

RESEARCH ARTICLE

Performance checklist and its influence on knowledge and satisfaction of intensive care nurses: A quasi-experimental study

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Abstract

Aim: The purpose of this study was to evaluate the impact of using a performance checklist on knowledge and satisfaction of intensive care nurses.

Method: This study was a quasi-experimental study and performed on 70 intensive care nurses in two groups. Performance checklists had to be filled by the nurses in experiment group during central venous pressure (CVP) measurement procedure. Knowledge and the nurses about standards of CVP measurement and their satisfaction were evaluated in both groups by a researcher-made questionnaire. The data were analysed using the SPSS software.

Results: In the experiment group, the level of knowledge significantly increased after the intervention ($p = .001$) and the majority of nurses (85.7%) had a high level of satisfaction. Also, there was a significant difference between mean knowledge scores of the two groups after the intervention ($p = .006$).

Conclusion: This showed that applying performance checklists can influence nurses' knowledge and should consider a simple indirect educational method.

KEYWORDS

intensive care, knowledge, nurse, performance checklist

1 | INTRODUCTION

Nowadays, one of the most important goals in all healthcare organizations is to provide high quality and desirable care parallel to the advances of science and technology around the world (Kruk et al., 2018). In order to provide high-quality care, nurses should constantly improve their knowledge in their professional life (McCullough et al., 2020). An approach that is known as "Best Practice" is a crucial way that can help nurses provide high-quality care to their patients. Best practice refers to clinical care, treatments

and interventions that will lead to the best possible outcomes for patients (Bvumbwe & Mtshali, 2018). Since nurses are a group of healthcare providers that have direct contact with patients, they can provide better care and support for the patients only if they possess an adequate level of knowledge (Said & Chiang, 2020). The ultimate goal in professional nursing is to give quality care to patients on all issues (biological, psychological and social), which requires a high level of knowledge (Araki, 2019). However, unfortunately, the quality of nursing care is not optimal for many reasons, such as high workload, shortage of nursing staff and increased

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provision of emergency services (Richards et al., 2018), and many patients do not receive adequate care consistent with the existing knowledge (Clement et al., 2018).

2 | BACKGROUND

One of the reasons for the poor quality of nursing care is the low level of nurses' knowledge. Several studies had referred to the nurses' insufficient knowledge, including Guerrero-Márquez et al. (2016), who, in their study in Spain, indicated that nurses' knowledge of drugs used in the children's emergency department was inadequate (Guerrero-Márquez et al., 2016). In Iran, although there are no accurate data on this topic, most studies that have focused on nursing knowledge or quality of nursing care provided to clients, patient satisfaction and other nursing care have indicated a relatively low quality of nursing care and complications that arise from this issue (Ahmadi Chenari et al., 2020; Chegini et al., 2020; Hasanlo et al., 2019).

Since in recent years, ICUs have played an important role in the care of critically ill patients with complex health problems, and also since the desired level of knowledge about care standards are essential requirements for ICU nurses (Tubbs-Cooley et al., 2019), paying attention to the nurses' knowledge in ICU is an imperative factor that should be considered (Zhang et al., 2021). However, some studies have shown that nurses' knowledge about some care in ICU is not satisfactory. For example, in a study conducted by Almomani et al. (2021) in Jordan, the knowledge of ICU nurses about the use of physical restraint for patients was not at a desirable level (Almomani et al., 2021). Another study showed that ICU nurses' knowledge about endotracheal suctioning of intubated patients was limited (Mwakanyanga et al., 2018), and in Iran, a systematic review in 2019 showed that the level of knowledge of nurses in pain management was inadequate (Khalighi et al., 2019).

Due to the importance and role of knowledge in the quality of nursing care, and to prevent the problems caused by nurses' insufficient knowledge and performance, nursing managers should try to increase the level of knowledge and skills of nurses through continuous education and promote information retention (Harley et al., 2019). Continued professional development is considered an essential component of the adult education system and should be planned according to pedagogy principles (Aminshayan Jahromi et al., 2017; Mirrezaei et al., 2018). The development of skills for self-directed learning during the lifetime, the opportunity of using learned subjects in the clinical setting and the consistency of training with the real experiences and needs of individuals are among the cornerstones of pedagogical theory (Omar & Arif, 2020). On the other hand, the necessity of utilizing educational approaches focus on high-level cognitive skills such as critical thinking or rethinking, which creates deep and practical learning in adults, has dual importance in adult learning (Hemphill et al., 2021). Consequently, it is better in professional continuing education that refers to adult learners, in order to learn profoundly and develop metacognitive skills, some

methods be carried out that is in line with the experiences of individuals and their needs (Day & Beard, 2019). Over and above, taking into account the adults' condition, such as busy life, working and lack of time, is essential in selecting educational methods for professional continued development, and applying some methods consistent with such constraints is crucial (Edelman et al., 2019). The performance checklists can be considered in this regard.

The performance checklists are now used to reduce mistakes caused by negligence, facilitate care and decrease non-standard care. A checklist is a list of items that have been arranged according to a standard protocol, and the users must mark the items they have performed or have not (Ervin et al., 2018; Ross Perfetti et al., 2020). The performance checklists have been used for over a century in reputable organizations as a safety management tool (Saxena et al., 2020). In some medical disciplines, the checklists are a valuable tool for promoting and improving care and reducing the rate of disease and death, and even as an instrumental and efficient measure for information exchange and team cohesion (Burian et al., 2018; Kaplan et al., 2021; Weiser & Haynes, 2018). In general, since the safety of patients and the improvement of quality of care are considered the main goals of medical sciences, applying the performance checklists can be related to outcomes improvement, errors reduction and budget and resources optimization (Hardy et al., 2018). However, some researchers are not sure about the effectiveness of the performance checklist in improving care. Simpson et al. (2007) affirmed they were unable to confidently determine the actual impact of these checklists on detecting mistakes and negligence, and removing and improving them (Simpson et al., 2007). Furthermore, all the studies conducted on the use of performance checklists have focused on reducing the adverse effects of poor performance and improvement of care outcomes (Mirzaeipour et al., 2015; Weiser & Haynes, 2018), and no study has ever used this tool as a method of increasing the knowledge of healthcare providers.

Consequently, because there is no agreement between researchers about the efficacy of the performance checklist in increasing the quality of care and due to relatively low level of nurses' knowledge in the commitment of the clinical standards during performing some nursing procedures, including measuring central venous pressure (CVP) as one of the most critical and common care in intensive care units that needs a high level of knowledge for correct measurement and interpretation (Dellinger et al., 2013), this study was designed and conducted. Also, due to the importance of satisfaction as an evaluative factor to discuss about educational methods, especially in adult learning (Hemphill et al., 2021), nurses' satisfaction with application of this tool as an indirect method for learning was evaluated, too.

2.1 | Aim

This study aimed to investigate the impact of performance checklist as a simple, inexpensive and accessible tool, which is based on self-directed learning and individual reflection as prominent

aspects of pedagogy and deep learning (Hemphill et al., 2021), on the level of knowledge of ICU nurses in CVP measurement and assess their satisfaction with using this method. If it be found efficacious, and the nurses be satisfied with, the use of a performance checklist could be considered as a method of continuous professional development that seems be more consistent with the work conditions of the ICU nurses. Also, it can be recommended for standardizing nurses' performance and subsequently improving the quality of care.

3 | THE STUDY

3.1 | Design and setting

The present study is a quasi-experimental study with two groups, before-after design. This study was conducted in two medical-surgical ICUs of a hospital in Tehran, Iran, in 2016. The research population consisted of all the nurses working in these two ICUs. The study sample consisted of (Inclusion criteria) nurses with a bachelor's degree in nursing or above with at least 6 months of work experience in ICU and willingness to participate in the study. Exclusion criteria included the reluctance of the sample to continue with the study, leaving the unit during the study, participation in other related educational courses during the study, and the use of the performance checklist less than three times during the intervention period.

The sample size was estimated to be 35 nurses in each group based on the standard deviation obtained from the pilot study, which was carried out on ten eligible nurses in another ICU.

The sample size was estimated to be 35 nurses in each group based on the standard deviation obtained from the pilot study ($S = 2$), which was carried out on 10 eligible nurses in another ICU in an environment other than the main research environment and by using the following formula:

$$n = \frac{(Z_{1-\alpha/2} + z_{1-\beta/2})^2 \times 2S^2}{d^2}$$

Two ICUs were divided randomly into the experiment group (medical ICU) and the control group (surgical ICU) using coin throwing. Sampling was done in each group according to the inclusion criteria by the conventional method.

3.2 | Instrument

The data collection tool was a questionnaire for assessing the nurses' knowledge about the standards of CVP measurement using the water manometer and was designed based on reliable sources (Roberts, 2018; Sole et al., 2017; Urden et al., 2018). The nurses' knowledge questionnaire had 11 multiple-choice questions. Each question had only one correct answer, which was given 1 for the correct answer and zero for the wrong answer. The questionnaire

range between 0 and 11, and a higher score indicated a higher level of knowledge.

The nurses' satisfaction was measured by a researcher-made questionnaire that was developed based on the similar articles. It consisted of 6 questions on a Likert scale with three options (dissatisfied = 0; relatively satisfied = 1 and completely satisfied = 2). The level of nurses' satisfaction was reported according to the total score of the questionnaire, which the range of this score was from 0 to 12, and a higher score indicated more satisfaction of the participants.

The reliability and validity of instruments were checked. So, about validity, we would say that the content validity of both questionnaires was approved by 15 faculty members of critical care nursing. We computed a content validity index from the review of the faculty members, for the knowledge assessment questionnaire (CVI = 0.81) and for the satisfaction questionnaire (CVI = 0.83). It should be noted that the knowledge questionnaire was designed based on the standards of multiple-choice questions and approved by three experts in medical education. The reliability of the knowledge questionnaire was verified by internal consistency that was estimated with the Kuder-Richardson coefficient (KR-20) after the pilot study; it is indicated for dichotomous variables that is equivalent to Cronbach's alpha ($\alpha = .94$). The reliability of the satisfaction questionnaire was estimated by the retest method. In this way, after conducting a pilot study, ten nurses completed the satisfaction questionnaire in two different shifts with a short time interval. Then, the obtained scores were determined, and their correlation coefficient was calculated ($r = .91$).

3.3 | Intervention

Because both ICUs were located in one hospital and to prevent the data contamination caused by their nurses' interaction, sampling began in the control group. Also, these two ICUs were located in two separate sections of the hospital and their staff did not meet or communicate with each other, even while eating. Data collection in the experiment group began after finishing in the control group. In the control group, the knowledge of eligible nurses was evaluated twice, at the beginning of the study and 1 month later, without making any changes in the unit's routine nurses' care. It should be noted that to prevent the nurses' consulting with each other, the knowledge questionnaire was completed by the participants in presence of the researcher and it was collected a short time after distribution, but in order to consider of non-interference with the busy time of the ward and the volume of work and unexpected events in the ward. The appropriate time for distributing the questionnaire was selected. It should be mentioned that the nurses of both units checked the CVP at least every 6h, routinely, and when they had order for that.

In the experiment group, the level of nurses' knowledge was evaluated before the intervention by the same questionnaire and the same method. Then, the intervention was implemented for 1 month. During this period, the performance checklists were developed based on the standards of CVP measurement (Roberts, 2018;

TABLE 1 Characteristics of the nurses

Group variable		Control	Experiment	Total	p-value
Age (years)	Mean ± SD	33.43 ± 7/08	32.54 ± 7.82	32.99 ± 7.42	.627 ^a
Experience in critical care units (years)	Mean ± SD	6.43 ± 4.91	5.83 ± 4.16	6.13 ± 4.53	.585 ^a
Total Experience (years)	Mean ± SD	9.75 ± 7.04	8.77 ± 7.19	9.26 ± 7.08	.583 ^a
Certificate of critical care nursing	Yes	17(48.6%)	18(51.4%)	35(50%)	.81 ^b
	No	18(51.4%)	17(48.6%)	35(50%)	
Gender	Men	18(51.4%)	18(51.4%)	36(51.4%)	1 ^b
	Women	17(48.6%)	17(48.6%)	34(48.6%)	
Educational degree	BSc.	27(74.3%)	26(77.1%)	53(75.7%)	.78 ^b
	MSc.	8(25.7%)	9(22.9%)	17(24.3%)	

Abbreviations: BSc, bachelor of science; MSc, master of science; SD, standard deviation.

^aIndependent t-test.

^bChi square.

Urden et al., 2018) located in the patient's files, and all nurses were required to complete these checklists whenever they measured the patients' CVP. At the beginning of the intervention, the researcher explained to nurses that after measurement the CVP they should read the items of the checklist one by one and then tick the "YES" option if they did that item, and the "NO" option if they did not. For example, if they had washed their hands, they would have ticked the "YES" option on the item related to hand washing. There was no more explanation or any education about that. The explanation of how to use the checklist was given only once, at the beginning of the intervention (after the initial assessment of their knowledge). And during the study until the end, no more explanation or education was given to the nurses about anything. In fact, the only difference between the two experiment and control groups was that during the study period, the nurses of the experiment group read and filled the checklist after each CVP measurement, but the nurses of the control group did not receive this checklist. This checklist consisted of 15 items with a yes and no answer, which were organized into three sections related to pre-procedure actions (3 items), actions during the procedure (9 items) and post-procedure actions (3 items). One week after the end of the intervention and removal of all performance checklists from the patients' files, the knowledge of eligible nurses was evaluated by the same tool and method. It is necessary to note that during the intervention and data gathering, no face-to-face or virtual training courses on how to measure CVP was carried out, and no poster, guideline, or other kinds of informative documents on CVP measurement were provided in the hospital and study settings. Thus, the only intervention at that time was the completion of the performance checklists by own nurses. At the end of the intervention, the questionnaires of satisfaction with the performance checklist were completed by the research units of the experiment group.

3.4 | Data analysis

The distribution of the population was assessed and confirmed using the Kolmogorov-Smirnov Test. The statistical analysis was

TABLE 2 Knowledge of the nurses before and after intervention

Group phase	Control (mean ± SD)	Experiment (mean ± SD)	Independent T-test
Before Intervention	5.27 ± 1.71	5.34 ± 1.81	<i>p</i> = .339
After Intervention	5.25 ± 1.72	6.42 ± 1.73	<i>p</i> = .006
Paired T-test	<i>p</i> = .16	<i>p</i> = .001	--

Abbreviation: SD, standard deviation.

performed using SPSS software (version 16; SPSS Inc), and the level of *p* < .01 was considered statistically significant. To compare the scores of knowledge before and after the intervention in each group paired *t*-test was used, and independent *t*-test was used to compare the two groups. To report satisfaction, descriptive statistics indicators including mean, standard deviation and percentage were used.

4 | RESULTS

In this study, 70 eligible nurses working in two medical and surgical intensive care units participated, of whom 51.4% were male, and 75.7% had bachelor's degrees. The nurses were in the age range of 24–50 years, with a mean of 32.99 ± 7.42 years. Most participants had ICU work experience of fewer than 7 years and total nursing experience was between 8 to 10 years and 50% of all nurses in the study had a certificate of intensive care nursing. Statistical analysis (independent *t*-test and chi-square) showed that the two groups were homogenous in all demographic variables (Table 1).

The findings showed that score of nurses' knowledge in the two groups of control and intervention is 5.4 ± 1.5, which was not a high score and indicates the need to improve knowledge in them. Also, the findings showed that the knowledge score of nurses in the control group was 5.27 ± 1.71 and 5.25 ± 1.72 before and after 1 month, respectively (*p* = .16). In the experiment group, the

TABLE 3 Satisfaction of the nurses with application of performance checklists

Index satisfaction	Frequency	Percentage
Low (0–4)	1	2.9
Moderate (5–8)	4	11.4
High (9–12)	30	85.7
Total	35	100
Mean \pm SD	10.8 \pm 2.66	

Abbreviation: SD, standard deviation.

mean of the knowledge score before and after the intervention (5.34 ± 1.81 vs. 6.42 ± 1.73) was statistically significant ($p = .001$) and had 20% increase from the baseline mean score. A comparison of the mean of knowledge score between two groups did not show any statistical significance before the intervention ($p = .33$), while it was statistically significant after the intervention ($p = .006$), and the knowledge of the experiment group was higher (Table 2). The effect size (Cohen D) was also calculated ($d = 0.76$), which indicates the large effect of the intervention to improve the level of knowledge of nurses.

Statistical data also show that the satisfaction score of most of the units in the experimental group in terms of using the performance checklist was in the range of 9–12 and was at a high level of satisfaction (Table 3).

5 | DISCUSSION

The results of this study showed that the nurses' knowledge about the standards of CVP measurement was not desirable and satisfactory, despite the sensitivity of this procedure and its essential role in the management of the hemodynamic status of the patients. The mean knowledge score of nurses was 5.8 out of 11.

So far, no research has been conducted to evaluate the nurses' knowledge about CVP measurement, but various studies have examined nurses' knowledge in other care, some of which concluded similar results to the findings of this study. For example, in a study by Ahmed et al. (2016) to evaluate the knowledge of ICU nurses in aggressive monitoring of hemodynamic in public hospitals of Khartoum, the results indicated that the level of knowledge of nurses in this issue was unacceptable, and this could cause errors and important mistakes in medical treatment and nursing practice (Ahmed et al., 2016). In another study in 2017, nurses' knowledge in general wards and critical units of a general hospital in Egypt, about the care of patients with nasogastric tube was evaluated. The results showed that the nurses' knowledge was insufficient, and the researchers stated that there is a necessity for improving nurses' knowledge (Al-Hawaly et al., 2016). Also, according to the results of Mwakanyanga et al. (2018) conducted in Dar es Salaam city, the knowledge of ICU nurses about endotracheal suctioning was inadequate and unexpected. While, this knowledge

insufficiency can lead to undesirable effects, such as hypoxia, increased risk of infection and hemodynamic changes that affect patient's safety (Mwakanyanga et al., 2018). Similar studies have been carried out in Iran, and almost none of them showed that the level of nurses' knowledge is ideal. Khojastehfar et al. (2019) performed research to determine intensive care nurses' knowledge about pressure ulcer prevention was insufficient (63.10 ± 47.31). Therefore, they stated there is a need for designing and implementing an educational program to improve the nurses' knowledge about the prevention and treatment of pressure ulcers (Khojastehfar et al., 2019).

The findings of this study indicated that using a performance checklist might be able to improve the nurses' knowledge about observing the standards of CVP measurement. Weheida et al. (2015) also investigated the effectiveness of a surgical safety checklist on the surgical team's knowledge in the operating room and found similar results. They showed that applying a surgical safety checklist has a positive effect on interactions among surgical team members, which can promote the patient's safety (Weheida et al., 2015). Another study examined the effect of using a checklist before induction of anaesthesia on improving the awareness of anaesthetic team members about patient's vital information, such as an allergy to drugs or drug history. The result showed that the use of a checklist significantly improved inter-group processes among the anaesthesia team and increased their awareness about patient's vital information, and also decreased the likelihood of errors resulting from the lack of information and coordination (Tscholl et al., 2015). In Iran, very few studies have examined the impact of a performance checklist, and they have mainly focused on the quality of performance. Habibzadeh et al. (2014) investigated the effect of using a checklist on the quality of intra-hospital transfer of ICU patients. In this study, the quality of 50 intra-hospital transfers was studied. Then, an intra-hospital checklist was given to nurses to use in patient's transfer and document all tasks they do before, during, and after the patient's transfer. One month later, the quality of 50 intra-hospital transfers was re-evaluated. The results showed that the quality of patients' transfer had significantly improved and committed to the standards ($p = .006$) (Habibzadeh et al., 2014).

Continuation and survival of any change or innovation require the support and adherence of individuals, and users' satisfaction with that change or innovation plays a vital role in this. In the field of teaching and learning, learners' satisfaction can help increase learning by motivating learners and leading to their scientific and practical development (Gagne, 2017). Therefore, this issue is of particular importance. In this study, ICU nurses' satisfaction was also high. The results of this study showed that most ICU nurses (85.7%) were satisfied with the use of performance checklists and their average satisfaction score was 10.08 out of 12 points (Table 3) which is a factor of their acceptance.

According to the findings of this study and similar studies, it can be concluded that the use of performance checklists, in addition to improving the nurses' performance, also might be able to

improve their knowledge by mentally engaging them and causing them to remember and rethink the standards of the procedure. In pedagogy, it is crucial that educational methods must not merely provide knowledge; but they must make the learner be active in the learning process and must emphasize self-directing and self-reflection and, at the same time, bring their satisfaction (Kawalilak & Groen, 2014). The performance checklists used in this study were consistent with the characteristics of adult learners as making them reflect on their performance considering items written in the checklists and help them not forget or ignore the right steps of the procedure.

It should be explained that studies that have been conducted about applying performance checklists were done in a single group, while the present study was carried out with a controlled design in two groups to verify the effectiveness of this technique more truthfully. Considering this, it is a valuable study compared to previous studies, mainly because no study has been found to evaluate the effect of a checklist on knowledge. Of course, the study also had some limitations, including non-randomized design. On the other hand, since this study was conducted in a small sample, it is better to design another randomized clinical trial with a larger statistical population for more generalizability and higher authenticity. It is also suggested that the effectiveness of performance checklists be investigated concerning other aspects such as infection rate, hospital stay, or even nurses' workload and costs. Since considering users' satisfaction and views can influence on using a tool or technique and its sustainability, it is recommended that nurses' opinion about the use of performance checklists and their satisfaction with this method as an indirect educational method be evaluated in comparison with other traditional methods of continues professional education.

6 | CONCLUSIONS

The findings suggest that application of performance checklists as a simple tool is consistent with the self-directing and rethinking principles of adult learning, and it can be recommended to upgrade and preserve nurses' knowledge about the standards of care procedures, especially the crucial and sensitive ones. It also helps to standardize care and improve the quality of nurses' performance. This technique can work as an indirect teaching method and is especially useful in ICUs, where many vital nursing procedures perform and enhancing nurses' knowledge and quality of their performance is essential for patients' safety.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

CONFLICTING INTEREST

There is no conflict of interest to be declared.

ETHICAL APPROVAL

This research was obtained ethics approval from the 'REDACTED'. The written informed consent was attained from all eligible nurses who participated in the study.

CLINICAL TRIAL REGISTRATION

This study was first recorded and approved by code IRCT201412028100N5 at the Clinical Trials Center of Health Ministry of Iran.

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