Assiut Scientific Nursing Journal
http://asnj.journals.ekb.eg http://www.arabimpactfactor.com
DOI:10.21608/asnj.2025.414250.2148 http://olddrji.lbp.world/indexedJournals.aspx
https://vlibrary.emro.who.int/journals/assiut-scientific-nursing-journal

Assessment of nurses' knowledge regarding invasive procedures in the intensive care unit

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Abstract:
Background: Critical care nurses are the health care professionals who have the obligation to care for critically ill patients. Therefore critical care nurses should have sufficient knowledge to achieve high quality nursing care. **Aim:** To assess the nurses' knowledge regarding invasive procedures in the intensive care unit **Methods:** This study used a descriptive cross sectional design. **Settings:** Study was conducted at trauma, general, anesthesia, obstetric and Alrajhy liver intensive care units at Assuit University hospitals. **Sample:** A convenience sample, A total of 75 nurses (15 nurses from every unit) who are working at Intensive Care Units **Tool: tool I:** nurses knowledge assessment tool which include two parts **part 1:** personal characteristics of nurses **part 2:** self-administered questionnaire of nurses knowledge. **Results:** About 30.7% of the studied nurses had a satisfied level of knowledge about invasive procedures for critically ill patients, while 69.3% of them had unsatisfied level of knowledge. **Conclusion:** Most of the studied nurses had unsatisfied level of knowledge about invasive procedures for critically ill patients. **Recommendations:** Conduct orientation and periodic in- service educational program for nurses in intensive care units regarding invasive procedures for continuous update of their knowledge.

Keywords: Intensive care unit, Invasive procedures &Nurses' knowledge.

Introduction:
The intensive care unit (ICU) performs a number of medical procedures every day. It is clear that complications are still common and can sometimes be fatal. subcutaneous ulceration, and necrosis **(Pronovost et al., 2021).** Intravenous catheters, nasogastric tubes, endotracheal tubes, central venous catheters, hemodialysis double-lumen catheters, and chest tubes are the most often utilized support and monitoring devices in the intensive care unit. Critically ill patients frequently experience procedures related complications, which can be fatal. **(Mayez et al., 2022).**

Invasive and non-invasive procedures are the two categories into which procedures fall. Any medical procedure that involves breaking the skin in some way is considered invasive. Non-invasive procedures, which are any medical procedure that doesn't involve breaking the skin, are also fairly common. Like any other surgical procedure, minimally invasive procedures carry the same risks and complications, which include bleeding, infection, adhesions, damage to internal organs, damage to blood vessels, blood clotting in the veins or lungs, respiratory issues, and death **(Whiteley et al, 2024).**

For many patients, invasive procedures like peripheral venous catheterization and endotracheal suctioning are an essential component of nursing care; however, any invasive procedure carried out improperly by nurses has the potential to cause patients to suffer severe physical harm. According to **Shibuya et al. (2024),** the World Health Organization defines patient safety as the prevention of needless patient harm and a continuous reduction in risks. Nurses must adhere to patient safety standards in order to provide high-quality nursing care and prevent nursing errors **(Vaismoradi et al., 2020).**

Particularly for novice nurses, there is a significant discrepancy between expected and actual professional patient care capacity for invasive procedures. Nurses were found to have differences between invasive procedures and guidelines. The American Association for Respiratory Care, for instance, created guidelines to lessen the negative effects of suction. According to a multicenter observational study conducted in France, nurses failed to use suctioning techniques as prescribed, such as using the appropriate suction catheter size **(Shibuya et al., 2024).** According to a cross-sectional study, many critical care nurses also disregard endotracheal suctioning protocol **(Alkubati et al., 2022).**

The management and care of patients following invasive procedures and their complications are falling more and more on nurses. To guarantee best practices and patient outcomes, knowledge of and application of evidence-based practice are crucial. The members of the healthcare team directly

responsible for patient care during any invasive procedure are nurses **(Mayez et al., 2022).**

Significance of the study:

Low-knowledge nurses are unable to effectively assess patients' needs, communicate with them, and appropriately address their physical, mental, social, and spiritual issues **(Mohamed & Ibrahim, 2021).**

Aim of the study:

This study aimed to assess the nurses' knowledge regarding invasive procedures in the intensive care unit.

Research Question:

What is the level of nurses' knowledge about invasive procedures in the intensive care unit?

Operational definition:

Invasive procedure: A procedure in which the body is penetrated or entered by a tube or a needle**.**

Subject & Method:

The subject and method of the current study were discussed under four designs (technical, operational, administrative, and statistical design).

Technical design:

Research design:

Descriptive cross sectional was conducted for this study.

Setting:

The study was carried out at the Assuit University hospitals' trauma, general, anesthesia, obstetric, and Alrajhy liver intensive care units. The regions of Upper Egypt are served by this hospital. There were 13 beds in the trauma intensive care unit, which was located on the first floor of Main Hospital. 13 beds were involved in the general found on the first floor of Main Hospital. Ten beds were involved in the anesthesia intensive care unit trauma that was discovered on the second floor of Main Hospital. Eight beds made up the obstetric intensive care unit, which was located on the third floor of Woman Health Hospital, and the Alrajhy liver intensive care unit, which had 12 beds and was located on the third floor of Alrajhy Hospital.

Subjects:

Sample:

A total of 75 nurses (15 nurses from every unit) who are working at Intensive Care Units (trauma, general, anesthesia, obstetric, and Alrajhy liver intensive care unit) at Assiut University Hospital were included in the convenience sample.

Tool of data collection:

Tool: Nurses' Knowledge Assessment tool: this tool was developed by the researcher after reviewing different related literature **(American thoracic society, 2022 and Perry A., et al., 2021).** The tool had two parts:

Part (1): It was concerned with demographic characteristics of nurses include: age, gender, qualifications, years of experiences,, and previous attendance of training courses regarding care of invasive procedures in intensive care unit.

Part (2): Nurses Self-administered Questionnaire to Assess Nurses' knowledge about Invasive procedures, This part was developed by the researcher after reviewing the related literature was concerned with assessed the level of CCNs' knowledge about invasive procedures which included general information about invasive procedures, information about central line catheters, urinary catheter installation, information about instruments used in invasive procedures, endotracheal tube insertion, suctioning and role of nurse during invasive procedures and information to be followed during invasive procedures in order to lower the patient's risk of infection **(Shibuya, et al., 2024).**

Scoring system:

Nurses' Level of knowledge consisted of 30 items in the form of multiple choice (MCQ) and open questions. Zero mark was given for each incorrect answer and (1) mark was given for each correct answer. The total score of questionnaire was 30 marks.

Preparatory phase:

The researcher obtained permission to conduct the study from the hospitals responsible authorities after explanation the aim of the study.

The researcher prepared and developed the tools used in data collection after reviewing the related literature**.**

Tool Validity:

Three panel experts from Assiut University's Faculty of Nursing's Critical Care Nursing department evaluated the study's instruments to ensure that they accurately measured the things they were intended to measure. The tool were modified in accordance with the panel's assessment of the items' order, appropriateness, and sentence clarity.

Tool Reliability:

The researcher used tool reliability to test the instruments' internal consistency. Cranach's alpha test was used to evaluate reliability. Reliability items extracted from scales and analyses found in the SPSS program were used to measure it. For the structured interviewing questionnaire, it was reported to be 0.786.

Pilot study:

To determine the validity and reliability of the study instruments, the questionnaire was pre-tested on 10% (8 nurses) of the nurses who were being studied, taking into account almost two nurses from each intensive care unit. Since the study instruments were not significantly altered, the subjects from the pilot study were included in the main study.

Field work:

Data collection of the study took about 7 months started at the beginning of July 2023, and completed by the end of February 2024.

Administrative design:

The responsible authorities at Assuit University Hospital's trauma, general, anesthesia, obstetric, and Alrajhy liver intensive care units granted permission to carry out the study. They received a letter from the director of the selected study setting at the nursing faculty of Assuit University, asking them to continue cooperating with the study.

Ethical considerations:

The ethical committee of the Assuit University Faculty of Nursing gave its approval for the proposed study to be carried out. The study subjects are not at risk while the research is being applied. Common ethical guidelines for clinical research were adhered to in this study. Following an explanation of the study's nature and objectives, nurses who took part gave their informed consent. Anonymity and confidentiality were guaranteed. Participants in the study are free to decline participation or to leave at any time without providing a valid reason. Privacy of study participants was taken into account when data was being collected.

Procedures:

- The researcher started gathering data as soon as authorization to carry out the suggested study was given.
- At Assuit University hospitals, information was gathered from the trauma intensive care unit, general, anesthesia, obstetric, and Alrajhy liver units.
- Following an explanation to the nurses who consented to take part in the study before any data was gathered.
- The nurses took 20 to 30 minutes to complete the questionnaire, which asked them to provide information about their personal characteristics and their knowledge of invasive procedures in intensive care.
- The researcher met with each nurse individually to complete the knowledge questionnaire

Statistical analysis:

The collected data was organized, categorized, coded, tabulated, and analyzed using the Statistical Package for Social Sciences (SPSS) version 26. The data was displayed in tables and figures with numbers, percentages, means, and standard deviations to assess the relationship between two qualitative variables. The Pearson test was utilized to demonstrate the significance of the correlation between the variables. Statistical significance was determined by using a P-value of less than 0.05.

Results:

Table (1): Frequency distribution of the studied nurses according to their personal characteristics (n=75)

Personal characteristics	N	%
Age/ years		
< 25 years	13	17.3
25-30 years	**37**	**49.4**
> 30 years	25	33.3
Age (mean± SD)	**28.87±51.82**	
Gender		
Male	12	16.0
Female	**63**	**84.0**
Residence		
Urban	37	49.3
Rural	**38**	**50.7**
Level of education:		
Three-year nursing diploma	16	21.3
Technical Institute	**39**	**52.0**
Bachelor's	20	26.7
Social status:		
Single	21	28.0
Widower	1	1.3
Married	**50**	**66.7**
Divorced	3	4.0
Type of intensive care units		
Trauma	15	20.0
Anesthesia	15	20.0
Obstetrics	15	20.0
General	15	20.0
El Raghy	15	20.0
Attended training courses on intrusive procedures before?		
Yes	**44**	**58.7**
No	31	41.3
If yes, when was this turn? (n=44)		
Not remember	**20**	**45.5**
< 1year	13	29.5
1-5 year	9	20.5
>5 years	2	4.5
If yes, what is the duration of the course		
Less than 10 hours	7	15.9
10 hours-1 day	7	15.9
More than 1 day	**30**	**68.2**
Duration (mean± SD)	**4.645±27.643**	
If yes, where did you take this course		
Main Hospital	**26**	**59.2**
Assiut University	3	6.8
Continuous learning	13	29.5
Others (Faculty of medicine, Institute of nursing)	2	4.5

Others (Faculty of medicine, Institute of nursing)

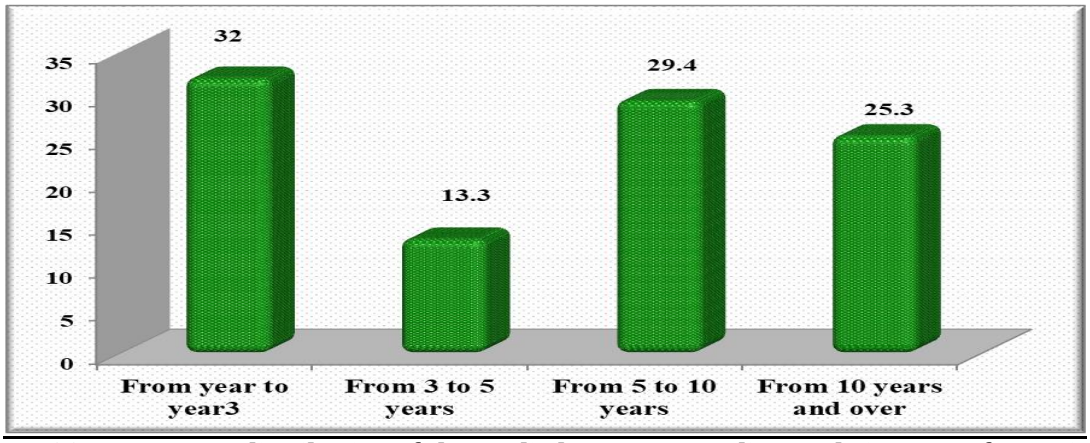

Figure (1): Frequency distribution of the studied nurses according to their years of experience (n=75)

Table (2): Frequency distribution of the studied nurses according to general knowledge about invasive procedures for critically ill patients (n=75)

Items	N	%
What is mean invasive procedure is?		
Correct answer	46	61.3
Incorrect answer	29	38.7
The goal of performing invasive procedure for patients in the intensive care unit?		
Correct answer	56	74.7
Incorrect answer	19	25.3
Don't know	0	0.0
What are laryngeal tubes?		
Correct answer	56	74.7
Incorrect answer	19	25.3
Don't know	0	0.0
When does the patient need a laryngeal tube?		
Correct answer	61	81.3
Incorrect answer	14	18.7
Don't know	0	0.0
What is the purpose of installing a laryngeal tube?		
Correct answer	37	49.3
Incorrect answer	**38**	**50.7**
Don't know	0	0.0
What are the complications that occur from the suction process		
Correct answer	61	81.3
Incorrect answer	14	18.7
Don't know	0	0.0
What is a central line catheter?		
Correct answer	63	84.0
Incorrect answer	12	16.0
Don't know	0	0.0
What is the purpose of installing the central line catheter?		
Correct answer	**66**	**88.0**
Incorrect answer	9	12.0
Don't know	0	0.0
What are the complications resulting from the installation of the central line catheter?		
Correct answer	25	33.3
Incorrect answer	**50**	**66.7**
Don't know	0	0.0

Items	N	%
What is the purpose of installing a urinary catheter?		
Correct answer	63	84.0
Incorrect answer	12	16.0
Don't know	0	0.0
What are the complications of installing a urinary catheter?		
Correct answer	**66**	**88.0**
Incorrect answer	9	12.0
Don't know	0	0.0

Table (3): Frequency distribution of the studied nurses according to knowledge about tools used in invasive procedures (n=75)

Tools	Yes		No	
	N	%	N	%
Central venous catheter	10	13.3	**65**	**86.7**
Laryngeal tube	14	18.7	61	81.3
Urinary catheter	24	32.0	51	68.0
Nasogastric tube	11	14.7	**64**	**85.3**
Personal protective equipment	**55**	**73.3**	20	26.7
Syringe	32	42.7	43	57.3
Suction catheter Laryngoscope	13	17.3	62	82.7
Urine collection bag	14	18.7	61	81.3
Disinfectant	**52**	**69.3**	23	30.7
Blaster	15	20.0	60	80.0
Sterile brushes	19	25.3	56	74.7
Sterile surgical instruments	33	44.0	42	56.0

Table (4): Correlation between total nurses knowledge of the studied nurses and their personal characteristics (n=75)

Items		Total knowledge
Age/ years	Pearson Correlation	0-.054
	Sig. (2-tailed)	0.643
Gender	Pearson Correlation	**0.323****
	Sig. (2-tailed)	**0.005**
Residence	Pearson Correlation	0-.147
	Sig. (2-tailed)	0.208
Level of education:	Pearson Correlation	**0.341****
	Sig. (2-tailed)	**0.003****
Years of experience	Pearson Correlation	**0.667****
	Sig. (2-tailed)	**0.000**
Social status	Pearson Correlation	0.022
	Sig. (2-tailed)	0.852
Type of ICU	Pearson Correlation	0.139
	Sig. (2-tailed)	.156
Attended training courses on intrusive procedures before?	Pearson Correlation	**.397****
	Sig. (2-tailed)	**.000**

Pearson test
(**) Highly Statistical significant difference *(*) Statistical significant difference*

Table (1): Illustrates that 49.4% of the studied nurses had an age group from 25-30 years with a mean age of 28.87±51.82, about 84.0% and 50.7% of them were female and lived at rural areas respectively. Concerning level of education, 52.0% of the studied nurses had technical institute, about 66.7% of them were married. Regarding type of intensive care units, numbers were taken equally (20%) from each unit. Concerning attending training courses on intrusive procedures before, about 58.7% of them attended training course, from them 45.5%, 68.2% and 59.2% of them not remembered when took it, took a duration

of > 1 day, and received it at Main Hospital respectively.

Figure (1): Shows that 32.0% and 29.4% of the studied nurses had years of experiences from 1-3 years and 5-10 years respectively.

Table (2): Clarifies general knowledge about invasive procedures for critically ill patients, and reported that 88.0% of the studied nurses answered correctly about "What is the purpose of installing the central line catheter?" and "What are the complications of installing a urinary catheter?", while 66.7% and 50.7% of them answered incorrectly about "What are the complications resulting from the installation of the central line catheter?" and "What is the purpose of installing a laryngeal tube?" respectively.

Table (3): Shows general knowledge about tools used in invasive procedures, and found that 73.3% and 69.3% of the studied nurses know and mentioned personal protective equipment and disinfectant respectively, while 86.7% and 85.3% of them didn't mention central venous catheter and Rayl respectively.

Table (4): Reports that there were positive correlation between total knowledge and the studied nurses' gender, level of education, years of experiences, and attended training courses. Negative correlation between total knowledge and nurse age and residence was observed while no correlation was observed regarding social status and type of ICU.

Discussion:

Critically ill patients who are surrounded by ventilators, monitors, and other advanced medical equipment, as well as a sizable staff and the participation of consultants from various specialties, make up intensive care units (ICUs), a significant part of the healthcare setting **(Schell et al., 2024).** The management and care of patients following invasive procedures and their complications are falling more and more on nurses. To guarantee best practices and patient outcomes, knowledge of and application of evidence-based practice are crucial. The members of the healthcare team directly responsible for patient care during any invasive procedure are nurses **(Koshy et al., 2021).**

The present study applied on 75 nurses worked at intensive care units of Trauma, Anesthesia, Obstetrics, General, and Al Rajhi. It aimed to assessment of nurses' knowledge regarding invasive procedures in the intensive care unit.

Regarding the personal characteristics of the nurses under study, the current study shows that the majority of the nurses were female and that slightly less than half of them were in the 25–30 age range. More than half had a technical institute and resided in rural areas. of them, two-thirds were married. Less than three-fifths of the nurses in the study had previously attended training sessions on intrusive procedures; of these, less than half, more than two-thirds, and slightly less than three-fifths did not recall when they took the course, which lasted more than a day, and were given at Main Hospital, respectively.

In line with earlier research, **Aziz et al., (2020)** conducted a study in Egypt to evaluate nurses' performance in implementing patient safety in intensive care units by evaluating nurses' knowledge and performance in this area. They found that most of the nurses in the study were female, that two-thirds of the nurses were between the ages of 20 and 30, and that two-fifths of them had attended nursing school. Additionally, training courses were taken by three-fifths of the nurses in the study.

In line with earlier findings **Mayez et al., (2022),** who conducted their study in Egypt to evaluate nurses' performance in relation to invasive procedures, the study found that the average age of the nurses was 24.60, that over three-quarters of them were female, that over two-thirds of them had graduated from a nursing institute, that over three-fifths of them had taken training courses, and that over one-third had not taken any training courses. According to the researcher, agreement may be related to using the same sample (nurses) and similar study settings, which creates similar personal data.

Conversely, **Yazdannik et al. (2018)** conducted a study in Iran titled "Performance of ICU Nurses in Providing Respiratory Care" and discovered that the majority of nurses had bachelor's degrees and were between the ages of 22 and 48, with a mean (SD) age of 30.42 (5.84) years. The reason for this discrepancy could be that the study was conducted in Iran, a different nation.

According to the actual study, slightly less than one-third, less than one-sixth, and less than one-third of the nurses under study had years of experience ranging from one to three years, three to five years, and five to ten years, respectively. Less than three-quarters of the nurses in the study had less than five years of experience, which was comparable to the findings of **Aziz et al., (2020)**. Additionally, **Mayez et al., (2022)** discovered that approximately 50% of the nurses in the study had between five and ten years of experience.

In a similar vein, **AbdElbaky et al. (2018)** conducted a study to assess the effect of simulated education on nurses' performance and knowledge regarding invasive procedures at intensive care units. They showed that most of the nurses in the study provided accurate answers when asked about the purpose of installing a urinary catheter and a central line catheter. According to **Abdelmoaty et al., (2020),**

who conducted their study in Egypt to evaluate nurses' knowledge and proficiency in managing indwelling urinary catheters, the majority of the nurses in the study were aware of the proper indications for urinary catheter insertion. According to the researcher, this is similar to the fact that the information is essential for nurses working in intensive care units, so the majority of nurses were aware of it.

According to a different viewpoint published by **Mahmoud et al. (2018),** who conducted a study titled "Nurses' Performance Regarding Central Venous Catheters at Neonatal Intensive Care Units," approximately one-third of the nurses in the study correctly identified the indications for catheter insertion, while half were unaware of them. This discrepancy could be the result of inadequate organization-provided training and follow-up for all nurses in charge of work.

According to the actual study, the majority of the nurses did not mention central venous catheters and Ryle, and less than three-quarters of them knew about and mentioned personal protective equipment and disinfectant, respectively, when it came to the instruments used in invasive procedures. Similar results were reported by **Gezie et al. (2019),** who conducted a study to evaluate health care workers' knowledge, attitude, and practice regarding hospital acquired infection prevention. They discovered that nurses were unaware of certain invasive procedure equipment. This explained the necessity of applying continuous training program and especially for newly employed nurses for all equipment used in the unit.

The current study clarified that, with regard to the overall knowledge level scores of the nurses who were studied, less than one-third of them had a satisfied level of knowledge regarding invasive procedures for critically ill patients, while over two-thirds had an unsatisfied level of knowledge because most of nurses not attending any training for the knowledge.

Less than one-third of the nurses in the study had a satisfied level of knowledge about invasive procedures, while more than two-thirds had an unsatisfied level of knowledge, which is consistent with earlier findings **Aziz et al., (2020).** Similar to earlier findings, more than half of the nurses in the study had unsatisfactory knowledge of invasive procedures, while more than two-fifths of them had satisfied knowledge **Mayez et al., (2022).** According to the researcher, it is crucial to provide intensive care nurses with ongoing workshops and training regarding invasive procedures because there is a lack of ongoing workshops to refresh their knowledge.

In terms of the relationship between the total knowledge of the nurses under study and their personal characteristics, the current study found that total knowledge was positively correlated with the nurses' gender, education level, years of experience, and training courses taken, but not with their age, place of residence, or social standing. Similarly, **Aziz et al., (2020)** demonstrated that total knowledge was positively correlated with the studied nurses' years of experience, education, and training course attendance, but not with their age. Additionally,

Conclusion:

Most of the studied nurses had unsatisfied level of knowledge about invasive procedures for critically ill patients.

There were positive correlation between total knowledge and the studied nurses' gender, level of education, years of experiences, and attended training courses

Recommendations

- Conduct orientation and periodic in- service educational program for nurses in intensive care units regarding invasive procedures for continuous update of their knowledge.
- Creating a thorough and streamlined pamphlet with instructions for invasive procedures in intensive care units
- Conduct the study with a larger sample and in various hospital settings.

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