Original Research Article

Assessment of Standard Nursing Practices Implementation during Blood Culture Sampling In Emergency Department

Naseem Akhtar[1], Muhammad Hussain[2], Muhammad Afzal[3], Prof. Dr. Syed Amir Gilani[4] and Awais Jamil[5]

[1]Student of Post RN Year 2, Semester II, (Lahore, Pakistan)

[2]Nursing Assistant Professor (Lahore, Pakistan)

[3]Nursing Principal (Lahore, Pakistan)

[4]DEAN of Allied Health sciences (Lahore, Pakistan)

[5]Clinical nurse manager (Lahore, Pakistan)

*Corresponding Author's E-mail:
naseem.akhtar.2538@gmail.com

Abstract

Blood culture sample is the main resource to identify the causing agent of severe infection and septicemia. It is also used for the appropriation of antibiotic regime. Unfortunately, blood culture contamination produces misperception regarding the importance of a positive result of blood culture. The knowledge of existing guidelines, education session and competency of blood culture sampling are very beneficial to reducing blood culture contamination. The study aimed to enhance nursing knowledge and practices after the blood culture sampling session and a quasi-experimental study design by an educational intervention. The sampling techniques were purposive; the sample size was 50 nurses, working in the emergency department. Its duration was three months. The rigor of study instruments were checked by content validity index 0.91 and reliability by Cronbach alpha 0.9. The study was analyzed through Statistical Package for the Social Sciences (SPSS). The demographic variable, knowledge and practices will be depicted in the form of frequencies and percentages. The score of an educational intervention was assessed by paired t-test. The results showed that there was an association of improved knowledge with educational intervention as the t-score was 11.79 and practices was 9.39. The p-value is significant at 0.000. Sufficient knowledge makes the nurses to be able to perform practices according to set standards and increased their responsibility to be aware of the criticality of every step taken to perform a procedure and their importance. Good practices can reduce the blood culture contamination rate and not to eliminate it.

Keywords: Blood, Practice, Contamination, Knowledge, Intervention, Education

INTRODUCTION

Blood culture sampling is a technique that needs sufficient knowledge and practice to draw a blood sample. Nurses are responsible to draw a blood culture in the emergency department. They should be knowledgeable about their criticality and the importance of standard techniques. The knowledge of existing guidelines, education session, and competency of blood culture sampling are very beneficial to reduce blood culture contamination. Furthermore, a study approved that evaluating the knowledge of phlebotomy may thus be the first step in the rejection of specimens and improving the quality of specimens (Simundic et al., 2015). Some

European and African studies have shown that health care professionals lack expertise or poor phlebotomy practices (Cai et al., 2018). Standards nursing practices play a vital role to reduce the contamination and prevention of infection by following universal precautions. The evaluation of standards precaution can improve the patient safety and treatment outcome and continuous monitoring of nurse's practices leads to keep the adherence of effective intervention to enhance compliance rate (Chu, 2018). Blood culture sample is the main resource to identify the causing agent of severe infection and septicemia and used for the appropriate

antibiotic regime. Unfortunately, blood culture contamination produces misperception regarding the importance of a positive result of blood culture (Schifman et al., 2015). A study emphasized that rationalizing equipment and less distraction during the procedure can help to reduce the blood culture contaminations.The knowledge and resources should be a help to prepare the guidance which can elaborate on the participants and provide attention to those factors which are required to achieve the purposes (Bentley et al., 2016). Globally, the highest rate of blood culture contamination is 0.6% to 12.5% in an emergency setting in different hospitals in developed countries (Garcia et al., 2018). According to the standard of the American Society of Microbiology and the Clinical and Laboratory standards institute states that an acceptable rate of blood culture contamination should be 2 to 3% (WHO, 2004). Nationally, not accurate data found but different studies are elaborated that blood culture contamination rate is increasing from the acceptance rate in middle-income countries which leads to mismanaging the patient with broad-spectrum antibiotics (Sheu et al., 2019). Locally, it is perceived that the blood culture contamination rate is too high from the benchmark of blood culture contamination in a tertiary care hospital in Lahore Pakistan. Different techniques are used to prevent contamination of the blood cultures as washing hands. Nurses can reduce skin flora contami-nation following these steps: Prepare the skin with chlorhexidine and alcohol scrub in 30 seconds. Let the skin dry out entirely. The tops of blood-culture bottles are disinfected with alcohol before inoculation (Proehl, 2016). Nurse's practices are a key indicator to improve the quality and safety of the patient (Shakerkovar et al., 2018). Most studies have been done in developed countries but less number of studies conducted in Asian countries. So, it is employed to research in Pakistan and to enhance the nurses' practices and reduce the blood culture contamination rate. Blood culture contamination is a major issue in the emergency department in a private setting in Lahore. The study helped nurses to follow the existing guideline to reduce the blood culture contami-nation rate. The study'spurpose was to improve the psychomotor skills of nurses to obtain blood culture sampling. The study was to promote the standard skills and utilize the existing knowledge during blood culture sampling. The study objectives were to identify the gaps in nursing practices in obtaining blood culture sampling and to improve nursing knowledge and practices regarding blood culture sampling by comparing with the standard blood culture sampling guidelines.

Scope of the study

To enhance nurses' knowledge and practices and making them able to perform the procedure according to set standards. Good practices improve the patient's safety and suffering as well as decreasing the patient's cost and length of stay in the hospital.

The study limitations were a shortage of time and too small data collection. This study was conducted in a single setting.

Literature Review

More than 1 million blood cultures are contaminated or produce false-positive results each year in the United States. Contaminants can be caused by equipment or the skin of the patient, so be sure to clean both (Proehl, 2016). Most of the pathogens exist on the skin of patients, the use of appropriate antiseptics will help to avoid contamination (Martínez et al., 2017). Some studies emphasized that the effectiveness of intervention can improve nurse's practices and reduces the peripheral blood culture contamination (Hughes et al., 2018). The trainer gained insight and understanding that the efficiency of the collection of blood culture specimens should be restricted to staff members who have received training and expertise in the process along with direct observation to verify their professional competence in the collection procedure (Moeller, 2017). Another study approved that contamination may come from palpate and must be re-disinfected. Non-touch techniques are most helpful during blood culture sampling (Kraft et al., 2019). Venepuncture's best locations are the veins in the antecubital fossa –the cephalic, basilic, and median cubital veins (Dougherty and Lister, 2015). A study stated that although best practices can reduce blood culture contamination but not eliminated (Al-Hamad et al., 2016). Nurses have no sufficient knowledge as well as practices about reasons for the increasing rate of blood culture contamination (Gasté et al., 2018). Bentley et al. (2016) stated that different factors affect blood culture contamination such as busy shift hours and strictly not following the standardized protocol practices. They were not following the hand hygiene practices and wait to dry the skin after disinfectant. The study indicates that many hospitals need to justify the policy or guideline for blood culture collection time and concluded that timely blood culture samples is helpful to identify blood stream disease (Garcia et al., 2018). There is no published study found in Pakistan to elaborate that the work has been done to assess the standard practices among nurses while taking blood cultures in the emergency department of private and public health care sectors.

METHODOLOGY

A quasi-experimental study was done in the emergency department at private hospital Lahore Pakistan. The

sample size was a total of 50 staff nurses in the emergency department. Purposive sampling techniques were applied. Targetted population of the study were staff nurses. All emergency nurses were included and agreed to participate in the study and they were considered as inclusion criteria and those who were not willing to participate in research and worked in other departments from emergency were exclusion criteria. A-I assessed nursing' knowledge through questionnaires and observing their practices during blood culture sampling. An education session was conducted for one month and also demonstrated how to collect blood culture specimens. After that, evaluation of the staff knowledge and practices for improvement were also done. Study Instrument 1: Socio-demographic datasheet to observe the participant's characteristics like age, gender, professional status, years of experience. Instrument 2: A structured question-naire was developed on the blood culture specimen selection information board. This was built to evaluate the nurses' knowledge after five expert opinions. This consists of 14 sets of close-ended questions that address the following areas: vein inspection, strategies to reduce blood culture contamination rate, infection control concerns before and after blood collection methods. The rating system has been graded as follows: 1-Bad knowl-edge (< 50%) 2- Fair knowledge (50-75%) 3- Good knowledge (more than 75%). Instrument 3: An obser-vation checklist, which was developed from the manual of clinical nursing procedure of Royal Marsden Hospital. 20 items were related to the practice of blood culture sampling techniques to assess the practice of nurses. There were 20 items related to the method of blood culture sampling techniques. The rating system of scoring the checklist comprises of two categories; performed and not performed, for all 20 items. The score of the performed item is (1) and the score not performed practice is (0). The scores vary from atleast zero to at most 20. The practice score was graded as: Poor Practice is (0-11) > 55%, Average Practice (12-16) 56% to 80%, Good Practice (17-20) < 81% (Atalla and Henedy, 2018). Validity checked by content experts and their opinion were calculated on excel sheet. The calculated values of CVI were 0.91. The reliability of instruments checked via Cronbach alpha and the values was 0.9. Data collection started from Jan 2020 to March 2020. The independent variable was blood culture sampling and dependent variables were nurse's knowledge and practice. The knowledge and practices of nurses on each shift was assessed which was very helpful to me. Furthermore, master trainers were trained and they also trained other staff. They were helpful in data collection. The study was analyzed through SPSS version 20. The demographic variable, knowledge, and practices were depicted in the form of frequencies and percentages. Pair "t" test applied to identify the significance of this study.

RESULTS

This project was done for the comparison of blood culture sampling practices by utilizing the quasi-experimental design. It was done by an educational intervention that was conducted by a session and checking of practices before and after the intervention. Pre and post-intervention scores of assessment were compared by paired t-test. The results showed that there was an association of improved knowledge with educational intervention as the t-score was 11.79 and the p-value is significant 0.000. On the other hand, there is an association of improved practice with educational intervention as the t-score was 9.39 and the p-value is significant 0.000. Table 1

Demographic Results

The majority of the respondents of this study belong to the age group of 25 - 31 years of age which was more than half of the total sample which is 56%. The other age group happens to be 22% for age 32 to 38 years. Master's level degree holders in nursing were only 10% of the respondents, whereas 24% of the respondents were Bachelor degree holders. 66% of the sample was diploma level in education. Most of the sample had five years or less than five years of experience in the field of nursing that is 60%. Nearly half of the respondents were diploma holders. Team leaders and official shift leaders comprise only 26% respectively. More than half of the respondents were male. Figure 1

Nurses' Practices Results

Staff was assessed for the practices of improvement of correct identification of patient and explanation of the procedure to the patient before and after the intervention. There was 18% increase in the practices of correct patient identification due to the educational intervention. In maintenance of patient's privacy and performance of proper hand hygiene, there was 18% increase in the variable before and after the intervention. For prevention of the contamination of the sample by visible soiled skin, staff were educated about observing cleanliness of any visible soiled skin on the patient with soap and water then dry before drawing samples. There is an improvement of 22% in the practice due to the intervention. There is a 22% increase in the practice of proper palpation of vein followed by application of a tourniquet and untying the tourniquet after vein assessment before drawing sample. The skin of the patient is cleaned with 70% w/v isopropyl alcohol swab in a circular motion (inward to outward) and let it dry for 30 seconds. The health care provider also applies 2% w/v chlorhexidine gluconate, 70% w/v

Table 1. Paired Samples Test

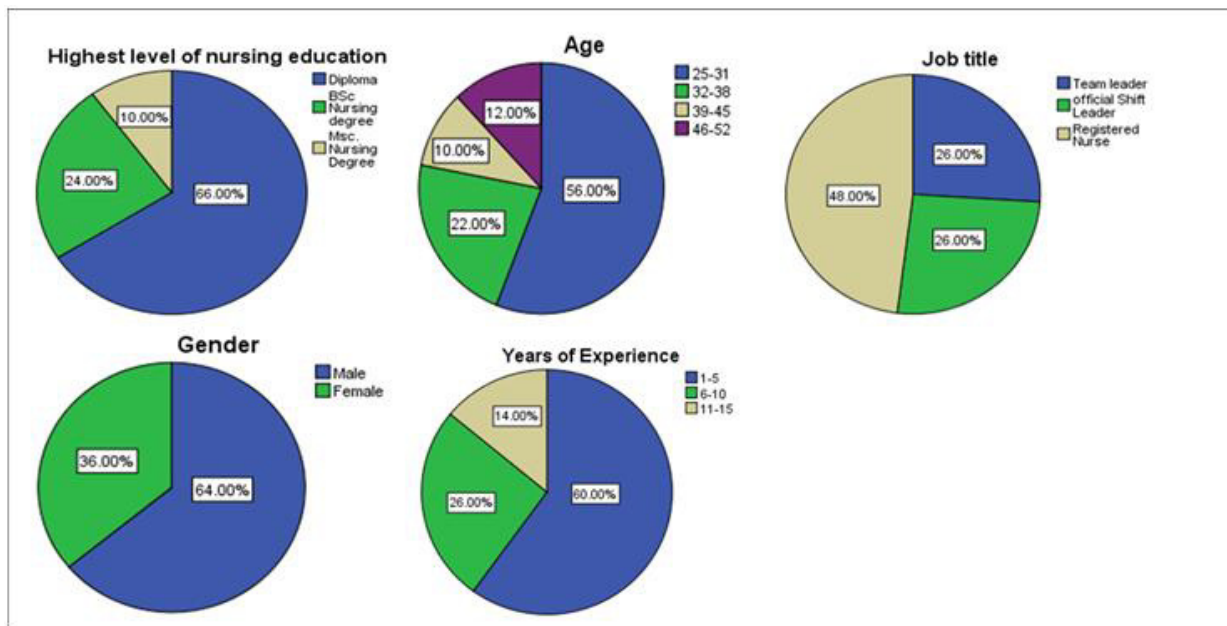|	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre.Education.Knowledge-Post.Education.knowledge	2.70000	1.61940	.22902	2.23977	3.16023	11.789	49	.000
Pre.Education.practice - Post.Education.practice	4.82000	3.62919	.51324	3.78860	5.85140	9.391	49	.000

Figure 1. Demographic Results

isopropyl alcohol spray and let it dry. The staff does not palpate the site again after cleaning. This practice was improved by 28% after the educational intervention. An increase of twelve percent practice of cleanliness of flip-off caps from culture bottles after the intervention of education. Washing and drying hands again or use alcohol hands rub and apply non-sterile gloves was improved by 20% after the educational intervention. The order of drawing sample is to attach aerobic bottle first, hold upright and use bottle graduation lines to accurately gauge sample volumes (at least 10 mL in each bottle or as recommended). Remove bottle and replace with an anaerobic bottle, take the same volume and remove the bottle. This practice shows an improvement of 24% after the intervention. The practice of release tourniquet and remove the winged device, apply pressure to the venipuncture site in the way that pressure gauze never touch the tip of the needle is improved by 18% after the educational intervention. The practice of discarding winged collection set in sharps container directly is

increased by 20%. The practice of removing gloves and performing hand hygiene was improved by 40%. The practice of application of appropriate dressing after sampling was improved by 32%. The practice of labeling bottles with appropriate patient details while in the presence of the patient by ensuring the bar codes on the intact bottle was improved by 34%. Figure 2

The practice of writing name, MR No (Medical Record Number), indications, site (peripheral/central), the volume of a blood sample, date and time of culture sample collection was improved by 32%. There was an increase in 28% of the practice of arranging prompt delivery to the microbiology laboratory to process immediately after sampling. There was a slight improvement in the documentation of the procedure in the patient's records. Table 2

The education has a very remarkable effect on nurses' knowledge. The above table showed the percentage of existing knowledge and the post-education session was improved on a significant level.
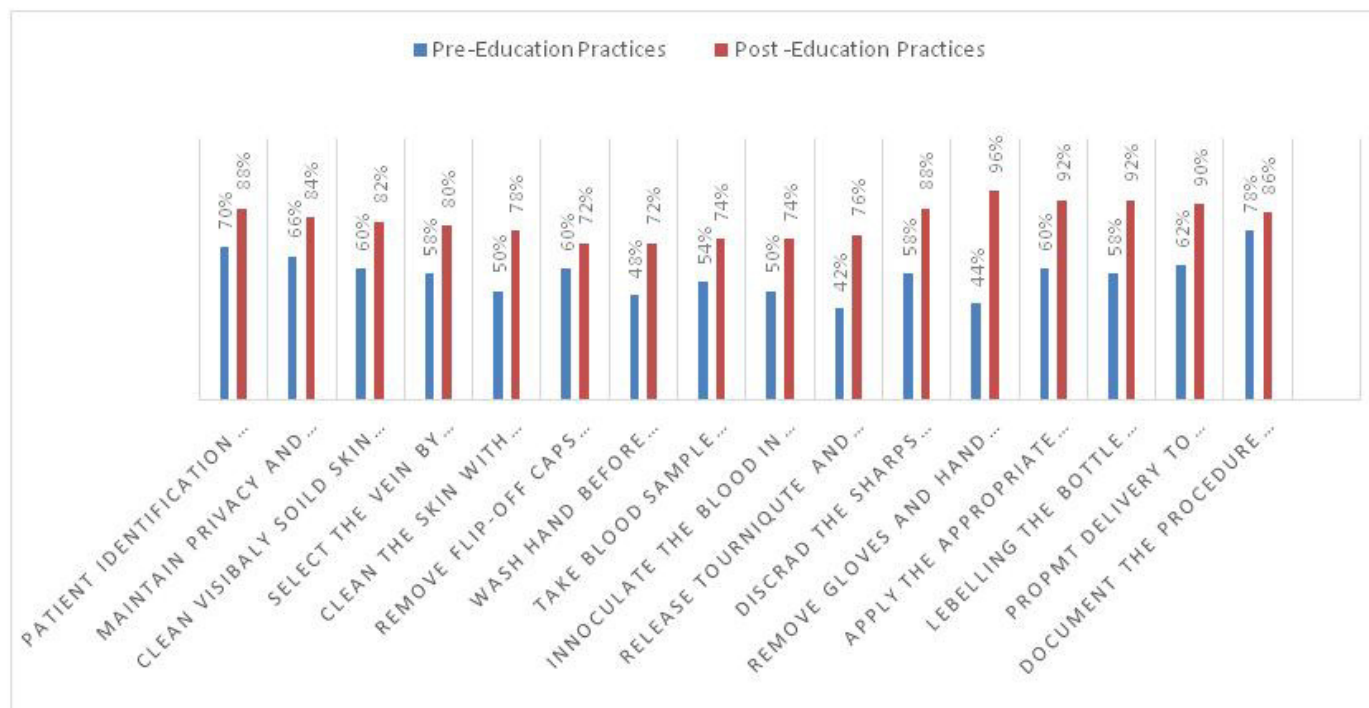
Figure 2. Nurses's Practice Results

Table 2. Comparison of knowledge pre and post-education session

		Pre				Post			
		Correct		**Incorrect**		**Correct**		**Incorrect**	
S/N0	**Questions Description**	%	*f*	%	*f*	%	*f*	%	*f*
1.	Hand hygiene is important before the procedure of blood culture sampling.	74	37	26	13	94	47	6	03
2.	Visibly soiled skin can be disinfected with soap and water.	54	27	46	23	90	45	10	05
3.	The vein should be assessed without a tourniquet.	34	17	66	33	76	38	24	12
4.	The most suitable vein for blood culture sample is cubital fossa.	40	30	60	20	74	37	26	13
5.	Usually, Skin should be disinfected with 2% chlorhexidine in 70% isopropyl alcohol swab.	36	18	64	32	70	35	30	15
6.	30 seconds should be allowed for skin disinfectant to air dry.	64	32	36	18	78	39	22	11
7.	Do not palpate the site again after cleaning.	54	27	46	23	72	36	28	14
8.	Hand hygiene is necessary before wearing gloves.	62	31	38	19	76	38	24	12
9.	Labeling of a culture bottle should be done after the inoculation of blood.	28	14	72	36	66	33	34	17
10.	Directly discard the sharps into the sharp box.	58	29	42	21	86	43	14	7
11.	Aseptic technique is important for blood culture.	68	34	32	16	86	43	14	7
12.	If you need to draw blood for multiple tests then blood culture will be first.	44	22	56	28	94	47	6	3
13.	The 10 ml volume of blood culture samples in adult patients need to inoculate the culture bottle.	58	29	42	21	78	39	22	11
14.	Blood culture should be drawn before the administration of antibiotics.	56	28	44	22	86	43	14	7

DISCUSSION

It is important to improve nurses' knowledge and practices by following educational intervention and demonstration by conveying the professional attitude near to the standard and aim. It is done by an educational intervention that is conducted through a session and checking of practices before and after the intervention. Pre and post-intervention scores of assessment were compared by paired t-test. The results show that there was an association of improved practices and knowledge with educational intervention as the t-score was 11.79 and the p-value was significant 0.000.

The majority of the respondents of this study belong to the 25 - 31 years age group which was more than half of the total sample which was 56%. The other age group happens to be 22% for age 32 - 38 years. Masters level degree holders in nursing were only 10% of the respondents, whereas 24 % of the respondents were bachelor degree holders. 66% percent of the sample was diploma level in education for the study for finding an association of educational intervention and improvement in practices. Most of the samples had five years or less than five years of experience in the field of nursing that is 60%. Nearly half of the respondents were diploma holders. Team leaders and official shift leaders comprise only 26% respectively. More than half of the respondents were male. Moreover, one study was conducted in Indonesia by Iswari et al. (2015). They supported the demographic data that out of a total of 81 subjects, more female subjects (51.9%) participated in this study. As many as 46.9% were between the ages of 30 - 39. 30.9 % were between the ages of 20 and 29 and 11.1% were 40.49. 29.6% of them had worked at Dr. Hasan Sadikin General Hospital for 11-19 years, 28.4% had worked for less than 5 years, 22.2% had worked for 5-10 years and 7.4% had worked more than 20 years.

Poor practices

In this study, some poor practices were observed which was improved after education session. Cleaning was applied with 70% w/v isopropyl alcohol swab in a circular motion (inward to outward) and let it dry for 30 seconds then apply 2% w/v chlorhexidine gluconate, 70% w/v isopropyl alcohol spray and let it dry. Do not palpate the site again after cleaning. Wash and dry hands again or use alcohol hand rub and apply non-sterile gloves (sterile gloves are not essential). Take blood samples for culture according to the age of the patient. For adults first, inoculate aerobic blood culture sample then anaerobic one. Attach aerobic bottle first, hold upright and use bottle graduation lines to accurately gauge sample volumes (at least 10 mL in each bottle or as recommended by the manufacturer). Remove bottle and replace with an anaerobic bottle, take the same volume

and remove the bottle. Release tourniquet and remove the winged device, apply pressure to the venipuncture site in the way that pressure gauze never touches the tip of the needle. Remove gloves and perform hand hygiene. After the education session, these practices were improved by 28%.

The results of a study which was conducted in 2014 by Rubia-Orti et al. showed that complex and varied blood sampling methods were developed to increase false-positive findings. In this regard, educational initiatives and initiatives to improve the management of blood collection in the relevant departments may be successful. In that study, the results of handwashing before wearing gloves, skin disinfectant solution, palpate the cleaned area, volume of blood culture and dressing of the puncture also had poor results. On the other hand, most professionals collected about 10 ml of blood to inoculate 5 ml per vial. A high percentage of nurses collected blood from existing catheters in patients to do blood cultures.

Average practices

Rather than poor practices, other practices were in average practices and acceptable such as explaining the procedure to the patient, correct identification is done, maintaining privacy, visibly soiled skin cleaned with soap and water, clean the blood culture bottle cap, directly discard the sharps into the sharp box, send the sample into the lab as soon as possible and proper documentation of the procedure. Education session contributes a little bit to the impact on its improvement which was almost 23% (Atalla and Henedy, 2018). More than a few practices related to venous blood sample collection were up to the mark and these practices were representing the educational program affected by the adherence to guideline practices. In the studied group, the maximum of 75% of subjects scored between average practice score in the pretest before structured education and 48.33% subjects scored between good practice score in the post-test after structured education.

Knowledge

The participants have fair knowledge because they also know blood culture sampling in the orientation program of the organization. Despite that education, they need to continue education to enhance their knowledge. Some participants have insufficient knowledge on some aspects of knowledge questionnaire as used in the tourniquet to assess the vein, which is vain for blood culture, approved skin disinfectant of organization, blood culture bottle should be labelled after the blood inoculation and sample must be first of blood culture which is necessary to reduce the blood culture contamination.

Indonesian research showed an acceptable degree of information about the method of gathering samples of blood culture. The majority of participants recognized that blood culture is used for the detection of systemic bacterial infection. They all agreed on the purpose of decontamination in the collection of blood culture samples (Iswari et al., 2015).

The results of the above-mentioned research was not uniform with the findings of the Atalla and Henedy research in Egypt (2018). The participants presented lack of knowledge among nurses regarding blood culture sampling techniques. The participants did not understand the content was considered hazardous in the blood culture sampling guidelines. Most of the participants had not known how to mark test tubes and perform blood culture sampling with the proper sequence and order of tubes before the educational program.

CONCLUSION

In the end, it was recapitulated that accurate or sufficient knowledge makes the nurses able to perform practices according to set standards and also increased their responsibility. They should be aware of the criticality of every step taken to perform a procedure and their importance. This study was to enhance nurses' knowledge and practices and made them to be able to perform the procedure according to set standards. Good practices were to improve the patient's safety and suffering as well as decrease in the patient's cost and length of stay in the hospital.

RECOMMENDATION

The blood culture sampling collection workshops and education sessions should be done regularly among nurses. Infection control practices must be launched and demonstrated in an organization or institution. I found a very low number of research work on blood culture which needs to conduct multiple studies with different strategies to improve the nursing knowledge and practices as well as blood culture contamination rate as per approved benchmark.

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