Use of Resource Algorithms by Undergraduate Students in a Drug Information Center

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ABSTRACT. The objective of this project was to implement drug information (DI) resource algorithms to facilitate appropriate resource selection by students for use in a DI Center. Algorithms were developed for three common categories of DI requests. Current undergraduate students were surveyed to assess self-reported ability to select and utilize appropriate DI resources. Students were then provided training in use of algorithms for certain categories of DI requests. A follow-up survey to assess the same parameters as the baseline survey was distributed after approximately six weeks of algorithm use. Pre-exposure surveys indicated that students felt confident in the ability to find and interpret DI. Post-exposure surveys indicated only minimal changes in student assessed parameters. There were no significant improvements in student perception of ability to find information in any category except that of compatibility/stability, and no change in ability to interpret information in any category. It appears that the provision of faculty-constructed algorithms did not significantly impact student perception of ability to find or interpret most drug information.

KEYWORDS. Algorithm, drug information, resource selection

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BACKGROUND

There has been some theoretical discussion of the place of algorithms in medical education (1), but there is limited information about the use of algorithms as a pharmacy teaching tool (2, 3). The published information regarding use of algorithms in pharmacy education is focused specifically on use in medicinal chemistry courses, and is descriptive in nature without an attempt to assess the value as a learning tool. There have also been surveys of the content of drug information (DI) curricula between colleges of pharmacy, but these surveys did not assess methods by which this information was taught (4). A literature search did not yield any published assessment or evaluation of algorithm use for teaching DI.

It has been suggested that an algorithm can serve as a useful teaching tool to help students in the development of a step-wise process for completing a general learning objective. When considering the role of algorithms in DI, the optimal scenario would involve each student developing his or her own individual process for DI retrieval and analysis. However, students early in the curriculum may have difficulty formulating this stepwise approach, due to the integration of DI lectures across the curriculum. Students may not recall key tertiary resources presented early in the curriculum, or may not yet have been exposed to helpful references for certain categories of requests.

It was theorized that providing an algorithm to guide in selection of initial resources would benefit students by decreasing the time required to formulate a response (due to a decrease in the time required to identify appropriate resources) and increase student confidence in the ability to find information. It was not expected that algorithms would impact student ability to interpret information.

SETTING

The Drug Information Center (DIC) at Ohio Northern University (ONU) responds to requests from both healthcare professionals and the lay public. The center is located on the university campus and is not affiliated with any healthcare system. The center is staffed by three pharmacy faculty and a number of pharmacy undergraduate students. The students do not have any specific training in DI skills before employment. Students participate by taking questions from requestors and performing searches for needed information. The process of responding to questions is closely supervised by pharmacy faculty, with final responses being ap-

proved and discussed with a faculty member prior to dissemination. However, much of the decision as to how to design search strategy initially is left to the student worker.

Students that work in the center range from their first to their fifth years of pharmacy school (on a zero to six curriculum). Due to the fact that the DI component of the curriculum is incorporated throughout the first three years of education, student workers are at different points in the development of their DI skills. During the first year of pharmacy school, students are exposed to tertiary references. The second year exposes students to use of secondary databases and some retrieval of primary literature; it is not until the third year that students have enough understanding of clinical aspects of pharmacy to begin analysis of the primary literature.

METHODS

Drug information requests for a two month time period were examined to determine the most common categories of requests. Classification of request categories was based on the classifications provided in the student's drug information text, Drug Information: A Guide for Pharmacists (5). The two most common request categories over that period of time were tablet/capsule identifications and adverse drug reactions. Those categories were selected as topics for algorithm development. Later an additional algorithm (compatibility/stability) was developed for one category of requests, based on the low-student confidence rating from the pre-exposure survey.

The algorithms were developed by one faculty member, with feedback and recommendations from other DI faculty. The basic listing of resources for each category of requests was based on recommendations from the student's textbook (5), adjusted to reflect resources available at the DIC or from other on-campus locations. Students were directed in a stepwise fashion from general tertiary literature (if appropriate) to specific tertiary literature to relevant secondary databases and then to alternative drug information sources. Ranking of utility of similar resources was based primarily on faculty experience and consensus as to ease of use and depth of information.

Pre-exposure and post-exposure surveys were prepared to administer to student workers. Surveys assessed student confidence in finding resources to address each category of request as well as ability to interpret information found. Students were also asked to self-assess the quality of

responses that they prepared and time taken to respond to a DI request. Additionally demographic information regarding year of school and years working in the DIC was collected. The post-exposure survey also asked students to indicate on a four point Likert scale the utility of any algorithms used.

Each academic quarter DI workers have a mini-training session, introducing newly acquired resources or policies and outlining goals for the upcoming quarter. Before this training session the pre-exposure survey was sent out via e-mail to all DI workers, completed surveys were printed and returned anonymously to the DIC administrative assistant. During the training session the algorithms were introduced and students were shown how to use them. No additional training or encouragement for use was provided by DI faculty. Approximately six weeks later a post-exposure survey was again distributed and collected as before. During the survey period eight additional DI workers were hired. They also received the post-exposure survey; however, they were not part of the original sample so their responses were disregarded.

This study was approved by the ONU social sciences investigational review board. Data were managed by SPSS 11.0. Mean pre-exposure and post-exposure values were measured by paired Wilcoxon Signed Ranks Test.

RESULTS

Pre-exposure surveys were distributed to 28 students and responses were obtained from 21 students providing a 75.0% response rate. Most respondents were in their 3rd year of school (range 1-5) and had 2.5 years of experience in DI (range 1-5). In general, students felt confident in their ability to find information in all categories. The categories in which confidence was highest (based on a 5 point Likert scale) included tablet identification and adverse drug reactions (see Table 1). The Likert scale ranged from 1 = Very Unsure to 5 = Very Confident. When ranking comfort with ability to interpret information found (on a similar 5 point Likert scale), students were most comfortable again with tablet identification and adverse drug reaction and least comfortable with compatibility/stability information (see Table 2). Respondents indicated that the average amount of time spent working on a single DI request was between 30 and 45 minutes (see Table 3). Self-rated quality of response (on a 4 point scale) was generally high, with 57% considering

TABLE 1. Student Rated Ability to Find Information Resources

Request Category	Pre-Exposure Ranking ±SD (n = 21)	Post-Exposure Ranking ±SD (n = 14)	P Value
Adverse drug reaction	4.3 ± 0.86	4.0 ± 0.87	0.218
Compatibility/stability	2.9 ± 0.93	3.5 ± 0.75	0.083
Dietary supplement	3.5 ± 0.83	3.9 ± 0.86	0.380
Drug/lab test interactions	3.1 ± 1.16	3.2 ± 0.89	0.271
Foreign drug identification	3.7 ± 1.2	3.6 ± 1.4	0.804
Investigational drug	2.9 ± 1.2	3.1 ± 1.02	0.617
Pregnancy	4.0 ± 1.1	3.9 ± 0.95	0.776
Tablet identification	4.8 ± 0.52	4.7 ± 0.61	0.257
Therapeutic use	3.6 ± 1.3	3.5 ± 1.3	0.721

Scale utilized was 1 = Very Unsure to 5 = Very Sure.

TABLE 2. Student Rated Ability to Interpret Information

Request Category	Pre-Exposure Ranking ±SD (n = 21)	Post-Exposure Ranking ±SD (n = 14)	P Value
Adverse drug reaction	4.3 ± 0.73	4.1 ± 0.73	0.366
Compatibility/stability	3.0 ± 1.0	3.6 ± 0.93	0.180
Dietary supplement	3.7 ± 0.81	3.9 ± 0.61	0.851
Drug/lab test interactions	3.4 ± 1.0	3.3 ± 0.91	0.943
Foreign drug identification	3.7 ± 1.0	4.0 ± 1.0	0.588
Investigational drug	3.0 ± 0.94	3.1 ± 0.9	0.854
Pregnancy	4.1 ± 0.76	3.5 ± 0.76	0.047*
Tablet identification	4.9 ± 0.37	4.6 ± 0.50	0.102
Therapeutic use	3.6 ± 1.3	3.6 ± 0.94	0.884

Scale utilized was 1 = Very unsure to 5 = Very sure.

*p value < 0.05 considered significant.

their responses "above average," 24% rating themselves "excellent" and the remainder rating as "average."

The post-exposure survey was given to 36 students (including the 8 additional employees), and responses were provided by 18 students (50%). After excluding responses from new employees (based on response to demographic question regarding length of time working in DIC) the number of usable responses was 14 (28.9%). Student demographics were similar, with most respondents in the 3rd year of school and 2.5 years of DI expe-

TABLE 3. Student Reported Time Spent Responding to Requests

Time Range Spent	Pre-Exposure (n = 21)	Post-Exposure (n = 14)
<15 minutes	0	0
15-30 minutes	4	1
31-45 minutes	10	7
46-60 minutes	4	6
61-90 minutes	1	0
>90 minutes	0	0

rience. Students felt most confident in abilities to find information for tablet identification and adverse drug reaction requests (see Table 1). Students also felt comfortable in their ability to interpret information about these categories (see Table 2). After the intervention students again reported spending an average of 30-45 (range 15-60) minutes responding to requests and still ranked their responses as of "above average" quality. Of the 14 respondents, 7 had used the algorithms (50%), and all rated them as "very helpful" (3 respondents) or "somewhat helpful" (4 respondents) on the provided four point Likert scale.

Mean scores for ability to find information for the three categories where algorithms were provided were compared by Wilcoxon signed ranks test. There was no significant change in ability to find information in any of the surveyed categories.

Ability to interpret information was not significantly affected by provision of algorithms. There was a statistically significant change ($p = 0.047$) in the student-rated ability to interpret information about medication use in pregnancy.

Due to the small sample size an association between algorithm use and years of student experience or years in school. The data describing the number of DI years experience in the algorithm use group are provided in Table 4.

DISCUSSION

Comparing the results between pre- and post-intervention results is difficult due to the small sample size. Overall it seems that the provision of faculty-constructed algorithms did not appear to significantly impact student ability to either find information or student-perceived ability to interpret information for DI requests.

TABLE 4. Years of DI Work Experience for Algorithm Users

	Use of Algorithm	No Use of Algorithm
1 year	1	1
2 years	2	3
3 years	3	2
4 years	0	0
5 years	1	1
Total (n)	7	7

It is interesting to note that students had the highest self-rated ability to find and interpret information in the categories of adverse drug reaction and tablet identification, the most commonly received categories of questions. This may reflect the impact of reference familiarity on student confidence. These are also two categories of questions which typically have fairly clear responses, with less need to clinically assimilate and evaluate data than other types of questions. Other questions such as therapeutic questions require greater interpretation of information and application to a specific patient, while tablet identification questions generally have only one response and there is minimal need to account for patient issues.

There were decreases reported in the ability to find and interpret information for several categories of requests. The decreases noted may be due to a number of factors. Students may have been exposed to new resources which may have required different searching strategies, affecting their ability to find information. Students may also have gained a greater understanding of the clinical issues surrounding some DI requests, and that may have impacted their self-perceived ability to interpret information. Specifically in the pregnancy category, topics in coursework may have introduced new ethical issues that students may not have previously considered. It is also possible that exposure to "real" DI questions with real patients, as opposed to exposure to resources via assignments, may have affected the students' confidence in their ability to interpret some information, reflecting a more mature understanding of the question complexity. It is also recognized that these small changes, due to the scale used, may not represent a clinically significant change.

LIMITATIONS

There were several limitations to the survey design, which might have impacted the quality of responses. The most significant limitation is the small sample size, raising the possibility of a beta error. The population selected for survey participation included only students working in the DIC, so those students may have had greater experience using the resources than other students; however, due to the fact that the resources are introduced stepwise over the curriculum this may not be a concern.

Some students may not have accurately responded to the question regarding amount of time required to respond to DI requests due to social acceptability of some response options. Students may have feared that indicating a longer time to respond to requests might be perceived as lower competence. Similar problems with social acceptability may have occurred with the student-rated quality of DI response. Possibly the provision of more varied response options may have attained a more accurate response. Additionally question difficulty would affect time to formulate a response and no attempt was made to evaluate this in the survey tool.

Some students may not have responded to both surveys, therefore, compromising the validity of comparisons between pre-exposure responses and post-exposure responses. To preserve respondent confidentiality there was no attempt to determine specifically which students returned each survey.

Also there was no attempt made to determine the actual amount of time spent performing DI work, beyond asking how many years the student had been employed in the DIC. The number of hours students work per quarter may vary from 1 to 6 hours a week, and no attempt was made to quantify hours worked. Students who worked a greater number of hours may have become more confident and comfortable using and interpreting information.

It is also possible that the question seeking information about the students' ability to interpret information found may have been unclear. Students may not have recognized that interpreting information is different from locating/finding information. The question also may not have been phrased appropriately to accurately assess student comfort/ability in interpreting information. However, this concern may not be valid due to the fact that average responses did differ between the score finding information and interpreting information.

CONCLUSIONS

This project examined student-assessed changes in the ability to find and interpret information necessary to respond to drug information requests in a functioning DIC. Although the small number of responders and the limited number of algorithms developed and introduced may have affected results, the study was not able to show a statistically significant difference in student ability to either find information or perceived ability to interpret information in most areas. The exception to this may be in areas where the student has had limited or no exposure to the topic in the series of coursework.

This lack of impact may indicate that students must formulate their own algorithms to receive maximal benefit from this learning tool. This would indicate that the development of the algorithm itself is the learning process.

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