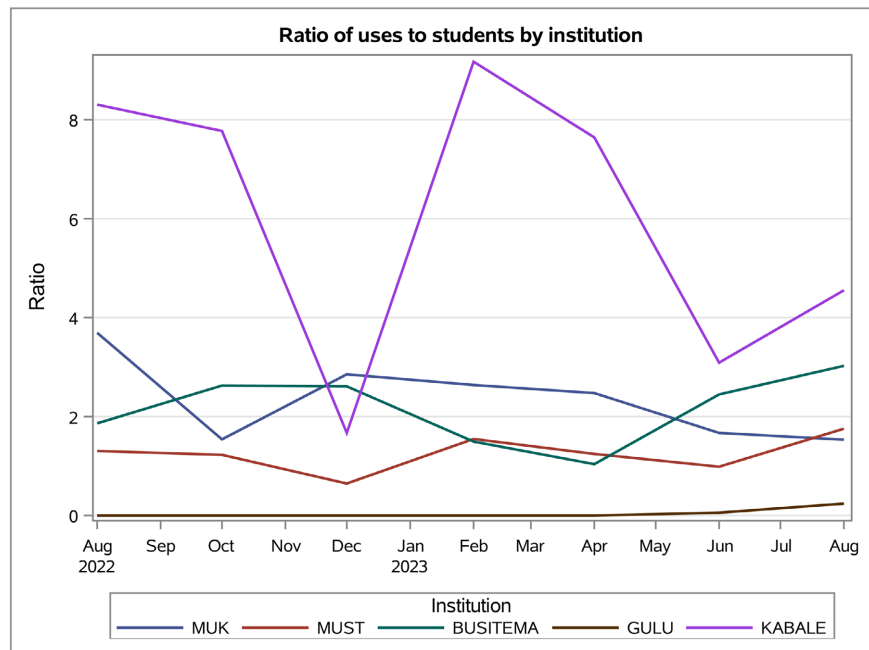
**Figure 2.** Total usage by institution.



**Figure 3.** Ratio of uses to eligible users by institution.

### 9.8. Ratio of Uses to Students by Institution

The ratio of uses to students and faculty by institution represents the comparison between the frequency of utilization of UpToDate within the institution and the total number of enrolled students in that institution. **Figure 4** shows the ratio of uses to students by institution. While Makerere, MUST and Busitema follow a similar pattern and show a relatively consistent pattern, Kabale shows more variability and generally higher usage rates.



**Figure 4.** Ratio of uses to students by institution.

The ratio of uses to students by institution also showed Kabale register a sharp increase and decrease, just like in **Figure 3**. The other four universities had average fluctuations over the period of study.

### 9.9. Feedback from the End Users at Five Institutions

We also extracted qualitative feedback from the Google survey results. Additionally, feedback was recorded by librarians from the end users at the five institutions as follows.

#### Kabale University

"Students don't want to practice without UpToDate. It is a part of them now"—*Medical Librarian*.

"More students need to be oriented on the use of this app because it is a must have"—*Faculty*.

#### Gulu University

"UpToDate has a user-friendly interface that helps me access updated clinical information"—*Resident*.

"I like how comprehensive UpToDate is, I can research on any medical

condition"—*Faculty*.

### Busitema University

"I am grateful for the continued support with free access to UpToDate, which our institution couldn't afford with its limited budget"—*Clinician*.

"Even in the remote areas during community placement, I can access UpToDate on my mobile phone to make clinical decisions"—*4th Year Clinical Student*.

### Makerere University

"I no longer use Google since I learnt about UpToDate"—*Resident*.

"I use UpToDate to give me cutting edge information on the treatment for my patients, disease prognosis. It also enables me to prepare for continuous professional development training as I get material to share with colleagues at my workplace. I am able to use it off campus and offline which is a great opportunity"—*Medical doctor*.

### Mbarara University

"I use the calculator in UpToDate to calculate the Expected Date of Delivery and the Body Mass Index of patients, just from my phone, at the point of care"—*Intern in Obstetrics and Gynaecology department*.

## 10. Discussion

A total usage of 214,407 throughout the year is a good sign that the tool is being embraced by students and faculty. However, the highest number of usage (as shown in Table 3 and Figure 1) does not necessarily mean the highest usage per user, because the number of registered users varies across institutions. It is also hard to compare across the institutions because they joined the donation program at different dates. The data indeed shows that schools that have had access the longest generally have the highest usage. For instance, Gulu University which joined in April 2023 has the least number of users. Similarly, the schools have different student body sizes. It is possible that the school size influences usage. Furthermore, Gulu, Busitema, Mbarara and Kabale universities are based in rural Uganda where electricity and internet connectivity are unstable, hence affecting usage of the tool [18].

The data also shows that there are somewhat similar trends across all schools, with use generally dwindling during examinations and recess terms, and picking up towards the start of the semesters. Ideally, usage should go up each time a training takes place. However, this cannot be substantiated since the training takes place throughout the semester.

There are a few commonalities in the topics viewed across the schools, including malaria-and pregnancy-related conditions, sickle cell disease, and non-communicable conditions. The data also shows that various departments are using the tool. For instance, malaria in pregnancy is one of the trending viewed topics. This could mean that clinicians use the tool at the point of the care treating pregnant mothers. The change in topics viewed from month to month indicates the utility

of the tool across a wide view of conditions and topics provided in UpToDate. It is unclear whether the changes correspond to curricular or clinical needs.

Most users register for their own account and use their account to search within the tool. However, a few users accessed the topics via unregistered UpToDate.com. Across all schools, use of the tool via the mobile app was more popular than use of the tool via the website. The data show fluctuating usage across the institutions over the reporting period. There is no steady increase over the months. This could be influenced by institutional activities and programs such as examination periods, recess terms when students are less busy with no lectures, on holiday, and peak lecture periods across the institutions. Gulu University has the least number of users accessing the topics over the period June to August 2023. This is probably due to the fact that the university joined the donation program recently (2023), and the users are yet to be fully aware of the resource before they use it. Furthermore, Makerere University's high usage could be attributed to the fact that there are two champions who are spreading the word faster and conducting training sessions more than sites with one champion.

In all schools, students are using the tool more than any other user group. This may be due to the fact that there are more students than other types of users. Physicians and residents also have relatively high usage rates. This is likely due to the clinical relevance of the tool to their work. While librarians can train others in using the tool, its use is not essential to their daily work. Similarly, few nurses are using the tool. This may be due to the fact that they are not the target audience for promotion and some of the content may be more complex or clinical than what they are trained to process or apply.

Paediatrics and Obstetrics, Gynaecology & Women's Health had the highest views among the top five topic specialties. However, surgical specialties were not in the top five specialties at any of the schools and dermatology was not common. Most of the topic specialties would be considered in the field of primary care and infectious disease. This makes sense given the broad range of conditions seen and the need for diagnosis and referral in such specialties.

Diverse topics were viewed among the top five medical topics, with conditions like sickle cell disease, malaria and pregnancy-related conditions (as shown in Table 6). Again, these topics would be considered primary in the healthcare field. The topics viewed indicate that the tool is being used to treat and manage the common conditions that communities in rural settings suffer from.

The high ratio of usage at Kabale University suggests that more users are utilizing the resource, even though the total number of users at the other four institutions is bigger than at Kabale. Likewise, the low ratio usage at the other four institutions may suggest under-utilization or potential inefficiencies in access or awareness of the tool.

The similarity between the ratio of uses to students by institution and the ratio of uses to eligible users by institution (Figures 2 and Figures 3) suggests that the tool is generally being used by similar users who double as both students and clinicians.

The health system in Uganda is composed of both public and private stakeholders [19]. The Ministry of Health oversees all the health-related operations in the country, supported by district health officers at district level, and health facilities from referral hospitals to health centre IIs. The private health facilities in the country supplement the operations of government hospitals. In all, access to reliable and current information that is evidence-based is emphasised by all health training institutions, both public and private, such as Makerere, Busitema, MUST, Kabale, and Gulu Universities, and Kampala International University and the Islamic University in Uganda. In addition to the universities, there are also paramedical training and nursing schools, such as the Mulago Nursing School, the Uganda Institute of Allied Health and Management Services. Access to clinical information at the point of care supports doctors and other health workers to provide quality healthcare, for improved health outcomes.

## 11. Conclusions and Recommendations

From the data, it is clear that the tool is useful, given the fact that its use is optional. Usage generally increases over time—it takes time for people to understand the full utility, integrate it into their workflow and for its use to spread.

Librarians play a critical role in helping clinicians integrate clinical decision support tools like UpToDate into learning and practice and may have a role to play in accelerating uptake among students. A tool in itself is insufficient, especially in settings where such tools have not previously been available.

While this work explores use of UpToDate in Uganda, other countries and regions may benefit from instituting similar evidence-based tools into their medical education programs to ensure a common language and practice among the next cadre of healthcare workers. The tool alone likely will be insufficient, especially in settings where such tools have not previously been available. Librarians will play a key role in promoting the use and uptake of this type of resource and training the next generation throughout the continent and beyond in how to use it for learning and decision-making.

It will be important to track the use of clinical decision support by clinicians in the country over time to see if introducing such tools early in training has a long-term impact on use of evidence-based clinical decision support tools in Uganda. There may also be potential to try to understand the long-term impact of such tools on patient health outcomes as Uganda works toward universal health coverage and reaching the UN Sustainable Development Goals.

Future research needs to look at trends among medical schools and increases in numbers over a longer time period, which could reveal additional patterns or drivers of use.

## 12. Limitations of the Study

The data used to inform this study was remotely captured by Wolters Kluwer, based on logins in the system and the topics viewed. Mere logging in and viewing topics

may not necessarily translate into use to improve healthcare outcomes. Secondly, the demographic characteristics of the respondents were not captured by the system, hence it is not very clear who exactly logged in and viewed the topics.

## Ethics Approval and Consent to Participate

No institutional review board (IRB) approvals were needed, given the nature of this work and the aggregate nature of the data that did not allow any individuals to be identified.

## Consent for Publication

Wolters Kluwer generated this data and has allowed the authors to publish it. In addition, all the medical schools have agreed to have their individual data shared.

## Availability of Data and Materials

Data and other supplementary material are available from Wolters Kluwer.

## Funding

## Authors' Contributions

Alison Annet Kinengyere drafted the initial concept of the study and wrote the original draft. Glorias Asiimwe, Adrine Nyamwiza, Wilson Adriko, Emmanuel Twinamasiko and Arthur Karemani collated and presented the data from the five institutions, and Julie Rosenberg supported analysis. All authors read, edited and approved the final manuscript.

## Acknowledgments

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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## Abbreviations

| | |
|---|---|
| BE | Better Evidence |
| BUFHS | Busitema University Faculty of Health Sciences |
| GU | Gulu University |
| KABSOM | Kabale School of Medicine |
| MUK | Makerere University Kampala |
| MakCHS | Makerere University College of Health Sciences |
| MUST | Mbarara University of Science and Technology |