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A New Algorithm in Phlebotomist Education; "Intensive Training Method"

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ABSTRACT

Objective: Training of all personnel involved in health services is very important. Even though human use of developing new technological fully automatic devices has diminished much, education is still at the forefront. Training is also very important in laboratory services, especially in the pre-analytical period. We aimed to provide detailed information about the "Intensive Training Method" (ITM) and to contribute to minimizing pre-analytical laboratory errors.

Design: Pre-analytical period laboratory errors are a process that can be corrected by training. All personnel who serve as a phlebotomist, especially clinical service nurses must undergo serious training. ITM has introduced a new algorithm for these trainings. For the first time, ITM has been identified and patented by us. Besides, it was proved to be successful in a 950-bed, three-campus hospital.

In our study, firstly the basic criteria of ITM were explained and the need for ITM was discussed. Besides, the difference between routine training methods and ITM was expressed in our study.

Method: The staff who can provide ITM training has been clarified. Again, for ITM, trainers, consultants and supervisors have been explained. Finally, how ITM trainings are applied is stated.

Conclusion: Pre-analytical laboratory errors fall into the maximum percentage of all laboratory errors. The good thing that it is preventable. During this period, very serious training should be given to phlebotomists. ITM, which presents a different algorithm than routine trainings, should be evaluated in this respect.

Keywords: *Algorithm, intensive training method, phlebotomist, laboratory error, pre-analytical period*

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Flebotomist Eğitiminde Yeni Bir Algoritma; "Yoğun Eğitim Metodu"

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ÖZ

Amaç: *Sağlık hizmetlerinde yer alan tüm personelin eğitimi çok önemlidir. Yeni gelişmiş teknolojiye sahip tam otomatik cihazlar olsa da eğitim hala ön plandadır. Laboratuvar hizmetlerinde eğitim, özellikle de analiz öncesi dönemde çok önemlidir. "Yoğun Eğitim Metodu" (YEM) hakkında detaylı bilgi vermeyi ve analiz öncesi laboratuvar hatalarının en aza indirilmesine katkıda bulunmayı amaçladık.*

Tasarım: *Analitik dönem öncesi laboratuvar hataları eğitim ile düzeltilebilen bir süreçtir. Flebotomist olarak görev yapan tüm personel, özellikle klinik hizmet hemşireleri ciddi eğitim almalıdır. YEM bu eğitimler için yeni bir algoritma geliştirmiştir. YEM, ilk kez tarafımızdan tanımlanmış ve patentlenmiştir. Ayrıca 950 yataklı üç kampüslü bir hastanede başarılı olduğu kanıtlanmıştır. Çalışmamızda ilk olarak YEM'in temel kriterleri açıklanmış ve ihtiyaç tartışılmıştır. Ayrıca çalışmamızda rutin eğitim yöntemleri ile YEM arasındaki fark ifade edilmiştir.*

Metot: *YEM eğitimi verebilecek personel açıklığa kavuşturuldu. Yine YEM için eğitmenler, danışmanlar ve süpervizörler açıklanmıştır. Son olarak, YEM eğitimlerinin nasıl uygulandığı belirtildi.*

Sonuç: *Analiz öncesi laboratuvar hataları, tüm laboratuvar hatalarının maksimum yüzdesine düşmektedir. İyi olan şey, önlenebilir olmasıdır. Bu dönemde flebotomistlere çok ciddi eğitim verilmelidir. Rutin eğitimlerden farklı bir algoritma sunan YEM bu açıdan değerlendirilmelidir.*

Anahtar Kelimeler: *Algoritma, yoğun eğitim yöntemi, flebotomist, laboratuvar hatası, analitik öncesi dönem*

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1. INTRODUCTION

Intensive Training Method (ITM) is a simple and understandable method that allows easy implementation. For ITM implementation to be successful, all stakeholders must perform their duties accurately. The main objective of ITM implementation is to minimize pre-analytical laboratory errors. Trained phlebotomists and other health care teams will act more consciously through ITM. Moreover, this will be provided without additional cost to hospitals.

There are many studies about the effectiveness of the trainings given to the health teams working in the clinics, Phillips, et al. (2019). In these studies, both the contribution of the trainings to the patient satisfaction and the effectiveness of intermittent education to the health professionals are investigated. In addition, the importance of laboratories in today's health services has increased. Since the clinicians, nowadays tend to avoid making a diagnosis without seeing the test results. Besides, the laboratory always plays a central role in treatment follow-up. Therefore, laboratories are obliged to present the test results to the clinicians in the most accurate and fastest way. Lundberg laid the foundations for the correct test process a long time ago, forty years ago. Lundberg implies that the first step begins in the brain of doctor and proceeds with the correct test selection. The last step is that the test result is delivered to the doctor-so called brain-brain cycle, Plebani, et al. (2011). However, changes in medical practice over the last few years have significantly altered this brain-brain cycle for laboratory testing. Although the brain-brain approach offers a perspective that combines laboratory and clinic, there is now a more popular approach: the turnaround time (TAT). TAT stands out as a new approach to laboratory testing processes. In today's hospitals, TAT data of laboratories are evaluated and taken into consideration by quality directors. There are also many recent studies on TAT, Lee, et al. (2017). TAT and the laboratory information system (LIS) were combined to perform patient-centered quality indicators for laboratory services. They managed to combine TAT and LIS data (82.66%±3.14% of the barcodes) from matched to issued tickets, Song, et al. (2018). The application of fully automated analyzers has been a crucial security step in the blood bank; reduces human error, provides standardization and improves return time,

Lazarova, et al. (2017). But in our opinion; routine blood collection procedures that are involved in the pre-analytical laboratory process are more important for TAT. Because; if phlebotomist training is inadequate and blood is faulty, the automation of the devices becomes inefficacious. As a result; it will be necessary to re-draw blood from the patient. This will have a negative impact in terms of time prolongation and patient discomfort.

A new training method for phlebotomists; Intensive Training Method (ITM)

We first had defined ITM in the literature in the IFCC-EFLM European Congress of Clinical Chemistry and Laboratory Medicine in the Paris (IFCC, 2015). Then, it was applied on the campuses of our hospital after the approval of the ethics committee (Sakarya University Medical Faculty Ethic Committee). The data obtained were converted into articles and published, Yazar, et al. (2016). Subsequently, a patent application was filed and patented for ITM (TURK PATENT, number: 201882513, date: 5.02.2019). ITM, which we described for the first time in the literature, is performed by phlebotomists in our hospital and is still included in the biochemistry test guide. As known, there are three main phases in laboratory studies; pre-analytical, analytical and post analytical, Da Rin, et al. (2009); Nutting, et al. (1996); Plebani, et al. (1997, 2006, 2007). ITM takes part in the pre-analytical period. When we were assigned as the clinical response for biochemistry laboratories in our hospital, we noticed that the rejection rates due to hemolysis were high. This was observed despite the routine training of phlebotomists and all the necessary apparatus (holder-vacutainer, vacuum injectors, different tubes, etc.). On the other hand, despite all efforts, quality targets at sample rejection rates were not achieved. We assessed the situation and decided to make phlebotomists' training and supervision more intensive. In doing so, we first defined a new training algorithm and performed a multidisciplinary practice. As a result, the ITM, defined by us for the first time, emerged. Subsequently, ITM was successfully implemented in Sakarya University Education and Research Central Campus Hospital, Yazar, et al. (2016).

2. DESIGN

In the pre-analytical process, the issues to be considered while performing the blood collection process by phlebotomists have been the subject of many researches. Without a doubt, the oldest one belongs to Mueller, who recommended the use of holder and vacutainer forty-six years ago, Mueller, et al. (1973). The use of these devices, especially in emergency rooms where hemolysis is seen commonly, still maintains its importance. From this point of view, the blood collection brochure was prepared in our hospital and the use of holder-vacutainer was made compulsory and trainings were conducted by using the ITM. All phlebotomists were given active training in their workplace. Blood collection brochures prepared according to the latest guidelines were used in the trainings. The brochures, which were prepared according to CLSI guidelines, containing simple, easy to understand, practical and visual materials, were delivered to all phlebotomists. Also, this special blood collection brochure was posted on the official hospital website. We want to draw attention to a point again; in our hospital, there was a "routine training" (RT). However, since the desired success was not obtained from RT, we defined and applied the ITM. However, ITM provides intensive on-site training and additionally provides on-site hidden supervision. ITM is a highly intensive training model in the form of twice-daily training and supervision. However, RT is given only once a month, collectively, in seminar halls. Practical, easy to understand educational materials are used in ITM. However, RT does not include such materials. As can be seen, there is a significant difference in efficiency between ITM and RT. Finally, it should be noted that the fact that ITM trainers are also hidden supervisors makes a significant difference.

3. MATERIALS and METHOD

ITM is applicable in all clinics where phlebotomists work. In this respect, it is a multidisciplinary training method capable of increasing total quality in hospitals. ITM should be applied in all clinics where phlebotomists work. From this point of view, it is a multidisciplinary training method which has the feature of increasing total quality in hospitals. ITM stakeholders are listed under three main headings (Figure, 1). These are; trainers, consultants and supervisors. In the ITM, trainers and supervisors consist of the

same people. This is one of the most important points of ITM. Because of this, the trainers have the opportunity to personally assess the success of their training so that they can immediately and quickly correct mistakes and inaccuracies they observed.

Fig 1. ITM, TURK PATENT original certificate (in Turkish) and its team. The ITM consist of, trainers, consultants, supervisors.

Model application

Let us take a look at the stakeholders of the ITM training method, respectively. Let's first examine the trainers. Trainers: consist of laboratory clinical chiefs, laboratory specialist doctors and nurses responsible for the blood collection unit. Consultants: laboratory clinical chiefs, ITM-administered clinical chiefs, laboratory specialist doctors, and ITM-administered clinic blood nurses. Supervisors: laboratory clinical chiefs, laboratory specialist doctors and nurses responsible for the blood collection unit, they are also trainers (Figure, 2). ITM trainings are given to all staff that are working in hospital blood collection units, twice a day, half an hour for each session. (08.30-09.00 and 13.30-14.00). ITM supervisions are carried out by the trainer team individually, unannounced, secretly. The supervisor should make and record his observation at least once a day at any time of the day. They should state the mistakes they found during the audit in the next training.

In this way, the training be turned into an active and effective training.

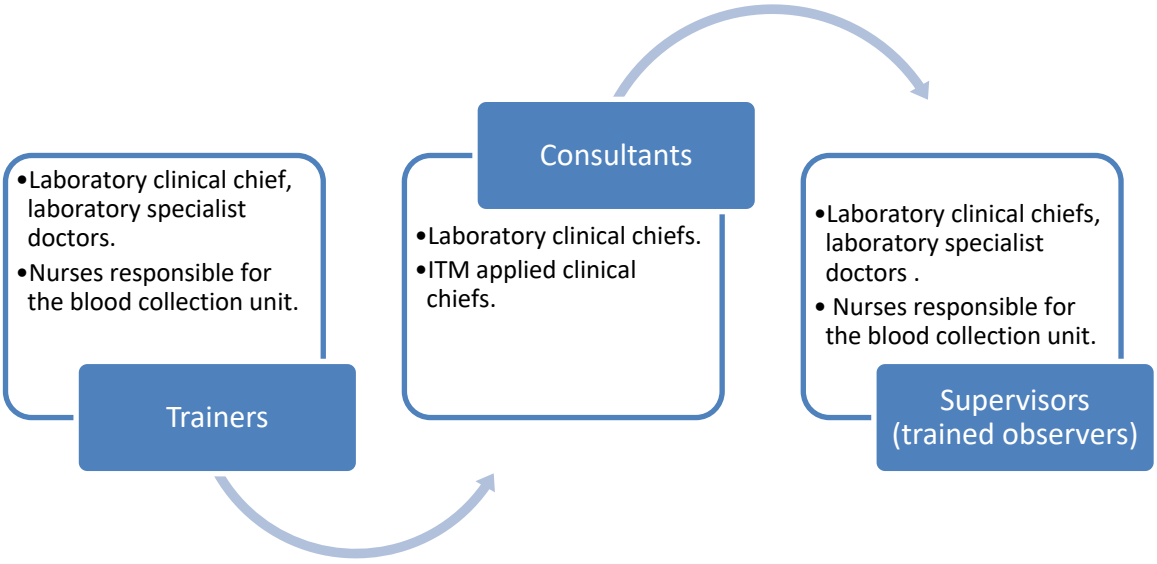

Fig 2. ITM, arranged or represented in a schematic form.

ITM recommends that trainers and observers are composed of the same people. This gives trainers an opportunity to self-control, even indirectly, in terms of seeing the success of their training.

ITM training material for phlebotomists

As the training material, blood collection brochures that are prepared according to CLSI current guidelines are used. Blood collection brochures consist of two pages in total. In the first page, the order of blood collection is mentioned and the tube caps are colored in order. Under each tube cap, how blood should be drawn, and the procedures that should be performed after taking blood are briefly described. There is also a tube step warning for phlebotomists. The order of the tubes used in our hospital according to ITM brochure, are as follows: respectively, blood culture tube (empty tube, red); coagulation (blue); sedimentation (black); biochemistry (gel, yellow); plasma (green); whole blood, ACTH, HbA1c (purple); ethanol (gray). The page contains a warning note with the following statements. "When ethanol sample is taken, it is necessary to use alcohol-free antiseptic as a disinfectant, to take 2 tubes and not to open the lid (Forensic Medicine)". Finally, on

the first page of the manual, for phlebotomists there is the warning "use protective equipment against infectious diseases". On the second page of the brochure, the rules to be taken into consideration while sampling are listed (Figure 3). Again, on this page, some important issues for phlebotomists are given (Figure, 4).

Some important issues reminded to of phlebotomists in ITM brochure.

A few minutes of stasis with the tourniquet affects many parameters in venous blood.

Samples should not be taken from a vessel or set used for donating liquid or blood. If necessary, the sample can be taken after 10-20 minutes of infusion. In these cases, the other arm should be the preferred for phlebotomy.

Maximum effort should be spent to prevent hemolysis of the blood taken. Ideally, phlebotomists should use the holder-vacutainer system. If there is no vacutainer, blood should never be sent to the tube from the needle tip, if possible, the tip of the syringe should be removed and the sample should be evacuated with slight pressure into the opened tube. Potassium, phosphorus, bilirubin and some enzymes are likely to be found higher in the hemolyzed sample. Hemolysis causes various errors in many other measurement methods as well.

The anticoagulant added to the blood sample is important. Blood should be collected with the anticoagulant that is appropriate for the parameter measured. When blood is drawn into coagulation tubes, the tube should be filled to the marked location. Barcodes affixed to the tube must not cover the mark. Coagulation samples should be taken into blue cap tubes (3.2% sodium citrate) under general blood collection techniques. After sampling, the sample should be gently inverted several times without agitation.

The waiting time should be taken into consideration. For example, if the sample is blood, the ideal centrifugation time is 30 minutes after collection.

The samples should be delivered to the laboratory and centrifuged within one hour. Otherwise, erroneous results may occur (e.g. false hypoglycemia) and this may misguide the clinicians when making their decisions. Transfer is very important in external lab samples; cold chain must be followed. Dry ice is the ideal one. While taking samples for testing arterial blood gas, bicarbonate and ethanol levels, the cap of the tube must not be

opened (the tube should not take air in it, otherwise the results may become inaccurate up to 50%).

Temperature is very important in coagulation tests, Yazar, et al. (2018). Coagulation tubes that have been sampled in services should not be placed in the refrigerator. Samples must be delivered to the laboratory within 1 hour at room temperature (20-25°C) with a transfer set and without shaking.

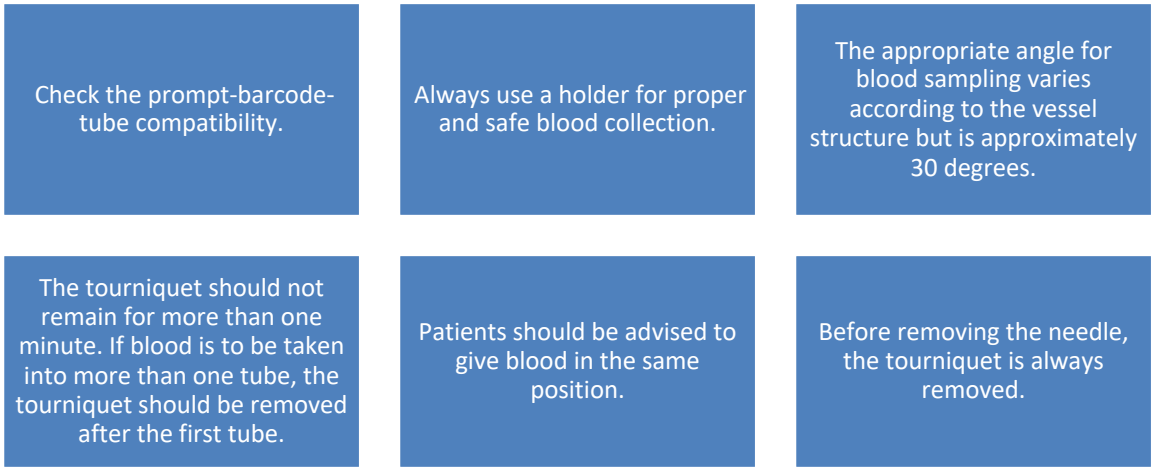

Fig 3. Some practical rules to take into consideration when taking samples according to ITM.

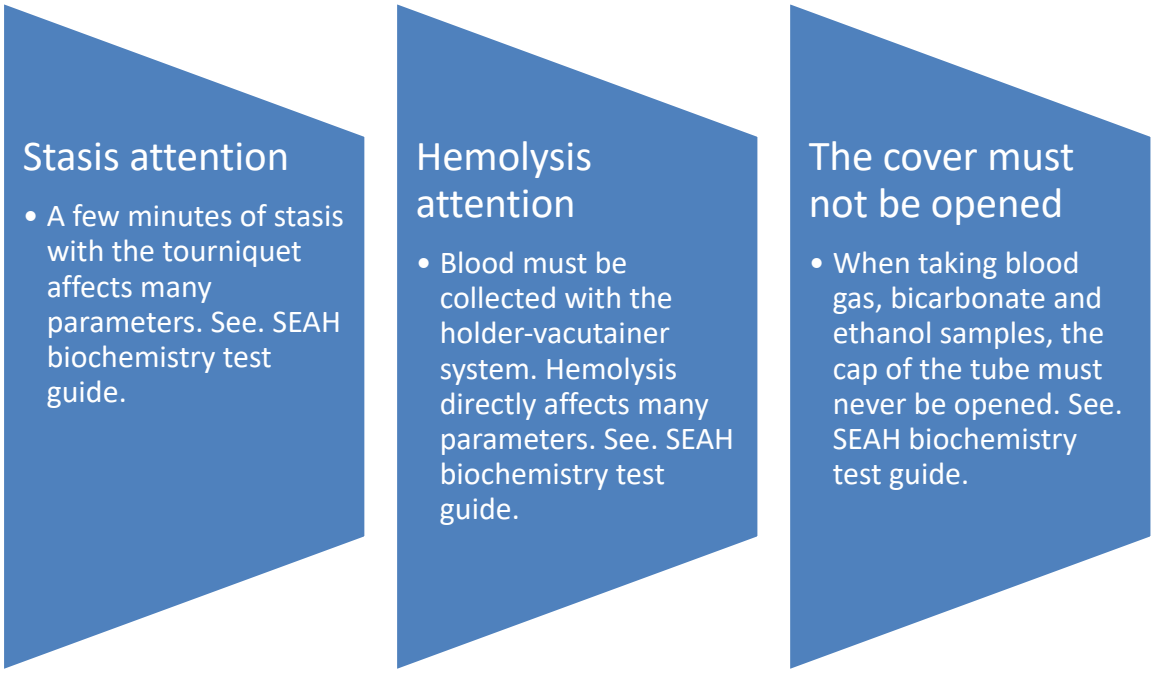

Fig 4. Some of the issues phlebotomists need to be cautious about.

Once samples are taken, they should be gently inverted several times without agitation. Additional information not included in the figure; when coagulation samples are taken, missing or excess blood should not be taken. Barcodes affixed to the tube must not cover the mark.

Model critique

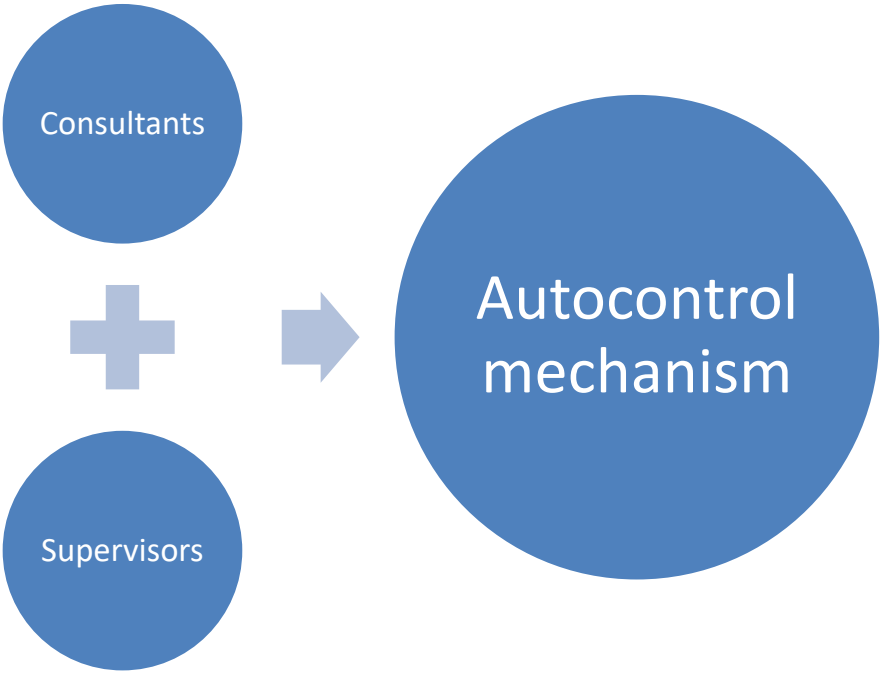

Fig 5. In ITM, auto control mechanism.

Trainers and supervisors consist of laboratory clinical chiefs, laboratory specialist doctors and nurses responsible for the blood collection unit. The most original part of the ITM is that the trainers and supervisors are the same people (Figure 5). This enables the auto control mechanism to work spontaneously and maximizes the efficiency of the education. The trainers personally see how their training is practiced and decide on the necessary arrangements by taking instant notes. The next day during the morning training hours, imperfections that were detected in the unannounced-confidential inspections are discussed and corrected. In this way, active and intensive training is provided. Perhaps, this is the biggest secret of the success of ITM.

4. CONCLUSION

As a result, ITM is a method that emphasizes that the human factor should not be ignored in pre-laboratory analytical errors in an era of automatic machines. At the same time, ITM is a cost-effective method that can be applied effectively in all hospitals with its easy to understand and simple solutions.

Suitability to Clinical Practice

When the ITM training method is applied to phlebotomists in hospitals, it is expected that there be a significant reduction in pre-analytical laboratory errors. This means a definite reduction in sample rejection rates and a reduction in costs. With ITM, patients will not have to give blood repeatedly. ITM will maximize patient satisfaction and increase hospital quality score. Briefly; A team is required for the ITM, the necessary documentation should be prepared, the requirements of the method should be met and then implemented in the pre-analytical process. The necessary materials should be delivered to the staff concerned. Again, the audits must be conducted secretly and recorded. In addition, all training documents should be uploaded to the hospital website and provided with easy, free access. Also, the documents should be uploaded to the phlebotomists' computers for offline usage.

Conflict of Interest

No conflict of interest has been declared by the author.

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