Review Article

A Review of Common Internet-Based Drug Interaction Information Resources and Survey of Students Opinion

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Abstract

Purpose: A drug interaction is a reaction that occurs when a substance (usually a drug) affects the activity of another drug when both are administered together. The importance of drug interactions in the administering of patient healthcare cannot be over emphasized enough. Drug interaction resources are very important tools used by clinicians worldwide in the detection and management of drug interactions. This study was done to compare six common drug-drug Interaction internet-based programs that are consumer oriented in order to see which is better at helping detect clinically important drug to drug interactions based on students' opinion.

Methods: Data was collected from first professional pharmacy students who enrolled to take a Drug Information Course as a part their curriculum. The data collected was then entered SPSS software for analysis. Descriptive statistical data based on their work experience, level of degree obtained, gender and whether or not they were able to find information in a particular category across each website was also collected. The data for each website was then compared against each other using different methods of statistical analysis such as the Wilcoxon Signed Rank Test and Binomial Tests to detect significance among the databases. Data was screened for outliers. All analysis was conducted using SPSS at an alpha of 0.05.

Results: Data was collected on a total of 38 professional pharmacy students, 15 males and 23 females. About 71% of the students reported having at least a bachelor's degree while 13.2% said they didn't have a degree. (This 13.2% participated in bridge programs so they didn't need to obtain a bachelor's degree before gaining admission into pharmacy school). About 60.5% of the students said they had work experience while 28.9% said that they had no prior work experience. From the results, its clearly obvious that among all of the six free data websites that are studied in this project, the students found Medscape and Drugs.com to be the best at finding information regarding drug interactions as over 94.7% of the students in both cases said that they were able to find needed information.

Conclusions: Drug interaction is one the major preventable drug related misadventures. Resources that are used to check drug interactions are key tools to potentially minimize such undesirable effects of drugs. Six websites are selected, and students were given the opportunity to navigate and rate each website based on their opinion. Based on the ranking obtained, Drugs.com and Medscape ranked the highest among the other websites included in this study. However, a further study is needed with a larger sample size. Since these websites are constantly getting updated and similar studies to be done periodically is recommended.

Introduction

A drug interaction is a reaction that occurs when a substance (usually a drug) affects the activity of another drug when both are administered together. This action can be synergistic (when the drug's effect is increased) or antagonistic (when the drug's effect is decreased) or a new effect can be produced that neither produces on its own. Typically, when we say drug interactions, the first thing that comes to mind is interaction between drugs (drug-drug interaction) first. However, drug interactions may1 also exist between drugs and foods (drug-food interactions), drug-lab, drug-disease, as well as herb-drug interactions. An example of drug-food interaction would be taking antidepressant drugs such as monoamine oxidase inhibitors with food containing tyramine which may lead to hypertensive crisis [1].

The importance of drug interactions cannot be over emphasized enough. Drug interaction screening tools are very important tools to be used by clinicians worldwide in the detection and management of drug interactions. However, clinicians should be aware of the advantages and limitations of these websites and software programs such as those mentioned later in this article. Some of these limitations being that they do not take into consideration that the dosage of certain drugs combined might cause an interaction that otherwise would not have happened if standard dosages were used.

In this study, we compared the ability of six common drug-drug Interaction internet-based programs that are consumer oriented to detect clinically important drug to drug interactions. The following is a brief description of each website that was used in this report. In the past numerous studies have been conducted that focused on evaluating drug interaction software programs such as the one conducted by Vonbach Priska [2]. However, these websites go through constant updates and periodic study is critical. The website programs selected for this study include Medscape, RxList and Drugs.com.

WebMD (https://www.webmd.com)

This website is an American corporation known primarily as an online publisher of news and information pertaining to human health and well-being. The site includes information pertaining to drugs and drug related issues. It is one of the top healthcare websites as rated by unique visitors. Its headquarters is in New York City, NY and was founded in 1996 by internet entrepreneur Jeff Arnold. WebMD uses a drug interaction checker which can allow an individual to cross check as many drugs as possible and can check herbal supplements as well as over the counter medications [3].

Drugs.com (https://www.drugs.com)

This website is an online pharmaceutical encyclopedia which provides drug information for consumers and healthcare professionals, primarily in the USA. It was founded on September 2001. The Drugs.com website is owned and operated by the Drug Site Trust, which is a privately held trust administered by two New Zealand pharmacists, Karen Ann and Phillip James Thornton. Drugs.com also has a drug interaction checker but also gives one the ability to save their lists for future reference [4].

RxList.com (https://www.rxlist.com)

This website was founded in 1995 by Dr Neil Sandow a pharmacist and is a very popular online medical resource of US prescription medications providing full prescribing information and patient education. RxList is an owned and operated site in the WebMD Consumer Network and was acquired by WebMD in December 2004. Rxlist has a drug interaction checker which also categorizes the severity of the interaction by labeling them as contraindicated, serious, significant and minor [5].

Medscape.com (https://www.medscape.com)

Medscape is a website providing access to medical information for clinicians; the organization also provides continuing education for physicians and health professionals. They offer educational credit hours to nurses, physicians and pharmacists. It references medical journal articles, Continuing Medical Education, a version of the National Library of Medicine's MEDLINE database, medical news, and drug information (Medscape Drug Reference). Medscape was launched in 1995 by SCP Communications, Inc. under the direction of its CEO Peter Frishauf. Medscape similar to WebMD allows one cross check as many drugs as possible and can check herbal supplements as well as over the counter medications [6].

Medicine Net (https://www.medicinenet.com)

This website is a medical website that provides information about diseases, conditions, medications and general health. MedicineNet.com launched in 1995. William Shiel co-founded Medicine Net and continues today as the Chief Medical Editor. Medicine Net is an owned and operated site in the WebMD Consumer Network and was acquired by WebMD in December 2004. [7]

Mayo Clinic (https://www.mayoclinic.org)

Mayo Clinic is a website of Web professionals, medical reviewers, subject matter experts and other content contributors who collaborate to ensure accurate, relevant and actionable information to provide site visitors with access to the knowledge, experiences and services of Mayo Clinic. Unlike the other websites, Mayo clinic and Medicine were not elaborate in their description of drug interactions on their websites. [8]

Methods of Research

Data was collected from 38 professional pharmacy students who enrolled to take a Drug Information Course as a part their

curriculum. The students chosen to participate in this project were all first professional year students because that's when the course drug information is usually held. The students were given a question related to drug interaction and asked to navigate each website to answer the questions. Students worked independently and were required to submit their findings to receive a grade for the activity. After answering the questions, students were also required to give their opinion based on their experiences in navigating the sites. The data collected was then entered SPSS software for analysis. A descriptive statistical data we obtained that was based on their work experience, level of degree obtained, gender and whether or not they were able to find information in a particular category across each website.

The data for each website is then compared against each other using different methods of statistical analysis such as the Wilcoxon Signed Rank Test and Binomial Tests to detect significance factors among the databases. Data was screened for outliers. All analysis was conducted using SPSS at an alpha of 0.05. Each website was evaluated on a specific category and it was determined that if 80% or more of the students were able to find information in that specific category that website was considered as highly effective. Beside checking drug interactions among the list of drugs give, students were asked their opinion regarding the friendliness of the website. Some of the questions asked were "Were you able to locate information easily? Was the information provided detailed and delivered in a concise manner?"

Results

Data was collected on a total of 38 professional pharmacy students, 15 males and 23 females. About 71% of the students reported having at least a bachelor's degree while 13.2% said they didn't have a degree. (This 13.2% participated in bridge programs so they didn't need to obtain a bachelor's degree before gaining admission into pharmacy school). About 60.5% of the students said they had pharmacy-related work experience before joining the pharmacy program while 28.9% said that they had no prior work experience. The following table summarizes statistical breakdown of the student's responses in whether they were able to find information on drug interactions across the six free data websites aforementioned earlier (Tables 1,2).

Table 1: The summary of response to the question stated as, "Where you able to find information on the drug interaction questions given to you?".

Websites	Yes (Able to find information)	No (Not Able to find information)
RxList	92.10%	7.90%
WebMD	92.10%	7.90%
Drugs.com	94.70%	5.30%
Medscape	94.70%	5.30%
Medicine	76.30%	23.70%
Mayo	76.30%	23.70%

Table 1: The summary of response to the question stated as, "Where you able to find information on the drug interaction questions given to you?".

From the results, its clearly obvious that among all the six free data websites that were included in this project, the students ranked Medscape and Drugs.com to be the best at finding information sites regarding drug interactions as over 94.7% of the students in both cases said that they were able to find information.

Table 2: Summary of Which Free Data Website Was More Significant using Binomial test.

Website	Test Proportion	Exact Sig (1-Tailed)
RxInter	0.8	0.039
WebMD	0.8	0.039
Drugs.Com	0.8	0.011
Medscape	0.8	0.011
Medicine Net	0.8	0.345
Mayo Clinic	0.8	0.345

We used a Binomial Test and set our test proportion at 0.80 indicating that any website that showed significance meant that over 80% of that students were able to find vital information on drug interactions on that website.

Discussion

Drug Interaction screening websites are widely used to identify potentially harmful drug interactions in the inpatient and outpatient setting. This study sought to compare the strength of randomly selected six free data websites based on their ability to give information regarding drug interactions based on the responses of 38 pharmacy students at Howard University College of Pharmacy. Out of 38 students, 36 of students showed cohesively that the websites Medscape and Drugs.com were far superior than their counterparts in finding information related to drug interactions. On the other hand, MedicineNet and MayoClinic proved be the least effective in finding drug interaction information given the fact that only 76.3% of the students said they were able to find information. A similar study like ours was conducted by a group of researchers published in 2014 [7]. In this study, a systematic electronic literature search was conducted with the following search terms: "database" and "software," and "drug-drug interactions" and "database," and the inclusion and exclusion criteria were applied in order to identify the publications of interest. The authors chose 38 publications that meet their inclusion criteria.

According to their report, the most commonly used software with the highest reliability and consistency was Micromedex® Drug-Reax. This database gives information about clinical consequences of the interaction, classifies underlying mechanism and onset of the adverse outcome (either rapid, or delayed) as well as severity (such as minor, moderate, or major), and provides the level of evidence which supports this information. The authors also found similar information is also provided by Drug Interaction Facts®, Lexi-Interact®, and Pharmavista® [7]. Another study similar to this was also conducted at the Department of Clinical Pharmacology and Toxicology, HUG, Geneva. In this study, they compared the ability of four programs to detect clinically important DDI [8]. Sixty-two random drug pairs were compared with 12 drug random drug pairs without clinically important Drug to Drug interactions and were tested together. In this study, Lexi-Interact and Epocrates were reported to be the most sensitive (95%) compared to the Compendium (a reference book that contains drug monographs and numerous features which help healthcare professionals prescribe and use drugs safely and appropriately) and Theriaque (a French medical website) (80 and 73%, respectively).

The Compendium and Theriaque also showed the lowest negative predictive value. All programs showed high specificity and positive predictive value [8]. That notwithstanding, the difference in these studies is that neither focused on student's opinions but were all fact based. Besides this, most of the databases included the study mentioned are subscription-based. In our study, we chose database and websites that are accessible for free and target the consumer. However, it is notable to point out that students have various computer and navigation skills which may affect their opinion rating these websites. The assignment was also graded, and a score was given which may affect how student's opinion is biased. Also, the sample size is small another study with a larger sample size may be recommended.

Conclusion

In this study, professional pharmacy students were asked to answer several selected drug information questions related to drug interaction using the most common consumer-based health information resources on the internet. The study was done as a part of the Drug Information course, which is a mandatory course for all the students. A total of 38 students participated in the study. The websites included in this study were RxList.com, WebMD, Drugs.com, Medscape.com, MedicineNet.com and MayoClinic. The scores for each website was tabulated, and binomial test was run to see for significance. Based on the results, Drugs.Com and Medscape were better at showing drug interactions than others according to our results. However further improvement is still needed in the design of drug interaction websites to ensure that the results that are delivered are accurate and replicable scientifically.

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