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marwa fathallah abdo
*The British University in Egypt*, marwa.fathallah@bue.edu.eg

manal elsayed ismail
*The British University in Egypt*, manal.ismail@bue.edu.eg

nahla shaban khalil
*cairo university faculty of nursing*, nahlakhalil28@yahoo.com

# Risk Factors Affecting Intrahospital Transport of Critically Ill Patients at Oncology Center

**Marwa Fathallah Mostafa[1,2], Eman Mansour[3], Manal IsmaiL[4],Nahla Shaaban Khalil[5]**

1. Assistant Professor of Critical Care and Emergency Nursing, Faculty of Nursing, Mansoura University, Egypt.
2. Associate Professor of Critical Care and Emergency Nursing, Faculty of Nursing, British University, Egypt.
3. Specialist Nurse, Oncology Center, Mansoura University, Egypt.
4. Professor of Critical Care and Emergency Nursing, Faculty of Nursing, British University, Egypt.
5. Professor of Critical Care and Emergency Nursing, Faculty of Nursing, Cairo University, Egypt.

***Corresponding author: E-mail** marwa.fathallah@bue.edu.eg

**Background**: Ensuring patient safety during intrahospital transportation (IHT) is a worldwide critical concern in healthcare settings. Critically ill patients are particularly vulnerable to complications during IHT. Aim: This study aimed to identify the risk factors affecting the intrahospital transport of critically ill patients at oncology center. **Methods:** A descriptive, observational design was utilized to collect data from two intensive care units (ICUs) at Mansoura oncology center in Egypt. The study included sixty adult patients undergoing IHT from the ICU to other departments. Two tools were used to gather information**.** Tool I: patient's demographic and medical relevant data, tool II: patients' risk factors during intrahospital transport that includes equipment-related factors, patient-related factors, transportation process factors, and staff-related factors. **Results:** The study revealed that 66.7% of patients were aged 50 years or older, The average score for equipment/material was 1.88 ± 0.324, and the total mean score for equipment-related risk factors was 4.1 ± 1.203. Patient-related risk factors included being away from the ICU for one hour (93.3%), severity of illness (70%), absence of agitation (98.3%), and urinary catheter as an invasive device (96.7%). Transportation-related factors such as daytime transportation (70%), elective urgency of transportation, receiving at the radiology department (96.7%), trolley transportation mode (96.7%), and transportation within 30 minutes (93.3%) were also identified as significant risks. Furthermore, staff-related risk factors included the absence of physicians (71.7%), physicians who had not received previous transport training courses (100%), and diploma-qualified nursing staff (100%). **Conclusion:** Equipment-related factors represent significant factors during IHT of critically ill patients. **Recommendations:** This study highlights the importance of developing protocols and guidelines to enhance safety during IHT and to improve patient outcomes.

Keywords: Critically Ill Patients, Intrahospital Transport, Oncology, Risk Factors.

## Introduction

Patient safety is an essential issue in the global healthcare industry, aimed at reducing risks. One of the main risk factors in the healthcare process is patient transportation, especially for critically ill patients with limited physiological reserves and those suffering from severe, life-threatening illnesses or trauma (Lawati et al., 2018).

Hospitalized patients often require intrahospital transportation (IHT) for various diagnostic, therapeutic, and logistical reasons. Critically ill patients are more susceptible to adverse events (AEs) during transportation, which may result from several factors such as unstable hemodynamics, continuous invasive advanced monitoring, use of multiple devices or catheters, or poor communication between healthcare providers (Juneja and Nasa, 2023).

Some patient characteristics are unchangeable, such as severe disease, large body weight, and the requirement for invasive mechanical ventilation with high positive end-expiratory pressure (PEEP). However, there may be simple ways to prevent other problems, particularly equipment malfunctions and human errors (Murata et al., 2022). The range of adverse events (AEs) related to inter-hospital transport in critically ill patients varies greatly in reported studies (17.1-79.9%). The reasons for this difference may be due to variations in patient populations, transport methods, team compositions, and the definitions used for reported AEs. (Nonami et al., 2022).

To better understand the incidence of IHT-related AEs and their impact on patient outcomes, the first multicenter study in India was conducted. This study found that emergency transport, team composition, and the severity of illness, as determined by the APACHE II score, were independent risk factors for AEs, with a reported incidence of 9.6% in 1065 IHTs. This research underscores the importance of identifying risk factors associated with IHT-related complications, which could inform the development of tailored protocols and regulations for healthcare systems (Zirpe et al., 2023).

Categorized as system- and patient-based factors, risk factors that occur during the IHT were investigated by Reinders et al. (2015), who reported that the majority of IHT incidents were connected to equipment failure, rather than the deterioration of the patient's physical condition. Nurses, who belong to the hospital's clinical departments, are accountable for preparing and stabilizing patients before their transportation and after their admission to the receiving department (Alizadeh Sharafi et al., 2020; Fanara et al., 2010). They must anticipate a potential deterioration in a patient's condition at any point during transportation (Day, 2010), and ensure that there are sufficient oxygen reserves and appropriate ventilator settings (Brunsveld-Reinders et al., 2015).

Furthermore, nurses are responsible for the daily charging of equipment and checking it for proper functioning and malfunction (Williams et al., 2020). This must be done after each transportation to ensure that no damage occurs, which could compromise the next transport. Before use, batteries should also be checked for their charge status

(Alamanou and Brokalaki, 2014). It is essential to have a sufficient number of transport escorts and to verify that the retrieval team and the destination site are operational, including the wall suction unit, oxygen connectors, defibrillator, extension cables, and sufficient space for the transport staff to move the patient. Consequently, these responsibilities should be assumed by nurses who have received appropriate training (Jones et al., 2016).

**Significance of the study**

Intrahospital transportation of critically ill patients is an important part of ICU care for diagnostic or therapeutic purposes. It requires a lot of assessment and preparation of the patient, staff, and equipment. Intrahospital transportation is not only a simple procedure of transport but also a continuous process of treatment and monitoring. **(Gimenez et al., 2017)**. IHT requires proper monitoring, efficient equipment, and highly trained and skilled practitioners. So it's crucial to identify the related risk factors to maintain a high level of patient safety and develop guidelines to be followed in the future.

**Aim of the Study**

This study aims to identify risk factors affecting intrahospital transport of critically ill patients at the oncology center

**Research question**

What are the risk factors that faced the patient during intrahospital transport?

**Method**

**Study Design**

A descriptive observational research design was employed to achieve the objectives of this study. It is a systematic way of gathering information about a phenomenon or population without manipulating any variables. It aims to describe the characteristics, behaviors, or trends of a specific group (Aggarwal & Ranganathan, 2019).

**Study Setting**

Data were gathered from two intensive care units (ICUs) at Mansoura Oncology center in Egypt. These units provide critical care to patients admitted from the surgical or medical wards and are equipped with advanced technology and personnel necessary for patient care. The average monthly patient flow rate in both ICUs is 30, and the average nurse-to-patient ratio is 1:3.

***Patient Sample Size Calculation***

The sample was estimated according to **EPI inf. Program version 7** using the following parameters $n = N/(1+(N*d^2))$. n = estimated sample size, N = Total population, d = Margin of error or precision. The sample size was calculated depending on the following measurements; the total number of patients admitted to medical and surgical ICUs in the Oncology Center as collected from hospital records about 360 patients annually (patient flow rate in both ICUs is 30 patients /month). About 150 transportation processes were done annually (N in the above formula). At least, 60% of them experience complications during transport. With an alpha error of 5% (d in the above formula), and a study power of 80% then the sample size is 109 in a whole year and 60 in the period of the study which is six months.

**Participants**

This study comprised a convenience sample of 60 adult patients of both genders who were transferred from the ICU to another department within the center for diagnostic or therapeutic purposes and were subsequently returned to the ICU.

**Data Collection Tools**

Two tools were used to collect data for the present study:

**Tool I: Patient's Demographic and Medical Relevant Data:**

This tool was developed by the researcher; it aimed to assess the patients' demographic data such as age, gender, marital status, in addition to their medical relevant data that included reason for ICU admission, current diagnosis, past medical history, and the length of stay in the hospital.

**Tool II: Patients' Risk Factors during Intrahospital Transport:**

This tool was developed by the researcher after reviewing the related literature **(Brunsveld-Reinders, Arbous, Kuiper & de Jonge, (2015); Parmentier-Decrucq et al., (2013) & the Intensive Care Society, 2011)**. It aimed to identify patients' risk factors during intrahospital transportation. It involved four main parts as follows:

**Part I: Equipment- Related Risk Factors:** It included equipment, the sufficiency of medication, monitoring devices, and transport ventilator. All these items were checked for availability.

**Part II: Patient-Related Risk Factor**s: The variables assessed in this study comprised the duration of intrahospital transport, the severity of illness, consciousness level, agitation, the presence of invasive devices, whether the patient was on mechanical ventilation, and the presence of cardiovascular and respiratory compromises. Additionally, the ability to communicate, vital signs-related risk factors, arterial blood gas analysis-related risk factors, arrhythmias, pain or discomfort, and airway status were evaluated.

**Part III: Transportation Process-Related Risk Factors:** It aimed to evaluate the risk factors related to the transportation process. It involved data about transporting time, the urgency of transport, the referring department, the receiving department, transporting mode, transporting duration, and pre-transport consent.

**Part IV: Staff-related risk factors:** It aimed to evaluate the risk factors related to the staff involved in the transportation process. It included: *staff data* such as the number of personnel accompanying the patient, presence of the physician, physician specialty, years of experience, previous transport training courses, presence of a nurse, nurses' qualifications.

**Ethical Considerations**

The Research Ethics Committee of the Faculty of Nursing at Mansoura University granted ethical approval (No. 0592) for this study. Additionally, official approval was

obtained from the hospital administrative authority following a clear explanation of the research's purpose. All intensive care nurses and physicians were informed before the study commenced. Informed consent was obtained from participants or their families after explaining the study's purpose. The study upheld ethical considerations through anonymity and confidentiality of the collected data. Voluntary participation and the right to withdraw from the study were emphasized to all participant patients.

**Validity and Reliability of the Tools**

The tools were tested for content-related validity by a panel of five experts in the field of the study (one professor of anesthesia, two professors of critical care medicine, and two professors of critical care nursing). They reviewed the tool for clarity, relevance, and applicability. The reliability of the tools was tested by Cronbach's Alpha test and proved to have a sensitivity and a specificity of 81% and 89% respectively with an internal consistency of 0.87.

**Pilot Study**

A pilot study was done to assess the clarity, feasibility, and applicability of the tools used for data collection. It was conducted on six patients who met the inclusion criteria and were excluded from the study. As well, the pilot study gave the researcher experience in dealing with the included subjects, familiarity with the setting, and ensuring the time needed to fill in the data collection sheets.

**Data Collection Procedure:**

The researcher commenced data collection by first introducing themselves to the patients and explaining the study's objective and purpose, reassuring them that they would not be subjected to any harm because of their participation. Subsequently, the researcher notified the transport team of the study's aim to secure their cooperation during the transportation process. To safeguard the anonymity of the subjects, the researcher meticulously coded the data collection sheets. An initial assessment was then carried out by the researcher to gather crucial information about the patient's demographics and health-related data.

Subsequently, the researcher assessed the nurses without interfering in any of their actions, to evaluate their readiness for the transportation process and the availability of necessary equipment. The researcher utilized tool II to assess the risk factors associated with the equipment, patients, transportation process, and staff.

**Data Analysis:**

The data analysis was undertaken using SPSS (Statistical Package for Social Science) version 22.0. Numbers and percentages were used to represent qualitative data. Quantitative data were described using mean and standard deviation (SD). Qui square test (X2) was used to compare qualitative variables. When p-value $\leq 0.05$ a significant level value was measured and a highly significant level value was indicated when p-value $\leq 0.001$, but p-value $> 0.05$ shows non-significant results.

## Results

**Table 1 Demographic Data of the Studied Patients (n=60)**

| Patients Personal Data | The Studied Patients (n=60) | |
|---|---|---|
| | No | % |
| **Age (in years)** | | |
| • (20-<30) | 5 | 8.3 |
| • (30-<40) | 4 | 6.7 |
| • (40-<50) | 11 | 18.3 |
| • ≥50 | 40 | 66.7 |
| **Range** | | (21-80) |
| **Mean ± SD** | | 57.52±14.592 |
| **Gender** | | |
| • Male | 23 | 38.3 |
| • Female | 37 | 61.7 |
| **Marital Status** | | |
| • Married | 55 | 91.7 |
| • Divorced | 4 | 6.7 |
| • Widowed | 1 | 1.7 |

Data are presented as Numbers & Percentages.

Table 1 presents the demographic data of the enrolled patients. The study comprised 60 ICU patients with a mean age of 57.5 years, ranging from 21 to 80. Over half of the patients (66.7%) were older than 50. Over half of the participants (61.7%) were female. Most of the patients (91.7%) were married.

**Table 2 Medical Relevant Data of the Studied Patients (n=60)**

| Category | No | % |
|---|---|---|
| **Body Mass Index (BMI)** | | |
| • (18 - <25) | 12 | 20.0 |
| • (25 - <30) | 8 | 13.3 |
| • (30 - < 35) | 24 | 40.0 |
| • (35 - < 40) | 2 | 3.3 |
| • ≥ 40 | 14 | 23.3 |
| **Range** | (22-41) | |
| **Mean ± SD** | 31.90±6.787 | |
| **Reason for ICU Admission** | | |
| • Post-operative monitoring | 8 | 13.3 |
| • Shock | 10 | 16.7 |

| Category | No | % |
|---|---|---|
| • Hypertension | 9 | 15.0 |
| • Dyspnea | 8 | 13.3 |
| • Distributed conscious level | 10 | 16.7 |
| • Dysrhythmia | 8 | 13.3 |
| • Bleeding | 7 | 11.7 |
| **Current Diagnosis (Type of Cancer):** | | |
| • Lung | 7 | 11.7 |
| • Gastrointestinal | 1 | 1.7 |
| • Hematologic | 16 | 26.6 |
| • Breast | 2 | 3.3 |
| • Gynecological | 7 | 11.7 |
| • Colorectal | 6 | 10 |
| • Others | 21 | 35 |
| **Duration Since Diagnosis:** | | |
| • ≤ 3 months | 18 | 30.0 |
| • > 3 months | 42 | 70.0 |
| **Past History** | | |
| • DM | 23 | 38.3 |
| • HTN | 26 | 43.3 |
| • Cardiac Disease | 9 | 15.0 |
| • Stroke | 1 | 1.7 |
| • Surgery | 2 | 3.3 |
| • TB | 1 | 1.7 |
| **Length of Stay in Hospital (in Days):** | | |
| • ≤ One day | 4 | 6.7 |
| • 2-3 days | 35 | 58.3 |
| • ≥ 4 days | 21 | 35 |

Data are Expressed as Numbers (N) and Frequency (%), SD= Standard Deviation

Table 2 presents medical data relevant to patients. According to the data, the mean BMI of the participants was 31.9 kg/m2, ranging from 22 to 41 kg/m2. The findings show that 13.3%, 16.7%, 15.0%, 13.3%, 16.7%, 13.3%, and 11.7% of participants were admitted to the ICU for post-operative monitoring, shock, hypertension, dyspnea, distributed conscious level, dysrhythmia, and bleeding, respectively. Among the patients, 26.6% were diagnosed with hematologic cancer, while gastrointestinal cancer was the least prevalent type, accounting for 1.7% of cases. Lung and breast cancer were observed in 11.7% and 3.3% of patients, respectively. The majority of patients (70%) had the disease for more than three months prior to hospitalization. Approximately 43.3% and 38.3% of patients had HTN and DM, respectively. The majority of patients (58.3%) stayed in the hospital for 2 to 3 days.

**Table 3 Frequency Distribution of Equipment-Related Risk Factors (n=60)**

| Items | Yes | | No | |
|---|---|---|---|---|
| | No | % | No | % |
| **A. Equipment/Materials** | | | | |
| • Fully charged transported trolley | 0 | 0.0 | 60 | 100.0 |
| • Defibrillator | 0 | 0.0 | 60 | 100.0 |
| • Oxygen cylinder | 53 | 88.3 | 7 | 11.7 |
| • Connections, lines, and catheters | 60 | 100.0 | 0 | 0.0 |
| • Ventilation equipment | 0 | 0.0 | 60 | 100.0 |
| **B. Medication/Infusion** | | | | |
| • Sufficient intravenous medication | 60 | 100 | 0 | 0.0 |
| • Additional intravenous sedatives | 0 | 0.0 | 60 | 100 |
| • Additional intravenous inotropic | 15 | 25.0 | 45 | 75.0 |
| • Additional syringe pump | 6 | 10.0 | 54 | 90.0 |
| • Additional intravenous fluids | 16 | 26.7 | 44 | 73.3 |
| • Insulin infusion | 0 | 0.0 | 60 | 100.0 |
| **C. Monitor** | | | | |
| • Monitor End-tidal CO2 | 0 | 0.0 | 60 | 100.0 |
| • Check and set visual and audible alarm | 0 | 0.0 | 60 | 100.0 |
| • Check that monitors are available and functioning | 0 | 0.0 | 60 | 100.0 |
| **D. Transport Ventilator** | | | | |
| • Turn on the oxygen before leaving | 18 | 30.0 | 42 | 70.0 |
| • Check and set visual and audible alarms | 18 | 30.0 | 42 | 70.0 |

Data are Presented as Number & Percentage **DM**= Diabetes Mellitus. **HTN**= Hypertension. **TB**= Tuberculosis.

Table 3 presents the equipment-related risk factors for the participants under study. It displays that all of the patients (100%, respectively) haven't a fully charged transport trolley, defibrillator, or ventilation equipment during IHT that considers equipment-related risk factors. Also, no additional intravenous sedatives or insulin infusions. Concerning transport ventilators, it was found that

only 30.0% of nurses turned on the oxygen before leaving, checking and setting visual and audible alarms however, there were no monitors available during transportation for all patients.

**Table 4 Total Mean Scores of the Equipment-Related Risk Factors Dimensions (n=60)**

| Equipment-Related Risk Factors Dimensions | No Items | Min | Max | Mean ± SD | Mean % | Ranking |
|---|---|---|---|---|---|---|
| A. Equipment/Material | 5 | 1 | 2 | 1.88±0.324 | 37.6 | 1 |
| B. Medication/Infusion | 6 | 1 | 3 | 1.62±0.691 | 27.0 | 3 |
| C. Monitor | 3 | 0 | 0 | 0.00±0.00 | 0.0 | 4 |
| D. Transport Ventilator | 2 | 0 | 2 | 0.6±0.924 | 30.0 | 2 |
| **Total Score of Equipment Related Risk Factors** | 16 | 2 | 7 | 4.1±1.203 | | |

Data are presented as numbers & percentage

Table 4 indicates the total mean scores of the equipment-related risk factors dimensions, it declares that equipment/material is the highest risk factor for patients during transportation as more than one-third of risk factors (37.6%) are related to equipment and material with a mean ±SD = 1.88±0.324, while 30.0% are related to transport ventilator with a mean ±SD = 0.6±0.924. Additionally, the total mean score of equipment-related risk factors is ±SD = 4.1±1.203

**Table 5 Frequency Distribution of Patient-Related Risk Factors (n=60)**

| Patient Risk Factors | No | % |
|---|---|---|
| **Duration of Absence from the ICU** | | |
| • one hour | 56 | 93.3 |
| • > one hour | 4 | 6.7 |
| **Severity of Illness:** | | |
| • Mild | 3 | 5.0 |
| • Moderate | 15 | 25.0 |
| • Severe | 42 | 70.0 |
| **Conscious Level (GCS):** | | |
| • Conscious | 42 | 70.0 |
| • Unconscious/ Comatose | 18 | 30.0 |
| **Agitation:** | | |
| • Present | 1 | 1.7 |
| • Absent | 59 | 98.3 |
| **Invasive Devices:** | | |
| • Urinary Catheter | 58 | 96.7 |
| • Ryle | 13 | 21.7 |
| • Redivac | 19 | 31.7 |
| • Drain | 17 | 28.3 |
| **Patient on Mechanical Ventilation:** | | |
| • Yes | 24 | 40.0 |
| • No | 36 | 60.0 |
| **Cardiovascular and Respiratory Compromises:** | | |
| • Present | 33 | 55.0 |
| • Absent | 27 | 45.0 |
| **Ability to Communicate:** | | |
| • Able | 41 | 68.3% |
| • Unable | 19 | 31.7 |
| **New-Onset Arrhythmias:** | | |
| • Present | 8 | 13.3 |
| • Absent | 52 | 87.8 |
| **Pain or Discomfort:** | | |
| • Present | 25 | 41.7 |
| • Absent | 35 | 58.3 |
| **Airway status:** | | |
| • Airway patent | 36 | 60.0 |
| • Artificial airway | 24 | 40.0 |

Data are Presented as Number & SD= Standard Deviation.

Table 5 represents patient-related risk factors. Regarding the absence from the ICU, most of the studied patients (93.3%) spend about one hour. less than three-quarters of them (70%, respectively) have severe illness and are conscious. As well, the majority of them (98.3%) didn't have agitation, while only 1.7% of them have. The majority of them (96.7%) have a urinary catheter. Additionally, two-fifths of them (40.0%) are connected with a mechanical ventilator. More than half of the studied patients (55.0%) have cardiovascular and respiratory compromises. Moreover, almost one-third of them (31.7) are unable to communicate. Furthermore, less than one-fifth of them (13.3%) have new-onset arrhythmias. 41.7% of patients have pain or discomfort. In addition, two-fifths of them (40.0%) have artificial airways

**Table 6 Frequency Distribution of Transportation Process-Related Risk Factors (n=60)**

| Transportation Process-Related Risk Factors | No | % |
|---|---|---|
| **Transporting Time** | | |
| • Daytime | 42 | 70.0 |
| • Nighttime | 18 | 30.0 |
| **Urgency of Transport** | | |
| • Elective | 60 | 100.0 |
| **Referring Department** | | |
| • Surgical ICU | 37 | 61.7 |
| • Medical ICU | 23 | 38.3 |
| **Receiving Department** | | |
| • Radiology | 58 | 96.7 |
| • Operating Room | 2 | 3.3 |
| **Transporting Mode** | | |
| • Trolley | 58 | 96.7 |
| • Wheelchair | 2 | 3.3 |
| **Transporting Duration (in minutes)** | | |
| • < 30 min | 56 | 93.3 |
| • ≥ 30 min | 4 | 6.7 |
| **Mean± SD** | 29±1.64 | |
| **Pre-transport Consent** | | |
| • Oral | 56 | 93.3 |
| • Written | 4 | 6.7 |

Data are Presented as Numbers & Percentage

Table 6 illustrates transportation process-related risk factors. It clarifies that 70.0% of the studied patients' IHT is done in the daytime and all of them (100.0%) have elective urgency of transport. Moreover, nearly two-thirds of them (61.7%) are referred from Surgical ICU. As well, the majority of them (96.7%, respectively) are received at the radiology department and are transported by trolley. As regard transporting duration, most of them (93.3%, respectively) take less than 30 minutes with mean ± SD= 29±1.64 and 93.3% of patients had the pre transport oral consent.

**Table 7 Frequency Distribution of Staff-Related Risk Factors**

| Staff Risk Factors | No | % |
|---|---|---|
| **Physicians:** | | |
| • Present | 17 | 28.3 |
| • Absent | 43 | 71.7 |
| **If Present (Specialty)** | | |
| • Anesthesia | 17 | 100.0 |
| **Years of Experience:** | | |
| • ≤ 1 year | 9 | 52.9 |
| • > 1 year | 8 | 47.1 |
| **Previous Transport Training Courses** | | |
| • No | 17 | 100.0 |
| **Nurses** | | |
| • Present | 60 | 100.0 |
| • Absent | 0 | 0.0 |
| **Qualifications** | | |
| ▪ Diploma | 60 | 100.0 |
| **Years of Experience:** | | |
| • ≤ 1 year | 23 | 38.3 |
| • 1 year | 37 | 61.7 |
| **Previous Transport Training Courses** | | |
| • No | 60 | 100.0 |
| **Others** | | |
| • Co-worker | 60 | 100.0 |
| • Technician | 7 | 11.7 |

Data are Presented as Numbers & Percentages.

Table 7 portrays that only 28.3% of the physician are present during IHT. All of them (100.0%) are anesthesiologists and more than half of them (52.9%) have less than one year of experience. Moreover, all of IHT were performed by nurses who had diploma degrees with two-thirds of them having more than one year of experience. Additionally, both nurses and physicians (100.0%) didn't attend any previous transport training courses.

## Discussion

Patient transportation is a critical component of the medical care process. It is imperative to consider the needs of patients with potentially life-threatening conditions (Mukabagire, 2019). Negative outcomes that may occur during transport can place the patient at risk. Numerous assessments and preparations must be performed for the patient, personnel, and equipment before, during, and after the transfer process. Intrahospital transportation is not simply a straightforward transportation operation; it is an ongoing process of care and observation (Lin et al., 2020). Patients who are critically ill are often moved around the hospital without proper preparation, which can make it difficult for the team, supplies, and equipment to be ready and may increase the likelihood of negative outcomes (Latzke et al., 2020).

The current study utilized a sample of 60 adult patients who were transported from the ICU to another department within the center for diagnostic or therapeutic

purposes and then returned to the ICU, Concerning the gender of the studied patients, the result of the present study showed that nearly two-thirds of them are females. conversely, this finding disagreed with study by Hanifi et al., (2021) who conducted a study about "Complications and Related Factors during the Intrahospital Transport of Critically Ill Patients" and reported that most of the studied patients were males.

The result of the present study revealed that the most common cause of admission was shock and distributed consciousness level. From the researcher's point of view, this result might be due to these conditions needing good observation and monitoring from all staff. this outcome agreed with a study published by Kortelainen et al., (2022) who reported that the first cause of admission in ICU among studied patients was distributed consciousness level related to the length of stay in the hospital.

The results of the current study indicate that checking all patients' connections, lines, catheters, and sufficient intravenous medication are considered risk factors among all of the studied patients. From the researcher's point of view, this result might be due to ensure safety. This result is consistent with a study published by Parmentier-Decrucq et al., (2013) entitled "Complications during intrahospital transport of critically ill patients" and reported that most nurses check patients' connections, lines, and catheters.

The present study's findings indicate that all participants concurred that sufficient intravenous medication was a crucial risk factor. This result is corroborated by a study conducted by Min et al. (2019), they also found that the use of medicine before transfer was an extremely reliable indicator of adverse events (AEs) when critically ill patients were transferred to a hospital. Moreover, it has been demonstrated that the administration of sedatives and vasoactive drugs is linked to a higher risk of AEs when critically ill patients are transferred, underscoring the significance of cautious medication administration in this population (Min et al., 2019).

The results of the current study indicate that equipment-related risk factors were the most significant contributor to the overall risks. The transport ventilator dimension was the second significant risk factor, followed by medication/infusion and monitoring dimensions, which exhibited a lower level of risk. this finding is in the same line with a study by Murata et al., (2022) who conducted a study about " Complications during intrahospital transport of critically ill patients" and showed that malfunctioning and unavailable equipment were risk factors for IHT of critically ill patients.

The result of the present study showed that the majority of patients didn't have agitation. This finding in same line with a study by Sharafi et al., (2021) who conducted a study about " Improving the safety and quality of the intra hospital transport of critically ill patients" and reported that most of the critical patients didn't transport when patients had agitation. Additionally, the present study revealed that two-fifths of patients are connected with mechanical ventilators. This finding is supported by the research conducted by Abo El Abbas et al. (2022), who found that patients who were on ventilators were more susceptible than other patients during transportation. Patients who are on mechanical ventilators pose a significant risk since improper management may result in desaturation and the need for intubation of the endotracheal tube. The findings suggest that the absence of ventilation may be a critical variable affecting IHT of critically ill patients. Additionally, Veiga et al. (2019) study supports the findings by showing that patients on mechanical ventilation have a higher chance of serious complications.

Concerning process-related risk factors, the result of the present study clarifies that transporting is done at daytime among less than three-quarters of the studied patients and urgency of transport is elective among all of them. from the researcher's point of view, this result might be due to most of the services worked in the morning, especially radiology and outpatients. This result is in line with a study by Zhang et al., (2022) who conducted "Proactive risk assessment of intrahospital transport of critically ill patients from emergency department to intensive care unit in a teaching hospital and its implications" and reported that most transport of critical ill was elective. Concerning the transporting mode, the result of the present study illustrated that the majority of the studied patients were transported by trolley. this finding is in accordance with a study by Akrami et al., (2019) who reported that less than two-thirds of the studied patients were transported by Stretcher.

According to the present study, transportation taking less than 30 minutes, and oral transport consent were all identified as significant transportation process-related risk factors. This finding is corroborated by the study conducted by Abo El Abbas et al. (2022), which found that approximately 75% of participants believed that the risk of transporting critically ill patients within a hospital setting increased with the distance between diagnostic units and hospital care. This result is consistent with the findings of Ismail et al. (2020), which demonstrated that a lengthy distance between hospital sites significantly increases the likelihood of transportation-related complications (Ismail et al., 2020).

On the other hand, Choi et al. (2012) found that daytime transporting, the distance traveled, identifying the time of patient transportation, essential pre-transfer patient stabilization, efficient interaction between various hospital departments, and transport preparation were the most significant transportation process-related risk factors. From the researchers' perspective, nurses should be aware of the importance of transportation time and manage their shifts so that patients are not transported after the shift. This is because nurses must leave their jobs at the end of their shift, not the end of the transportation operation. Another study by Kim & Kwon (2022) represented that less than three-quarters of the studied nurses didn't obtain consent from patients or family

The present study showed that staff-related risk factors were identified as the absence of physicians, the presence of anesthesia, and the presence of physicians who had not received a prior transport training course. Amongst the nursing staff, the most significant risk factors were the presence of nursing staff, diploma-qualified nursing staff, the presence of nurses who had not received a prior transport training course, and the presence of co-workers.

These findings agreed with the published international guidelines on staff-related risk factors. IHT team should consist of a minimum of two persons, the nurse who has the responsibility of the patient or a nurse specialized in intensive care, trained in CPR, and a trained bearer (Alamanou & Brokalaki, 2014). If the patient is attached with mechanical ventilation, it is recommended to be accompanied by a pulmonologist trained in cardiopulmonary resuscitation. Patients who are intubated and have many intravenous or arterial catheters and drains should be accompanied by two or

three additional people. A nurse, an emergency room technician and an intensivist (or anesthetist) are needed for hemodynamically unstable patients who may require immediate intervention (Williams et al., 2020).

The current study demonstrates that the optimal approach for ensuring patient safety during interhospital transportation involves the presence of both a doctor and a nurse. This finding is supported by the trained crew's responsibility for continuous patient monitoring throughout the transportation process, which is essential for mitigating potential risks. In contrast, previous studies by Abo El Abbas et al. (2022) and Ringdal et al. (2016) yielded differing results. Abo El Abbas et al. (2022) found that half of the surveyed nurses believed that nursing expertise alone was sufficient for transferring critically ill patients without a doctor's presence, whereas Ringdal et al. (2016) reported that 67% of nurses reported being the sole responsible party for the patient during interhospital transportation, with no doctor present. These discrepancies highlight the importance of continued research to establish evidence-based guidelines for optimal patient care during interhospital transportation.

**Limitations**

Several constraints have been identified in our study. Firstly, the absence of data on all critical patients who were transported during the research period in the hospital raises the potential for selection bias. Additionally, the study did not factor in minor variations in physiological indicators as transport-related issues. The study's limited sample size and single-center design further complicate the findings.

**Conclusions:**

The research findings emphasize the significance of appropriate equipment preparation, patient evaluation, and personnel training prior to intrahospital transport. Furthermore, the results stress the necessity of adopting a multidisciplinary approach to guarantee the secure relocation of critically ill patients. The study delivers crucial insights into the elements that affect the intrahospital transportation of critically ill patients at an oncology center. The results highlight the importance of a comprehensive approach to patient care, which encompasses equipment preparation, patient assessment, and employee training.

**Recommendations**

- It is recommended to implement regular health education programs that cover the definitions of IHT for critically ill patients, risk factors, expected complications, and how to handle these complications for nurses.
- Utilize IHT techniques in ordinary hospitals to enhance patient safety and prevent complications.
- Develop and provide standardized protocols in the form of checklists to emergency departments (EDs) and ICUs to reduce the frequency of IHT-related risk factors.
- Additional research is necessary to identify more IHT risk factors.

**References**


1. Akrami, S., Sargazi, G. H., Safabakhsh, L., & Mofrad, Z. P. (2019). Assessing the Effect of training the safe transport checklist on the quality of intrahospital patient transport: An interventional study. Medical-Surgical Nursing Journal, 8(4).
2. Alamanou, D. G., & Brokalaki, H. (2014). Intrahospital transport policies: The contribution of the nurse. Health Science Journal, 8(2), 166.
3. Alizadeh Sharafi, R., Ghahramanian, A., Sheikhalipour, Z., Ghafourifard, M., & Ghasempour, M. (2020). Improving the safety and quality of the intra□hospital transport of critically ill patients. Nursing in Critical Care.
4. Brunsveld-Reinders, A. H., Arbous, M. S., Kuiper, S. G., & de Jonge, E. (2015). A comprehensive method to develop a checklist to increase safety of intra-hospital transport of critically ill patients. Critical Care, 19(1), 1-10.
5. Canellas, M., Palma, I., Pontífice-Sousa, P., & Rabiais, I. (2020). Checklist for a safe intra-hospital transport of critically ill patients: A scoping review. Enfermería Global, 19(4), 525-572.
6. Choi, H. K., Do Shin, S., Ro, Y. S., Shin, S. H., & Kwak, Y. H. (2012). A before-and after-intervention trial for reducing unexpected events during the intrahospital transport of emergency patients. The American Journal of Emergency Medicine, 30(8), 1433-1440.
7. Fanara, B., Manzon, C., Barbot, O., Desmettre, T., & Capellier, G. (2010). Recommendations for the intra-hospital transport of critically ill patients. Critical Care, 14(3), 1-10.
8. Gurrala, S. (2021). Improving Intra-Hospital Patient Transportation System by Implementing Geographic Assignment Logic Using Discrete Event Simulation State University of New York at Binghamton].
9. Hanifi, N., Ghadimi, M., & Dinmohammadi, M. (2021). Complications and Related Factors during the Intrahospital Transport of Critically Ill Patients: An Observational Prospective Study. Journal of Critical Care Nursing, 14(4), 69-61.
10. Ismail, M. R. M., Baharuddin, K. A., Abidin, Z. E. Z., Bakar, M. A. A., & Sjahid, A. S. (2020). Study on the incidence of adverse events during intra-hospital transfer of critical care patients from emergency department. Medl J Malaysia, 75, 325-330.
11. Jones, H. M., Zychowicz, M. E., Champagne, M., & Thornlow, D. K. (2016). Intrahospital transport of the critically ill adult: A standardized evaluation plan. Dimensions of Critical Care Nursing, 35(3), 133-146.
12. Kim, Y., & Kwon, I. G. (2022). Intrahospital Transport of Critically Ill Patients: Critical Care Nurses' Perceptions. Journal of Korean Critical Care Nursing, 15(1), 1-12.
13. Kue, R., Brown, P., Ness, C., & Scheulen, J. (2011). Adverse clinical events during intrahospital transport by a specialized team: a preliminary report. American Journal of Critical Care, 20(2), 153-162.
14. Parmentier-Decrucq, E., Poissy, J., Favory, R., Nseir, S., Onimus, T., Guerry, M. J., ... & Mathieu, D. (2013). Complications during intrahospital transport of critically ill patients: incidence and risk factors. Annals of intensive care, 3(1), 1-10.
15. Latzke, M., Schiffinger, M., Zellhofer, D., & Steyrer, J. (2020). Soft Factors, Smooth Transport? The role of safety climate and team processes in reducing adverse events during intrahospital transport in intensive care. Health care management review, 45(1), 32-40.
16. Lawati, M. H. A., Dennis, S., Short, S. D., & Abdulhadi, N. N. (2018). Patient safety and safety culture in primary health care: a systematic review. BMC family practice, 19(1), 1-12.
17. Lin, S.-J., Tsan, C.-Y., Su, M.-Y., Wu, C.-L., Chen, L.-C., Hsieh, H.-J., Hsiao, W.-L., Cheng, J.-C., Kuo, Y.-W., &

Jerng, J.-S. (2020). Improving patient safety during intrahospital transportation of mechanically ventilated patients with critical illness. BMJ open quality, 9(2), e000698.

18. Min, H. J., Kim, H.-J., Lee, D. S., Choi, Y. Y., Yoon, M., Lee, D., Cho, J. Y., Park, J. S., Cho, Y.-J., & Yoon, H. I. (2019). Intra-hospital transport of critically ill patients with rapid response team and risk factors for cardiopulmonary arrest: A retrospective cohort study. PLoS One, 14(3), e0213146.
19. Mukabagire, D. (2019). Nurses' Knowledge, attitudes and practice towards intra-hospital transportation management of the critically ill adult patients: in selected referral hospitals, Kigali-Rwanda University of Rwanda].
20. Murata, M., Nakagawa, N., Kawasaki, T., Yasuo, S., Yoshida, T., Ando, K., Okamori, S., & Okada, Y. (2022). Adverse events during intrahospital transport of critically ill patients: a systematic review and meta-analysis. The American Journal of Emergency Medicine, 52, 13-19.
21. Peltola, M., Tulppo, M. P., Kiviniemi, A., Hautala, A. J., Seppänen, T., Barthel, P., Bauer, A., Schmidt, G., Huikuri, H. V., & Mäkikallio, T. H. (2008). Respiratory sinus arrhythmia as a predictor of sudden cardiac death after myocardial infarction. Annals of medicine, 40(5), 376-382.
22. Ringdal, M., Chaboyer, W., & Warrén Stomberg, M. (2016). Intrahospital transports of critically ill patients: critical care nurses' perceptions. Nursing in critical care, 21(3), 178-184.
23. S Abo El Abbas, M., S Sobeih, H., & M Khalil, B. (2022). Risk Factors Associated with Intra-Hospital Transportation among Critically Ill Patient. Egyptian Journal of Health Care, 13(4), 296-312.
24. Sharafi, R., Ghahramanian, A., Sheikhalipour, Z., Ghafourifard, M., & Ghasempour, M. (2021). Improving the safety and quality of the intra□hospital transport of critically ill patients. Nursing in Critical Care, 26(4), 244-252.
25. Veiga, V. C., Postalli, N. F., Alvarisa, T. K., Travassos, P. P., Vale, R. T. d. S., Oliveira, C. Z. d., & Rojas, S. S. O. (2019). Adverse events during intrahospital transport of critically ill patients in a large hospital. Revista Brasileira de terapia intensiva, 31, 15-20.
26. Williams, P., Karuppiah, S., Greentree, K., & Darvall, J. (2020). A checklist for intrahospital transport of critically ill patients improves compliance with transportation safety guidelines. Australian critical care, 33(1), 20-24.
27. Zaman, S., & Kovoor, P. (2014). Sudden cardiac death early after myocardial infarction: pathogenesis, risk stratification, and primary prevention. Circulation, 129(23), 2426-2435.
28. Zhang, W., Lv, J., Zhao, J., Ma, X., Li, X., Gu, H., ... & Zhou, R. (2022). Proactive risk assessment of intrahospital transport of critically ill patients from emergency department to intensive care unit in a teaching hospital and its implications. Journal of Clinical Nursing, 31(17-18), 2539-2552.