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NURSES' PERFORMANCE REGARDING MEDICAL DEVICES INDUCED ULCER AMONG CRITICALLY ILL PATIENTS

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Abstract

Background: Medical Devices Related Pressure Ulcer are skin breakdown due to certain medical devices. **Aim:** Assess nurses' level of knowledge and practice regarding medical devices induced ulcer among critically ill patients. **Design:** Descriptive exploratory research design. **Setting:** General Intensive Care Unit of Beni-Suef University Hospital. **Subjects:** All nurses (40 nurses) from General Intensive Care Unit of Beni-Suef University Hospital. A convenient sample of all available nurses who worked at the previous mentioned setting. **Tools:** The investigator prepared an interview form including two tools. Tool (I) Self-administered Interview Questionnaire consisted of 2 parts; Part (I): Questionnaire to assess demographic characteristics of studied nurses. Part (II): Questionnaire to asses' nurses' level of knowledge regarding medical devices induced ulcer. Tool (II) Observational checklist to assess nursing care of endo tracheal and tracheostomy tube. **The main results of the present study:** the study results revealed that more than three fifth of the studied nurses were having unsatisfactory total level of knowledge and less than three fifth of the studied nurses were having incompetence total level of practice regarding medical devices induced ulcer among critically ill patients. **Conclusion:** It can be concluded that there was statistically significant positive correlation between nurses' total level of knowledge and their total level of practice. **Recommendation:** Develop and implement intervention program to improve nurses' performance regarding medical devices induced ulcer among critically ill patients.

Index Terms: Critically Ill Patients, Medical Devices, Nurses' Performance, Ulcer.

INTRODUCTION

Pressure ulcer defined as local injuries to the skin and/or underlying tissue as a result of constant pressure for a long period of time. Pressure ulcers are classified as either devices related pressure ulcer, or non-devices related pressure ulcer. Research recommends that approximately a third of reported pressure ulcers are related with the use of medical devices **[1]**.

National pressure ulcer advisory Panel has reported that the definition of medical devices related pressure ulcer (MDRPU) occurred as the result of the use of devices for diagnostic or therapeutic purposes. Pressure ulcer take the shape of the device itself. Medical devices related pressure ulcer varies from classic pressure ulcer. It causes a localized injury to the skin or underlying tissue as a result of prolonged pressure from medical devices **[2]**.

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Medical devices related pressure ulcer considered significant health problem among critically ill patients. Its account more than 30% of all hospital acquired pressure ulcer. Related to the previous study, the risk for pressure ulcer development in patients with medical devices is 2.4 times larger than that in other patients. In other study showed in Egypt, reported that, the incidence of tracheal tube related pressure ulcer was 90% **[3]**.

Critically ill patients vulnerable to MDRPU for a many of reasons, such as malnourishment, decreased moving and mobility and decrease sensory perception as a result of sedative medications, and severe peripheral neuropathy that prevent alertness of pressure and movement in reply to tissue ischemia. So, decreased tissue perfusion and higher rate of usage of supportive medical devices in the Intensive Care Unit place the patients at a higher risk of developing medical devices related pressure ulcer **[4]**.

Medical devices related pressure ulcer occur on the head, neck and face and may be produced by inappropriate devices used, inappropriate securement, or unable to visualize the skin under the devices, lack of practice rules and workload of the staff and experience also impact on the risk of MDRPU development. Endotracheal and tracheostomy tube accounting for the majority of these pressure ulcer. Preceding studies have been revealed that, medical devices related pressure ulcer occur in 24% to 34.5% of patients and, of those, 30% to 70% were caused by respiratory related medical devices, especially in critical care settings **[5]**.

The medical devices itself creates pressure, humidity, and heat that cause altering the microclimate of the skin. Often these devices must be secured strongly to assure a proper cap, which in turn makes pressure in unusual areas rather than bony prominence. The material used to secure the devices e.g., tape or ties may make it difficult to examine the underlying skin beneath them. All of these factors increase the risk of MDRPU among critically ill patients **[6]**.

Critical care nurse had the special challenge of identifying the right interventions to prevent medical devices related pressure ulcer progress. They should know how to stage pressure ulcer, examine skin under and around the devices, apply constant methods to secure devices to avoid pressure, follow manufacturer instructions for indication, observing, application and removal of this devices **[7]**.

Finally, nursing preventive measures used to prevent MDRPU in agreement with evidence based practice which include many things related to endotracheal and tracheostomy tube, such as correct methods of securing endotracheal tube and tracheostomy tube such avoiding securing ETT and TT fixation tie under patients' head and repositioning of ETT from right, middle to left , providing mouth care to patient by normal saline solution, application of ETT for no more than three weeks by which time TT must be suggested, putting dressing under the tracheostomy flange during period after surgery, keep skin under tie and stoma care at least every 8:12 hours **[8]**.

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Significance of the Study:

Medical devices related pressure ulcer are associated with an increased risk of mortality, cost and length of stay at hospital. Nurses have a vital role in preventing MDRPU. So, nurses who provide direct care to critically ill patients should be have adequate level of knowledge and practice regarding medical devices induced ulcer **[2]**.

Globally, according to the previous study in Ireland, the incidence of MDRPU in adults within the acute hospital setting to be 28.1%. The most common locations of MDRPU included the ears, nose, face, chin, and lips. The most common gradings of MDRPU were grade 1 or grade 2 ulcers. The most common medical devices that caused MDRPU included face masks, nasal cannulas, endotracheal, tracheostomy and nasogastric tubes **[9]**.

In other study conducted in Egypt reported that, the incidence of tracheal tube related pressure ulcer was 90%. The control group of 52 subjects. With regard to ETT related Pressure ulcer, the incidence in the control group was 90%. Incidence of Nasogastric tube related pressure ulcer in the control group was 77.8%. The most common anatomical locations of MDRPU included the ears, nose, face, chin, and lips. The most common medical devices that caused MDRPU included ETT and NGT **[10]**.

Operational Definitions of Research Variables:

Nurses' performance: Mean nurse's knowledge and practice. It is a process of performing a task measured against preset known standards of accuracy, completeness, cost and speed.

Medical Devices: Include endo tracheal tube and tracheostomy tube.

AIM OF THE STUDY:

This study aims to:

1. Assess Nurses' level of knowledge regarding medical devices induced ulcer among critically ill patients.
2. Assess Nurses' level of practice regarding medical devices induced ulcer among critically ill patients.

Research Questions:

1. What is the Nurses' level of knowledge about medical devices induced ulcer among critically ill patients?
2. What is the Nurses' level of practice about medical devices induced ulcer among critically ill patients?

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SUBJECTS AND METHODS:

The subject and methods for this study were portrayed under the four main Items as follows:

I. Technical items.

II. Operational items.

III. Administrative items.

IV. Statistical items.

I. Technical items:

It included research design, setting, subject and tools for data collection.

Research design: This research utilized a descriptive exploratory research design to achieve the aim of the current study.

Research setting: This study was conducted at General Intensive Care Unit at Beni Suef University Hospital.

Research subject: A Convenient sample of all available nurses about (40 nurses) working at the previous mentioned unit and agree to participate in this study.

Tools for data collection:

Data collected through the following tools:

Tool (I): Self-administered Interview Questionnaire: It was used to assess Nurses' level of knowledge regarding medical devices induced ulcer. It was developed by the investigator after reviewing related literature and written in simple Arabic language to gather data regarding the following parts:

- **Part (I):** It was concerned with demographic characteristics of the Nurses at intensive care unit, it included: age, gender, marital status, Years of experience in ICU, educational level, previous educational sessions related to medical devices induced ulcer.
- **Part (II):** Nurses' Knowledge Assessment Tool: It was developed by investigator based on the relevant and recent scientific literature review (Gefen et al., 2020; Tan et al., 2020) **" [3], [10] ".** It was concerned with the assessment of nurses' level of knowledge related to anatomy of skin, definition of pressure ulcer and medical devices related pressure, causes, risk factors, stages and complication of medical devices related pressure ulcer, the most affected site, most common devices cause pressure ulcer, endotracheal and tracheostomy tube related pressure ulcer.

Scoring system for knowledge:

According to the answers obtained from studied nurses, a scoring system was followed. The total score was 35 and converted to 100%. The studied nurses' answers were

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compared with a model key answer, where (1) score for correct answer, and (zero) for incorrect answer. According to the nurses' answers, their total level of knowledge was categorized as the following :

- ≥75%(27 grade) was considered satisfactory level of knowledge.
- < 75% (27 grade) was considered unsatisfactory level of knowledge.

Tool (II):

- **Part (I): Observational checklist to assess nursing care of endotracheal tube:** It was adapted and modified by the investigator after reviewing the related literature to observe nurses' level of practice for endotracheal tube care. It includes 18 items with done\not done answer format. This tool included (Prepare the equipment, Identify the patient, introduce yourself and explain the procedure to the patient, establish the privacy, hand washing, put on gloves and other personal protective equipment, place clean towel across patient's chest. suction, remove old tie, inspect condition of skin, reposition ETT, clean around ETT by saline- soaked gauze, mouth care, secure endotracheal tube carefully, apply the skin barrier to the patient' face where the tie will sit, change tie, clean, store, and replace equipment, remove gloves and wash hands (Perry et al., 2018 ; Lynn, 2019) **" [11], [12] ".**
- **Part (II): Observational checklist to assess nursing care of tracheostomy tube:** It was adapted and modified by the investigator after reviewing the related literature to observe nurses' level of practice for tracheostomy tube care. It includes 17 items with done\not done answer format. This tool included (Prepare the equipment, identify the patient and explain procedure, maintain privacy, hand washing, put on gloves and other PPE, place towel on patient's chest under tracheostomy site, suction the trachea and pharynx, unlock, remove inner cannula or replace it with new one, inspect the area, clean the skin around tracheostomy, change tracheostomy tie, keep knot at the side of the neck, alternate knot from side to side, ties should be tight enough but loose enough to permit two fingers to fit between tie and neck, place a gauze pad between the stoma site and the tracheostomy tube, clean and return equipment, remove gloves and wash hands (Sharma, 2019 ; Lynn ,2019). **" [12], [13] ".**

Scoring system for observational checklist :

The total scores of nurses' level of practice was 35 scores and converted to one hundred percentages (100%). Nurses' level of practice was evaluated by giving (1) score for done answer and (zero) score for not done answer, then the scores are converted to percentage and total score categorized as the following :

- ≥80 %(28 grade) was considered competence level of practice.
- < 80% (28 grade) was considered incompetence level of practice

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Validity :

Is whether or not the instrument measures what it is designed to measure.

Testing Validity :

Content validity was conducted to determine whether the tool covers the aim. The tools were revised by a jury of 5 experts: Associate professors and lectures of medical surgical nursing from faculty of nursing Helwan University, who revised the content of the tools for comprehensiveness, accuracy, clarity, relevance and applicability, minor modifications were done .

Reliability :

Is the consistency of the measurement instrument. The degree to which an instrument measures the same way each time it is used under the same condition with the same subjects.

Testing Reliability :

Reliability of the tools was tested to determine the extent to which the questionnaire items are related to each other. The Cronbach's Alpha model which is a model of internal consistency was used in the analysis respectively. Statistical equation of Cronbach's Alpha reliability coefficient normally ranges between 0 and 1, higher value (more than 0.7) denotes acceptable reliability .

Testing reliability of the study tool was done by Cronbach's Alpha, it was (0.795) for knowledge questionnaire and (0.815) for practice checklists.

Ethical Considerations:

An official permission to conduct the proposed study was obtained from the Scientific Research Ethics Committee Faculty of Nursing Helwan University. Participation in the study is voluntary and subjects were given complete full information about the study and their role before signing the informed consent. The ethical considerations were include explaining the purpose and nature of the study, stating the possibility to withdraw at any time, confidentiality of the information where it was not be accessed by any other party without taking permission of the participants. Ethics, values, culture and beliefs was respected.

II- Operational Items:

Preparatory phase:

It was included reviewing of past, current, national and international related literature and theoretical knowledge of various aspects of the study using books, articles, internet, periodicals and magazines to develop tools for data collection.

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Pilot Study:

The pilot study was done on 10% (4 nurses) of the sample to examine the clarity of the tool and time needed to complete the study tools. No modification done, so, the participants in the pilot study were included in sample size.

Field work

- Data collected by the investigator over three days per week during morning shift at General Intensive Care Unit in Beni Suef University Hospital.
- Data collection was stated and completed within 3 months from April (2022) until the end of June (2022).
- For data collection, each nurse was assessed individually using the study tools. The investigator was available at the study setting three days weekly from 9am to 2pm and started by introducing herself to the nurses then informing them about the aim of the study to assess nurses' level of knowledge and practice regarding medical devices induced ulcer among critically ill patients.
- The investigator gave each nurse the knowledge questionnaire tool to answer it and observed each nurse individually during their work in morning shift to assess their level of practice.
- The time consumed for completion of the questionnaire format was 10-15 minutes. As regards the nurses' level of practice, time consumed for answering the checklist was 10-20 minutes.

III- Administrative Items:

After explanation of the study aim and objectives, an official permission was obtained from the Dean of faculty of nursing Helwan University and the general manager of Beni Suef University Hospital, asking for cooperation and permission to conduct the study.

IV-Statistical Items:

Statistical presentation and analysis of the present study was conducted, using the mean, standard deviation, chi-square test was used to compare between groups in qualitative data and linear correlation coefficient was used for detection of correlation between two quantitative variables in one group. By (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.

RESULTS:

Part I: Nurses 'Demographic Data

Table (1): As observed from this table, regarding age, slightly more than half (52.5%) of the studied nurses were in the age group of 18:< 30 years and the mean age for them were (28.07±3.51). Additionally, this table showed that more than three fifth (62.5%) of the studied nurses were female, (60%) of the studied nurses had technical institute of

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nursing, the mean years of experience inside ICU were (6.44±3.5) and more than four fifth (80%) of studied nurses not attend previous educational sessions related to medical devices induced ulcer**.**

Part II: Nurses 'level of knowledge

Table (2A): Illustrated that all nurses (100%) under study have correct answer of knowledge regarding (Definition of pressure ulcer and the skin of the elderly is thinner and more susceptible to ulceration than younger people). While three quarter (75%) of the studied nurses were having incorrect answer of knowledge regarding (Differences between Classic Pressure ulcer and medical device related pressure ulcer).

As regarding to causes and risk factors of medical devices related pressure ulcer all of nurses (100%) under study have incorrect answer of knowledge regarding (Nutritional status of patients is not important factor in preventing medical device related pressure ulcer) and more than four fifth (80%) of the studied nurses were having incorrect answer of knowledge regarding (The main causes for medical devices related pressure ulcer, previous injury to site connected with device affected on occurrence of medical device related pressure ulcer, important factor for medical device related pressure ulcer, size of device not effect on occurrence of medical device related pressure ulcer and risk for developing medical device related pressure ulcer).

Table (2B): Illustrated that all of nurses (100%) under study have correct answer of knowledge regarding (The most important signs of first, second and third-degree medical device related pressure ulcer and complication of medical device related pressure ulcer). While all of nurses (100%) under study have incorrect answer of knowledge regarding (The most important signs of un stageable ulcer for medical device related pressure ulcer, The most common sites affected by medical device related pressure ulcer and the most common devices are responsible for medical device related pressure ulcer). While more than four fifth (80%) of studied nurses were having incorrect answer regarding (the most important signs of deep tissue ulcer for medical device related pressure ulcer).

Table (3): Illustrated that all of nurses (100%) under study have correct answer of knowledge regarding (Purpose of insertion of ETT, evaluation of skin around connection of ETT and keeping skin clean and dry help to prevent ETT related Pressure ulcer). While (95%) of the studied nurses were having incorrect answer of knowledge regarding (Repositioning of ETT). While more than four fifth (80%) of the studied nurses were having incorrect answer of knowledge regarding (Duration of the ETT intubation before the tracheostomy tube operation and prevention of endotracheal tube related pressure ulcer).

Table (4): Illustrated that more than three fifth (62.5%) of the studied nurses were having correct answer of knowledge regarding (Purpose of tracheostomy tube and assessment of skin under tracheostomy tie), While all of nurses (100%) under study have incorrect answer of knowledge regarding (Preventive nursing procedures to prevent ulcer are associated with tracheostomy tube tape) and more than four fifth (80%) of studied nurses

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were having incorrect answer of knowledge regarding (Complications of tracheostomy tube, inspection of stoma and fixing of tracheostomy tube).

Table (5): Illustrated that (37.5%) of the studied nurses were having satisfactory level of total knowledge and more than three fifth (62.5%) of the studied nurses were having unsatisfactory level of total knowledge regarding medical devices induced ulcer among critically ill patients.

Part III: Nurses 'level of practice

Table (6): Illustrated that above half (60%) of the studied nurses were having done regarding (clean, store, and replace equipment). While (55%) of the studied nurses were having done regarding (Mouth care by normal saline 0.9%, remove gloves and wash hands). While three quarter (75%) of the studied nurses were having not done regarding (Place clean towel across patient's chest), While less than three quarter (70%) of the studied nurses were having not done regarding (Establish the privacy of the patient, change tie or tape every day or when soiled or insecure and Put on gloves and other personal protective equipment).

While more than three fifth (67.5) of the studied nurses were having not done regarding (Remove old tie or tape. While more than three fifth (65%) of the studied nurses were having not done regarding (Apply the skin barrier to the patient' face where the tie will sit). While (62.5%) of the studied nurses were having not done regarding (Introduce yourself, explain the procedure to the patient, perform proper hand washing and reposition ETT to opposite side of mouth or center).

Table (7): Illustrated that more than three fifth (62.5%) of the studied nurses were having done regarding (Hand washing) and (60%) of the studied nurses were having done regarding (Prepare the equipment). While more than four fifth (82.5%) of the studied nurses were having not done regarding (Insert new tracheostomy tie, Keep knot at the side of the neck).

While more than three quarter (77.5%) of the studied nurses were having not done regarding (Change tracheostomy tie and unlock and remove inner cannula,). While three quarter (75%) of the studied nurses were having not done regarding (Alternate knot from side to side each time ties are changed). While less than three quarter (72.5%) of the studied nurses were having not done regarding (securing the tie enough) and (70%) of the studied nurses were having not done regarding (Place a gauze pad between the stoma site and the tracheostomy tube).

Table (8): Illustrated that slightly more than two fifth (42.5%) of the studied nurses were having competence level of total practice and less than three fifth (57.5%) of the studied nurses were having incompetence level of total practice regarding Endotracheal Tube (ETT) and Tracheostomy Tube (TT) care.

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Part IV: Relation between demographic characteristics of nurses under study and their Total level of knowledge.

Table (9): There was highly statistically significant relation between total level of knowledge with age, Years of experience inside ICU and attend previous educational sessions related to medical devices Induced Ulcer when p-value <0.001**. Also, this table show statistically significant relation between total level of knowledge with gender and level of education when p-value <0.05*.

Part VI: Relation between demographic characteristics of nurses under study and their Total level of Practice.

Table (10): There was highly statistically significant relation between total level of practice and demographic characteristics regarding level of education and attend previous educational sessions related to medical devices induced ulcer when p-value <0.001**. Also, this table show statistically significant relation between total level of practice with age, gender and years of experience inside ICU when p-value <0.05*.

Part V: Correlation between the study variables

Table (11): There was statistically significant positive correlation between total level of knowledge score and total nursing care of endo tracheal and tracheostomy tube score with (r= 0.839) & (r= 0.953) respectively. Also show statistically significant positive correlation between total level of knowledge score and total level of practice score with (r= 0.962) with p-value <0.001**.

Figure (1): Illustrated that there was statistically significant positive correlation between total level of knowledge score and total nursing care of endo tracheal tube score with (r= 0.839).

Figure (2): Illustrated that there was statistically significant positive correlation between total level of knowledge score and total nursing care of tracheostomy tube score with (r= 0.953).

Figure (3): Illustrated that there was statistically significant positive correlation between total level of knowledge score and total level of practice score with (r= 0.962) with p-value <0.001**.

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Part I: Nurses 'Demographic Data

Table (1): Percentage distribution of the studied nurses according to their demographic characteristics (n=40).

Variables	N	%
Age		
From 18: <30years	21	**52.5**
From 30: <45years	15	37.5
45 years and more	4	10
Mean±SD	**28.07±3.51**	
Gender		
Male	15	37.5
Female	25	**62.5**
Marital status		
Single	9	22.5
Married	29	**72.5**
Divorced	2	5
Level of education		
Diplome	5	12.5
Technical level	24	**60**
Bachelor degree	8	20
Master/Doctorate degree	3	7.5
Years of experience inside ICU		
1:<5 years	21	**52.5**
5: <10 years	12	30
10 :<15 years	3	7.5
15 years and more	4	10
Mean±SD	**6.44±3.5**	
Did you attend previous educational sessions related to medical devices Induced Ulcer		
Yes	8	20
No	32	**80**

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Part II: Nurses 'level of knowledge

Table (2A): Percentage distribution of the studied nurses' level of knowledge regarding medical devices induced ulcer among critically ill patients (n=40).

Variables	Correct		Incorrect	
A) Anatomy, definition of pressure ulcer, causes and risk factors of medical devices related pressure ulcer	**N**	**%**	**N**	**%**
Component of skin.	25	62.5	15	37.5
Definition of pressure Ulcer	40	**100**	0	0
Definition of pressure ulcer related to medical devices	16	40	24	60
Differences between Classic Pressure ulcer and medical device related pressure ulcer	10	25	30	**75**
The main causes for medical devices related pressure ulcer are devices itself or securing methods	8	20	32	**80**
Constant pressure from devices on the skin is an insufficient reason for medical device related pressure ulcer	16	40	24	60
Nutritional status of patients is not important factor in preventing medical device related pressure ulcer	0	0	40	**100**
The skin of the elderly is thinner and more susceptible to ulceration than younger people	40	**100**	0	0
Previous injury to site connected with device affected on occurrence of medical device related pressure ulcer	8	20	32	**80**
Important factor for medical device related pressure ulcer	8	20	32	**80**
Size of device not effect on occurrence of medical device related pressure ulcer	8	20	32	**80**
Risk for developing medical device related pressure ulcer	8	20	32	**80**

Table (2 B): Percentage distribution of the studied nurses' level of knowledge regarding medical devices induced ulcer among critically ill patients (n=40).

Variables	Correct		Incorrect	
B) Stages, Complication of medical devices related pressure ulcer and the most affected site and most common devices cause pressure ulcer	N	%	N	%
The most important signs of first-degree medical device related pressure ulcer	40	**100**	0	0
The most important signs of second-degree medical device related pressure ulcer	40	**100**	0	0
The most important signs of third-degree medical device related pressure ulcer	40	**100**	0	0
The most important signs of fourth-degree medical device related pressure ulcer	14	35	26	65
The most important signs of deep tissue ulcer for medical device related pressure ulcer	8	20	32	**80**
The most important signs of un stage able ulcer for medical device related pressure ulcer	0	0	40	**100**
complication of medical device related pressure ulcer	40	**100**	0	0
The most common sites affected by medical device related pressure ulcer	0	0	40	**100**
The most common devices are responsible for medical device related pressure ulcer	0	0	40	**100**

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Table (3): Percentage distribution of the studied nurses' level of knowledge regarding endotracheal tube (ETT) related pressure ulcer (n=40).

Variables	Correct		Incorrect	
	N	%	N	%
Purpose of insertion of ETT	40	**100**	0	0
Most common sites affected by oral ETT related PU	23	57.5	17	42.5
The most common factors contributing to ETT related PU	23	57.5	17	42.5
Evaluation of skin around connection of ETT	40	**100**	0	0
Repositioning of ETT	2	5	38	**95**
Duration of the ETT intubation before the tracheostomy tube operation	8	20	32	**80**
Prevention of endotracheal tube related pressure ulcer a small piece of gauze should be placed between the ETT and the skin	8	20	32	**80**
Keeping skin clean and dry help to prevent ETT related Pressure ulcer	40	**100**	0	0

Table (4): Percentage distribution of the studied nurses' level of knowledge regarding tracheostomy tube (TT) related pressure ulcer (n=40).

Variables	Correct		Incorrect	
	N	%	N	%
Purpose of tracheostomy tube	25	**62.5**	15	37.5
Complications of tracheostomy tube	8	20	32	**80**
Important factor in preventing ulcers associated with tracheostomy tube	23	57.5	17	42.5
Assessment of skin under tracheostomy tie	25	**62.5**	15	37.5
Inspection of stoma and fixing of tracheostomy tube	8	20	32	**80**
Preventive nursing procedures to prevent ulcer are associated with tracheostomy tube tape	0	0	40	**100**

Table (5): Percentage distribution of the studied nurses' total level of knowledge regarding medical devices induced ulcer among critically ill patients (n=40).

Total knowledge	N	%
Satisfactory (≥ 75%)	15	37.5
Unsatisfactory (< 75%)	25	62.5
Total	40	100

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Part III: Nurses 'level of practice

Table (6): Percentage distribution of the studied nurses' level of practice regarding nursing care of Endo tracheal tube (n=40).

Variables	Done		Not done	
	N	%	N	%
Prepare the equipment	17	42.5	23	57.5
Identify the patient.	16	40	24	60
Introduce yourself and explain the procedure to the patient.	15	37.5	25	**62.5**
Establish the privacy of the patient	12	30	28	**70**
Perform proper hand washing.	15	37.5	25	**62.5**
Put on gloves and other personal protective equipment.	12	30	28	**70**
Place clean towel across patient's chest.	10	25	30	**75**
Suction oropharynx / ETT when needed.	16	40	24	60
Remove old tie or tape carefully and ask assistance if needed.	13	32.5	27	**67.5**
Inspect condition of skin, lips and angle of the mouth for any break in integrity.	19	47.5	21	52.5
Reposition ETT to opposite side of mouth or center.	15	37.5	25	**62.5**
Clean around ETT by saline- soaked gauze or cotton swab.	20	50	20	50
Provide mouth care by normal saline 0.9%.	22	**55**	18	45
Secure Endotracheal tube carefully.	19	47.5	21	52.5
Apply the skin barrier to the patient' face (under nose, on cheek, and lower lip) where the tie will sit.	14	35	26	**65**
Change tie or tape every day or when soiled or insecure.	12	30	28	**70**
Clean, store, and replace equipment	24	**60**	16	40
Remove gloves and Wash hands.	22	**55**	18	45
Total	16	40	24	60

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Table (7): Percentage distribution of the studied nurses' level of practice regarding nursing care of tracheostomy tube (n=40).

Variables	Done		Not done	
	N	%	N	%
Prepare the equipment	24	**60**	16	40
Identify the patient and explain procedure to the patient.	23	57.5	17	42.5
Maintain privacy of the patient.	21	52.5	19	47.5
Perform hand washing.	25	**62.5**	15	37.5
Put on gloves and other PPE.	20	50	20	50
Place towel on patient's chest under tracheostomy site.	21	52.5	19	47.5
Suction the trachea and pharynx if needed.	22	55	18	45
Unlock and remove inner cannula, if disposable replace it with new one, if reusable remove it and clean.	9	22.5	31	**77.5**
Inspect the area for redness, discharge, pain, skin breaks.	21	52.5	19	47.5
Clean the skin around tracheostomy with water or saline. If infected wound clean it with an antiseptic solution, dry and Apply antibiotic ointment to the stoma.	17	42.5	23	57.5
Change tracheostomy tie	9	22.5	31	**77.5**
Insert new tracheostomy tie, Keep knot at the side of the neck.	7	17.5	33	**82.5**
Alternate knot from side to side each time ties are changed.	10	25	30	**75**
Ties should be tight enough to keep tube securely in the stoma, but loose enough to permit two fingers to fit between tie and neck.	11	27.5	29	**72.5**
Place a gauze pad between the stoma site and the tracheostomy tube per facility policy	12	30	28	**70**
Clean and return equipment	20	50	20	50
Remove gloves and wash hands.	21	52.5	19	47.5
Total	18	45	22	55

Table (8) : Percentage distribution of the studied nurses' total level of practice regarding medical devices induced ulcer among critically ill patients (n=40).

Total practice	**N**	**%**
Competence (≥ 80%)	17	42.5
Incompetence (< 80%)	23	57.5
Total	40	100

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Part IV:

Table (9): Relation between demographic characteristics of nurses under study and their Total level of knowledge regarding medical devices induced ulcer among critically ill patients (n=40).

Variables	Total level of knowledge						
	Satisfactory %75 ≤		Unsatisfactory %75 <		Total	Chi-square	
	N	%	N	%	=	X^2	P-value
Age							
From 18: <30years	3	14.3	18	86	21	13.1	<0.001**
From 30: <45years	8	53.3	7	47	15		
45 years and more	4	100	0	0	4		
Gender							
Male	9	60	6	40	15	5.184	0.023*
Female	6	24	19	76	25		
Marital status							
Single	4	44.4	5	56	9	1.387	0.5
Married	11	37.9	18	62	29		
Divorced	0	0	2	100	2		
Level of education							
Diplome	0	0	5	100	5	14.4	0.002*
Technical level	6	25	18	75	24		
Bachelor degree	6	75	2	25	8		
Master/Doctorate degree	3	100	0	0	3		
Years of experience inside ICU							
1: <5 years	3	14.3	18	86	21	16.58	<0.001**
5: <10 years	5	41.7	7	58	12		
10: <15 years	3	100	0	0	3		
15 years and more	4	100	0	0	4		
Did you attend previous educational sessions related to medical devices Induced Ulcer							
Yes	8	100	0	0	8	16.67	<0.001**
No	7	21.9	25	78	32		

Not sig. > 0.05

***sig. < 0.05**

****highly sig. <0.001**

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Part IV: Table (10): Relation between demographic characteristics of nurses under study and their Total level of practice regarding medical devices induced ulcer among critically ill patients (n=40).

Variables	Total level of practice						
	Done		Not done		Total	Chi-square	
	N	%	N	%	=	X^2	P-value
Age							
From 18: <30 years	4	19	17	81	21	12.02	0.002*
From 30: <45 years	9	60	6	40	15		
45 years and more	4	100	0	0	4		
Gender							
Male	11	73	4	27	15	9.337	0.002*
Female	6	24	19	76	25		
Marital status							
Single	4	44	5	56	9	1.556	0.459
Married	13	45	16	55	29		
Divorced	0	0	2	100	2		
Level of education							
Diplome	0	0	5	100	5	21.59	<0.001**
Technical level	6	25	18	75	24		
Bachelor degree	8	100	0	0	8		
Master/Doctorate degree	3	100	0	0	3		
Years of experience inside ICU							
1: <5 years	4	19	17	81	21	14.47	0.002*
5: <10 years	6	50	6	50	12		
10: <15 years	3	100	0	0	3		
15 years and more	4	100	0	0	4		
Did you attend previous educational sessions related to medical devices Induced Ulcer							
Yes	8	100	0	0	8	13.53	<0.001**
No	9	28	23	72	32		

Not sig. > 0.05

***sig. < 0.05**

****highly sig. <0.001**

Part V: Correlation between the study variables

Table (11): Correlation between total level of studied nurses' knowledge and total level of practice regarding medical devices induced ulcer among critically ill patients (n=40).

Variables	Total knowledge score	
	R	P-value
Total nursing care of endo tracheal tube score	0.839	<0.001**
Total nursing care of tracheostomy tube score	0.953	<0.001**
Total practice score	0.962	<0.001**

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Figure (1): Correlation between total level of studied nurses' knowledge and total nursing care of endo tracheal tube score (n=40).

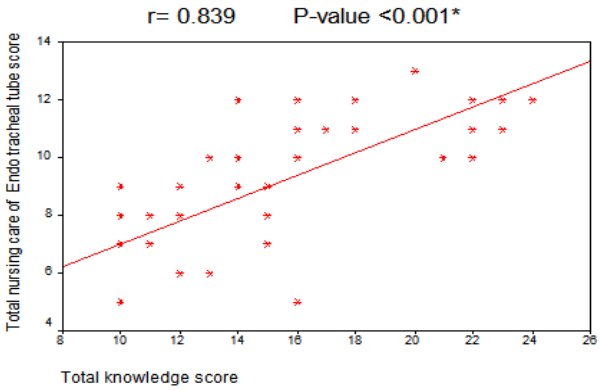


Figure (2): Correlation between total level of studied nurses' knowledge and total nursing care of tracheostomy tube score (n=40).

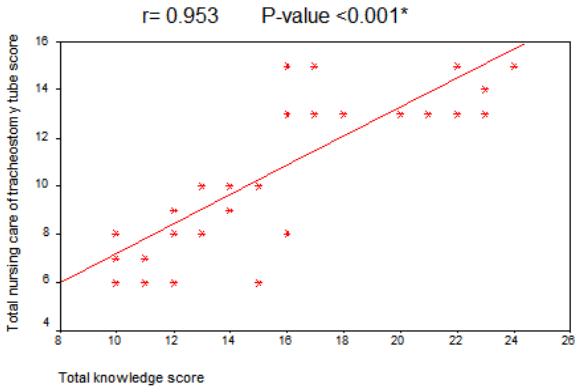
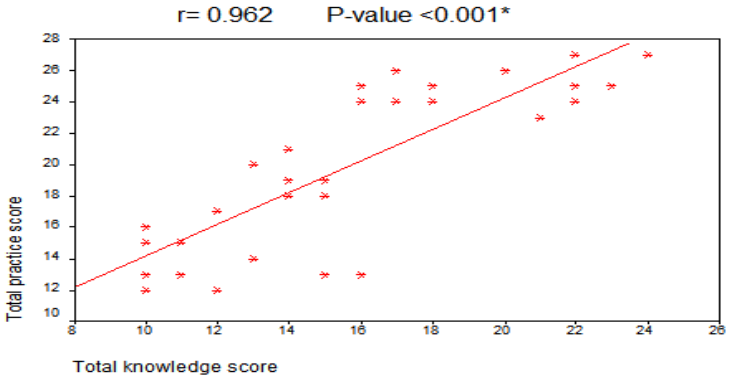


Figure (3): Correlation between total level of studied nurses' knowledge and total level of practice regarding medical devices induced ulcer among critically ill patients (n=40).



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DISCUSSION

Medical devices are used in treatment many of diseases and follow up of patient condition. However, these devices can also cause pressure ulcer. Medical devices related pressure ulcer (MDRPU), it occurs around or underneath the medical devices and take the shape of these devices. MDRPU reported that prevalence ranged from 17% to 86% **[1]**.

Medical devices related pressure ulcer (MDRPU) is an issue very important to taken more attention as it can lead to decrease the patient quality of life, causes worsening of health, cause many complications such as infection, prolonging stay in hospital and increase unnecessary medical expenditure. Moreover, if untreated, it can increase the risk of death **[6]**.

Nurses play a fundamental and an important role in the prevention, treatment and reduction of the incidence of MDRPU. Therefore, it is extremely important to determine the nurses' level of knowledge and practice about MDRPU, also nurses play an important role in identifying patients at risk of MDRPU and preventing it. The quality of health care provided by nurses is increase with the increase in nurses' knowledge and practice about how to prevent medical devices related pressure ulcer from occurrence and how to provide good care **[8]**.

So that, the aim of this study is to. Assess nurses' level of knowledge and practice regarding medical devices induced ulcer among critically ill patients.

Part (I): Demographic data of the studied nurses

The current study sample constitutes of 40 nurses working at general Intensive Care Unit (ICU) at Beni Suef University Hospital. Regarding to the age of the studied nurses, the result of present study showed that slightly more than half of the studied nurses their age between 18: < 30 years old and three fifth of the studied nurses had technical level of nursing, this could be related to young nurses can tolerate the nature of ICU work and many of them graduate within two years, so the number of graduates of the technical institution is larger than any educational level of nursing.

This finding agreed with (Sönmez & Bahar, 2022) **[14]** who carried out a study in Turkey which entitled ”Medical device-related pressure injuries: Knowledge levels of nurses and factors affecting these“ revealed that slightly more than half of participant nurses was between 18:29 years and also agreed with (Mohamed & Weheida, 2019) **[15]** who carried out a study in Egypt which entitled ”Effects of implementing educational program about pressure ulcer control on nurses' knowledge and safety of immobilized patients“ revealed that the majority of registered nurses had only had a secondary education and technical institute of nursing.

On the other hands, these findings were disagreed with (Zhang et al., 2021) **[16]** who carried out a study in western China which entitled” Knowledge, attitude, and practice of nurses in intensive care unit on preventing medical device–related pressure injury

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“revealed that more than half of the studied nurses had aged more than 30 years and bachelor’s degree of education.

As regard to gender and years of experience of the studied nurses, the current study reported that, about more than three fifth of the studied nurses were females and slightly more than half of the studied nurses’ years of experience in ICU 1:< 5 years, this may be because those male nurses joined nursing lately in recent years and the studied nurses newly graduated and those age less than 30 years.

This result agreed with (Gaterega et al., 2021) **[17]** who carried out a study in Rwanda which entitled ”Nurses’ knowledge and practices regarding tracheostomy care at a selected referral hospital in Rwanda–A descriptive cross-sectional study” revealed that more than half of the studied nurses was females and the majority of nurses years of experience in ICU 0: 5. And disagreed with (Lotfi et al., 2019) **[18]** who carried out a study in Iran which entitled” Iranian nurses' knowledge, attitude and behavior on skin care, prevention and management of pressure injury: A descriptive cross-sectional study” revealed that two third of the studied nurses had more than 14 years of experience.

The current study reported that more than four fifth of the studied nurses not attended educational sessions related to medical devices induced ulcer. The result could be related to lack of funding for training nurses and shortage in nursing staff that didn’t allow them to participate in training activities and inadequacy of trainers that able to give educational sessions to nurses.

This finding agreed with (Hanonu & Karadag, 2018) **[19]** who carried out a study in Turkey entitled ”A prospective, descriptive study to determine the rate and characteristics of and risk factors for the development of medical device-related pressure ulcers in intensive care units” revealed that more than half of the studied nurses not attend any training programs.

This finding agreed with (Yan et al., 2021) **[20]** who carried out a study in China which entitled” Effect of training programmes on nurses' ability to care for subjects with pressure injuries: A meta-analysis” revealed that the majority of the studied nurses were females and having years of experience less than 5 years and most of studied nurses not attend any training programs.

Part (II): Nurses’ level of knowledge regarding medical devices induced ulcer among critically ill patients

Regarding nurses' level of knowledge to anatomy, definition, causes and risk factors of MDRPU, the current study reported that three quarter of the studied nurses had unsatisfactory level of knowledge regarding difference between classic pressure ulcer and MDRPU. This result may be related to lack of educational programs offered to nurses.

This finding in the same line with (Karadağ et al., 2017) **[21]** who carried out a study in Istanbul which entitled ”A Prospective, Descriptive Study to Assess Nursing Staff Perceptions of and Interventions to Prevent Medical Device-related Pressure Injury”

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revealed that the majority of studied nurses did not know that every medical device may cause MDRPU. Moreover, approximately half of the nurses think that MDRPU usually occurs in bony prominences areas and that there is no difference between the appearance of general pressure ulcer and MDRPU.

This result reported that more than four fifth of the studied nurses were having unsatisfactory level of knowledge regarding causes and risk factors of MDRPU, this finding due to lack of trainers provided educational sessions to nurses. This finding was in the same line with (Tan et al., 2020) **[10]** who carried out a study in Singapore which entitled"Nurses' perception and experiences towards medical device-related pressure injuries: A qualitative study" revealed that more than three quarter of the studied nurses were having unsatisfactory level of knowledge regarding identifying causes and risk factors of medical devices related pressure ulcer.

On the other hand, the study reported by (Zhang et al., 2020) **[16]** who carried out a study in western China which entitled "Knowledge, attitude, and practice of nurses in intensive care unit on preventing medical device–related pressure injury" revealed that the knowledge level of the nurses about the definition and causes of MDRPU was acceptable without training program.

As regarding to stages of medical devices related pressure ulcer, all of the nurses had unsatisfactory level of knowledge regarding the most important signs of un stageable ulcer for MDRPU and more than four fifth of the studied nurses had unsatisfactory level of knowledge regarding the most important signs of deep tissue ulcer for MDRPU. This could be related to young age of nurses, lack of adequate experience and training programs.

This finding was in the same line with (Uba et al., 2017) **[22]** who carried out a study in Nigeria which entitled" Knowledge, attitude and practice of nurses toward pressure ulcer prevention in University of Maiduguri Teaching Hospital, Borno State, North-Eastern, Nigeria" revealed that the most of studied nurses had unsatisfactory level of knowledge about definition, risk factor and stages of pressure ulcer.

Also, this finding agreed with (Saleh et al., 2019) **[23]** who carried out a study in Jordan which entitled "Nurses' knowledge and practice of pressure ulcer prevention and treatment: an observational study" revealed that unsatisfactory knowledge level about stages and complication of pressure ulcer and this study disagreed with (Nuru et al., 2017) **[24]** who carried out a study in Ethiopia which entitled "Knowledge and practice of nurses towards prevention of pressure ulcer and associated factors in Gondar University Hospital, Northwest Ethiopia" revealed that majority of nurses had adequate knowledge about stages of pressure without training program.

As regarding to most affect site and common devices that are responsible for MDRPU, this result showed that all of nurses had unsatisfactory level of knowledge regarding most affected site and common devices causing MDRPU. These findings were due to nurses had technical level of education and not trained enough.

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These findings were in the same line with (Sönmez & Bahar, 2022) **[14]** who carried out a study in Turkey which entitled" Medical device-related pressure injuries: Knowledge levels of nurses and factors affecting these" revealed that the nurses' proportion answering correctly to items of type of devices that responsible for medical devices related pressure ulcer was not unacceptable and the majority of nurses stated that face masks did not cause MDRPU.

As regarding to endo tracheal tube (ETT) related pressure ulcer, the present study reported that the majority of nurses had unsatisfactory level of knowledge about repositioning of ETT and more than four fifth of the studied nurses had unsatisfactory level of knowledge regarding duration of ETT intubation and prevention of ETT related pressure ulcer. This finding was due to work overload caused nurses' carelessness increase patient to nurse ratio.

This finding was in the same line with (Erbay Dalli & Kelebek Girgin, 2022) **[25]** who carried out a study in Turkey which entitled "Knowledge, perception and prevention performance of intensive care unit nurses about medical device-related pressure injuries" revealed that unsatisfactory nurses' level of knowledge about ETT related pressure ulcer prevention and care in critical care units.

Also, this study agreed with (Aboalizm & Elhy, 2019) **[26]** who carried out a study in Egypt which entitled "Effect of Educational Intervention on Nurses' Knowledge and Practices Regarding Endotracheal Tube Suctioning" revealed that nurses had unsatisfactory level of knowledge about ETT care.

Also, this finding was in the same line to study reported by (Mohammed & Weheida, 2019) **[15]** who carried out a study in Egypt which entitled "Effects of implementing educational program about pressure ulcer control on nurses' knowledge and safety of immobilized patients" revealed that there was unsatisfactory level of knowledge regarding prevention of ETT.

As regarding to endo tracheal tube (ETT) related pressure ulcer. This study reported that more than four fifth of the studied nurses had unsatisfactory level of knowledge regarding complications and care of tracheostomy tube such inspection of stoma and fixing of tracheostomy tube, all of studied nurses were having unsatisfactory level of knowledge regarding prevention of tracheostomy tube related pressure ulcer. This result due to nurses don't have enough money to participate in educational sessions.

This result in the same line with (Abdelazeem et al., 2019) **[27]** who carried out a study in Khartoum which entitled" Effect of training program on nurses' knowledge and competence regarding endotracheal tube and tracheostomy care in mechanically ventilated patients" revealed that participants in this study were having unsatisfactory level of knowledge about tracheostomy tube complications and prevention of TT related pressure ulcer.

This result in the same line with (Moser et al., 2022) **[28]** who carried out a study in Maryland which entitled" Factors associated with endotracheal tube related pressure

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injury" revealed that nurses' knowledge level toward tracheostomy related pressure ulcer prevention inadequate.

Nurses' Total Level of Knowledge about Medical Devices Induced Ulcer among Critically Ill Patients.

The present study illustrated that more than three fifth of the studied nurses had unsatisfactory total level of knowledge regarding medical devices induced ulcer among critically ill patients. These findings related to lack of training programs offered to nurses and nurses' work overload that prevent them to attend educational sessions.

This result was agreed with (Zhang et al., 2020) **[16]** who carried out a study in western China which entitled "Knowledge, attitude, and practice of nurses in intensive care unit on preventing medical device–related pressure injury" revealed that more than half of the studied nurses had unsatisfactory nurses' total level of knowledge about the medical devices related pressure ulcer.

Also, agreed with (Galetto et al., 2020) **[7]** who carried out a study in Brazil which entitled "Medical device-related pressure injury prevention in critically ill patients: nursing care" revealed that the total level of nurses' knowledge percentage inadequate. This result was agreed with (Crunden et al., 2022) **[29]** who carried out a study in New York which entitled" Barriers and facilitators to reporting medical device-related pressure ulcers: A qualitative exploration of international practice" revealed that the total level of knowledge of nurses about medical devices related pressure ulcer was insufficient.

On the other hand, this finding was disagreed with (Yan et al., 2021) **[20]** who carried out a study in China which entitled"Effect of training programmes on nurses' ability to care for subjects with pressure injuries: A meta-analysis" revealed that the levels of knowledge, attitude and practice of nurse in ICU on pressure ulcer was adequate.

Nurses' Level of Practice Regarding Endotracheal Tube Nursing Care

As regard nurses' level of practice about endotracheal tube care. This study was reported that three quarter of the studied nurses have incompetence level of practice regarding place clean towel across patient' chest and less than three quarter of the studied nurses have incompetence level of practice regarding establish privacy of the patient, change tie or tape every day or when solid or insecure and put on gloves and other protective equipment.

Also, the present study reported that more than three fifth of the studied nurses have incompetence level of practice regarding remove old tie or tape and apply the skin barrier to the patient' face where the tie will sit. Those findings related to shortage of staff and nurses' carelessness. This study agreed with (Colombage & Goonewardena, 2020) **[30]** who carried out a study in Sri Lanka which entitled "Knowledge and practices of nurses caring for patients with endotracheal tube admitted to intensive care units in National Hospital of Sri Lanka" revealed that incompetence nurses' level of practice regarding change tie or tape every day, assessing facial skin and mouth care.

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The present study reported that more than three fifth of the studied nurses have incompetence level of practice regarding to reposition ETT to opposite side of mouth or center frequently. This finding due to the threat of having dislodgement of ETT while repositioning of the tube.

This study agreed with (Mussa et al., 2018) **[31]** who carried out a study in Indonesia which entitled ”Factors associated with endotracheal tube related pressure injury” revealed that increase in the prevalence of oral tracheal tube related pressure ulcer due to low level of practice to reposition ETT. On the other hand, this finding disagreed with (Adhikari & Subba, 2020) **[32]** who carried out a study in Nepal which entitled ”Practice Regarding Care of Endotracheal Tube Among Nurses Working in Teaching Hospital” revealed that more than three fifth of participant nurses had satisfactory level of practice regarding reposition of endotracheal tube.

This finding in agreement with (Krug, 2017) **[33]** who carried out a study in Turkey which entitled”Changing Endotracheal Tube Taping Practice: An Evidence-based Practice Project” revealed that participants had incompetence level of practice about the ETT securement and changing tie. On the other hand, this study disagreed with (Winton et al., 2018) **[34]** who carried out a study in Austral which entitled ”Improving documentation of endotracheal intubation in an adult emergency department” revealed that more than half of studied nurses secure and change tie of ETT correctly so facial skin break down prevented.

This finding reported that more than half of the studied nurses had incompetence total level of practice regarding endotracheal tube care. This result due to nurses’ carelessness and shortage of staff. This in agreement with (Mohammed & Weheida, 2019) **[15]** who carried out a study in Fayoum, Egypt which entitled ”Effects of implementing educational program about pressure ulcer control on nurses' knowledge and safety of immobilized patients” revealed that incompetence level for total practice of nurses related to ETT care.

Nurses' Level of Practice Regarding Tracheostomy Tube Nursing Care

Regarding nurses' level of practice about tracheostomy tube care. The current study reported that more than four fifth of the studied nurses were having incompetence level of practice regarding insert new tracheostomy tie and keeping knot at the side of the neck. While more than three quarter of the studied nurses were having incompetence level of practice regarding change tracheostomy tie and unlock and remove inner cannula. This result due to the nurse's fear of the movement and extubation of tracheostomy tube from the patient and increase patient's complications.

This study agreed with (Abdelazeem et al., 2019) **[27]** who carried out a study in Egypt which entitled” Effect of training program on nurses’ knowledge and competence regarding endotracheal tube and tracheostomy care in mechanically ventilated patients” revealed that most of the nurses having incompetent level of practices about change of tracheostomy tie, stoma and skin care and change of tracheostomy inner cannula.

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The current study was reported that less than three quarter of the studied nurses were having incompetence level of practice regarding ties should be tight enough to keep tube securely in the stoma but loose enough to permit two fingers to fit between tie and neck and place gauze pad between the stoma site and the tracheostomy tube. This result due to nurse's fear of the movement and extubation of tracheostomy tube so, nurses secure it tightly.

This study in the same line with (Gaterega et al., 2021) **[17]** who carried out a study in Rwanda which entitled" Nurses' knowledge and practices regarding tracheostomy care at a selected referral hospital in Rwanda–A descriptive cross-sectional study" revealed that participant majority of nurses were having incompetence level of practice regarding clean stoma by Sodium chloride in tracheostomy care, tracheostomy tube securement.

This finding reported that more than half of the studied nurses had incompetence total level of practice regarding tracheostomy tube care due to nurses less interested to participate in educational sessions that enhance their level of practice regarding tracheostomy care. This finding in the same line with (McGrath et al., 2020) **[35]** who carried out a study in Manchester which entitled" Improving tracheostomy care in the United Kingdom: results of a guided quality improvement programme in 20 diverse hospitals" revealed that more than three fifth of the studied nurses had incompetence total level of practice regarding tracheostomy tube care.

Nurses' Total Level of Practice Regarding Medical Devices Induced Ulcer among Critically Ill Patients

The current study was reported that less than three fifth of the studied nurses had incompetence total level of practice regarding medical devices induced ulcer among critically ill patients. This result related to work overload on nurses and due to shortage of staff that limit their participation in educational sessions.

This study agreed with (Tan et al., 2020) **[10]** who carried out a study in Singapore which entitled" Nurses' perception and experiences towards medical device-related pressure injuries: A qualitative study" revealed that the majority of nurses having incompetence total level of practice regarding medical device care to reduce MDRPU.

This finding was similar with (Seo & Roh, 2020) **[36]** who carried out a study in Korea which entitled "Effects of pressure ulcer prevention training among nurses in long-term care hospitals" revealed that incompetence total level of practice regarding pressure ulcer prevention.

Relation between Demographic Characteristics of Nurses under Study and Their Total level of Knowledge Regarding Medical Devices Induced Ulcer among Critically Ill Patients

The current study reported that there was high statistically significant relation between total levels of knowledge with age, Years of experience inside ICU and attend previous

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educational sessions related to medical devices induced ulcer and there was statistically significant relation between total level of knowledge with gender and level of education.

This finding due to the greater the age of the nurse, her level of education, and her years of experience, the greater her knowledge, because she has gone through many forms of cases, dealt with more than one case, and benefited from more than one colleague. Also, the level of higher education provides the opportunity for education and increased knowledge for the nurse.

This finding in the same line with (Zhang et al., 2021) **[16]** who carried out a study in western China which entitled ”Knowledge, attitude, and practice of nurses in intensive care unit on preventing medical device–related pressure injury” revealed that a significant relationship was found between the nurses ’knowledge score and their age and educational level, showed that nurses in a higher age group, years of experience and educational level had higher medical devices related pressure ulcer knowledge scores.

This finding in the same line with (Galetto et al., 2020) **[7]** who carried out a study in Brazil which entitled” Medical device-related pressure injury prevention in critically ill patients: nursing care” revealed that there was statistically significant relation between total level of knowledge with nurses’ level of education and gender.

Relation between Demographic Characteristics of Nurses under Study and Their Total Level of Practice Regarding Medical Devices Induced Ulcer among Critically Ill Patients

This current study reported that there was high statistically significant relation between total levels of practice with level of education and attend previous educational sessions related to medical devices induced ulcer and there was statistically significant relation between total level of practice with age, gender and years of experience inside ICU.

This finding was due to the higher age of the nurse, level of her education, and the years of her experience, the higher the level of her practice, because she will have gone through a large number of cases that make her gain more experience. She has dealt with more than one case and benefited from more than one colleague. Also, her higher educational level in the bachelor’s degree provides the opportunity for increases the level of practice for her.

This finding in the same line with (Tyrer, 2020) **[37]** who carried out a study in Brazil which entitled ”Evaluating Dermisplus Prevent for the avoidance of development of medical device-related pressure ulcers” revealed that a significant relation between total level of practice with age, total work experience and educational program attended on medical devices care to prevent pressure ulcer.

This finding disagreed with (Zeb et al., 2017) **[38]** who carried out a study in Egypt which entitled” Knowledge and attitudes on pressure ulcer prevention among nurses working in neurological departments in tertiary care hospitals of peshawar: a multicenter study” revealed that there was no significant relation between total level of practice with age,

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total work experience and educational program attended on pressure ulcer because the P value is above 0.5.

Correlation between Total level of Knowledge Score of The Studied Nurses and Their total level of Practice Score Regarding Medical Devices Induced Ulcer among Critically Ill Patients

This finding reported that there was statistically significant positive correlation between total level of knowledge score and total nursing care of endo tracheal and tracheostomy tube score. This result due to if the nurse had a deficiency and unsatisfactory level of knowledge, it will lead to a decrease and incompetence level of practice, because practice is based on knowledge and a high level of knowledge leads to a high level of practice.

This result in the same line with (Sayed et al., 2022) **[1]** who carried out a study in Tanta, Egypt which entitled" Effect of Educational Program about Preventive Nursing Measures of Medical devices related Pressure Injuries on Nurses' Performance and Patients' Clinical Outcome" revealed that the studied nurses had unsatisfactory total level of knowledge and incompetence total level of practice so there was significant correlation between knowledge and practice.

This finding also in the same line with (Mohamed & weheida, 2019) **[15]** who carried out a study in Egypt which entitled "Effects of implementing educational program about pressure ulcer control on nurses' knowledge and safety of immobilized patients" revealed that scores of nurses' knowledge was statistically significantly correlated with scores of nurses' practice.

This result was disagreed with (Mahmoud et al., 2018) **[39]** who carried out a study in Egypt which entitled" Pressure ulcer among critical care patients: Critical care nurses' knowledge, perception and practice" revealed that there was no statistically significant correlation between total knowledge score and total practice score of the studied nurses.

Conclusion

In the light of the present study findings, it can be concluded that, more than three fifth of the studied nurses were having unsatisfactory total level of knowledge regarding medical devices induced ulcer among critically ill patients, and also less than three fifth of the studied nurses were having incompetence total level of practice regarding medical devices induced ulcer among critically ill patients.

Recommendations

In the light of the study findings, the following recommendations are suggested to

- Develop and implement intervention program to improve nurses' performance regarding medical devices induced ulcer among critically ill patients.
- Developing follow up courses and training programs should be offered to maintain effective performance for care of patients with endotracheal and tracheostomy tube

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- Encouraging the nurses or newly employed nurses to attend conferences and workshops about medical devices related pressure ulcer.
- Periodical evaluation for nurses to determine the progression of their knowledge and practice regarding medical devices induced ulcer among critically ill patients.
- The study should be replicated on large sample selected from different geographical areas of Egypt to raise the efficiency of nurses' performances

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