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Research Article

Availability of Various Categories of Drug-Related Information among Free Drug Databases: Survey of First Professional Year Students

DeAna Smalls[1], Ositadinma B. Akaeme[1], Bisrat Hailemeskel[2*], Mary Maneno[2]

[1]Department of Pharmacy, Howard University, Washington, USA

[2]Department of Clinical and Administrative Pharmacy Sciences, Howard University, Washington, USA

[*]**Correspondence Author:** Bisrat Hailemeskel, Department of Clinical and Administrative Pharmacy Sciences, & Co-Director for International Grants, College of Pharmacy, Howard University, 2300 4th Street, NW Washington, DC 20059, USA. Tel: +1-2028064214; Fax: +1-2028064478; Email: bhailemeskel@Howard.edu

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Abstract

Objective: To determine the availability of drug related information on six open access drug information websites

Methods: First year pharmacy students at Howard University College of Pharmacy were asked to answer several drug related questions using each of the six databases and determine whether the information was present on the website

Results: Of the six websites utilized by the 38 students of the first-year class, RxList.com, WebMD.com. and Drugs.com had the highest frequency of availability of drug related information. Of the drug information questions, disease condition, drug interactions, and dosing information were the most frequently found among the first-year students.

Conclusion: From this study, RxList.com proved to have the most information available regarding common drug information queries. However, due to the small sample size, a larger study is needed in order to increase the validity of the results.

Introduction

Drug information databases are online tools utilized by clinicians, consumers, and students to look up therapeutic data, guidelines, and therapy options to relay to consumers and other health care professionals. In fact, a survey of junior medical officers found that utilization of online resources is typically the first approach when seeking medical advice. The most frequent information accessed by these resources dealt with medication related inquiries [1]. Pharmacy students in particular are taught early during their matriculation how to access and optimally utilize these databases to retrieve accurate drug and clinical information in a timely fashion. It has been shown that electronic references are among most preferred resources, especially among young pharmacists. These sources are most commonly utilized for common drug information [2]. Studies show that pharmacy students frequently use drug information, especially during rotations to access clinical data pertaining to their patients. Though the more commonly used sites are those that are subscription based, students tend to utilize sites that are free for them to use. These sites include both those paid for by their institution or those that are free to download via a mobile app [3]. This trend is applicable to current pharmacists as well.

A study from 2014 showed that out of 5973 pharmacists, 48% use a handheld electronic device to access drug information databases, the majority accessing these databases daily. And of the ones who do not use these handheld devices, the main reason for this was access to computer based drug information databases [4]. Though there are several options students can choose from, these drug information databases are not equal in terms of their accessibility and quality of their information [3]. Various studies have emerged examining the differences in some of the most common databases used. One such an example includes a study published by Kevin et al in 2007 [5]. In this study, seven databases (Clinical pharmacology, Epocrates online premium, Epocrates online free, RxList, Facts and Comparisons 4.0, Lexi-Comp Online, and Micromedex) were compared based on 15 categories of drug information questions (dosing, interactions, mechanism of action, side effects, OTC information, etc.) that were considered important to healthcare professionals. Weighted questions were present in each category and answers to each question was verified against at

least one gold standard resource and scored accordingly.

The results of the study showed that Clinical Pharmacology, Micromedex, and Lexi-Comp had the highest composite scores and highest amount of comprehensive data. At the conclusion of this study, it was determined that subscription databases provided a broader scope of information compared to free databases ($p < 0.01$). Studies like this are important when clinicians and students are deciding what database to use to provide the most reliable information in clinical practice. These results are consistent throughout other studies as well where, compared to other databases, Lexi-comp is considered the most preferred and most reliable [6]. Studies analyzing what online database is superior in terms of utilization and completeness of information are of interest with those involved in drug informatics. Though there have been studies evaluating the quality of databases, they mainly focus on subscription-based sites. In this study we will examine availability of information on six free access websites as well as the opinions of pharmacy students when it comes to accessing and utilizing these databases.

Methods

First year pharmacy students at Howard University College of Pharmacy, a class containing a total of 38 students, were instructed to evaluate six websites as part of their Drug Informatics course which is a two-credit hour mandatory course for all entering professional pharmacy students. The project was given as a part of the course assignment. Students were given several standard drug information questions to answer using all of the websites and rate their findings as yes or no depending on the availability of the information to answer the questions given. Six websites are included in this study. These websites are:

- Rxlist.com-WebMD owned and operated site that provides full prescribing information and patient education for US prescription medications [7].
- WebMD.com-a site ran physicians, journalists, and community moderators offers health related information and community support [8].
- Drugs.com-Provides prescription drug information and news for professionals and consumers [9].
- Medscape.com- provides the latest medical news and expert perspectives, essential point-of-care drug and disease information, and relevant professional education [10].
- MedicineNet.com-an online, healthcare media publishing company that provides authoritative medical information. Owned and operated by WebMD [11].
- MayoClinic.org-a nonprofit organization that focuses on patient care, research, and education [12].

The majority of these sites are geared specifically towards health care practitioners and contain an interface that caters to their health-related inquiries [13]. These sites were evaluated based on their availability of drug information. This information requested included: disease information, dosing information, drug identification/imprint, access to medical dictionary, information related to diagnostic procedure/tests, drug-food interactions, and drug-drug interactions Students were given a survey and instructed to mark either yes, indicating that the information was present, or no, indicating that the information was absent. Differences in the availability of information between the six sites were then evaluated using a binomial distribution via SPSS.

Results

See (Tables 1-4)

Table 1: Descriptive statistics of the study population.

Descriptive Statistics	
Age (N = 35)	In years
Mean	24.51+3.584
Range	20 - 39
Gender (N = 38)	Percentage
Male	39.50%
Female	60.50%
Work Experience (N = 38)	
Has worked before	60.50%
Never Worked	28.90%
Prior Degree (N= 38)	
Degree	71.10%
No Prior Degree	13.20%

Table 2: Summary of drug information availability for free access drug databases by participant's response.

Information Retrieved on	Database	Yes (able to find information)			
		No.	Percentage	P-value	Average
Disease Conditions	RxList.com	35	92.10%	0.039	
	WebMD.com	38	100.00%	0	
	Drugs.com	31	81.60%	0.5	
	Medscape.com	38	100.00%	0	
	MedicineNet.com	38	100.00%	0	
	MayoClinic.org	36	94.70%	0.011	94.73%
Dose and Dosage Information	RxList.com	33	86.80%	0	
	WebMD.com	33	86.80%	0.2	
	Drugs.com	36	94.70%	0.011	
	Medscape.com	38	100.00%	0	
	MedicineNet.com	28	73.70%	0	
	MayoClinic.org	30	78.90%	0	86.82%
Identification of tablet or capsule by their imprints	RxList.com	35	92.10%	0.039	
	WebMD.com	30	78.90%	0.5	
	Drugs.com	35	92.10%	0.039	
	Medscape.com	29	76.30%	0.345	
	MedicineNet.com	3	7.90%	0.039	
	MayoClinic.org	2	5.30%	0.011	58.77%
Access to A Dictionary	RxList.com	35	92.10%	0.039	
	WebMD.com	27	71.10%	0	
	Drugs.com	32	84.20%	0.34	
	Medscape.com	10	26.30%	0.216	
	MedicineNet.com	34	89.50%	0.099	
	MayoClinic.org	8	21.10%	0.5	64.05%
Information on Diagnosis	RxList.com	31	81.60%	0.5	
	WebMD.com	32	84.20%	0.34	
	Drugs.com	20	52.60%	0	
	Medscape.com	34	89.50%	0.099	
	MedicineNet.com	29	76.30%	0.345	
	MayoClinic.org	36	94.70%	0.011	79.82%
Information on two or multiple Drug, herb, and nutrient Interactions	RxList.com	35	92.10%	0.039	
	WebMD.com	35	92.10%	0.039	
	Drugs.com	36	94.70%	0.011	
	Medscape.com	36	94.70%	0.011	
	MedicineNet.com	29	76.30%	0.345	
	MayoClinic.org	29	76.30%	0.345	87.70%

Table 3: Summary of drug information availability for free access drug databases by health information websites.

	Disease	Dose	Identification	Dictionary	Diagnosis	Drug Interaction	Average	RANK in all Categories
RxList.com	92.1	86.8	92.1	92.1	81.6	92.1	89.47	1
WebMD.com	100	86.8	78.9	71.1	84.2	92.1	85.52	2
Drugs.com	81.6	94.7	92.1	84.2	52.6	94.7	83.32	3
Medscape.com	100	100	76.3	26.3	89.5	94.7	81.13	4
MedicineNet.com	100	73.7	7.9	89.5	76.3	76.6	70.67	5
MayoClinic.org	94.7	78.9	5.3	21.1	94.7	76.3	61.83	6
Average	94.73	86.82	58.77	64.05	79.82	87.75	78.66	

Table 4: Summary of drug information availability for all health information websites included in this study.

Average	Information on Disease conditions	Dose and Dosage Frequency Information	Identification of tablets or capsules by their imprints	Direct Access to a medical Dictionary	Information of disease or illness diagnosis	Information on Drug Interaction on two or more drug s	Average
For All six Health Information Websites	94.73%	86.82%	58.77%	64.05%	79.82%	87.75%	78.66%

Table 5: Summary of drug information availability for all health information websites included in this study.

A total of 38 first professional year pharmacy students participated in this study and they were given assignment to access the various websites included in this study. Of these students, the majority (60.5%) were female. The average age of the participants was 24.5 years (SD+3.584). Over 60% of students have held a pharmacy related job, while 71.1% of students obtained another degree prior to enrollment in to our pharmacy program. The six websites were compared using a binomial distribution. The frequency in which students were able to find the designated information and the significance of these findings are displayed in (Tables 3-5). Of the six websites, it was determined that RxList had an overall better performance across all categories of information requested comparing to the other websites evaluated in this study. Information obtained from RxList website was significant for each of the drug information topics, except for information related to diagnosis (disease; $p = 0.039$, dose; $p = 0$, drug interactions; $p = 0.039$, medical dictionary; $p = 0.039$, drug identification; $p = 0.039$) thereby favoring RxList for all of the aforementioned topics.

In contrast, Mayo Clinic, Medscape and Medicine Net were the poorest performers in this study. Medscape only showed significant results for three drug information topics (disease; $p = 0.00$, drug interaction; $p = 0.039$, and dose; $p = 0.00$). Medicine Net also showed significant results for three topics (disease; $p = 0$, dose; $p = 0$, and drug identification; $p = 0.039$). Several sites scored significantly lower than expected in certain topics. For drug identification, Medicine Net ($p = 0.039$) and Mayo Clinic ($p = 0.011$) both had significantly lower availability compared to the other four sites. Access to Medical dictionary also showed significantly low score for both Medscape ($p = 0.00$) and Mayo Clinic ($p = 0.00$). Drugs.com also showed to have significantly low availability when it came to diagnosis ($p = 0.00$). In regard to the types of information available on these sites, the percentage of students who were able to find the requested information was recorded for each site. The average of these percentages was then found in order to determine the overall frequency of certain drug information across all the free drug databases. It was found that information of disease condition (94.73%), drug interactions (87.75%), and dosing (86.82%) were the top three types of information available on these websites. The drug information that was found the least amongst these six sites was tablet identification (58.77%).

Discussion

Drug information websites are key tools utilized by consumers, health care providers, and students. The availability of information on these sites are crucial in times when quick data retrieval is needed. Though these sites are similar, however, the availability of drug information varies from site to site. Therefore, our study examined the availability of common drug information queries on six common drug information databases. After comparing the results of the questionnaire completed by first professional year pharmacy students, it was determined that RxList preformed the highest compared to the other sites, indicating that drug information is more readily available and accessible from this site. In contrast, Medicine Net and Mayo Clinic were among the lowest performers in accessing drug

information, both showing significantly low performance in 3 of the 6 drug information topic areas tested in this study.

Though there are other articles that compare the availability and the accuracy of information provided by various drug information databases, the primary focus of these articles was comparing subscription-based websites versus free databases based on student's feedback. In each of these instances cited in the previous section, subscription-based sites outperformed the free databases, thus our study provides a unique perspective by focusing on the information provided by free databases only. These results are similar to a study conducted in 1999 by Hatfiled which examined the quality of consumer information provided by four sites, including RxList and Medicine Net, based on drug information on the top 30 drugs at the time [14]. The results of this study showed that RxList and Medicine Net were the top performers. Of the two, however, RxList out performed Medicine Net in terms of both documentation and accuracy of drug information [14].

On another hand, a study similar to the 2007 by Keven et al. study was conducted in 2008, focusing on the use of drug information websites for clinical decision making in infectious disease cases via their ability to answer 147 questions, as well as the completeness of their answers [5,15]. Though our study reached a similar conclusion, determining that subscription-based sites outperformed free databases in terms of completeness and availability overall, Medscape Drug Reference was among some of the top performers when it came to both study outcomes.[10] In contrast to our study, though Medscape performed well in almost all areas of drug information, it fell short with the medical dictionary section, having only 26.3% of students being able to find the information. As far as performance goes, our results also contradict the findings of a 2009 study that looked at the completeness and accuracy of drug information sites as it pertains to methotrexate. In this study, though WebMD was ranked higher than Drugs.com and Medicine Net by Google, at the conclusion of the study it was found that Drugs.com and Medicine Net both outperformed WebMD in terms of completeness and accuracy of information on methotrexate [16]. Though most of the information was available on the listed sites, what we did not measure was the completeness and the accuracy of the information retrieved.

In reviewing all the databases, the most common type of information students was able to access are information on disease conditions, information on two or more drug/herb/nutrient interactions, and dose and dosage information. However, the least type of information available were related to identification of tablets or capsules by their imprint, and direct access to a medical dictionary (see Table 5). There were several limitations to our study. First, our study sample was very small composing of only 38 students. This limits the power of our study and may cause skewness in our results. Second, students in the study were a part of a drug informatics course. Before the survey, they were taught how to utilize various drug information databases to achieve optimal search results. Therefore, these results may not be applicable to patients or other users without training in drug information retrieval. However, since the students are well versed in informatics, these results could provide a truer reflection of the type of information available on the sites since those who have less training could find it more difficult to access the information. Finally, this survey was presented as a graded assignment to students in the drug information class. This could affect the quality of the information found since student's main motivation for finding the information could be to achieve a high grade.

Conclusion

This study reports the finding from student's assignment on the presence or availably of various categories of drug related information among six consumer-based free internet based health information websites. The websites included in this study were RxList, WebMD, Drugs.com, Medscape, Medicine Net, and MayoClinic.org. based on the participants rating, RxList ranked the highest in all categories in this study. Medicine Net and MayoClinic.org ranked the bottom. The most commonly found information among all the websites studied were related to disease conditions, dose and dosage information, and drug interaction reports. However, a larger study with more number study participants may be needed before making a solid conclusion.

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