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Medical information seeking practices among medical students in Kenya: A descriptive cross-sectional study

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Abstract
Purpose: Many medical schools in low- and middle-income countries (LMICs) have adopted a problem-based learning (PBL) approach. PBL requires medical students to independently access and correctly interpret medical information. There is paucity of information on how students in LMICs retrieve medical information and apply Evidence Based Medicine (EBM) principles.
Methods: A cross-sectional survey was carried out among medical students in their clinical years at Moi University School of Medicine (MUSOM), a large medical school in Kenya between August and November 2016.
Results: Authors analyzed results of 206 clinical year medical students at MUSOM (response rate of 84%). Standard textbooks (47.8%) and lecture slides (20.9%) were the most preferred sources of general medical information. Medscape®, a free mobile medical information application, was the most utilized drug information source. Sources which directly link to primary biomedical literature such as PUBMED and HINARI were used by 14.1% and 7.8% of students respectively. A quiz testing key clinical epidemiology concepts was also performed with a mean score of 49% (SD, 23.8).
Conclusion: There is preference for standard textbooks. Low scores on the clinical epidemiology quiz, coupled with most students endorsing limited understanding of key EBM concepts emphasizes the need for broader EBM training.

Keywords: anxiety, study, Authors analyzed, EBM, LMICs

Introduction
The explosion of medical knowledge requires medical professionals at all levels of training and experience to adopt strategies to become life-long learners while keeping abreast of new information and knowledge in medical literature. Evidence based medicine (EBM) which highlights best practices in incorporating clinical epidemiology, library science and information management into clinical practice is a critical tool for the practitioner to maintain and expand their medical knowledge [1]. Recognizing the need to train students to be life-long learners, many programs in low- and middle income countries (LMICs) have adopted self-directed learning (SDL) approaches, as a core component of problem-based learning (PBL) curricula.
PBL for medical education uses clinical cases to facilitate learning of key concepts by students, imparting critical thinking skills, problem-solving abilities, and communication skills [2]. SDL, as a core component of PBL, requires the medical student to "take the initiative, with or without the help from others, in diagnosing their learning needs, formulating goals, identifying human and material resources, choosing and implementing appropriate learning strategies, and evaluating learning outcomes" [3]. Information seeking forms a large part of SDL, with the approach taken by the medical students determining success of their learning process. A clear understanding of information seeking approaches used by medical students in PBL programs is thus very important in determining the effectiveness of student learning. This is especially key in the setting of rapidly evolving modalities for information retrieval, such as the ever-increasing use of digital technologies. Mobile technology and the internet have greatly revolutionized access to medical information and in the process made many tools used in the past either unpopular or obsolete [4, 5]. As reported by Institute for International Medical Education (IIME) (1999), modern technology has allowed medical innovation to disseminate so rapidly that it has fundamentally altered the entire dynamic of medical education [6]. Kenya has also experienced remarkable growth in the Information and Communications Technology (ICT)

sectors in recent years and evidence suggests that medical students have been part of this rapid evolution [7].
Unfortunately, very few evaluations currently exist that aim to understand the information seeking practices of students within LMICs. These mostly come from the Middle East and Asia, including United Arab Emirates, Malaysia [8, 9]. One study from sub-Saharan Africa mostly focused on the sources of new medical information for students, without emphasis on understanding their pespectives on EBM and abilityto accessandinterpret literature-a keytenet of EBM [10].
In this study, we set out to evaluate the information seeking practices of medical student learners in a sub-Saharan LMIC setting that uses a PBL curriculum. Through a cross-sectional study, we sought to: (a) establish the sources of medical information of clinical year medical students at the study institution; (b) determine factors influencing choice of source of medical information among clinical year medical students; and (c) use clinical epidemiology as a use case to assess knowledge of the core clinical epidemiology concepts.

Methods

Study site: This study was conducted at Moi University School of Medicine (MUSOM) in Uasin Gishu County in western Kenya. MUSOM was established in 1988 and is the second largest of the eight medical schools in Kenya by student population, with 993 undergraduate and postgraduate students. The school offers PBL- and SDL-based medical curriculum which heavily relies on the Student-centered, Problem-based, Integrated, Community-based, Elective and Systematic (SPICES) model [11]. In this model, the students (often with minimum supervision from faculty) engage in continuous search for literature/medical information to achieve specific objectives set out in their curriculum. The expectation is that students develop necessary skills to access, interpret and apply data from a wide range of sources both for their hospital practice and overall learning experience.
During their clinical years, students at MUSOM pursue activities within the community under the Community Based Education and Service (COBES) program [12]. MUSOM is also linked to Moi Teaching and Referral Hospital (MTRH), that is one of three public national referral hospitals in Kenya, serving a catchment area of 20 million inhabitants of Western Kenya.

Study population: This study targeted medical students in the clinical years, namely fourth, fifth- and sixth-year students for a sample size of 263 students. We excluded students who declined to participate in the study, those who did not complete the study evaluation, and those who participated in the pilot study.

Study implementation: Our study was designed as a descriptive cross-sectional survey for the whole target study population. The survey used was adapted from the validated EBM questionnaire from the British Medical Journal [13]. In addition to using components of the EBM questionnaire, the following modifications were made to it: a section on bio data, ownership of electronic devices, sources of general medical information, sources of drug information, challenges in accessing medical information and factors affecting choice of medical information source were adopted. It should be noted that drug information is a key subset of medical knowledge relevant to student education, and was used as a surrogate to assess student information seeking skills. A clinical epidemiology quiz was included. It comprised of three multiple choice questions testing basic clinical epidemiology concepts such as sensitivity, specificity, prevalence, incidence, bias and the different types of studies. Five sets of questions were randomly attached to the questionnaires.
The modified survey was pre-tested during a pilot study carried out among ten clinical year medical students randomly selected during grand round sessions in July of 2016 to determine its feasibility, accuracy, appropriateness and applicability as a data collection tool to meet the objectives of the evaluation. Participants in the pilot study were not included in the main study. Modifications to the survey were made based on the pilot results.
The cross-sectional survey of all clinical year medical students was conducted from August to November2016. The self-administered paper-based survey was distributed to students during classes and also during other class-wide activities. Informed written consent was sought from potential study participants. Students were made aware that partipation in the survey was voluntary, and that all their responses would remain anonymous and would only be presented in aggregate anonymized format as part of the study. Completing the survey was approximated to take 15 minutes. Completed surveys were returned to a trained research personnel in the participant's own time within a week due to strict class schedules. To avoid duplication of responses, respondents were tracked on a paper-based master-list which was destroyed at the end of data collection by being shredded two months after completion of data collection. Completed surveys were evaluated for inconsistencies, errors and omissions by one investigator [O.O.C] and data was cross-checked by a second investigator [O.L]. Questionnaires found to have errors and inconsistencies were excluded from the study while those that were incomplete only in part were retained for analysis of duly filled sections after discussion and reaching consensus. The study was approved by the Institutional Review and Ethics Committee at Moi University School of Medicine, Eldoret, Kenya.

Data analysis: The survey data was analyzed using Statistical Package for Scientific Studies (SPSS) program version 20 (Armonk, New York). We used descriptive statistics such as mean and standard deviation for age and the clinical epidemiology quiz score while frequency listings were used to describe categorical data. This included number of participants by year of study, gender, ownership and use of device, sources of medical information, understanding of key clinical epidemiology concepts.

Results

Table 1 summarizes the important demographic data of the study sample. Out of the 243 questionnaires that we distributed, 206 were returned giving a response rate of 84.8%. Eighty-seven (42.2%) of the participants were fourth year students, 68 (33.0%) were fifth year students and 51 (24.8%) were in the sixth year. The mean age of the respondents was 24 years. The response rate by year was 80.1%, 85.0% and 68.0% for fourth, fifth and sixth year respectively. Eighty-four-point nine percent of the respondents (175) owned both a laptop and a smartphone, and only a small percentage had either a laptop (6.8%) or a smartphone (8.3%) only. Most importantly, 93.2% (192) of the participants had a smartphone with access to the internet and 71.8% (148) of respondents reported using primarily electronic devices to access sources of new medical information. Fifty-eight respondents (28.2%) used mostly

print materials. A further breakdown of respondents with access to electronic media showed that 96.1% (198) and 97.6% (201) respectively reported having used a laptop/desktop computer or smartphone/tablet in the preceding month to access new medical information. If given the option, 62.1% (128) of the respondents reported they would prefer accessing new medical information electronically although a significant minority 37.9% (78) preferred printed materials.

Among the study participants, textbooks were rated the most important general medical information source for medical students (47.8%, n=206) followed by lecture slides (20.9%, n=206) and Medscape® mobile application (19.9%, n=206). When queried about the reasons and frequency of accessing medical information, the participants cited the following: to get specific information on a disease e.g. pathophysiology (93.7%, n=206), to get drug information (85.4%, n=206) and to complete an assignment (84.0%, n=206). Table 2 summarizes the frequency of medical students accessing the most common sources of medical information in the month preceding the survey. More than three quarters of the students (n=206) used textbooks, lecture handouts and Medscape ® more than three times in the preceding month. Pub-Med and UpToDate® were accessed more than three times in the preceding month by 14.1% (29) and 30.6% (63) respectively of the respondents. In contrast, 53.4% (110) and 43.2% (89) of students had not accessed Pub-Med or UpToDate® in the last month. Of note, 92.2% (190) of students had not accessed Hinari, a free or very low cost biomedical journal access application for not-for-profit institutions in developing countries in the month before the survey.

Table 1: Demographic variations of clinical year medical students at Moi University School of Medicine in Eldoret, Kenya between August and November 2016. Number of respondents with the sample population percentage.

Variable	Measure
Gender	No. (%)
Male	98 (47.6)
Female	108 (52.4)
Year of study	No. (%)
Fourth year	87 (42.2)
Fifth year	68 (33.0)
Sixth year	51 (24.8)
Fee payment mode	No. (%)
Government sponsored	175 (85.0)
Privately sponsored	31 (15.0)
Age in years, mean (SD)	24 (2.09)

Abbreviations: SD, standard deviation.

Table 2: Frequency of access of different sources of medical information over the preceding month by fourth, fifth and sixth (clinical) year medical students at Moi University School of Medicine in Eldoret, Kenya between August and November 2016 (n=206). Actual number denoted and percentages represented in parenthesis.

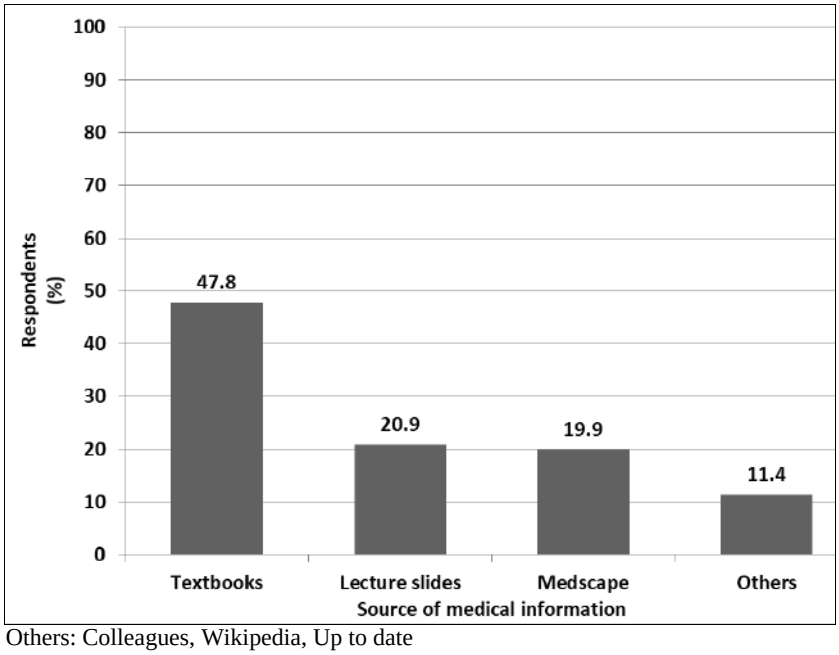
Source of medical information	Frequency of access of medical information sources over the last one month No. (%)		
	Never	Once-Twice	More than three times
Textbooks	8 (3.9)	34 (16.5)	164 (79.6)
MoH Guidelines	42 (20.4)	74 (35.9)	90 (43.7)
Pub-Med	110 (53.4)	67 (32.5)	29 (14.1)
Wikipedia	14 (6.8)	52 (25.2)	140 (68.0)
Lecture slides	5 (2.4)	26 (12.6)	175 (85.0)
Medscape	6 (2.9)	27 (13.1)	173 (84.0)
Colleagues/Peers	7 (3.4)	39 (18.9)	160 (77.7)
Up to Date	89 (43.2)	54 (26.2)	63 (30.6)
Hinari	190 (92.2)	10 (4.9)	6 (2.9)

Abbreviations: MoH means Ministry of Health

The analysis of medication use information strategies showed that the most important drug information sources included Medscape (35.0%), textbooks (17.5%), hospital protocols (17.0%) and lecture slides (16.0%). Respondents' reasons for accessing drug information and their sources of information are summarized in Table 3 and Figure 1 respectively. Ease of access was considered as the most important factor when choosing a source of new medical information (98.5%) followed by reliability (92.2%), user friendliness (87.9%) and affordability (59.7%). In regard to drug information use, medication dosage and side effects were cited most frequently as the reason for accessing sources of drug information while drug cost and safety issues during pregnancy and breastfeeding were considered least.

Table 3: Reasons for accessing sources of drug information by fourth, fifth and sixth (clinical) year medical students at Moi University School of Medicine in Eldoret, Kenya between August and November 2016 (n=206).

Reason for accessing drug information source	Respondents who consider a specific reason No. (%)				
	Never	Almost never	Sometimes	Almost every time	Every time
Cost of medication	98 (47.6)	47 (22.8)	55 (26.7)	6 (2.9)	0 (0.0)
Safety in pregnancy	16 (7.8)	18 (8.7)	135 (65.5)	26 (12.6)	11 (5.3)
Use when breastfeeding	18 (8.7)	23 (11.2)	127 (61.7)	27 (13.1)	11 (5.3)
Pharmacokinetics	5 (2.4)	11 (5.3)	41 (19.9)	98 (47.6)	51 (24.8)
Dosage	3 (1.5)	2 (1.0)	23 (11.2)	74 (35.9)	104 (50.5)
Side effects	0 (0.0)	2 (1.0)	25 (12.1)	66 (32.0)	113 (54.9)
Drug interactions	4 (1.9)	9 (4.4)	51 (24.8)	71 (34.5)	71 (34.5)
Dose adjustment in renal or hepatic failure	7 (3.4)	24 (11.7)	72 (35.0)	54 (26.2)	49 (23.8)
Drug formulation	4 (1.9)	13 (6.3)	64 (13.1)	51 (24.8)	74 (35.9)



Others: Colleagues, Wikipedia, Up to date

Fig 1: Most important medical information sources among fourth, fifth and sixth (clinical) year medical students at Moi University School of Medicine by percentage, Eldoret, Kenya, August-November 2016. (n=201 respondents)

Participants identified the following as major challenges in accessing on-line medical information: cost (72.3%), lack of time (52.9%), lack of adequate training (51.5%). Despite 70.4% (145) of the respondents rating themselves as good to excellent in searching and interpreting research findings, 78.2% (161) of the participants felt they would benefit from additional training in critical appraisal.

A significant proportion of the participants did not understand technical terms used frequently in EBM sources of information but indicated an interest in additional learning opportunities. Meta-analysis, odds ratio, and confidence interval were the least understood terms. Table 4 summarizes self-reported understanding of various clinical epidemiology terms. The average score on a three-question key clinical epidemiology concept quiz was 49.2% (SD, 23.8).

Table 4: Understanding of key clinical epidemiology terms among fourth, fifth and sixth (clinical) year medical students at Moi University School of Medicine in Eldoret, Kenya between August and November 2016 (n=206). Percentages are in parenthesis.

Clinical Epidemiology term	Respondents who understand a specific clinical epidemiology term No. (%)		
	Don't understand but would like to	Some understanding	Fully understand and could explain to others
Relative risk	43 (20.9)	99 (48.1)	64 (31.1)
Absolute risk	41 (19.9)	89 (43.2)	76 (36.9)
Systematic review	60 (29.1)	80 (38.8)	66 (32.0)
Odds ratio	138 (67.0)	56 (27.2)	12 (5.8)
Meta-analysis	145 (70.4)	46 (22.3)	15 (7.3)
Clinical effectiveness	39 (18.9)	97 (47.1)	70 (34.0)
Number needed to treat	80 (38.8)	77 (37.4)	49 (23.8)
Confidence interval	126 (61.2)	59 (28.6)	21 (10.2)
Heterogeneity	104 (50.5)	68 (33.0)	34 (16.5)
Publication bias	67 (32.5)	84 (40.8)	55 (26.7)

Discussion

The rapid expansion of medical knowledge and the revolution in electronic technology make it imperative for physicians to be facile with the use of dynamic sources of medical information. Our study reveals that most of the respondents still rely heavily on standard textbooks accessed either by print or electronic means as their most important source of general medical information. This is consistent with studies both in East Africa and elsewhere in the world [9, 10, 14-16]. During their clinical training years, medical students at our institution used resources such as Pub-Med, Hinari and UpToDate® at a significantly lower rate, a finding similar to a study in Peru; a low-middle income country in South-America where higher access rates to textbooks, government guidelines and lecture hand-outs were reported [17]. While they are broadly accessible, (mostly as free electronic copies that can be shared easily), standard textbooks do not represent the emerging "state of the art" for medical information due to the rapidly accelerating pace of new medical knowledge. In addition, textbooks may have less contextual validity for students in low- and middle-income countries since they potentially lack information relevant to medical education and practice in these settings. This is perhaps most true for epidemiologic data. In our view, the over reliance on standard textbooks by clinical year medical students at our institution and similar medical schools in resource limited countries poses a challenge in the practice of EBM. Medical students should be able to not only access but also utilize up to date medical information in patient care and education. This is particularly true for medical schools which have adopted a PBL curriculum.

We have already expressed the opinion that information seeking patterns in medication use are a paradigm for medical information access in general. Medication use information forms a key sub-set of medical information

critical to high quality medical care in any setting. The finding that Medscape® mobile application was the most used source of drug information in our cohort represents a welcome departure from what has been described in the East African region where colleague opinion, literature from pharmaceutical companies and hard copy printed research publications were the most popular sources of drug information [18]. Our findings were consistent with a study in Malaysia where Medscape® was widely used by hospital pharmacists [19]. Medscape® and the Medscape Drug Reference include current, peer reviewed and objective medical and drug information. According to its founder, George Lundberg, the former editor of the Journal of the American Medical Association, Medscape® represents a "publishing platform on the Internet for credible original educational content and an aggregator-distributor of carefully chosen selections from the world of medical literature" [20]. Similar to a study carried out in Uganda, our study cohort placed greatest emphasis on pharmacokinetics, dosage, side effects and drug interactions [21]. While these areas of drug use are undoubtedly critical in ensuring drug safety, the less frequent attention to dosage adjustment in renal and hepatic failure, safe prescribing in pregnancy and medication use in mothers who are breastfeeding are less favorable features of our analysis. Also, while we acknowledge that the participants were medical students transitioning from basic science training and probably more eager to master dosage interaction and side effects, these results should inform future interventions in improving drug education in the medical curriculum. Medical educators in low- and middle-income settings should particularly highlight the importance of learning about dosage adjustment in organ dysfunction. Another concerning finding would be the low number of searches specific to drug cost. While accurate drug costs specific to Kenya or East Africa may be difficult to locate, Kenya's position among the top ten countries with the largest populations of the extremely poor makes it hard to argue against the value of cost-sensitive prescription of drugs.[22] Sustained effort in sub–Saharan Africa to assess suitability of in hospital use of mobile applications such as Medscape®, PubMed, Hinari and Up To Date® is required. Particular focus is needed on broader utilization of free, widely accessible evidence-based drug information. Furthermore, greater emphasis should be placed on the use of primary literature, including journals and research articles which reflect the most current scientific evidence to guide quality patient care.

The noted prominent use of laptops and smartphones among the study participants reflects a growing world-wide trend of the emergence of information technology as a critical component of medical education and practice [23-28]. The benefits of this transition are intuitive- quick, accessible and user-friendly access to information [23, 28]. Additionally, use of mobile devices offers the opportunity to access the most up to date information [29]. In this regard, the already widespread adoption of internet enabled mobile phones by medical students is a critical step towards guaranteeing access to EBM sources. However, the benefits of enhanced use of mobile devices in real time should be balanced against the potential for distraction from direct patient care and the potential negative appearance it has for patients and colleagues [30]. It is not known the extent to which patients perceive that health care professionals using smartphones during face-to-face encounters are accessing medical information and not conducting non-medical activities. As the use of smartphones in medicine rapidly expands to include vision and hearing assessment, photographic and video documentation of physical examination findings and applications to support personalized medicine and patient education, guidelines will be necessary to ensure appropriate and efficient use of mobile devices by medical students.

Challenges faced in accessing new medical information included cost, lack of time and lack of adequate training in literature searching contributing to a trend shown by other studies in sub-Saharan Africa [10, 31]. A majority (70%, n=206) of the students rated themselves as good to excellent in searching and interpreting literature but still felt they would benefit from additional training in critical appraisal. This is in line with more authorities advocating for greater emphasis on teaching methodologies forsearching, analyzing and synthesizing medical information to guide clinical decision making [32, 33]. In an attempt to link these methodologies to the broader concept of fostering EBM practice, we attempted to briefly assess the respondents' understanding of core concepts of clinical epidemiology. It is noteworthy that a significant proportion of the medical students reported poor understanding of basic technical terms found in EBM sources of information. This concern is underscored by the low scores on the clinical epidemiology quiz.

We can identify several limitations of this study. First, although we assured participants that their questionnaire responses would be anonymized and held in confidence, participants may have been embarrassed or reluctant to share their experiences and practices thereby creating the potential for inaccurate responses. Second, we acknowledge that despite a career in medicine being a lifelong learning journey where one will end up independently seeking knowledge, the study was carried out at a medical school which has adopted a PBL curriculum, results may not be generalizable to an institution with a different curriculum model.

Notwithstanding these limitations, we conclude that our study population and findings are representative of learners and the current status of information gathering in a resource limited setting. In any setting, we maintain that medical professionals at the start of their careers face a daunting task in making sense of the vast and increasingly complex body of biomedical literature. Fortunately, EBM and its tenets are critical tools to increase the confidence of learners across the continuum in appraising and using the literature.[34] Medical educators and faculty in low resource settings might benefit from greater collaboration with medical educators around the world to share best practices and successful models on the journey to incorporating EBM in practice [17]. In our institution, the culmination of these efforts will be the effective partnering of problem-based learning with consistent reliance on EBM and increased real-time use of knowledge from the internet.

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