

Effect of Educational Program about Intra-Hospital Safety Transportation of Critically Ill Patients on Nurses' Performance and Patients' Clinical Outcomes

Gehan A Younis¹, Shereen Ali², Sabry Mohamed Amin³, Heba A. Al-etyazidy⁴

^{1,4} Assist. Prof. of Critical Care and Emergency Nursing, Faculty of Nursing, Tanta University, Egypt

² Master degree in Critical Care and Emergency Nursing, Faculty of Nursing, Tanta University, Egypt

³ Professor of Anesthesia and Surgical Intensive Care and Pain Management, Faculty of medicine, Tanta University, Egypt

Abstract: Intra-hospital transportation of critically ill patients within the hospital is potentially dangerous and creates a challenging and highly stressful work, even for experienced nurses because of the severity of the illnesses and the need for continuous monitoring during transportation. **The aim of the study was to** evaluate the effect of educational program of intra-hospital safety transportation of critically ill patients on nurses' performance and patients' clinical outcomes. **Setting:** This study was conducted at Surgical Intensive Care Units in Emergency Hospital of Tanta Main Hospitals, Egypt. **Method:** A quasi-experimental design was utilized in this study. Sample of the study consisted of all nurses (70) who are working in the ICU and convenience sampling of 60 critically ill patients, which divided equal into 30 patients of both study and control groups. **Tools:** Three tools was used to collect data, **Tool (I)** Socio demographic data of studied nurses, **Tool (II)** Structured Interview Schedule **and Tool (III)** patient' clinical outcome. **Results:** It was observed that vast majority (96%) of the studied nurses reported low level of total knowledge pre implementation of educational program compared with the majority (84%) them reported high level of knowledge post implementation of educational program. Additionally, the majority of the studied nurses (88.6%) had unsatisfactory practice level compared with vast majority (92%) of them had satisfactory level of practice post educational program and there were high statistical improvement on critically ill patients' clinical outcomes during intra-hospital transportation. **Conclusion:** A well designed safe intra-hospital transportation education program could positively affect the nurses' knowledge and practice and decline the patients' adverse events and complication during transportation **Recommendation:** It was recommended that encouraging nurses' in-service training program can improve critically ill patients' safety during intra-hospital transportation.

Keywords: Educational Program, Safety Intra-Hospital Transportation, Critically Ill Patients, Nurses' Performance, Patients' Clinical Outcomes.

Introduction

Critically ill patients (CIPs) are at increased risk of morbidity and mortality during transport. Risks can be minimized and outcomes improved with careful planning, the use of appropriately qualified personnel and selection and availability of appropriate equipment. During transportation, there is no hiatus in the monitoring or maintenance of a patient's vital functions. Furthermore, the accompanying personnel and equipment are

selected by training to provide for any ongoing or anticipated acute care needs of the patient⁽¹⁾.

Continuous assessment of the CIPs is very important inside and outside Intensive Care Unit (ICU) and should be undertaken by an appropriately trained clinician and follow a structured ABCDE, which include airway, breathing, circulation, disability and exposure format. This structure facilitates correction of

life-threatening problems by priority and provides a standardized approach between professionals⁽²⁾.

The complications that occur during intra-hospital transport of CIPs are usually affected organs and body's system as circulatory and respiratory systems and in a series conditions may lead to death. Complications may derived from transportation's equipment. The risk factors for these complications are complex and related to patients and severity of illness, equipment and malfunction of the devices, poor communication between staff that prepare and accompany the patient, inadequate monitoring of patient during transport and insufficient documentation of intra-hospital transport procedure.⁽³⁾

On this context, series complication which face CIPs during IHT also include cardio vascular system complications such as cardiac arrest, changes in blood pressure usually hypotension, tachycardia, arrhythmia, pulmonary edema. Complications related to respiratory system include: changes in respiratory frequency, pneumonia, and aspiration, airway obstruction, accidental displacement/movement of endotracheal tube, respiratory arrest, O₂ reduction, and blood gas alteration^(3,4).

So, a well-trained and knowledgeable team can improve the safety of the IHT of CIPs by practicing comprehensive planning, establishing good communication, providing essential equipment, and correctly judging patients' clinical conditions. Nurses as the main members of the transport team, attend each stage of the transport process. Based on their knowledge, skills and experience, they can detect potential life-threatening risks that arise during the transport of patient as they provide continuous care and have close proximity to the patient. Early detection and

monitoring for any adverse event that can be arise during transportation, immediate intervention, careful preparation of the patients, and adapted sedation, assessing the adequacy of equipment and prompt intervention and regular patient and equipment checks increase patients' safety during transportation considered the main role of critical care nurse⁽⁵⁾.

Significance of the study:

Intra- hospital transportation has been reported as a risky procedure, especially for CIPs. Even the shortest transportation may lead to life-threatening complications due to the crisis situation of critically ill patients. Therefore, nursing intervention is one of the most important parts in IHT. Critical care nurses are in need for increasing their knowledge, practice about application of intra-hospital safety transportation guidelines to minimize adverse effects of transportation and improve patients' clinical outcomes. Therefore, the existence of educational program of intra-hospital safety transportation is valuable and important for CIPs' safety

The aim of the study was to evaluate the effect of educational program of intra-hospital safety transportation of critically ill patients on nurses' performance and patients' clinical outcomes.

Research hypothesis: There are two research hypotheses for the current study as the following:

1-Post implementation of the educational program, the nurses exhibited improve in their performance regarding intra-hospital safety transportation for critically ill patients.

2-Patients' clinical outcomes are expected to be improved after implementing intra hospital safety transportation educational program.

Subjects and method:

Study design: A quasi-experimental research design was utilized in this study.

Setting: This study was conducted at Surgical Intensive Care Units in Emergency Hospital of Tanta University Hospitals.

Subjects:

All nurses (70) who are working in the previously mentioned settings and give direct nursing care and directly contact with CIPs regardless their age, education, gender, education and years of experience.

Additionally, a convenience sampling of 60 critically ill patients were selected, The inclusion criteria were met by a random sample of 60 CIPs born in the intensive care units of hospitals affiliated with Tanta's university. Epi-info was used to estimate the sample size as a percentage of the total annual number of intensive care unit admissions (300 patients admitted per year to the Emergency ICU and 200 patients admitted per year to Anesthesia ICU of educational Hospital) and divided into two equal groups, 30 in each as the following:

Control Group: It was consisted of 30 critically ill patients fulfilling the inclusive criteria and they were followed hospital routine of care for IHT. Routine care during transportation conducted without assessment of patient, connected tubes or equipment checkup before, during and after transportation. There were no continues assessment during transportation). Regarding medication , just adrenaline ampule and diluted sedation was taken pre transportation . Regarding equipment, just taken ambo bag with oxygen.

Study Group: It was consisted of 30 critically ill patients who exposed to safe IHT program.

The patients' Inclusion Criteria were newly admitted critically ill patients that need IHT for any purpose, stability of hemodynamic parameters of CIPs.

Tools of Data Collection:

Three tools were used for data collection of this study.

Tool I: Structured Interview Schedule:

It comprised of two parts as follow:

Part (A): Nurse's socio-demographic data as age, gender, level of education, years of experience in ICU, previous training courses, and workshops regarding safety.

Part (B): Critical care Nurses' Knowledge questionnaire regarding Intra-Hospital Transportation; it was developed by the researcher after reviewing the relevant literature ^(5.6.7.8) to assess nurses' knowledge before, during and post IHT. The nurses' Knowledge included general knowledge (9 items), nurse 'knowledge before IHT (10 items), nurse 'knowledge during IHT (8 items), nurse 'knowledge post IHT (7 items), nurse 'knowledge regarding immediate nursing intervention during IHT (8 items).

Scoring System:

Three level of scoring for questions will be as the following: Correct and complete answer scored (2) Correct and incomplete answer scored (1) Don't know or incorrect answer (0) The total scoring system of patients' knowledge will be calculated and classified as the following:

-Good → > 80% of the total score

-Fair → ≥ 60% - 80% of the total score

- Poor → < 60% of the total score.

The score had been summed up and converted into total score percent according to the following category: Low level of knowledge was considered less than 60% moderate level of knowledge was considered from 60% to

less than 80% high level of knowledge was considered from 80% and more.

Tool II: Critical Care Nurses Observational Checklist regarding Intra-Hospital Transportation:

This tool was developed by the researcher after reviewing the relevant literature⁽⁹⁻¹³⁾ to assess nurses' practice before, during and post IHT through a designed observational checklist. The nurses' practice consisted of 6 domains; checking of necessary equipment (22 items), preparation of necessary medications (5 items), preparation of the patient's connected tubes, devices, intravenous fluids and position (19 items), checking of cardiac monitor and ventilator position (7 items) monitoring of hemodynamic parameters (7 items), nurse' practice during transportation phase (7 items), and nurse' practice immediate post IHT.

Scoring system: Scoring system for practice will be as follow:

- Done practices will take (1)
- Not done practices will take (0)

The total practices score will be calculated and classified as:

- satisfactory → $\geq 80\%$ of the total score
- Unsatisfactory → $< 80\%$ of the total score

Tool III: Critically Ill Patient' Outcome Assessment Tool:

This tool was developed by the researcher after reviewing the relevant literature^(14,15,16) for collection of the baseline data regarding CIPs. It compromised three parts as follows:

Part (A): Patients' bio-Socio demographic Data; such as age, gender, diagnosis, chronic disease, method of ventilation, assessment of patient' physical condition, hemodynamic parameters, respiratory parameters, connected tubes and devices as gastric tube, urinary catheter, arterial lines, surgical wound drains

Part (B): Glasgow Coma Scale (GCS): It was developed by Teasdale G et al (1979)⁽¹⁶⁾ to assess the level of consciousness of CIPs. The GCS was assigned into three domains which include eye response, verbal response, and motor response. The levels of response were scored from 1 for no response to normal values of 4 in eye-opening response, 5 in verbal response, and 6 in motor response. The level of consciousness was determined by the sum of the given score for each domain and was classified as follows:

- Score of 13-15 considered mild.
- Score of 9–12 considered moderate.
- Score of 3-8 considered severe.

Part (C): Intra-Hospital transportation related complications; It was developed by the researcher after reviewing the relevant literature^(13,14) and was used to assess CIPs complications and adverse events that can occur during and post IHT which included; disconnection of endotracheal tube/tracheostomy tube, intravenous lines, disconnection/removal of chest tube, nasogastric tube displacement, disconnection of wound drainage, accidental central line catheter removal or blocked, Spo₂ fall $> 5\%$ from baseline for more than 1 min, temperature $< 35^{\circ}\text{C}$ (hypothermia, increase heart rate, decrease 20 mmHg in systolic and 10 mmHg decrease in diastolic pressure from baseline for more than 5 min (hypotensive event), Increase 20 mmHg in systolic and 10mmhg increase in diastolic pressure from baseline for more than 5 min (hypertensive event), arterial line blocking, accidental dislodging of urinary catheter, altered in mental status, needing advanced O₂ support, hypoxia, and cardiac arrest

Scoring system: The intra-hospital related adverse events and complications were scored as present or not present. Present

complications were scored as (1) and not present complications were scored as (0).

Methods of data collection:

1. An official permission for data collection was obtained from the Faculty of Nursing and was submitted to responsible authorities of the selected settings for permission to carry out the study.

2. Ethical and legal consideration:

- Ethical committee of the faculty of nursing at Tanta university approval was obtained with code (139-12-2022)

- All participants was informed about the purpose of the study, confidentiality of information, benefits and right to withdraw from the study at any time if desired. Nurses' written informed consent to participate in this study was obtained after explaining the aim of the study, the nature of the study was not cause any harm to the entire subjects. Confidentiality regarding data collection and patient' privacy was maintained.

3. All tools of the study was developed by the researcher after reviewing recent related literature except tool 3, part B was developed by Teasdale G et al (1979)⁽¹⁶⁾.

4. The content validity of the developed tools was tested for clarity and applicability by seven experts in Critical Care Nursing and Biostatistics to ensure their validity and modifications were done. it was calculated and found to be = (88%).

5. All tools were tested for reliability using , the Cronbach Alpha was calculated for Tool I (0.85), Tool II (0.75) and Tool III part C (0.82) to confirm the reliability by test- retest on two occasions of the pilot of the instrument on the same participants.

5. Pilot study was done on (10) nurses and (10) patients to test if the questionnaire was readable and easily understandable, before the actual data collection. In response to the

results from the pilot study errors were corrected and adopted in the questionnaire and observation checklist.

Duration of data collection:

Data collection was expected to take about 8 months and conducted in the period from beginning of February to the end of September 2021.

The study was conducted at four phases including assessment, planning, implementation, and evaluation phases as the following:

Assessment phase: It was carried out by the researcher to collect information by using Tool (I and II) to assess nurses' knowledge and practice regarding safe IHT. The researcher was met each nurse individually to answer the knowledge questionnaire sheet.

Additionally, the patient was assessed by using tool III (part A) to assess their bio-socio demographic characteristics. Tool III (part B) used by the research pre implementation of educational program to assess IHT related complications. The knowledge questionnaire sheet was filled by the nurse within 20-35 minutes and observational check list was filled by the researchers within 20 minutes for each nurse.

Planning phase: An educational program was planned according to nurses 'educational needs assessment and based on literature review which expected to improve nurse' performance and patients' clinical outcome. An illustrative structured booklet was prepared in a simple Arabic language supported by illustrative pictures as a guide for the nurses, and different methods of teaching were used such as video, group discussion and presentation for theoretical part and demonstration and redemonstration for the practical part.

It consisted of 4 sessions; each session was conducted for two consecutive days. The sessions were scheduled in the morning shift. The time for each session was about 20- 30 minutes. For practical phase, was conducted through observational checklist for studied nurses pre and post implementation of educational program.

Educational program was implemented by the researcher for nurses using interactive lectures, video presentations, and booklet. They were divided into seven groups, each subgroup was consisted of ten nurses and after that each group was divided into sub group with five nurses in each one and sometimes to three nurses according their endorsement shifts distribution.

Implementation: The researcher implemented the educational program for all study nurses as the following:

It consisted of 4 sessions; each session was conducted for two consecutive days. The sessions were scheduled in the morning shift. The time for each session was about 20- 30 minutes. For practical phase, was conducted through observational checklist for studied nurses pre and post implementation of educational program.

Theoretical part sessions focused on the following:

The first session: Focused on definition of hospital transportation, type, indications, purposes, contraindications, complications and adverse events regarding IHT.

The second session: Focused on safe IHT steps such as preparation, monitoring of patient, equipment preparation and communication before IHT.

The practical part focused on the following sessions:

The third session: Focused on nursing assessment and intervention of CIPs during and post IHT.

The fourth session: focused on nursing intervention and CIPs' assessment during and post IHT.

Educational program was implemented by the researcher for nurses using interactive lectures, video presentations, and booklet. They were divided into seven groups, each subgroup was consisted of ten nurses and after that each group was divided into sub group with five nurses in each one and sometimes to three nurses according their endorsement shifts distribution.

Evaluation phase, after implementation of safe IHT educational program, the researcher used tool (I and II) to evaluate nurses' knowledge and practice .Tool III (part B and C) to evaluate CIPs' clinical outcome. A comparison between pre and post educational program was done once after week from attendance to educational program to evaluate the effect of implementing safe IHT educational program.

Statistical analysis: The data entry and data analysis were done using (SPSS Ver. 19), descriptive statistics (number, percentage, mean and standard deviation) were collected, A Chi-square test was done to compare qualitative variables between the before and after the protocol for the studied groups. When p is 0.05, a P-value is considered statistically significant.

Results:

Table (1) Percentage distribution of the studied nurses regarding their socio - demographic characteristics. Shows that the majority of studied nurses (90%) were within the age group of (21<30) years and more than two-thirds of the studied nurses (78%) were females. Additionally, more than two thirds of

studied nurses (70%) were technical, while only 2.9% were diploma degree. Regarding years of experiences in ICU, it was observed that three quarters of the studied nurses (75%) worked in ICU from one to less than five years. It can be seen that only 4.3% of studied nurses attended to educational sessions regarding safety IHT of CIPs. Also, no one of the studied nurses received workshop related to safety IHT of critically ill patients. Also, more than one third (42%) of the studied nurses revealed no previous incidence reports regarding adverse events happened during IHT of critically ill patients.

Table (2): Percentage distribution of the studied nurses according to their total knowledge level about safe IHT of critically ill patient pre and post implementation of educational program. illustrates that vast majority (96%) of the studied nurses reported low level of total knowledge pre implementation of educational program compared with the majority of studied nurses who then reported high level of knowledge (84%) post implementation of educational program. Also, the total mean \pm SD regarding studied nurses knowledge pre implementation of educational program was 28.14 ± 4.133 compared to 71.23 ± 5.139 post implementation of educational program.

Table (3): Mean scores of the knowledge domains of the studied nurses about intra hospital transportation of critical ill patient pre and post intervention. clarifies that there were highly statistical significant differences observed regarding all knowledge domains pre and post implementation of educational program, where $p = 0.00$.

Table (4): Percentage distribution of the studied nurses according to their total practice level pre and post implementation

of educational program. shows that the majority of the studied nurses (88.6%) had unsatisfactory practice level compared with vast majority (92%) of studied nurses had satisfactory level of practice post educational program. Moreover, Mean \pm SD regarding nurse' practice pre-implementation of educational program was 42.04 ± 18.144 compared to 82.43 ± 4.020 post implementation of educational program.

Table (5): Mean scores of practice domains of the studied nurses pre and post intervention. clarifies that there were highly statistical significant differences regarding checking of necessary equipment, nurse' practice during transportation phase, and immediately post IHT domains $p = 0.000$. On the other hands, it was observed that there were no statistical significant differences regarding preparation of necessary medications, patient's connected tubes, devices, intravenous fluids and position, checking of cardiac monitor and ventilator, and monitoring of hemodynamic parameters $p > 0.05$.

Table (6): Comparison and correlation between total knowledge level and total practice level among studied nurses pre and post intervention. reveals that there were no significant differences among studied nurses regarding total knowledge level pre and post implementation of educational level, where $p > 0.05$. Additionally, there was a positive correlation between the total practice and total knowledge level among the studied nurses pre and post implementation of educational program, where ($r = 0.003$ and $p = 0.979$).

Table (7) Percentage distribution of the studied patients regarding their biosocio-demographic characteristics. clarifies that there were no statistically significant differences observed regarding socio-demographic characteristics of studied patients where $p > 0.05$. Moreover, this table clarified that about one third (33%) of the control group was between (30<40) and more than one third (40%) of study group was between (18-<30) regarding gender, it was noticed that the majority (83.3% and 80%) of studied patients in both control and study groups were males respectively. Additionally, regarding to transportation areas, it was observed that more than two thirds (73.3% and 70%) of studied patients in both control and study groups were transported to computerized tomography scan unit respectively.

Table (8): Percentage distribution of the studied patients of both study and control regarding the Glasgow coma scale throughout period of study. shows that there were no statistically significant differences regarding conscious level among

the studied patients pre, during and after transportation.

Table (9): Percentage distribution of the studied patients in both study and control groups according to the adverse events and complications during intra hospital transportation. clarifies that the most common adverse events and complications among. Patients in control and study groups. In this table, it was found that, more than half (60%) of patient in control group exposed to disconnection of ETT and IV lines compared to only 26.7% of patients in study group with significant differences, where $p < 0.005$. In addition, more than half (53.3%) of control group reported NGT displacement compared to only (13.3%) of study one with significant differences between two groups respectively, where $p < 0.005$. On the other hand, no significant differences were observed among control and study groups in relation to other items of adverse effects of IHT.

Table (1): Percentage distribution of the studied nurses regarding their socio - demographic characteristics

Characteristics	The studied nurses (n=70)	
	N	%
Age (in years)		
▪ (21<30)	63	90.0
▪ (30<40)	7	10.0
Gender		
▪ Male	15	21.4
▪ Female	55	78.6

Educational level		
▪ Diplomas	2	2.9
▪ Technical	49	70.0
▪ Bachelor	19	27.1
Years of experience years in ICU		
▪ (1 <5)	53	75.7
▪ (5< 10)	15	21.4
▪ (10<15)	1	1.4
▪ (≥15)	1	1.4
Previous educational sessions related to safety IHT of critically ill patient		
▪ Yes	3	4.3
▪ No	67	95.7
Previous workshops regarding safety IHT of critically ill patient		
▪ No	70	100.0
Previous incidence reports regarding adverse event happened during IHT of critically ill patient		
▪ Yes	28	40.0
▪ No	42	60.0

Table (2): Percentage distribution of the studied nurses according to their total knowledge level about safe IHT of critically ill patient pre and post implementation of educational program

Total Knowledge Level	The studied nurses (n=70)				χ^2 P
	Pre		Post		
	n	%	N	%	
▪ Low	62	96.0	0	0.0	140.00 0.000**
▪ Moderate	6	3.0	11	15.7	
▪ High	2	1.0	59	84.3	
Range	(17-37)		(51-81)		t=54.66
Mean ± SD	28.14±4.133		71.23±5.139		P=0.00**

* Significant at level P<0.05

**High significant at level P<0.01

Table (3): Mean scores of the knowledge domains of the studied nurses about intra hospital transportation of critical ill patient pre and post intervention.

Knowledge domains	Range Mean \pm SD		t P
	Pre	Post	
A) General questions related to IHT of critically ill patient	(0-9) 5.46 \pm 2.198	(10-18) 15.39 \pm 1.636	30.31 0.000*
B) Knowledge related to before IHT of critical ill patient	(1-12) 7.93 \pm 2.440	(11-20) 16.91 \pm 1.792	24.83 0.000*
C) Knowledge related to during IHT of critical ill patient	(0-7) 4.04 \pm 1.813	(9-16) 13.36 \pm 1.615	32.08 0.000*
D) Knowledge related to post IHT	(2-7) 4.77 \pm 1.342	(7-14) 11.99 \pm 1.302	32.27 0.000*
E) Knowledge related to immediate nursing intervention regarding to adverse action and hazards that may face both the patient and the nurse during IHT	(1-11) 5.94 \pm 2.206	(8-16) 13.59 \pm 1.611	23.41 0.000*
Total knowledge score	(17-37) 28.14\pm4.133	(51-81) 71.23\pm5.139	54.66 0.000*

Pre: Pre educational program

Post: Post educational program

IHT: Intra-hospital Transportation

** highly statistical significant at level P<0.01

Table (4): Percentage distribution of the studied nurses according to their total practice level pre and post implementation of educational program

Total practice level	The studied nurses (n=70)				χ^2 P
	Pre educational program		Post educational program		
	n	%	N	%	
▪ Unsatisfactory	62	88.6	5	7.1	FE 0.000**
▪ Satisfactory	8	11.4	65	92.9	
Range	(23-81)		(70-90)		t=18.182 P=0.000**
Mean \pm SD	42.04\pm18.144		82.43\pm4.020		

* * high Significant at level P<0.01

FE: fisher exact test

Table (5): Mean scores of practice domains of the studied nurses pre and post intervention

Domains of nurse's practice mean score	The studied nurses (n=70) Range Mean \pm SD		t p
	Pre	Post	
	▪ Checking of necessary equipment	(5-18) 9.61 \pm 3.052	
▪ Preparation of necessary medication	(1-5) 2.57 \pm 0.791	(1-5) 2.76 \pm 0.788	1.392 0.166
▪ Preparation of the patient's connected tubes, devices, intravenous fluids & position	(0-15) 4.06 \pm 3.002	(0-15) 5.09 \pm 3.488	1.870 0.064
▪ Checking of cardiac monitor and ventilator	(0-6) 1.71 \pm 1.580	(0-6) 2.10 \pm 1.729	1.378 0.171
▪ Monitoring of hemodynamic parameters	(0-6) 2.50 \pm 1.359	(0-6) 2.76 \pm 1.429	1.091 0.277
▪ Nurse' practice during transportation phase	(0-13) 6.41 \pm 4.227	(11-13) 12.64 \pm 0.512	12.238 0.000*
▪ Nurse' practice immediate post IHT	(3-18) 10.06 \pm 4.436	(15-20) 19.41 \pm 0.893	17.301 0.000*
Total practice mean score	(23-81) 42.04\pm18.144	(70-90) 82.43\pm4.020	18.182 0.000*

Table (6): Comparison and correlation between total knowledge level and total practice level among studied nurses pre and post intervention

Total knowledge level	The studied nurses (n=70) Total practice level							
	Pre				Post			
	Unsatisfactory (n=62)		Satisfactory (n=8)		Unsatisfactory (n=5)		Satisfactory (n=65)	
	n	%	n	%	n	%	N	%
▪ Low	62	88.6	8	11.4	0	0.0	0	0.0
▪ Moderate	0	0.0	0	0.0	2	2.9	9	12.9
▪ High	0	0.0	0	0.0	3	4.3	56	80.0
χ^2 , P	-				FE, 0.173			
r, P	0.003, 0.979				0.092, 0.446			

Pre: Pre educational program Post: Post educational program FE: fisher 'exact test

Table (7):- Percentage distribution of the studied patients regarding their bio-socio-demographic characteristics.

Characteristics	The studied patients (n=60)				χ^2 P
	Control group (n=30)		Study group (n=30)		
	n	%	n	%	
Age (in years)					
▪ (18-<30)	8	26.7	12	40.0	5.622 0.132
▪ (30-<40)	10	33.3	8	26.7	
▪ (40-<50)	9	30.0	3	10.0	
▪ (50-60)	3	10.0	7	23.3	
Gender					
▪ Male	25	83.3	24	80.0	FE
▪ Female	5	16.7	6	20.0	1.00
Transported from					
▪ Computerized tomography	22	73.3	21	70.0	1.761 0.185
▪ Dialysis unit	7	17.6	5	16.7	
▪ Operation unit	1	3.3	2	6.7	
▪ X-ray	1	3.3	0	0.0	

Table (8): Percentage distribution of the studied patients of both study and control regarding the Glasgow coma scale throughout period of study.

Glasgow Coma Scale	The studied patients (n=60)													
	Control group (n=30)						χ^2 P	Study group (n=30)						χ^2 P
	Pre		During		Post			Pre		During		Post		
	n	%	n	%	N	%		n	%	N	%	n	%	
- Severe (3-8)	13	43.3	12	40.0	13	43.3	1.300 0.861	13	43.3	10	33.3	10	33.3	0.822 0.935
- Moderate(9-12)	5	16.7	5	16.7	3	10.0		12	40.0	12	40.0	13	43.3	
- Mild (13-15)	12	40.0	13	43.3	14	46.7		5	16.7	8	26.7	7	23.3	
Range	(3-15)		(3-15)		(3-15)		F=0.066	(3-15)		(3-15)		(3-15)		F=0.006
Mean ± SD	9.50±2.874		9.80±3.295		9.67±3.437		P=0.936	10.00±4.698		10.13±4.740		10.10±4.838		P=0.994

Pre: pre transportation During: During transportation post: post transportation

Table (9): Percentage distribution of the studied patients in both study and control groups according to the adverse events and complications during intra hospital transportation.

Clinical data	The studied patients (n=60)				FE P
	Control group (n=30)		Study group (n=30)		
	n	%	n	%	
▪ Disconnection of endotracheal tube/tracheostomy tube	15	50.0	16	53.3	1.00
▪ Disconnection of intravenous lines	18	60.0	8	26.7	0.018*
▪ Disconnection/removal of chest tube	1	3.3	1	3.3	1.00
▪ Nasogastric tube displacement	16	53.3	4	13.3	0.002*
▪ Disconnection of wound drainage	9	23.3	4	30.0	0.771
▪ Accidental central line catheter removal or blocked	9	13.3	7	30.0	0.209
▪ SPO2 fall >5% from baseline for more than 1 min (Hypoxic event)	9	30.0	10	33.3	1.00
▪ Temperature <35°C (Hypothermia)	0	0.0	1	3.3	1.00
▪ Increase heart rate	12	40.0	5	16.7	0.084
▪ Decrease 20 mmHg in systolic and 10mmhg decrease in diastolic pressure from baseline for more than 5 min (Hypotensive event)	2	6.7	3	10.0	1.00

▪ Increase 20 mmHg in systolic and 10mmhg increase in diastolic pressure from baseline for more than 5 min (Hypertensive event)	2	6.7	0	0.0	0.492
▪ Arterial line blocking	8	26.7	4	13.3	0.209
▪ Accidental dislodging of urinary catheter	9	30.0	8	26.7	1.00
▪ Altered in mental status	3	10.0	1	3.3	0.612
▪ Needing advanced O2 support	5	16.7	1	3.3	0.195
▪ Hypoxia	6	20.0	5	16.7	1.00
▪ Cardiac arrest	1	3.3	1	3.3	1.00

* Significant at level $P < 0.05$

Discussion:

Implementation of Intra-hospital transportation protocol may affect the incidence of adverse complications and events. Adverse events are usually related to a patient's clinical condition, equipment, system, and human factors. Thus good nurse 'knowledge and practice of care are crucial in limiting incidence of adverse events during intra-hospital transportation. Also, knowledgeable nurse have a vital role in enhancing their practice and improve patients' outcome^(7,12).

The aim of the study: Evaluate the effect of educational program about intra-hospital safety transportation of critically ill patients on nurses' performance and patients' clinical outcomes.

Regarding to socio-demographic characteristics of the studied nurses, the findings of the present study reveals that the majority of the studied nurses were in the age group between 21<30 years old. In this regard, this finding may be related to that new graduate nurses were appointed to work in the Intensive Care Unit because youth and adulthood considered the healthiest life time and have an ability to tolerate the work load in the Intensive Care Unit. It also considered the

effective time to learn and modify their practice through training in ICU to improve the sense of identity and develop successful intimate relations. This finding is in the same line with **Alizadeh sharafi et al (2021)⁽¹⁷⁾**, who reported that more than three quarters of the studied nurses had age less than 30 years old and more than half of them were female. Additionally, **Xie et al (2020)⁽¹⁸⁾** reported that the majority of studied nurses were less than 30 years old.

Regarding gender, it was observed that the majority of the studied nurses were females. The finding may attributed to males learnt nursing lately in recent years, majority of male nurses working outside country, and before that most of the nursing education was done by females. This finding is in harmony with **Song et al (2022)⁽¹⁹⁾**, who revealed that the majority of the staff nurses who work in ICU were female.

Concerning educational level and years of experience in ICU, the finding showed that more than two thirds of studied nurses were technical and three quarters worked in intensive care unit from one to less than five years. This could be because the number of

graduates of the technical institution is larger than high educational level of nursing. This findings agreed with **Anchal and Reema (2020)** ⁽²⁰⁾ they stated that, the majority of studied nurses graduated from the institute of nursing and had from five to less than ten years of experience similarly in ICU. Also, this finding was supported by **Keykaleh et al (2018)** ⁽²¹⁾, who found that the majority of studied nurses had a secondary education and graduated to technical institute of nursing. Additionally, The finding is also supported by **Seilbeaet al, (2020)** ⁽²²⁾, who clarified that the highest percentage of studied nurses was graduated from nursing institutes and spending less than 10 years in ICU .

Regarding previous incident report during intra hospital transportation, the current study finding revealed than one third of the studied nurses reveals previous incidence reports regarding adverse events happened during IHT of critically ill patients. This findings may be related to less experience of the studied nurses regarding IHT adverse events and unknowing about the importance of documenting adverse events which happened during transportation .This finding is matched with a research conducted by **Ignatyeva et al (2018)** ⁽²³⁾, who reported that incidence of adverse events during intra hospital transport was between 30% to 50% of nurses

Studied nurses' knowledge related to safe intra-hospital transportation; the finding of this study suggested that there were highly statistical significant differences observed regarding all knowledge domains pre and post implementation of educational program. Most of the studied nurses had a decent level of knowledge after the educational program had been implemented, suggesting that the program had a positive impact on nurses' knowledge. The result was consistent with

Ignatyeva et al (2018) ⁽²³⁾, who reported that nurses' knowledge of intra hospital transfer for the CIPs increased after educational program.

Studied nurses' practice related to safe intra-hospital transportation, the present study showed significant improvement in the nurses' practice post implementation of educational program. This result may be related to interesting of nurses with educational topic. Also improving in nurse's practice regarding improving in nurse 'knowledge post implementation of educational program

These findings were matched with **Hatem S (2019)** ⁽²⁴⁾ , who conducted a study which reflected that implementation of training to critical care nurses enhancing their practice and reduce the incidence of adverse events regarding IHT of critically ill patients. Moreover, **Fatemeh et al (2021)** ⁽²⁵⁾ reported that nurses who shared in educational sessions enhancing their skills and practice regarding IHT.

The current findings indicated that there was a positive correlation between the total practice and total knowledge level among the studied nurses pre and post implementation of educational program. It might be connected to how better education and training for the nurses under study can result in better patient care. The result was consistent with **Shwu et al (2020)** ⁽²⁶⁾ and **Ahmed et al (2015)** ⁽²⁷⁾, they revealed that there was a statistical correlation between critical care nurses and practice which reflect the effect of intra-hospital transportation training program.

Regarding the socio-demographic characteristics of the studied patients among the studied groups, current study results clarified that there were no statistically significant differences observed regarding socio demographic characteristics among the

study and control groups but it was observed that the majority of the involved patients on both study and control were youth and more than two thirds of the total studied patients were males. These findings were matched with a study findings which conducted by **Ismail et al (2020)** ⁽²⁸⁾ they reported that majority of involved patients were males with age group in between 20 to 40 years old. The findings of the current study revealed that the majority of patients were youth and admitted to the hospital as a result of traffic accidents which lead to traumatic events. It also clarified that majority of studied patients were transported to computerized tomography scan unit, it also may be related to the pandemic condition of corona virus as all patients in need of CT chest to evaluate the patient's chest condition plus diagnosis, evaluation and follow up their traumatic events.

Additionally, these findings were matched with **Ismail et al (2020)** ⁽²⁸⁾, who showed that most of the studied patients were transported to radiology department, especially CT scan. **Also - Omer et al, (2020)** ⁽²⁹⁾ found that the CT scan room was the most common destination for critically ill patients in hospitals. Also, it was observed that majority of the studied patients in both study and Control were admitted to ICU related to trauma event also this` finding showed that more than half of the total studied patients were on mechanical ventilator with complete dependent. These findings were matched with **Qurram et al (2020)** ⁽³⁰⁾, they revealed that majority of the patients were on MV during transportation and transported by beds.

Concerning Level of consciousness of the studied patients: The current result showed that there were no statistically significant differences regarding to conscious level among the studied patients pre, during and

after transportation. The majority of studied patients was on mechanical ventilator with complete dependent on sedative drugs affect during transportation and received dose of sedation and anesthetic drugs before transportation. The findings were supported by **Martin et al (2017)** ⁽³¹⁾, who revealed that no significant changes in conscious level during transportation of critically ill patients.

Regarding adverse events and complications of the studied patients during intra-hospital transportation; the finding showed that the patients' adverse events and complications were declined among patients in the study group than the control. Additionally, the most common adverse events and complications among patients in control and study groups were disconnection of IV lines followed by nasogastric tube displacement and disconnection of endotracheal tube or tracheostomy tube, while disconnection of endotracheal tube or tracheostomy is most common adverse events in study group. This findings may be related to far away between the ICU and transportation unit, also many times of holding the patients as (bed to table of scanning or chair of dialysis or operation' table), also over crowded during transportation from visitors ,relatives and workers.

The findings of the current study were synchronized with **Habibzadeh et al (2020)** ⁽³²⁾, who showed that the incidence of adverse events was significantly reduced after personnel received safe intra-hospital training program. On this context, the finding harmonic with **Fatemeh (2021)** ⁽²⁵⁾, who showed that after conducting the interactive workshop, the quality of patient transfer was improved dramatically as less than one tenth of the transfers were undesirable complications and adverse events. **Additionally**, a study conducted by **Weiyang et al (2021)** ⁽³³⁾ reported

that training could significantly improve the quality of intra-hospital patients' transportation and contribute in reducing the adverse events during transportation and increased knowledge and skills of nurses can cover the deficits of their performances. Also, **Venn et al (2021)**⁽³⁴⁾ showed that the most common adverse event that was observed during IHT of critically ill patients was desaturation and dislodged peripheral line.

On the other hands, These findings were contradicted with a study conducted by **Mohamad et al (2021)**⁽¹²⁾, they reported that the most common adverse events during the transportation process was deterioration in respiratory status and deterioration in hemodynamic status. Also, **Ismail et al (2020)**⁽²⁸⁾, showed that the critically ill patients who involved in an intra-hospital transfer are suffered from hypotension, desaturation and dislodged peripheral lines. **Additionally, Sinara et al (2020)**⁽³⁵⁾ reported that the most common physiological alterations during IHT of critically ill patients were increase of heart rate, increase of intracranial pressure, changes in blood pressure, cardiac arrhythmias, heart attacks, respiratory distress, cardiac arrest, agitation, decrease in oxygen saturation and some other blood disorders

Conclusion:

The majority of studied nurses (90%) were within the age group of (21<30) years and more than two thirds of the studied nurses (78%) were females.

-More than two thirds of studied nurses (70%) were technical, while only (2.9%) were diploma degree

The majority, (83.3% and 80%) of studied patients in both control and study were males.

The implementation of nursing educational program have appositve effect of improving

nurse 'knowledge and practice regarding safe IHT of critically ill patients.

Improving patients'clinical outcome post implementation of educational program

Recommendation:

It was recommended that encouraging critical care nurses' in-service training program regarding safe IHT can improve critically ill patients' outcomes

Limitation of the study:

- 1- Pandemic of COVID 19 and isolation of staff nurse during implementation phase of the study.
- 2- The study was conducted on one area in Egypt and inability to generalize the results was assured.

References:

1. Ackley B, Ladwig G, Makic M, Kratz M and Zanotti M. Nursing Diagnosis Handbook E-Book: An Evidence-Based Guide to Planning Care.12th ed. Canada: Elsevier Health Sciences Co., 2020; 1:1-13.
2. Zangrillo A, Beretta L, Silvani P, Colombo S, Scandroglio A. Fast reshaping of intensive care unit facilities in a large metropolitan hospital in Milan, Italy: facing the COVID-19 pandemic emergency. *Critical care and resuscitation*, 2020; 22(2):91-4.
3. Alizadeh Sharafi R, Ghahramanian A, Sheikhalipour Z, Ghafourifard M, Ghasempour M. Improving the safety and quality of the intra-hospital transport of critically ill patients. *Nursing in Critical Care*.2021; 26(4):244-52.
4. Association of perioperative Registered Nurses (AORN) Anonymous. Adverse event during intra-hospital transport: The official voice of perioperative nursing the official voice of perioperative nursing. *AORN Journal* 2022; 111(5):577-9.

5. Maddry J, Arana A, Savell S, Reeves L, Perez C, Mora A, Bebartá V. Critical care transport team evacuation of medical patients without traumatic injury. *Mil Med* 2017; 182(11):1874-80.
6. Hu Y, Shi D, You L, Li W. Intra-hospital transport of critically ill patients: A survey of emergency nurses. *Nursing in Critical Care*, 2021; 26(5): 326-32.
7. Williams P, Karuppiyah S, Greentree, K, Darvall J. Checklist for intra-hospital transport of critically ill patients improves compliance with transportation safety guidelines Australian Critical-Care, 2020; 33(1):2024.
8. Eigsti J. Updating external ventricular drainage care and intra-hospital transport practices at a community hospital. *Journal of Neuroscience Nursing*, 2020; 52(6):273.
9. Mukabagire D. Nurses' Knowledge, attitudes and practice towards intra-hospital transportation management of the critically ill adult patients: in selected referral hospitals, Kigali-Rwanda, Published Doctoral dissertation, University of Rwanda. 2019.
10. Akrami S, Sargazi GH, Safabakhsh L, Mofrad ZP. Assessing the Effect of training the safe transfer checklist on the quality of intra-hospital patient transfer: An interventional study. *Medical-Surgical Nursing Journal*, 2019; 8(4):e99593.
11. Asadiyan M, Heidari MR. The Incidence of Adverse Events Associated with Physiological Changes during the Transfer of Patients in Intensive Care Units. *Journal of Critical Care Nursing*, 2020; 13(4):22-33.
12. Mohammad A, Fahad M. Effect of applying checklist on quality of intra-hospital transport of intensive care patients. *Iranian Journal of Cardiovascular Nursing*. 2021; 3(3):30.
13. Souza M, Xavier A, Araújo, C, Pereira, E, Duarte S, Valladares B. Communication between pre-hospital and intra-hospital emergency medical services: literature review. *Revista Brasileira de Enfermagem*, 2022; 73(6):1-8.
14. Putra K, Wulandari I, Suharsono T, Hany A. Adverse events during intra-hospital transport of critically ill patients: an observational study. *Central European Journal of Nursing and Midwifery*, 2022; 13(3):699-706.
15. Madalena C, Isabel P, Patrícia P, Isabel R. Checklist for a safe intra-hospital transport of critically ill patients: A scoping review, *Enfermería Global journal*, 2020; 19(4):525-72.
16. Teasdale G, the Glasgow Coma Scale. (1979), *Nursing Times*. 110(42).
17. Alizadeh sharafi, Ghahramanian A, Sheikhalipour Z, Ghafourifard M, Ghasempour M. Improving the safety and quality of the intra-hospital transport of critically ill patients. *Nurs Crit Care*. 2021, (26), 244–252.
18. Xie Y, Xiao Y, Zhou J, Li L. Demands of experiential training for ICU nurses in Hunan of China. *International Journal of Nursing Sciences*, (2020); 7(4): 427–432.
19. Song Y, Zhao Q, Yang M, Xie X, Gong M, Chen H. Intra-hospital transport of critically ill patients: A cross-sectional survey of Nurses' attitudes and experiences in adult intensive care units. *Journal of Advanced Nursing*, 2022.
20. Anchal G and Reema G. Study to Assess the Effectiveness of an Information

- Booklet on Knowledge Regarding the Intra Hospital Transport Protocol for Critically Ill Patient among GNM 3rd Year Students Studying in Integral College of Nursing, Lucknow. *International Journal of Trend in Scientific Research and Development (IJTSRD)* 2020, 5(5).
21. Keykaleh M, Safarpour H, Yousefian S, Faghisolouk F, Mohammadi E, Ghomian Z. The relationship between nurse's job stress and patient safety. *Open Access Maced J Med Sci.* 2018; 6(4):2228-32.
 22. Seilbea L, Vasconcello K. Adverse events during the intra-hospital transfer of critically ill perioperative patients in a South African tertiary hospital.2020; 26(3):131-38.
 23. Ignatyeva Y,Nguyen A, Schmidt U, Barak R, AgarwalR. Transport of critically ill cardiovascular patients. *Crit Care Nursjour.*2018; 41:413-25.
 24. Hatem S. Assessment of Nursing Knowledge and Practices during Intra-Hospital Transfer of Critically Ill Patients, department of Nursing Faculty of Health Sciences, Beirut Beirut, Lebanon. Ppublished Master Thesis. Arab University, 2019.
 25. Fatemeh H, Jaleh M, Masoomeh I, Abbas M, The effect of interactive workshop on the quality of intra-hospital patients' transfer : A quasi-experimental study. Department of Critical Care Nursing, School of Nursing and Midwifery, Tehran University of Medical Sciences, Tehran, Iran, *NursPract Today.*2021; 4(2):79-86.
 26. Shwu, Droogh J, Smit M, Absalom A. Transferring the critically ill patient: are we there yet? *Crit Care,* 2020; 19:62.
 27. Ahmed A, Thongprayoon C, Schenck L, Malinchoc M, Konvalinová A, Keegan M. Adverse in-hospital events are associated with increased in-hospital mortality and length of stay in patients with or at risk of acute respiratory distress syndrome, *Mayo Clin Proc.* 2015 Mar;90(3):321-8.
 28. Ismail M, Baharuddin K, Zainal Abidin Z, Abu Bakar MA, Sjahid AS. Study on the incidence of adverse events during intra-hospital transfer of critical care patients from emergency department. *Med J Malaysia.* 2020; 75(4):325-30.
 29. Omer S, Metin A, Mustafa B, Fatma B, Polat D, Necmi B, Cemil K. Intra-hospital critical patient transport from the emergency department, public health.2020;16(2):337.
 30. Qurram A, Ismail, Lin R. Improving patient safety during intra-hospital transportation of mechanically ventilated patients with critical illness. *BMJ Open Qual.* 2020; 9: e 000698.
 31. Martin M, Cook F, Lobo D. Secondary insults and adverse events during intra hospital transport of severe traumatic brain-injured patients. *Neurocrit Care* 2017; 26:87-95.
 32. Habibzadeh F, Aliha J, Imanipour M, Mehran A. The effect of interactive workshop on the quality of intra-hospital patients' transfer: a quasi-experimental study. *NursPract Today.* 2020; 4:79-86.
 33. Weiyang Z, Jianhong L, Jin Z, Xiaoyan M, Xueyan L, Hongming G, Meiyang Z, Runv Z. Proactive risk assessment of intra hospital transport of critically ill patients from emergency department to intensive care unit in a teaching hospital and its implications, department of nursing, Shanghai East Hospital, Tongji University School of Medicine, Shanghai, China.

- Journal of Critical Nursing, 2021. 31:2539-52.
34. Venn A, Sotomayor C, Godambe S, Vazifedan T, Jennings A, Qureshi F, Mullan P. Implementation of an Intra-hospital Transport Checklist for Emergency Department Admissions to Intensive Care. *Pediatr Qual Saf.* 2021; 23:6(4):e426.
35. Sinara F, Clesnan M, Rosângela F and Fabíola G. going and coming from a surgical center: assessing risk inpatient transport in a university hospital of Brazil, *Bioscience Journal.* 2020; 36 (2):663-71.