Effect of Intra-Hospital Safe Transportation Guidelines for CriticallyIll Patients on Nurses' Performance and Patients' Clinical Outcomes

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Abstract

Background: Intra-hospital transportation is the term for when critically ill patients are moved within a hospital for therapeutic or diagnostic reasons. Even for experienced nurses, this kind of work can be risky and very stressful due to the severity of the patients' illnesses and the need for constant monitoring during the transfer. **The aim of the study was to** evaluate the effect of intra-hospital safe transportation guidelines for critically ill patients on nurses' performance and patients' clinical outcomes. **Setting**: This study was conducted at Surgical Intensive Care Units in Minia university Hospital, Egypt. **Method**: A quasi-experimental design was utilized in this study. **Sample** of the study consisted of all available nurses (70) who are working in the Surgical ICU and convenience sampling of 60 critically ill patients, which divided equal into 30 patients of both study and control groups. **Tools**: Three tools were used to collect data, **Tool (1)** Nurses' self-administered questionnaire**, Tool (II)** Nurses' practice observational checklist **and Tool (III)** Patients' clinical outcomes. ***Results*:** It was observed that great majority (90%) of the studied nurses reported low level of total knowledge pre-implementation of guidelines compared with the majority (82.9%) of them reported high level of knowledge post implementation of guidelines. Additionally, the majority of the studied nurses (90%) had incompetence practice level compared with great majority (98%) of them had competence level of practice post implementation of guidelines and there was high statistical improvement on critically ill patients' clinical outcomes during intra-hospital transportation. **Conclusion*:*** A well designed safe intra-hospital transportation guidelines could positively affect the nurses' knowledge and practice and decline the patients' adverse events and complication during transportation. **Recommendation:** It was recommended that continuous application of intra-hospital transportation guidelines, protocols and checklists in all intensive care units to prevent occurrence of adverse events.

Keywords: Guidelines, Safe Intra-Hospital Transportation, Critically Ill Patients, Nurses' Performance, Patients' Clinical Outcomes.

Introduction

The risk of morbidity and death during transport is higher for critically ill patients (CIPs). By carefully planning, using staff that are qualified for that position and choosing or having access to the right equipment, risks can be reduced and results might be enhanced. During transportation, there is no hiatus in the monitoring or maintenance of a patient's vital functions. Furthermore, the critical functions of a patient are continuously monitored and maintained during the process of transportation. Additionally, trained personnel and equipment are chosen to meet the patient's ongoing or displayed acute care demands **(Ackley et al., 2020).**

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 **(Zangrillo et al., 2020)**.

Patient safety is one of critical importance throughout the whole continuum of care, including home, primary, community care, and extending to acute, long-term care and palliative care. It is estimated that 64 million

disability-adjusted life years are lost every year because of unsafe care worldwide. This means that patient harm due to adverse events (AEs) is probably one of the top 10 causes of death and disability in the world ***(World Health Organization, 2021).***

Critically ill patients (CIPs) who are admitted to the ICU are at higher risk of AEs associated with IHT. Adverse events can occur for various reasons, including unstable hemodynamics, the need for many devices such as a ventilator, and miscommunication between healthcare providers ***(Murata et al., 2022).***

The guidelines stipulate that the standard procedures for intra-hospital patient transport should be provided at the same level of care, ensure monitoring and intervention that are available in the ICU; prioritization of the sickest patients during the transfer. Safety should be put under consideration during patients handling including timing, route and destination ***(Khan et al., 2021).***

Hospitals in different countries developed patients transport and transfer guidelines with reference to the ones developed in developed countries, but not all hospitals have the guidelines or follow them as set ***(Araiza et al., 2021).***

The intra hospital transport guidelines should include information on the preparation for the IHT, as patient assessment, ongoing monitoring and management considerations as recommend by **Sharma *et al. (2020).*** Performing a risk-benefit evaluation, ensuring the qualifications of transport personnel, assessing the adequacy of equipment and running through a pre-transport check list are also recommended to increase safety during IHT ***(Hu et al., 2021).***

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 derive 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 ***(Sharafi et al., 2021)***.

On this context, series complication which face surgical 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, O_2 reduction, and blood gas alteration ***(Association of perioperative Registered Nurses (AORN) Anonymous, 2022).***

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 **(Ackley et al., 2020).**

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 ***(Catalán-Ibars et al., 2022).***

Significance of the study:

A study conducted by ***Murata et al. (2022)***, revealed that the transport of critical patients is hazardous, where between 6%-70% of all IHT was associated with adverse events , changes in vital signs, accidental extubation,and cardiopulmonary arrest have been reported to occur in 8% of cases which needed medical therapy. Also, serious adverse outcomes identified in 31% of transport incidents were reported in the Australian Incident Monitoring Study in Intensive Care, with death of the patients resulting in 2% of such report ***(Williams et al., 2020).*** In Minia University

Hospital, there was no statistical result revealed patients' morbidity and mortality rate occurred during IHT.

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 safe transportation guidelines to minimize adverse effects of transportation and improve patients' clinical outcomes. Therefore, the existence of intra-hospital safe transportation guidelines is valuable and important for CIPs' safety.

Aim of the study

This study aimed to evaluate the effect of guidelines for intra-hospital safe transportation of critically ill patients on nurses' performance and patients' clinical outcomes; it will be achieved through the following:

1. Assessment of the nurses' level of performance (knowledge and practice) for intra-hospital safe transportation of critically ill patients.
2. Develop and implement intra-hospital safe transportation guidelines for nurses caring of critically ill patients.
3. Evaluate the effect evaluate of intra-hospital safe transportation guidelines for critically ill patients on nurses' performance and patients' clinical outcomes.

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

- Post implementation of guidelines, the nurses will be exhibited improves in their performance (knowledge and practice) for intra-hospital safe transportation of critically ill patients.
- Patients' clinical outcomes are expected to be improved after implementing intra-hospital safe transportation guidelines**.**

Operational Definitions

Nurses performance: means nurses' knowledge and practice.

Guidelines: the researcher will develop safe IHT guidelines for critically ill patients to prevent various adverse events accompanied with their transportation based on the related recent literatures.

Critically ill patients: means those patients who admitted to surgical intensive care units at the selected hospital.

Patients' clinical outcomes: includes the following parameters: adverse events and complications during intra hospital transportation such as: disconnection of endotracheal tube/ tracheostomy tube, disconnection of 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 (Hypoxic event), temperature <35C^{o} (Hypothermia), increase heart rate, decrease 20 mmHg in systolic and 10mmhg 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).

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 Minia University Hospitals, which a teaching hospital at the first floor and equipped with 47 beds, the capacity of beds in Surgical ICU was (27 beds) and Anesthesia ICU was (20 beds).

Subjects:

All available nurses 70 who are working in the previously mentioned settings and give direct nursing care and directly contact with CIPs. Additionally, a convenience sampling of 60 critically ill patients were selected, the subjects were selected by a random sample of 60 CIPs born in the intensive care units of hospitals affiliated with Minia'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 surgical 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 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 bagwith oxygen.

Study Group: It was consisted of 30 critically ill patients were newly admitted that need IHT for any purpose**,** stability of hemodynamic parameters of CIPs, who exposed to safe IHT guidelines.

Tools of Data Collection:

Three tools were used for data collection of this study.

Tool I: Nurses' self-administered questionnaire:

It comprised of two parts as follow:

Part (1): Nurse's demographic characteristic as age, gender, level of education, years of experience in ICU, previous training courses, and workshops regarding safety.

Part (2): Nurses' Knowledge questionnaire regarding Intra-Hospital Safe Transportation; it was developed by the researcher after reviewing the relevant literature **(Maddry et al., 2017, Williams et al., 2020, Hu et al., 2021&Mohammed et al.,2023)** to assess nurses' knowledge before, during and post IHT. The nurses' Knowledge included general knowledge (9 items), nurses' knowledge before IHT (10 items), during IHT (8 items) and post IHT (7 items), nurses knowledge regarding immediate nursing intervention during IHT (8 items).

Scoring System:

Three level of scoring for questions would 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 → > 85% of the total score
- Fair → ≥ 60% - 85% 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 85% high level of knowledge was considered from 85% and more.

Tool II: Nurses` Practice Observational Checklist regarding Intra- Hospital Transportation:

This tool was developed by the researcher after reviewing the relevant literature **(Mukabagire, 2019, Souza et al., 2022& Mohammed et al.,2023)** 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 will take (1)
- Not done will take (0)

The total practices score would be calculated and classified as:

- -Competence → ≥ 85% of the total score
- -Incompetence → < 85% of the total score

Tool III: Patients' Clinical Outcomes

Assessment Tool:

This tool was developed by the researcher after reviewing the relevant literature **(Teasdale, 1979, Madalena et al., 2020&Putra et al., 2022)** for collection of the baseline data regarding CIPs. It compromised three parts as follows:

Part (A): Patients' 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 (1979)** 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 **(Putra et al., 2022& Souza et al., 2022)** 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, Spo_2 fall > 5% from baseline for more than 1 min, temperature $<35^0$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 02 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).

Operational design

Preparatory phase:

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

Tools Validity and reliability

Content Validity: With the exception of tool 3, part B, which had been developed by Teasdale (1979), all of the tools used in the study were developed by the researcher after a review of current, relevant literature.

Seven experts in medical surgical and critical care nursing evaluated the generated tools' content validity and implemented the necessary revisions after determining that it was clear and applicable. Calculations revealed that the result was = (88%).

Reliability: All tools were tested for reliability using; to verify the reliability of the instrument by test-retesting it twice on the same participants who had part in the instrument pilot, the Cronbach Alpha was computed for Tool I (0.85), Tool II (0.75), and Tool III part C (0.82).

Pilot study:

A pilot study was conducted on ten nurses and ten patients prior to the actual data collection to ensure the questionnaire was legible and easily understood. Errors in the questionnaire and observation checklist were incorporated and addressed in response to the pilot study's results.

Field Work:

Data collection was expected to take about 6 months and conducted in the period from beginning of June to the end of November

2023.

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 distributed it to nurses to be filled by each one. Additionally, the patient was assessed by using tool III (part A) to assess their demographic characteristics. Tool III (part B) used by the researcher pre-implementation of guidelines to assess IHT related complications. The knowledge questionnaire was filled by the nurses within 20-35 minutes and observational check list was filled by the researcher within 20 minutes foreach nurse.

Planning phase: A guidelines program was planned according to nurses 'educational needs assessment and based on literature review(Lynn,2018,McGann,2019&Mohammed et al.,2023) 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 redemonstrations 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 guidelines intervention.

Guidelines program was implemented by the researcher for nurses using interactive lectures, video presentations, and booklet. Nurses 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 guidelines program for all studied 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 guidelines.

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.

Guidelines program was implemented by the researcher for nurses using interactive lectures, video presentations, and booklet. Nurses 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 guidelines, the researcher used tool (I and II) to evaluate nurses' knowledge and practice. Tool III (part B and C) to evaluate CIPs` clinical outcomes. A comparison between pre and post safe IHT guidelines was done once after week from attendance to guidelines program to evaluate the effect of implementing safe IHT guidelines.

Administrative design

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.

Ethical and legal consideration:

Ethical committee of the faculty of nursing at Minia university approval was obtained with code (REC 2023117).

All participants were 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 causing any harm to the entire subjects. Confidentiality regarding data collection and patient' privacy was maintained.

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): Shows that (88.6%) of the studied nurses were within the age group of (21<30) years and (77.1%) of the studied nurses were females. Additionally**,** (67.1%) of studied nurses were technical, while only (4.3%) were diploma degree. Regarding years of experiences in ICU, it was observed that around (74.2%) of the studied nurses worked in ICU from one to less than five years. It can be seen that only (7.1%) of studied nurses attended to guidelines sessions regarding safe IHT of CIPs. Also, no one of the studied nurses received workshop related to safety IHT of critically ill patients.

Figure (1): Shows that (60%) of the studied nurses revealed no previous incidence reports regarding adverse events happened during IHT of critically ill patients.

Table (2): Clarifies that there were highly statistically significant differences observed regarding all knowledge domains pre and post implementation of safe IHT guidelines, where p =0.000.

Table (3): Illustrates that (90%) of the studied nurses reported low level of total knowledge pre-implementation of safe IHT guidelines compared with (82.9%) of studied nurses who then reported high level of knowledge post implementation of educational guidelines. Also**,** the total mean ± SD regarding studied nurses' knowledge pre-implementation of safe IHT guidelines was (28.13±4.122) compared to (71.33±5.128) post implementation of guidelines**.**

Table (4): Shows that there were highly statistically significant differences regarding checking of necessary equipment, nurses' practice during transportation phase, and immediately post IHT domains p=0.000. On the other hands, it was observed that there were no statistically 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 (5): Shows that (90.0%) of the studied nurses had incompetence practice level compared with (98.6%) of studied nurses had competence level of practice post implementation of safe IHT guidelines. Moreover, mean ±SD regarding nurses' practice pre-implementation of guidelines was (42.11±18.150) compared to (82.49±4.050) post implementation of safe IHT guidelines.

Table (6): Reveals that there was a positive correlation between the total practice and total knowledge level among the studied nurses pre and post implementation of guidelines, where (r=0.425, r =0.521 at P=0.000) respectively.

Table (7): Illustrates that there was statistically negative correlation between AEs occurred and levels of knowledge and practice pre intervention (r= -0.589, -0.423 at P<*0.001*). While, there was highly statistically positive correlation between AEs occurred and levels of knowledge and practice post intervention (r=0.487at P<*0.001*).

Table (8): Clarifies that there were no statistically significant differences observed regarding demographic characteristics of studied

patients where p >0.05. Moreover, this table clarified that about (36.6%) of the control group was between (30<40) and (36.6%) of study group was between (18-<30) regarding gender, it was noticed that (90.0% and 86.6%) of studied patients in both control and study groups were males respectively. Additionally, regarding to transportation areas, it was observed that (66.6% and 73.4%) of studied patients in both control and study groups were transported to computerized tomography scan unit respectively.

Table (9): Shows that there were no statistically significant differences regarding conscious level among the studied patients (study and control group) pre, during and after transportation

Table (10): Illustrates that the most common adverse events and complications among Patients in control and study groups. In this table, it was found that, (50%) of patient in control group exposed to disconnection of ETT and IV lines compared to only 16.7% of patients in study group with significant differences, where p <0. 005.

In addition, (56.7%) of control group reported NGT displacement compared to only (16.7%) of study one with significant differences between two groups respectively, where p <0.05. 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 demographic characteristics (N=70).

Characteristics	The studied nurses (n=70)	
	N	%
Age (in years)		
▪ (21<30)	62	88.6
▪ (30<40)	8	11.4
Gender		
▪ Male	16	22.9
▪ Female	54	77.1
Social Status		
▪ Single	40	57.1
▪ Widow	30	42.9
▪ Divorced	0	0.0
Educational level		
▪ Diplomas	3	4.3
▪ Technical	47	67.1
▪ Bachelor	20	28.6
Years of experience years in ICU		
▪ (1 <5)	52	74.2
▪ (5< 10)	14	20.0
▪ (10<15)	2	2.9
▪ (>15)	2	2.9
Previous educational sessions related to safetyIHT of critically ill patient		
▪ Yes	5	7.1
▪ No	65	92.9
Previous workshops regarding safety IHT ofcritically ill patient		
▪ No	70	100

Figure (1): Percentage distribution of the studied nurses regarding their previous incidence reports about adverse event happened during IHT of critically ill patient (N=70).

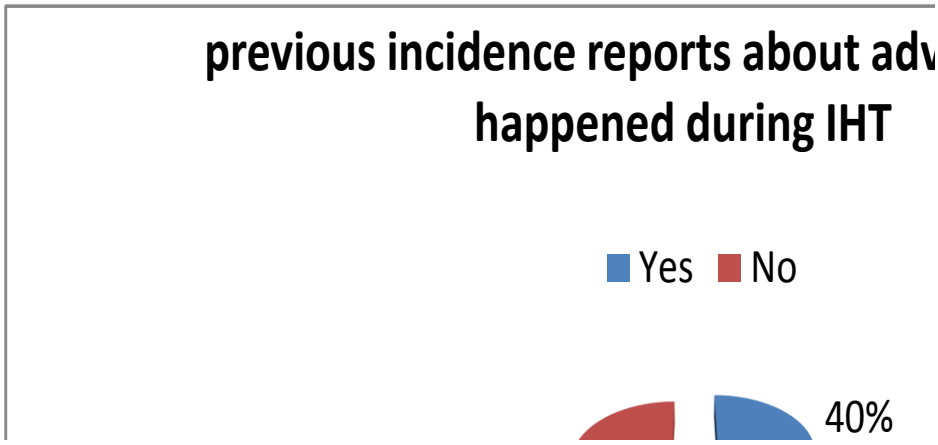

Table (2): Mean scores of the knowledge domains of the studied nurses about intra hospital transportation of critical ill patient pre and post intervention (N=70).

Knowledge domains	Range Mean ± SD		t P
	Pre	Post	
• General questions related to IHT of critically ill patient	(0-8) 5.35±2.201	(9-17) 15.48±1.712	29.88 0.000**
• Knowledge related to before IHT of critical ill patient	(0-11) 7.89±2.439	(10-19) 16.97±1. 785	24.88 0.000**
• Knowledge related to during IHT of critical ill patient	(0-8) 4.11±1.793	(9-17) 13.77±1.710	32.23 0.000**
• Knowledge related to post IHT	(1-6) 4.65±1.372	(7-13) 11.88±1.307	32.31 0.000**
• Knowledge related to immediate nursing intervention regarding to adverse action and hazards that may face both the patient and the nurse during IHT	(1-12) 5.99±2.211	(9-17) 13.77±1.675	23.47 0.000**

Pre: Pre- safe IHT guidelines
IHT: Intra-hospital Transportation
Post: Post safe IHT guidelines
** highly statistically significant at level P<0.001

Table (3): Percentage distribution of the studied nurses according to their total knowledge level about safe IHT of critically ill patient pre and post implementation of guidelines(N=70).

Total Knowledge Level	The studied nurses (n=70)				x^2 P
	Pre		Post		
	N	%	% N	%	
▪ Low ▪ Moderate ▪ High	63 6 1	90.0 8.6 1.4	1 11 58	1.4 15.7 82.9	**140.00** **0.000****
Range **Mean ± SD**	**(17-37)** **28.13±4.122**		**(51-81)** **71.33±5.128**		**t=54.68** **P=0.000****

* Significant at level P<0.0
**High significant at level P<0.001

Table (4): Mean scores of practice domains of the studied nurses pre and post intervention (N=70).

Domains of nurse's practicemean score	The studied nurses (n=70) Range Mean ± SD		t p
	Pre	Post	
▪ Checking of necessary equipment	(4-17) 9.21±3.077	(5-18) 11.18±3.455	0.382 0.000**
▪ Preparation of necessary medication	(1-5) 2.56±0.790	(1-5) 2.77±0.799	1.391 0.167
▪ Preparation of the patient's connected tubes, devices,intravenous fluids & position	(0-14) 4.01±3.009	(0-14) 5.07±3.466	1.855 0.051
▪ Checking of cardiac monitor and Ventilator	(1-6) 1.79±1.583	(1-6) 2.17±1.803	1.384 0.195
▪ Monitoring of hemodynamic parameters	(1-6) 2.55±1.360	(1-6) 2.77±1.442	1.099 0.288
▪ Nurse' practice during transportation phase	(1-13) 6.55±4.231	(11-13) 12.77±0.517	12.249 0.000**
▪ Nurse' practice immediate post IHT	(2-17) 10.02±4.441	(11-19) 19.51±0.899	17.327 0.000**

Table (5): Percentage distribution of the studied nurses according to their total practice level pre and post implementation of safe IHT guidelines(N=70).

Total practice level	The studied nurses (n=70)				x^2 P
	Pre guidelines		Post guidelines		
	N	%	N	%	
• **Competence**	7	10.0	69	98.6	**FE**
• **Incompetence**	63	90.0	1	1.4	**0.000****
Range	**(24-82)**		**(71-91)**		**t=18.190**
Mean ± SD	**42.11 ± 18.150**		**82.49 ± 4.050**		**P=0.000****

****** high Significant at level P<0.001 FE: fisher exact test

Table (6): Correlation between total level of knowledge and practice among studied nurses pre and post intervention(N=70).

Total knowledge level	The studied nurses (n=70) Total practice level	
	R	P- value
Pre	0.425	0.000**
Post	0.521	0.000**

Pre: Pre-guidelines Post: Post guidelines * * high Significant at level P<0.001

Table (7): Correlation between nurses' total scores of knowledge and practice regarding intra-hospital safe transportation of critically ill patients & adverse events occurred pre & post intervention(N=70).

variables		Total score of knowledge		Total score of practice	
		Pre	post	Pre	post
Adverse Events	R	-0.589		-0.423	
	p-value	<0.001**		<0.001**	
	N	70		70	
	R		0.487		0.487
	p-value		<0.001**		<0.001**
	N		70		70

Table (8): Percentage distribution of the studied patients regarding their demographic characteristics (N=60).

Characteristics	The studied patients (n=60)				X^2 P
	Control group (n=30)		Study group (n=30)		
	N	%	N	%	
Age (in years)					
▪ (18-<30)	7	23.4	11	36.6	
▪ (30-<40)	11	36.6	9	30.0	5.633
▪ (40-<50)	8	26.6	2	6.7	0.137
▪ (50-60)	4	13.4	8	26.7	
Gender					
▪ Male	27	90.0	26	86.6	FE
▪ Female	3	10.0	4	13.4	1.00
Transported from					
▪ Computerized tomography	20	66.6	22	73.4	
▪ Dialysis unit	6	20.0	6	20.0	1.759
▪ Operation unit	2	6.7	1	3.3	0.189
▪ X-ray	2	6.7	1	3.3	

Table (9): Percentage distribution of the studied patients of both study and control regarding the Glasgow coma scale throughout period of study (N=60).

GlasgowComa Scale	The studied patients(n=60)													
	Control group(n=30)						x^2 P	Study group(n=30)						x^2 P
	Pre		During		Post			Pre		During		Post		
	N	%	n	%	N	%		n	%	N	%	n	%	
- **Mild (13-15)**	12	40.0	13	43.3	14	46.7	1.300	5	16.5	8	26.7	7	23.3	**0.822**
- **Moderate (9-12)**	5	16.7	5	16.7	3	10.0	0.861	12	40.0	12	40.0	13	43.3	**0.935**
- **Severe (3-8)**	13	43.3	12	40.0	13	43.3		13	43.3	10	33.3	10	33.3	
Range **Mean ± SD**	**(3-15) 9.50 ± 2.873**		**(3-15) 9.80 ± 3.294**		**(3-15) 9.67 ± 3.436**		**F=0.065 P=0.935**	**(3-15) 10.00 ± 4.697**		**(3-15) 10.13 ± 4.739**		**(3-15) 10.10 ± 4.837**		**F=0.005 P=0.993**

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

Table (10): Percentage distribution of the studied patients in both study and control groups according to the adverse events and complications during intra hospital transportation (N=60).

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	15	50.0	5	16.7	0.018*
- Disconnection/removal of chest tube	1	3.3	1	3.3	1.00
- Nasogastric tube displacement	17	56.7	5	16.7	0.002*
- Disconnection of wound drainage	9	23.3	4	30.0	0.771
- Accidental central line catheter removal or blocked	8	26.7	7	30.0	0.209
- SPO2 fall >5% from baseline for more than 1 min (Hypoxic event)	8	26.7	10	33.3	1.00
- Temperature <350C (Hypothermia)	0	0.0	1	3.3	1.00
- 9.Increase heart rate	12	40.0	6	20	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)	3	10.0	1	3.3	0.492
- Arterial line blocking	9	30.0	4	13.3	0.209
- Accidental dislodging of urinary catheter	8	26.7	7	23.3	1.00
- Altered in mental status	2	6.6	0	0.0	0.612
- Needing advanced 02 support	6	20.0	1	3.3	0.195
- Hypoxia	5	16.7	4	13.3	1.00
- Cardiac arrest	2	6.7	2	6.7	1.00

* Significant at level P<0.05

Discussion:

Adverse events and complications may occur less frequently if an intra-hospital transportation protocol is implemented. Adverse events usually have something to do with the clinical state of the patient, the system, the equipment, or human factors. Thus, reducing the frequency of adverse events during intra-hospital transportation requires competent nursing knowledge and practice. Additionally, competent nurses play a critical role in improving patient outcomes and their own practice **(Souza et al., 2022).**

Aim of this study: Evaluate the effect of guidelines for intra-hospital safe transportation of critically ill patients on nurses' performance and patients' clinical outcomes**.**

Regarding to demographic characteristics of the studied nurses, According to the study's findings, the majority of the nurses under study were between the ages of 21<30 years old. This finding may have to do with the fact that newly graduated nurses were assigned to work in the intensive care unit because this age group is

thought to be the healthiest and can handle the workload in the surgical 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)** 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)** reported that the majority of studied nurses were less than 30 years old.

While, this finding is in contrary with ***Song et al. (2022)*** who conducted their study about "Intra hospital transport of critically ill patients: A cross-sectional survey of Nurses' attitudes and experiences in adult intensive care units" and revealed that more than half of the nurses their age was above thirty-five years old.

Regarding gender, it was observed that the majority of the studied nurses were females. The finding may attribute 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)**, who revealed that the majority of the staff nurses who work in ICU were female.

Also, more than half of the studied nurses were single. This study finding is consistent with ***Sharafi et al. (2021)*** who conducted their study about "improving the safety and quality of the intra-hospital transport of critically ill patients" and showed that more than three fifth of the studied sample were married this could be attributed to their young age where half of them aged from 18 to less than 25 years old.

Concerning educational level and years of experience in ICU, the finding showed that more than two thirds of studied nurses were technical and around 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 finding agreed with ***Edrise et al. (2021)*** who conducted their study about "Knowledge of Nurses Regarding Transfer of Critically Ill Surgical Patients in Three University Hospitals in Khartoum" and found that two thirds of the studied sample had less than five years of nursing experience in ICU.

Also, this finding agreed with **Anchal and Reema (2020),** 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)**, who found that the majority of studied nurses had a secondary education and graduated to technical institute of nursing. Additionally, the finding also supported by **Seilbeaet al. (2020)**, 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 that more than one third of the studied nurses reveals previous incidence reports regarding adverse events happened during IHT of critically ill patients. This finding 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 was matched with a research conducted by **Ignatyeva et al. (2018)**, who reported that incidence of adverse events during intra hospital transport was between one thirty to half of nurses.

Studied nurses' knowledge related to safe intra-hospital transportation; the finding of this study revealed that there were highly statistically significant differences observed regarding all knowledge domains pre and post implementation of safe IHT guidelines. Most of the studied nurses had a decent level of knowledge after the guidelines had been implemented, revealing that the safe IHT guidelines had a positive impact on nurses' knowledge. The result was consistent with **Ignatyeva et al. (2018),** who reported that nurses' knowledge of intra hospital transfer for the CIPs increased after guidelines.

Studied nurses' practice related to safe intra-hospital transportation, the present study showed significant improvement in the nurses' practice post implementation of

safe IHT guidelines. The finding might be related to nurses' interest in guideline topics. Moreover, nurses' knowledge and practice were becoming better as a result of the post-implementation of the guidelines.

These findings were matched with **Hatem (2019),** 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)** reported that nurses who shared in educational sessions were enhancing their skills and practice regarding IHT.

The current findings indicated that there was a highly statistically significant with positive correlation between the total practice and total knowledge level among the studied nurses pre and post implementation of guidelines. 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)** and **Ahmed et al. (2015)**, revealed that there was a statistical correlation between critical care nurses' knowledge and practice which reflect the effect of intra-hospital transportation training program.

Concerning correlation between total scores of knowledge and practice regarding intra-hospital safe transportation of CIPs, the current study revealed that, there was highly statistical negative correlation between AEs occurred and levels of knowledge and practice pre intervention. Also, there was highly statistical positive correlation between the study variables and AEs occurred post intervention. From researcher opinion this might be due to any practices / skills to be corrected should be based on right knowledge that becoming better as a result of the post-implementation of guidelines, which reflected on patients' outcome by avoiding any AEs to occur.

The study finding is supported by ***Khan et al., (2021)*** who revealed at their study that there was highly significant positive correlation between total knowledge, total score of practice of the studied nurses and total attitude of the nurses & AEs occurred regarding transportation CIPs. In the same line with ***Arpit et al., (2018)*** who found that there was statistically significant positive correlation between the studied nurses' total knowledge, total practice and total score of attitude.

Regarding the demographic characteristics of the studied patients among the studied groups, current study results clarified that there were no statistically significant differences observed regarding 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 the majority of the total studied patients were males. These findings were matched with a study finding which conducted by **Ismail et al. (2020**) 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),** who showed that most of the studied patients were transported to radiology department, especially CT scan. **Also - Omer et al. (2020)** 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),** 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),** 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 after implementation of guidelines. 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 finding 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),** 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**), 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 **Weiying et al. (2021**), 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)** 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), 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),** 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**), 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:

- There was a highly statistically significant with a positive correlation between the total level practice and knowledge among the studied nurses pre and post implementation of safe IHT guidelines.
- Additionally**,** the implementation of nurses` safe transportation guidelines has a positive effect on improving nurses` 'knowledge and practice regarding safe IHT of critically ill patients and improving patients` clinical outcomes post implementation of guidelines.

Recommendation:

It was recommended that:

- Encouraging critical care nurses' in-service training program regarding safe IHT can improve critically ill patients' outcomes.
- A similar study should be replicated on a large sample and other settings to generalize the findings.
- Further study should be suggested to evaluate factors affecting patients' safety during IHT.

Limitation of the study:

The study was conducted on one area in Egypt and inability to generalize the results was assured.

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