Evidence-based Learning as a Tool of Competency Improvement for the Phlebotomist

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ABSTRACT

Nowadays, clinical laboratory service has an important role in patient care management. A quality test result must be obtained, but this can be affected by many factors. The correct process for specimen acquisition is very necessary and must be done by competent professional personnel. The objective of this study was to improve the competency of blood collection by phlebotomists through evidence-based learning. Evidence-based information gathering from nurses, medical technologists and clinical laboratory assistants was analyzed and synthesized to use as teaching material. Subjects were divided into two groups. The results showed that the trained groups of the "lecture" type and the "evidence-based" type had different levels of improvement, with the more competent group being the evidence-based one. Five out of eight assessed parameters showed significant improvement. The overall score was increased from 49.79 to 73.08 percent In addition, the evidence-based group showed their improved competency by the ability to improve the venipuncture process from 76.59 to 92.31 percent and the time to perform venipuncture per patient was reduced by 43 seconds.

Keywords: evidence-based learning, competency improvement, phlebotomist, specimen acquisition

บทคัดย่อ

ในปัจจุบันผลการวิเคราะห์ทางห้องปฏิบัติการมีความสำคัญต่อการดูแลรักษาผู้ป่วยเป็นอย่างยิ่ง ดังนั้นการรายงานผลการวิเคราะห์จึงต้องมีทั้งคุณภาพและประสิทธิภาพ และปัจจัยที่มีความสำคัญอย่างยิ่งต่อคุณภาพของผลการวิเคราะห์คือ การได้มาซึ่งสิ่งส่งตรวจด้วยความสำคัญนี้ คณะผู้วิจัยจึงได้ศึกษาวิธีการพัฒนาศักยภาพของบุคลากรที่ทำหน้าที่เก็บสิ่งส่งตรวจด้วยการเจาะเลือด โดยใช้ evidence-based learning ซึ่งสร้างบทเรียนขึ้นมาจากกรณีศึกษา และปัญหาที่เกิดขึ้นจากการทำงานของพยาบาลนักเทคนิคการแพทย์และเจ้าหน้าที่ที่ทำหน้าที่เจาะเลือดผู้ป่วย และจัดให้อบรมร่วมกัน เปรียบเทียบกับกลุ่มผู้ที่ได้รับการอบรมโดยการบรรยายเฉพาะเนื้อหาทางวิชาการ และจัดการอบรมแยกเฉพาะกลุ่ม พบว่ากลุ่มที่อบรมร่วมโดยใช้ evidence-based มีคะแนน competency test เพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติ 5 หัวข้อจาก 8 หัวข้อ

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โดยมีคะแนนรวมเพิ่มจากร้อยละ 49.79 เป็นร้อยละ 73.08 และยังพบว่าผู้เข้ารับการอบรมนำความรู้ไปปรับใช้ได้เพิ่มขึ้นจากร้อยละ 76.59 เป็นร้อยละ 92.31 ส่วนเวลาที่ใช้ในการเจาะเลือดลดลงเฉลี่ย 43 วินาทีต่อผู้ป่วย 1 คน

คำสำคัญ: evidence-based learning การพัฒนาศักยภาพผู้ทำหน้าที่เจาะเลือด การเก็บสิ่งส่งตรวจ

INTRODUCTION

It is recognized that clinical laboratory service plays an important role in patient care management. Dock (2005) reported that 70 percent of all information used by clinicians to diagnose and treat patients comes from clinical laboratory data. Therefore, there is a unique role played by the clinical laboratory in producing the quality test results for individual patients. To achieve quality test results, one must understand the whole process of clinical laboratory testing. The clinical laboratory process is composed of two main phases: the non-analytical phase and the analytical phase. The non-analytical phase is subdivided into pre-analytical and post- analytical phases. In most clinical laboratories, pre-analytical errors contributed a large proportion of the total laboratory errors (Plebani and Carraro, 1997). Since this phase involves several healthcare personnel, human errors can happen easily. In the main, nurses and clinical laboratory personnel make up the two professions involved in the pre-analytical phase. Both groups are responsible for performing specimen collections from patients. In this study, they are each called a phlebotomist.

To achieve a quality test result, the laboratory needs to obtain a good specimen that represents a real-patient situation. It has been known that there are potential errors from failure in specimen acquisition, such as incorrect patient identification, use of incorrect tubes or containers, collection of an inadequate volume or an invalid specimen, wrong time of collection, improper transport conditions and so on. Consequently, the competent phlebotomist plays an important role in the clinical laboratory setting.

Since nurses and clinical laboratory personnel have been trained in different institutions, they might have different concepts and experiences in phlebotomy. In order to correct and/or prevent errors by the phlebotomists, they must be competent and able to work accurately and effectively under stress. The performance of each individual must be "tuned to the one station". The goal of the study was to improve the competency of the phlebotomists. The training project for phlebotomists was launched by holding several meetings with both nurses and clinical laboratory personnel. Evidence-based learning was used as the training approach and evidence-based information was gathered from the participants. This valuable information was used as an important training tool. Therefore, the objective of this study was to improve the competency of blood collection by the phlebotomists using evidence-based learning.

METHODOLOGY

The participants of the current study consisted of 30 nurses and 113 clinical laboratory personnel, with the latter subdivided into 91 medical technologists and 22 clinical laboratory assistants. All participants were working actively in the clinical laboratory of either a government or private hospital.

Study instrument

A universal questionnaire on specimen acquisition was adopted and used. It was composed of two categories. The first category involved general information, such as the type of hospital, number of beds, number of daily specimens collected, experience in performing blood collection procedures, academic background, the provision of guidelines or a standard operating procedure (SOP) for blood collection, number of daily blood collections and number of accidents or near-miss events during blood collection. The second category involved several questions that related to performing the blood collection (Garza and

Becan-McBride, 1996). The questionnaire was validated by a peer group. Evidence-based information retrieved from participants was analyzed, synthesized and used as a tool of learning.

Methods

The learning process in the current study was divided into two types: the lecture and the evidence-based activities. In the first phase, the current competency on phlebotomy of participants of the so-called "lecture" group was assessed by questionnaire. In the second phase, the same questionnaire was used to determine the participants' competency in the so-called "evidence-based" group. The "evidence-based" information retrieved was analyzed, synthesized and used as a learning tool in this group, in an after-learning session and the same questionnaire was reapplied to assess their competency. A Chi-square test was used for data analysis.

RESULTS AND DISCUSSION

The total number of participants was 143, with 98 assigned to the "lecture" group and the remaining 45 to the "evidence-based" group. The "lecture" group consisted of clinical laboratory personnel who worked in a clinical laboratory. It should be noted that, in some clinical laboratories there was a small number of clinical laboratory assistants involved in the process of specimen acquisition. These personnel were under the supervision of a licensed-medical technologist, and most of them (approximately 70.41%) worked in one of 48 government hospital laboratories. However, the "evidence-based" group was quite different, with the personnel responsible for specimen collection being nurses, medical technologists and clinical laboratory assistants. This group was from the government sector including 10 government hospital laboratories and 3 small healthcare clinical laboratories.

The competency of the "lecture" group on phlebotomy was assessed with a universal specimen acquisition questionnaire. The learning concept was based on what they had previously learned via lecture classes. Various parameters were assessed that were related to the performance of phlebotomy (Table 1). It was found that the overall competency score of this group was only 55.58 percent. It must be understood that a quality test result can only be considered as very beneficial if the specimen is collected from the right patient and the rule of thumb is "sampling the right patient". Therefore, correct patient identification must be the number one concern in specimen acquisition (Lippi *et al.*, 2009). In the study, the lecture group used a technique that involved a double-active identification process.

Table 1 Competency assessment on phlebotomy of the "lecture" group

Assessed parameter	Score (mean ± SD)	Score of each parameter
1. Patient identification	1.83 ± 0.52	3
2. Skin disinfection	4.13 ± 0.93	6
3. Infection control	2.66 ± 0.91	7
4. Tourniquet application	0.82 ± 0.99	4
5. Venipuncture technique	5.60 ± 1.34	9
6. Order of tube collection	2.56 ± 1.89	5
7. Tube mixing technique	2.88 ± 0.90	4
8. Problem solving	8.30 ± 3.01	14
Total	28.88 ± 6.16	52
% of overall scores	55.58%	

SD = standard deviation.

The competency of the "evidence-based" group on phlebotomy is shown in Table 2, with the same questionnaire being used to assess their competency in both the pre-test and post-test. During the learning process, their competency was assessed by the same questionnaire as used in the previous group. Evidence-based information retrieved during the training was used as teaching material and their competency was reassessed using the same questionnaire at the end of the session.

As demonstrated in Table 2, there was a substantial improvement in competency with an increase in the overall score from 49.79 to 73.08 percent that was statistically significant ($p < .01$). The improvement in competency on phlebotomy of the "evidence-based" group was indicated in five parameters relevant to specimen acquisition, that is patient identification, infection control, venipuncture technique, order of tube collection and problem solving. There were statistically significant differences between the pre-test and post-test results of these five parameters at the $p=0.03$ level for patient identification and at the $p<.01$ level for the other four parameters (Table 2). In addition, there was a statistically significant ($p < .01$) difference between the "lecture" group and the "evidence-based" group as shown by Table 1 (% of overall scores=55.58%) and Table 2 (% of overall scores from the post-test = 73.08%).

Ability with regard to trouble shooting during blood collection is considered an important factor, so competency on problem solving was assessed in detail (Table 3). The problems that were assessed included: penetration through a vein during needle insertion, formation of hematoma, allergies to antiseptic agents, two failed attempts to draw blood, and the occurrence of nerve injury during venipuncture. It was considered that these problems had a high impact on patient safety as well as patient satisfaction. Competent phlebotomists should be capable of solving any problem in an appropriate manner.

An improvement in competency was found, with a significant ($p<.01$) increase in the percentage of overall scores on problem solving, with pre-test and post-test scores of 53.93 and 79.93 percent, respectively. The study demonstrated that the "evidence-based" learning process was a more effective tool as show in Table 2 (competency of the post-test), because the retrieved "evidence-based" information was not only gathered directly, but also analyzed and synthesized to form the teaching materials.

In addition, Table 4 demonstrates the effectiveness of training using an "evidence based" approach. There was a 15.72 percent improvement

Table 2 Competency assessment on phlebotomy of the "evidence-based" group

Assessed parameter	Pre-test (mean ± SD)	Post-test (mean ± SD)	Score of each parameter	p-value
1. Patient identification	1.40 ± 0.90	1.88 ± 0.86	3	0.03*
2. Skin disinfection	4.00 ± 0.90	4.07 ± 0.90	6	0.75
3. Infection control	3.20 ± 0.92	4.35 ± 0.85	7	<0.01*
4. Tourniquet application	1.06 ± 1.01	1.46 ± 1.07	4	0.12
5. Venipuncture technique	4.11 ± 1.54	7.34 ± 1.31	9	<0.01*
6. Order of tube collection	1.64 ± 1.86	4.54 ± 1.39	5	<0.01*
7. Tube mixing technique	2.85 ± 0.91	3.15 ± 0.82	4	0.15
8. Problem solving	7.55 ± 3.17	11.19 ± 1.74	14	<0.01*
Total	25.89 ± 5.54	38.00 ± 4.76	52	<0.01*
% of overall scores	49.79%	73.08%	-	<0.01*

SD = standard deviation.

* statistically significant.

in the venipuncture process, while the time taken to perform venipuncture was reduced by 43 seconds. This implied skill improvement which also indicated competency. The rate of accidents and/or near-misses was reduced also. Moreover, the participants were able to handle effectively several unpleasant situations, such as syncope during venipuncture, and site selection for venipuncture in a patient having IV fluid. This finding demonstrated that the evidence-based approach could improve patient care.

Evidence-based learning has been a discussion topic in education institutes for several years. In addition, medical professionals, such as physicians and nurses, have been promoting evidence-based practice. The medical technologist considers this as a challenge. Some training courses in medical technology are starting to use this concept and practice with evidence-based learning is on an upward trajectory. In the current study, the success of the evidence-based learning process was governed by several factors and benefitted from a good understanding of the concept of "No Child Left Behind", so that any retrieved evidence should be considered as important. The evidence involved real-time events that needed immediate corrective action, because such events can cause strong patient impact. Not only gathering good evidence, but also responding adequately and appropriately was very necessary. Therefore, a loop between the instructor and participants was built in as a continuous cycle and maintained with good coordination.

Retrieving information from either nurses or clinical laboratory personnel on any unpleasant events that had happened during the phlebotomy process was a difficult task, since the participants were composed of two professions that had undergone training and had practiced for a long time and developed experience. Consequently, leading them in the retrieval process required a tacit approach that was best achieved in a safe and friendly environment.

Table 3 Competency of the "evidence-based" group in problem solving related to phlebotomy

Assessed problem-solving parameter	Pre-test (mean ± SD)	Post-test (mean ± SD)	Score of each parameter	p-value
1. Occurrence of needle penetration through the vein	1.62 ± 1.26	2.62 ± 0.85	4	<0.01*
2. Formation of hematoma	2.04 ± 1.41	3.00 ± 0.00	3	<0.01*
3. Allergies to antiseptic agents	0.72 ± 0.05	1.08 ± 0.48	2	<0.01*
4. Two failed attempts to draw blood	1.45 ± 0.90	1.85 ± 0.54	2	0.04*
5. Occurrence of nerve injury during venipuncture	1.72 ± 1.50	2.65 ± 0.98	3	0.01*
Total	7.55 ± 3.17	11.19 ± 1.74	14	<0.01*
% of overall scores	53.93%	79.93%	-	<0.01*

* statistically significant.

SD = standard deviation.

Table 4 Effectiveness of "evidence based" training as an index for competency improvement

Indicator	Pre-training	Post-training
1. Modification of venipuncture process	76.59%	92.31%
2. Time for each venipuncture (minute±SD)	4.61 ± 4.92	3.90 ± 4.01
3. Accident and/or near-miss event	21.28%	19.23%

SD = standard deviation.

Finally, the enthusiasm and professionalism of the participants need to be acknowledged as great driving forces of success, with everyone looking for a quality test result leading to proper management for the patient. Moreover, competent staff is a necessary factor in the quest for quality assurance in a clinical laboratory.

CONCLUSION

The results indicated the power of "evidence-based" learning as an effective tool for training phlebotomists. The information retrieved from the participants came from real-time events during venipuncture. After careful analysis, the teaching material was synthesized and used in the training session resulting in a great improvement in the competency of the phlebotomists.

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