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The educational role of clinical informationist on improving clinical education among medical students: Based on Kirkpatrick model

Marzieh Tahmasebi[1], Peyman Adibi[2], Firoozeh Zare-Farashbandi[3], Ahmad Papi[1,4], Alireza Rahimi[3]

Abstract:

INTRODUCTION: Due to time constraints and a significant increase in medical information, one of the ways to keep physicians and medical teams up to date is to use evidence-based medicine. The current research focused on the effects of the educational role of clinical informationist (CI) on improving clinical education among medical students based on the Kirkpatrick (KP) model.

METHODS: The method was semiexperimental research in two group designed with pretest and posttest. The research population included thirty medical students for each group that was selected by the convenience time-based sequential sampling method. The study data were collected using a researcher-made two questionnaires and a checklist. Data were analyzed by the descriptive statistics and inferential statistics using SPSS version 20 software.

RESULTS: Based on the first level of the KP model, the total mean of medical students' satisfaction in the experimental group was 4.06 from 5. Based on the second, third, and fourth levels of the model, the independent *t*-test showed that before the intervention, the mean scores of attitude, knowledge, information-seeking skills and behaviors, and also clinical skills were not significantly different in both the intervention and control groups ($P > 0.05$). After the intervention, the results of covariance test showed that attitude, knowledge, information-seeking skills and behaviors, and also clinical skills of the intervention group are significantly better than that of the control group ($P < 0.001$).

CONCLUSION: Training and the presence of the CIs in the clinical round had resulted in the improved satisfaction, attitude, knowledge, and information-seeking skills while also improving information-seeking behaviors and clinical skills of medical students.

Keywords:

Clinical education, clinical informationist, clinical librarian, educational program, medical students

[1]Department of Medical Library and Information Sciences, School of Management and Medical Information Sciences, Isfahan University of Medical Sciences, [2]Integrative Functional Gastroenterology Research Center, Isfahan University of Medical Sciences, [3]Health Information Technology Research Center, Isfahan University of Medical Sciences, Isfahan, [4]Department of Medical Library and Information Sciences, Virtual School, Tehran University of Medical Sciences, Tehran, Iran

Address for correspondence:
Dr. Alireza Rahimi, Health Information Technology Research Center, Isfahan University of Medical Sciences, Isfahan, Iran. E-mail: a_rahimi@mng.mui.ac.ir

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Introduction

Based on time constraints and the significant increase in medical information, one of the methods for offering up-to-date information to physicians and medical teams is the use of evidence-based medicine.[1] Evidence-based medicine and the need for credible information have created a new role for clinical librarians in medical teams as the clinical informationist (CI).[2] Today, various educational, research, and clinical roles have been defined for CI.[3-6] Some of the advantages of CI's presence in medical team include better patient care, better training for physicians and medical teams, saving time, reduced treatment cost, and improved sharing of information.[7,8]

Studies have also indicated low information-seeking abilities in physicians while emphasizing the need for learning

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new and numerous skills.[9,10] Therefore, the need for teaching and development of information searching, evaluation, and sharing skills is evident to have access to necessary information and the evidence in diagnosis, treatment, and medical education.[11] It appears that teaching information-seeking skills is one of the most important roles of clinical librarians and the CIs in today's medical context.[9,12,13]

Many studies concluded that with the help of clinical librarians improve users' attitudes, knowledge, skills, and information behavior. The clinical librarians' abilities increase physicians' desire for the accessibility and seeking of medical information and saving valuable.[5,14-16] It is necessary that clinical informationist to be present a permanent member in medical teams. At the end of any educational program, it is necessary to evaluate the results to determine the value of the program. The final goal in the evaluation of educational programs is to judge and decide possible continuation, change, or elimination of the program based on its results. The Donald Kirkpatrick (KP) model is one of the widely known models for evaluation of educational programs which include four levels (reaction, learning, behavior, and results) [Figure 1].[17]

The aim of the study is to investigate the educational role of the CI on improving clinical education among medical students using the KP evaluation model.

Methods

This was an applied study using semiexperimental research with intervention and control groups and pre and posttests approach. The study population consisted of all medical students spending their Exterm period in the Department of Gastroenterology at Al-Zahra hospital in Isfahan, which consisted of a total of 296 students in the year 2018. Sample size was determined using equation $n = \frac{(Z_1 + Z_2)^2 (2S^2)}{d^2}$, to be at least 28 students in each group. A total of thirty students placed in each group (thirty students in the intervention and thirty in the control groups) were selected using convenience time-based sequential sampling method.

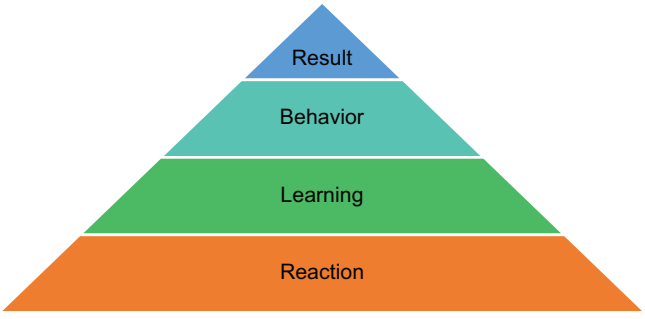


Figure 1: Different levels of Kirkpatrick pyramid[17]

Two researcher-made questionnaires and one checklist were used for data gathering. The first questionnaire consisted of 49 items related to attitude, information-seeking behavior, and clinical skills scored using a five-point Likert scale and ten four-choice questions related to knowledge. The second questionnaire included 27 items related to satisfaction which was scored using the five-point Likert scale. The checklist consisted of 5 yes/no questions and one question related to the information seeking duration which measured medical students' information-seeking skills. Furthermore, two different clinical questions were written down for database search. The validity of tools was confirmed by experts, and their reliability was determined using Cronbach's Alpha coefficient (0.76 for attitude, information-seeking behaviors, and clinical skill questions, 0.72 for knowledge questions, and 0.91 for satisfaction questions). The scores for satisfaction, attitude, information-seeking skills and behavior and also clinical skills were calculated from 5 and the knowledge score was calculated from twenty.

The CI's educational intervention was carried out for 10 days. The first questionnaire was answered by the control and intervention groups. Medical students in all groups were faced with a clinical question and were asked to search for its answers. The checklist was then filled based on their results by the CI. The various training rounds were provided by the CI to the intervention group included the identification of type of clinical questions, formulation of clinical questions, use of search operators, knowledge of databases with emphasis on the specialized clinical databases, and methods for evaluation, filtering, storage and management of the information. CI used different educational methods such as the face-to-face training, lectures, group discussions, leaflets, workshops, and use of virtual social networks (e.g., Telegram and WhatsApp) to train the intervention group members in information-seeking skills.

To inform the CI about the content and concept of the clinical question and enable students to provide the necessary education, the CI participated in clinical round along with the intervention group. The clinical questions presented by the intervention group were recorded, and methods of searching for answers were taught to the intervention group.

After the end of daily clinical round, the CI held a daily educational workshop for the members of the intervention group based on a predefined schedule. The schedule for the workshop conducted by the CI included introduction to different types of clinical questions,

search techniques, introduction to relevant databases such as Up to Date, DynaMed Plus, Trip database, Medscape, Clinical Key, PubMed, Scopus and Web of Science, Cochrane Library, and ProQuest as well as local databases consist of SID, Magiran, NOPA, and Barakat.

Another part of the educational intervention was carried out using Telegram and WhatsApp. A total of nine educational messages, leaflets, introduction to relevant applications such as Up to Date, Medscape, and Darooyab as well as articles, guidelines, images and videos related to clinical questions were sent to the intervention group. The intervention group was also able to ask their question from CI using virtual social networks without any time limitations.

After the educational intervention, the first questionnaire was again answered by both the intervention and control groups. A unified clinical question (different from the clinical question in the pretest) was searched by the intervention and control groups, and checklist was filled based on their answers. The second questionnaire regarding satisfaction was only answered by the intervention group. Data were analyzed by the descriptive statistics and inferential statistics using SPSS 20 software. This study was approved by the Research Ethics Committee at Isfahan University of Medical Sciences (Ethical code = IR.MUI.REC.1396.908).

Results

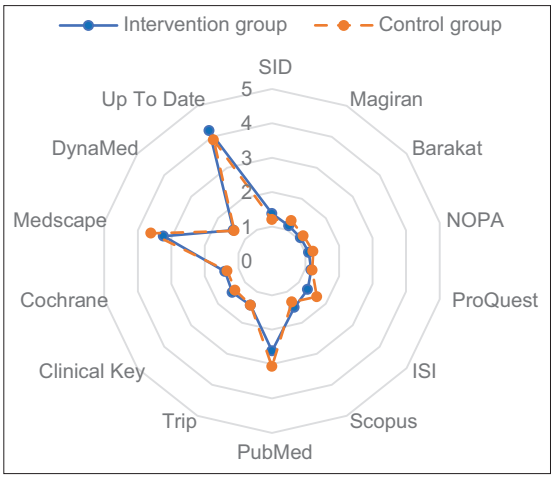
A total of 53.3% of the intervention group and 56.7% of the control group were female. The results of the Chi-square test showed that there was no statistically significant difference between gender distribution of intervention and control groups (P = 0.795). The next section presents the findings regarding the four levels of the KP model.

First level: Reaction

The mean total satisfaction score for the medical students in the intervention group was 4.06 (±0.455). Since these results are measured in the Likert's scale, this value indicates high satisfaction of the intervention group regarding CI educational program. The highest satisfaction mean scores belonged to the program content 4.34 (±0.551), educator 4.23 (±0.659), teaching method 3.85 (±0.470), and the educational facilities and the equipment 3.64 (±0/872).

Second level: Learning (attitude, knowledge, and skill)

Graphs 1 and 2 show the attitudes of intervention and control groups toward information databases before and after the intervention. Before the intervention, the attitude toward the different databases is almost similar in both groups, but the attitude of the intervention group toward databases is positive after the intervention.



Graph 1: The average attitude score toward various information databases before intervention

To better understand the attitudes of the intervention and control groups toward various databases, these databases were divided based on their aim and content to three categories of the local databases (e.g., Magiran, SID, NOPA, and Barakat), the reference databases (e.g., ProQuest, Scopus, and ISI), and the specialized clinical databases (e.g., Cochrane, Clinical Key, Trip, PubMed, Up to Date, DynaMed, and Medscape) [Table 1].

The results of independent t-test showed that there is no significant difference between the attitude scores of control and the intervention groups before the intervention (P = 0.706). The results of covariance analysis test showed that the attitude scores are significantly higher in the intervention group compared to the control group after the intervention (P < 0.001). The changes in attitude scores of the intervention group after intervention were from highest to lowest toward the specialized clinical databases, the reference databases, and finally, the local databases [Table 1].

The results of independent t-test showed that the knowledge score has no significant difference between the control and intervention groups before the intervention (P = 0.738). The results of covariance analysis test showed that after the intervention, the knowledge score of the intervention group was significantly higher than that of the control group (P < 0.001) [Table 2].

Table 3 shows the number of students who have given correct answers in each of the five components (formulation of clinical question, database use, correct database selection, improving search results, and access to information). The results of independent t-test

Table 1: Attitude score toward various information databases

Database types	Before intervention, mean±SD		After intervention, mean±SD		*P*, PES
	Intervention group	Control group	Intervention group	Control group	
Local databases	1.16±0.296	1.22±0.492	2.54±0.876	1.25±0.471	<00.01**, 0.483
Reference databases	1.33±0.580	1.40±0.707	2.96±0.845	1.37±0.585	<00.01**, 0.595
Specialized clinical databases	2.26±0.625	2.30±0.623	3.52±0.547	2.29±0.662	<00.01**, 0.625
Average total	1.75±0.446	1.80±0.523	3.12±0.584	1.80±0.523	
P, PES	0.706*		<0.001**, 0.659		

**P*=Independent samples *t*-test, ***P*=ANCOVA. PES=Partial eta squared, SD=Standard deviation

Table 2: Knowledge score regarding information sources

Time	Mean±SD		*P*
	Intervention group	Control group	
Before intervention	3.57±1.832	3.73±1.999	0.738*
After intervention	14.47±4.208	2.87±2.013	<0.001**, 0.769

**P*=Independent samples *t*-test, ***P*=ANCOVA. PES=Partial eta squared, SD=Standard deviation

showed that there was no significant difference between information-seeking skills score of the control and intervention groups before the intervention ($P = 0.564$). After the intervention, the results of covariance analysis test showed that the information-seeking skills' score of the intervention group in all five components is significantly higher than that of the control group ($P < 0.001$) [Table 3].

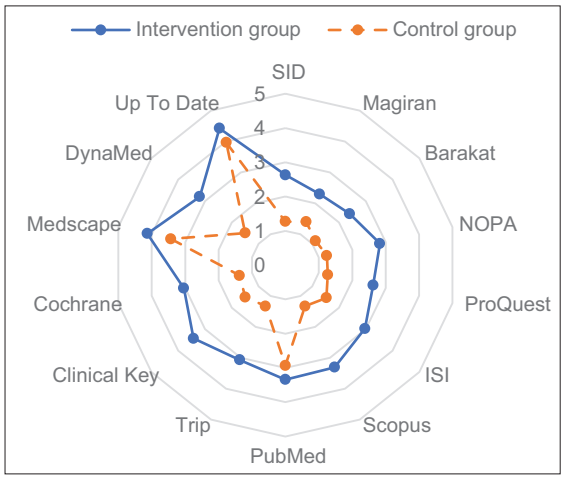
Furthermore, the search duration in the intervention group was 6 min before intervention and 1.17 min after the intervention. On the other hand, average search duration for the control group was 4.23 min before the intervention and 3.03 min after intervention. The results of independent *t*-test showed that before the intervention, there was no significant difference between search duration of the intervention and control groups ($P = 0.062$). However, the results of covariance test showed that after the intervention, the search duration of the intervention group was significantly shorter than that of the control group ($P < 0.001$).

Third level: Behavior

The results of independent *t*-test showed that there was no significant difference between information-seeking behaviors of the intervention and control groups before the intervention ($P = 0.693$). However, after the intervention, the results of covariance test showed that information-seeking behavior of the intervention group is significantly better than that of control group ($P < 0.001$) [Table 4].

Fourth level: Results

The results of independent *t*-test showed that the clinical skills scores of the intervention and control groups were not significantly different before the intervention ($P = 0.102$). The results of the covariance test after the intervention showed that the clinical skills' score of intervention group is significantly higher than that of the control group ($P < 0.001$). The results of the Mann–Whitney test showed that after the educational intervention, the clinical skills of the intervention group in several dimensions including use of evidence in diagnosis, selection of treatment methods, selection of diagnosis methods, and problem-solving skills increased compared to the control group [Table 5].



Graph 2: The average attitude score toward various information databases after intervention

Discussion

Based on the first level of the KP model, the intervention group had high satisfaction regarding the implemented CI educational program in dimensions of content, educator, teaching method and facilities and equipment. These results are similar to those reported by Cheng,[15] Swinglehurst *et al*.,[3] and Grefsheim *et al*.[6] which showed the high satisfaction toward CI participation, demeaning constant CI presence.

The results of the second level of the KP model shows that the attitude of the intervention group toward electronic resources was low before the intervention with only positive attitudes being toward the PubMed, Up to Date, and Medscape. These results are similar to those reported by Zare[11] and Hashemian *et al*.[18] Zare,[11]

Table 3: Information-seeking skills' scores

Components	Before intervention, frequency (%)		After intervention, frequency (%)		
	Intervention group	Control group	Intervention group	Control group	*P* (Fisher's exact test)
Formulation of clinical question	8 (26.7)	9 (30)	30 (100)	15 (50)	<0.001
Database use	17 (56.7)	15 (50)	30 (100)	17 (56.7)	<0.001
Correct database selection	16 (53.3)	12 (40)	30 (100)	16 (53.3)	<0.001
Improving search results	10 (33.3)	12 (40)	29 (96.7)	11 (36.7)	<0.001
Access to information	9 (30)	4 (13.3)	30 (100)	11 (36.7)	<0.001
Average±SD	2±1.983	1.73±1.552	4.97±0.183	2.33±1.971	
P, PES	0.564*		<0.001**, 0.501		

**P*=Independent samples *t*-test, ***P*=ANCOVA. PES=Partial eta squared, SD=Standard deviation

Table 4: Information-seeking behavior scores

Time	Mean±SD		*P*
	Intervention group	Control group	
Before intervention	2.98±0.320	3.01±0.347	0.693*
After intervention	3.40±0.314	2.93±0.333	<0.001**, 0.511

**P*=Independent samples *t*-test, ***P*=ANCOVA. PES=Partial eta squared, SD=Standard deviation

in her study, showed that physicians are less likely to search in specialized medicine databases for their information and are instead more likely to use PubMed database. Hashemian *et al*.,[18] in their findings, reported that the largest level of familiarity among the research community was with Up to Date database. After the CI intervention, the attitude of the intervention group toward databases improved and moved toward more specialized clinical databases.

The results indicated that the knowledge of the intervention group has increased after the presence of CI in rounds and the implementation of the educational program. These results are similar to the findings by McGowan,[19] Linda *et al*.,[14] and Cheng[15] who showed that presence of CI and subsequent training can increase the knowledge of research community regarding the application and use of information databases.

The CI educational intervention has resulted in an increase in information-seeking skills in the intervention group which in turn resulted in the better formulation of clinical questions, increased use of databases, and higher skills in the evaluation and improving search results among the participants. The training provided for the members of the intervention group also resulted in saving time. These results are similar to the conclusions by McGowan,[19] Cheng,[15] Linda *et al*.,[14] Aitken *et al*.,[20] Just,[21] Perrier *et al*.,[22] and Swanberg *et al*.[12] However, these results are in contrast to the conclusion presented by Ilic *et al*. Because of the short length of the educational workshop was only 2 h. However, the workshop was successful in improving the self-esteem of the students.[23]

Based on the third level of the KP model, after the educational intervention, the information-seeking behavior of the intervention group tended more toward the use of information databases and search. Also, the majority of medical students stated that they require access to medical information when meeting the new patients. These results are similar to the conclusions reported by Oluwaseye,[24] Cheng,[15] and Urquhart *et al*.[16] Quoting Aina, Oluwaseye[24] states that the information-seeking behavior of users depends on the education, access to library and librarians, and the time limitation of the user during search for information The current study also showed that the desire of participants in the intervention group for new information when meeting the patients increased due to the educational workshops and the presence of CI during rounds. Some studies concluded that with the help of clinical librarians, it is possible to change the information-seeking behavior and increasing the desire of physicians for searching new information.[15,16]

Based on the fourth level of the KP model, after the educational intervention, the clinical skills of the participants in the intervention group increased significantly compared to the control group. These results are similar to the results reported by Linda *et al*.,[14] Aitken *et al*.,[20] and Perrier *et al*.[22] Linda *et al*.[14] showed that the presence of clinical librarians in clinical teams has the positive effects on improving patient care, education, topic presentation, and research. Aitken *et al*.[20] showed that interventions by the clinical librarians have a positive effect on the desire to change diagnosis and treatment plans, especially on improving clinical decisions. Perrier *et al*.[22] also showed that the services provided by the CIs can help improve information-seeking skills and integration of evidence in the clinical decision-making while also reducing the hospitalization time. The study had the limitation of including the small sample size and had three innovations. First, the role of the CI in teaching information-seeking skills has been the first performed in Iran. The second, using the KP model for evaluating CI educational programs. Third, the uses of virtual social networks (e.g., Telegram and WhatsApp) in CI educational programs are of the innovations of this study.

Table 5: Clinical skills' score

Dimensions	Before intervention, mean±SD		After intervention, mean±SD		*P* (Mann-Whitney test)
	Intervention group	Control group	Intervention group	Control group	
Use of evidence in diagnosis	3.13±0.776	3.20±0.714	3.90±0.845	3.07±0.640	<0.001
Selection of treatment methods	2.67±0.711	2.57±0.728	3.73±1.048	2.70±0.750	<0.001
Selection of diagnosis methods	2.77±0.817	2.93±0.740	3.77±1.165	2.83±0.791	0.001
Problem-solving skills	2.77±0.817	3.27±0.907	2.87±0.937	3.43±0.858	0.023
Familiarity with symptoms	3.07±0.521	3.23±0.679	3.67±0.922	3.23±0.626	0.052
Interpretation of clinical information	2.97±0.615	3.30±0.596	3.07±0.583	3.33±0.606	0.110
Acquiring patient's history	3.67±0.844	3.87±0.730	3.80±0.805	3.97±0.669	0.407
Educating the patient	3.07±0.907	3.33±0.711	3.60±1.037	3.47±0.776	0.419
Physical examination method	3.32±0.612	3.47±0.681	3.53±0.730	3.50±0.938	0.874
Total average	3.04±0.436	3.24±0.472	3.54±0.482	3.28±0.460	
P	0.102*		<0.001**, 0.216		

**P*=Independent samples *t*-test, ***P*=ANCOVA. SD=Standard deviation

Conclusion

One of the important roles of the CI is the training of the information-seeking skills to medical teams. Due to the importance of access to up-to-date medical information for clinical specialists, familiarity with the medical databases and correct methods of search, retrieval, and evaluation of search results is always necessary.

The results showed that special attention should be paid to the satisfaction of the target population for the success of CI programs. Also, the findings revealed the additional facilities and equipment should be provided to assist CI in clinical settings. CI's training and the presence of in the clinical round had resulted in improved satisfaction, attitude, knowledge and information-seeking skills and behavior and also clinical skills of medical students. The results indicated that educational CI intervention has resulted in better information-seeking skills. We can also expect an increase in the use of databases for future clinical activities, decision-making, and services which can also affect both clinical decisions and clinical education. Also, evidence-based medical databases that are mostly used by medical students should be prioritized and continuously trained.

Due to the educational role of CI, we suggest that CI should have an active presence in medical teams to help educate physician, members of medical teams, and medical students in information-seeking skills. Along with their educational role, CIs can also play important clinical and research roles and answer many questions presented by the members of the medical teams.

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Conflicts of interest

There are no conflicts of interest.

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