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Predictors of Hazards Occurrence among Critically Ill Patients Transferred from Intensive Care Unit

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Abstract:
The transition from intensive care unit to the general ward poses significant risks resulting in higher mortality, increased readmission rates. **Aim of the study:** To assess the hazards occurrence among critically ill patients transfer from intensive care unit. **Research design:** A descriptive quantitative study. **Setting:** This study was carried in intensive care units at Assiut University Hospital in Egypt. **Subjects**: All available patients (96) admitted to intensive care unit during six months according to inclusion criteria. **Tools:** Three tools were utilized to collect data of study. **Method:** The researcher assessed adverse event occurrence among critically ill patients who transferee from intensive care unit using three tools. **Results:** The results of the current study shows that (36 %) of participants have readmission with while (64%) have not readmission. **Conclusion:** The study confirmed that readmission to intensive care unit and death were hazards occurrence in intensive care unit. **Recommendation:** It is recommended that healthcare institutions develop standardized protocols and risk assessment tools to identify critically ill patients at high risk for hazards during intensive care unit -to-ward transfers.

***Keywords**: Critically ill patients, Hazards, Predictors & Transferred.*

Introduction:
The transfer of patients from the ICU to a general ward represents a vulnerable and high-risk Procedure, as it involves shifting the care of medically unstable individuals to environments with fewer monitoring capabilities and less specialized staff. This transition frequently results in clinical management challenges, largely due to limited ward resources and increased nursing burdens **(Sauro et al., 2020).**

Consequently, early signs of patient deterioration are often overlooked, increasing the likelihood of preventable complications. These adverse events commonly reported after ICU discharge are considered harm resulting from the medical care itself rather than the patient's underlying condition. Such incidents can contribute to unexpected clinical decline, ICU readmissions, elevated mortality rates, prolonged hospital stays, and increased healthcare expenditures. Research has identified frequent post-ICU complications, including respiratory problems and fluid imbalance **(Güven et al., 2024).**

Nurses working in general wards play a vital role in the ICU-to-ward transition. Therefore, understanding their experiences during this handover process is essential. One study reported that ward nurses expressed concerns about limited resources, the critical condition of patients, and their complex care requirements **(Kauppi et al., 2018)** .Another study highlighted that nurses felt overwhelmed when receiving patients from the ICU due to differences in clinical competencies, patient-to-nurse ratios, technological resources, and the overall workload. Additionally, challenges were noted in interdepartmental collaboration and communication **(van Sluisveld et al., 2015).**

Significance of the study:
Patients in intensive care units (ICUs) face a heightened risk of adverse events due to the severity of their condition and the complexity of medical interventions required (**Kane-Gill, et al., 2010)**. Even after discharge from the ICU, many patients continue to need intensive care, leaving them vulnerable to complications in general ward settings. Research indicates that up to one-third of post-ICU patients may experience adverse outcomes, including mortality and readmission, with over half of these incidents considered preventable through improved standards of care **(Hosein et al., 2013).**

Aim of the study:
To assess the predictors of the hazards occurrence among critically ill patients transferred from intensive care unit.

Research Question:
What are the predictors of hazards occurrence among critically ill patients transferred from intensive care unit?

Research design:
A descriptive quantitative study that was conduct in this study.

Setting of the study:
The data were collected from different intensive care units (Trauma ICU, General ICU and Critical ICU), all at main Assiut University Hospital in Egypt.

Sample:
The sample was gathered for approximately six months (who were 96 patients) started from September 2024 to February 2025 in accordance with the inclusion criteria.

Inclusion criteria:
1. All critically ill patients who newly admitted to ICU within 48 hours ago.
2. All critically ill patients who early transferred from ICU to general ward.
3. Patient able to conduct a personal interview.

Exclusion criteria:
1. Hemodynamic instability.
2. Patient with GCS < 8.
3. The patient who refused to participated in the study.
4. Patient with cognitive disorder.

Data Collection Tools:
Tools: three tools were used to collect the necessary information for the study, the following tools were used**:**

Tool (I): Patient demographic and clinical data:
This tool developed by the researcher after reviewing of literatures to form base line data of the patient, It includes patient's gender, age, setting, smoking, diagnosis, and past history, to fulfill patient profile criteria.

Tool (II): The Patient Acuity and Complexity Score (PACS):
This tool adapted from **(Sansonet et al., 2020).** It measures patient acuity and care complexity in a standardized way. The seven field of assessment are waking \transfer, self-care feeding, self-care bathing\ hygiene, self-care continence, minimum frequency of monitoring and finally drug administration they are scored from 1 to 4 points. The PACS total score can range from 7 to 28 points, it's degree arrange as following (score ≤ 60% is consider mild level of patient complexity/acuity, if score from 61% to 75 % is consider moderate level of patient complexity/acuity, and if score is > 75 % is consider sever level of patient complexity/acuity).

Tool (III): Hazards assessment sheet: This tool consist of three parts:

Part (1): Modified Early Warning Score (MEWS):
This part adopted from **(Stenhouse et al., 2000)** and recently used by **(Aygunal. 2022).**
It includes: respiratory rate, temperature, systolic blood pressure, saturation, heart rate, level of conscious, and temperature. Each parameter of MEWS scales is scored on a 0 to 3. The total score of this system was divided into categories according to level of risk as following (green color means no risk which score about 0)-(yellow color means mild risk which score about 1)-(orange color means moderate which score about 2)-(red color means high risk which score about 3) It's grade divided as following: if score from 0 to 2 assessment is repeated in 12 hours in ICU and hospital ward , and if score is ≥ 3 assessment is repeated in 2 hours in ICU and hospital ward.

Part (2): Stability and Workload Index for Transfer Score (SWIFT):
This part adopted from **(Farmer 2006)** and recently used by **(Hidayat et al., 2025).**
It includes: original source of ICU admission, total ICU length of stay, last measured Pao2 / Fio2 ratio. Each parameter of SWIFT scales is scored as (original source of ICU admission: if patient is in emergency department which score about o , if patient transferred from a ward or out hospital which score about 8) – (Total ICU length of Stay which score about if duration < 2 score about 0, if duration from 2 to 10 score about 1, if duration > 10 score about 14) - (Last measured Pao2/Fio2 ratio ≥ 400 which scored about 0, if Pao2/Fio2 ratio < 400 and ≥ 150 scored about 5, if Pao2/Fio2 ratio < 150 and ≥ 100 score about 10 if Pao2/Fio2 ratio < 100 score about 13) – (Glasgow Coma Scale (GCS) at time of ICU discharge ≥ 14 score about 0 if GCS is from 11 to 14 is scored about 6, if GCS is from 8 to 11 is score about 14 if GCS < 8 scored about 24) – (Last arterial blood gas Paco2 ≤ 45 mmHg score about 0 , if Last arterial blood gas Paco2 > 45 mmHg is score about 5). Its degree arrange as following: if total score < 15 it is mean less length of stay, and if total score > 15 it is mean long length of stay.

Part (3): Acute Physiologic Assessment and Chronic Health Evaluation (APACHE) II:
This part adopted from **(Knaus et al., 1985).**
It include the physiologic variables, age, and chronic health status.

Method of data collection

Data was collected in two phases:

Preparatory phase:
- Permission to conduct the study obtained from the responsible hospital authorities in stroke, anesthesia, neuro-surgical, general, trauma, and medical intensive care units after explaining the aim and nature of the study.
- Construction for data collection tools was done by the researcher after extensive literature review.
- Content validity: the tools were tested for content related validity by jury of (7) experts who are specialists in the field of critical care and emergency nursing and specialists in anesthesia and intensive care medicine department from Assiut University, and necessary modifications will be done.

A pilot study:
A pilot study of (10) patients was conducted in the selected setting to examine the applicability, feasibility, efficiency and the clarity of the developed tools, before beginning of data collection.

Validity of study tools:
The material of tools was designed and validated for content validity by jury of (4) experts who are specialists in field of critical care and emergency nursing and by (3) experts who are specialists in anesthesia and intensive care medicine department and necessary modifications were done.

Reliability of study tools:
The reliability of the test was calculated for: **"Tool II"** the Patient acuity and complexity score tool was accepted with percentage 92%.**" Tool III" part (1)**: Modified early warning score tool was accepted with percentage 82%.**part (2)**: Stability and workload index for transfer score was accepted with percentage 95%. **Part (3)**: Acute physiologic assessment and chronic health evaluation was accepted with percentage 84%. It was estimated by Alpha Cronbach's test for this study. **(Cronbach 1951)**

Ethical considerations:
Research proposal was approved from Ethical Committee in the Faculty of Nursing, Assiut University on (26\8\2024), with ID approval (1120240859). Patients were informed about their right to discontinue their participation in the study at any time. The study adhered to standard ethical principles in clinical research, ensuring both confidentiality and anonymity for all patients.

- There is no risk for study subject during application of the research.
- Informed consent was obtained from patient participating in this study, after explaining the nature and purpose of the study.
- Confidentiality and anonymity wase assured.
- Patients have the right to participate, refuse and or withdraw from the study without any rational at any time.
- Study subject's privacy was considered during collection of data.

Assessment phase:

- During this phase the researcher assessed patient from the first day of admission and record patient demographic and clinical data before any data collection by taking this information from his/her sheet using tool I.
- The researcher monitored intensive care patient at the last 2 days in ICU before discharge and first 3 days in hospital ward.
- The researcher assess the patient ability of walking and transferee, self-care feeding, self-care bathing/ hygiene, self-care continence, mental status and sleep and drug administration through using tool (II).
- The researcher assessed patient's need for monitoring of early warning score , if it's needed to repeated in 12hr, 2hr, 1hr or continuously by measuring body temperature, systolic blood pressure, heart rate, respiration, spo2, and level of conscious and this is achieved through using tool III (Part1).
- The researcher assessed patient's risk for unplanned readmission to ICU if it is positive or negative through assess the original source of ICU, total ICU length of stay, Pao2\fio2 ratio, glasgow coma scale at time of discharge , and paco2 through using tool III (part 2&3).
- Finally, the researcher recorded whether the patient is dead in hospital wards, readmission to ICU, not readmitted to ICU or alive at discharge.

Statistical analysis:

The computer program SPSS (ver.25) was used to computerize and analyze the data. Descriptive statistics were used to present the data, either as means ± standard deviations for quantitative data or as frequencies and percentages.

Results:

Table (1): Demographic and clinical data of the sample (N = 96)

Demographic data		N	%
Age Group	18 - < 35 yrs.	13	13.5%
	35 - < 50 yrs.	19	19.8%
	50 - 65 yrs.	64	66.7%
	M ± SD	52.74 ± 14.95	
Gender	Male	57	59.4%
	Female	39	40.6%
Smoking	Yes	37	38.5%
	No	59	61.5%
Diagnosis	Trauma	15	15.6%
	Post-Operative	55	57.3%
	Neurologic department	5	5.2%
	Cardiovascular	7	7.3%
	Respiratory	6	6.3%
	Disturbance of Conscious level	8	8.3%
Setting	Anesthesia ICU	33	34.4%
	Trauma ICU	25	26.1 %
	General ICU	26	27.1%
	Neurosurgery ICU	8	8.3%
	Critical ICU	4	4.2%
Past History	Diabetes mellitus	27	28.1%
	Hypertensive	18	18.8%
	Diabetes mellitus and Hypertensive	12	12.5%
	Congestive Heart Failure	5	5.2%
	Chronic kidney disease	5	5.2%
	Asthmatic	8	8.3%
	Cerebrovascular Stroke	11	11.5%
	Other	10	10.4%

Table (2): Distribution of participants according to Acute Physiologic Assessment and Chronic Health Evaluation (APACHE) score (N = 96)

APACHE score	Readmitted	Not readmitted	P –value
1st day	12.14 ± 2.76	9.10 ± 4.55	.001*
2nd day	11.71 ± 2.69	8.49 ± 4.71	.001*
3rd day	9.94 ± 4.98	6.67 ± 4.38	.001*

Independent sample T test,
**Significant level at P value < 0.05.*
Pearson correlation test.

Table (3): Distribution of participants according to Modified Early Warning Score (MEWS), (N = 96)

MEWS	Readmitted	Not readmitted	P –value
1st day	3.77 ± 1.17	2.56 ± .922	.001*
2nd day	4.06 ± 1.14	2.36 ± .708	.001*
3rd day	3.94 ± 1.08	2.23 ± .990	.001*
4th day	3.20 ± 1.47	1.70 ± 1.13	.001*
5th day	2.0 ± 2.04	1.18 ± 1.37	.021*

Independent sample T test,
**Significant level at P value < 0.05.*
Pearson correlation test.

Table (4): Percentage distribution of participants according to the Patient Acuity and Complexity Score (PACS) categories (N = 96)

PACS categories		Readmission		p-value
		Readmitted (n=35)	Not readmitted (n=61)	
		N (%)	N (%)	
1st day	Mild ≤ 60 %	30 (85.7%)	51 (83.6%)	.784
	Moderate 61 % – 75 %	5 (14.3%)	10 (16.4%)	
2nd day	Mild ≤ 60 %	15 (42.9%)	55 (90.2%)	.001*
	Moderate 61 % – 75 %	20 (57.1%)	6 (9.8%)	
3rd day	Mild ≤ 60 %	13 (37.1%)	55 (90.2%)	.001*
	Moderate 61 % – 75 %	16 (45.7%)	6 (9.8%)	
	Sever >75 %	6 (17.1%)	0 (0.0%)	
4th day	Mild ≤ 60 %	15 (42.9%)	55 (90.2%)	.001*
	Moderate 61 % – 75 %	13 (37.1%)	5 (8.2%)	
	Sever >75 %	7 (20.0%)	1 (1.6%)	
5th day	Mild ≤ 60 %	13 (37.1%)	55 (90.2%)	.001*
	Moderate 61 % – 75 %	8 (22.9%)	5 (8.2%)	
	Sever >75 %	14 (40.0%)	1 (1.6%)	

Chi-square test (Number & percentage), **Significant level at P value < 0.05.*

Table (5): Percentage distribution of participants according to Stability and Workload Index for Transfer Score (SWIFT) assessment (N = 96)

SWIFT assessment		Readmission		p-value
		Readmitted (n=35)	Not readmitted (n=61)	
		N (%)	N (%)	
1st day	Negative risk for unplanned readmission < 15	17 (48.6%)	57 (93.4%)	.001*
	Positive risk for unplanned readmission > 15	18 (51.4%)	4 (6.6%)	
2nd day	Negative risk for unplanned readmission <15	21 (100.0%)	61 (100.0%)	.001*
	Positive risk for unplanned readmission >15	14 (40.0%)	0 (0.0%)	
3rd day	Negative risk for unplanned readmission <15	16 (45.7%)	61 (100.0%)	.001*
	Positive risk for unplanned readmission >15	19 (54.3%)	0 (0.0%)	
4th day	Negative risk for unplanned readmission <15	21 (100.0%)	61 (100.0%)	.001*
	Positive risk for unplanned readmission >15	14 (40.0%)	0 (0.0%)	
5th day	Negative risk for unplanned readmission<15	27 (77.1%)	61 (100.0%)	.013*
	Positive risk for unplanned readmission >15	8 (22.9%)	0 (0.0%)	

Chi-square test (Number & percentage), **Significant level at P value < 0.05.*

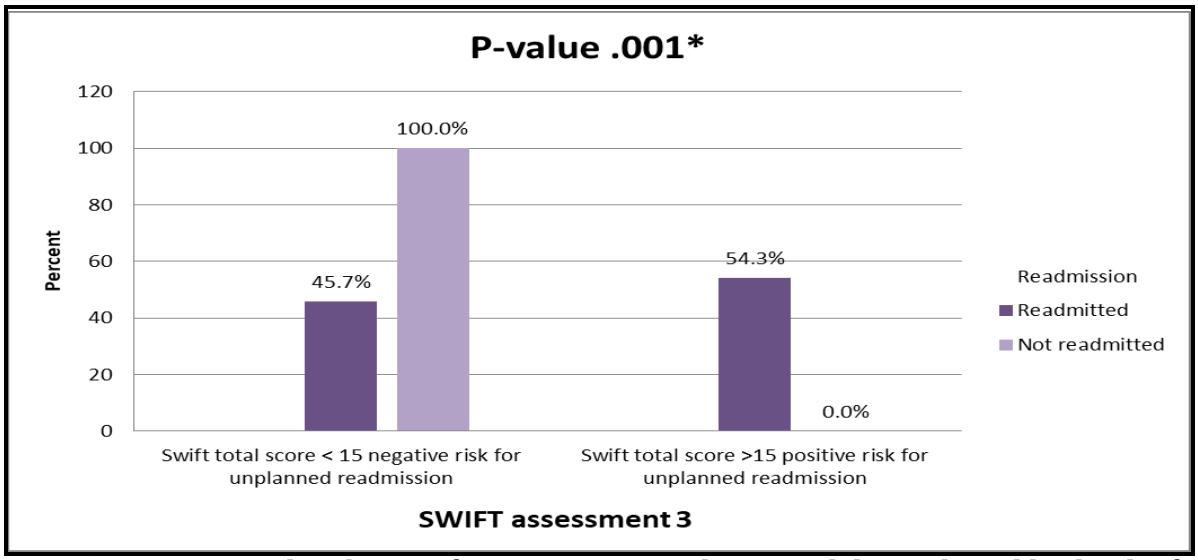

Figure (1): Percentage distribution of participants according to Stability and Workload Index for Transfer Score (SWIFT) assessment (n = 96)

Table (1): Illustrates demographic and clinical data of studied Patients table reveals that a majority (66.7%) of participants in (50 - 65 yrs.) age group, with mean of age (52.74 ± 14.95). About (59.4%) of studied patients were male, whereas female were (40.6%). More than half (61.5%) of studied patients were non-smoker, and (57.3%) of these studied patients are post-operative, and also reveals that about (28.1%) of patients have DM.

Table (2): This table reveals that at third day the mean of APACHE score is higher among readmitted patients (11.71 ± 2.69) than non-readmitted patients (8.49 ± 4.71) and with statistically significant difference (P-value .001*).

Table (3): This table reveals that at third day the mean of Modified Early Warning Score (MEWS) is higher among readmitted patients (3.94 ± 1.08) than non-readmitted patients (2.23±.990) with statistically significant difference (P-value .001*).

Table (4): This table shows that at third day, about (45.7%) of readmitted patients have moderate PACS degree, but the most (90.2%) of these patients mild PACS degree, with statistically significant difference (P-value .001*).

Table (5): This table reveals that at first day, about (51.4%) of readmitted patients have positive risk for unplanned readmission, but most (93.4%) of non-readmitted patients have negative risk for unplanned readmission, with statistically significant difference (P-value .001*).

Figure (1): This figure reveals that at third day, about (54.3%) of readmitted patients have positive risk for unplanned readmission, but all (100%) of non-readmitted patients have negative risk for unplanned readmission, with statistically significant difference (P-value .001*).

Discussion:

The transition from the ICU to the ward is a high-risk procedure mainly because of differences in care level, including a lower patient–nurse ratio, less monitoring and limited resources to meet patients' needs, and is commonly associated with increased mortality, ICU readmissions and poor patient satisfaction. **(Herve MEW et al ., 2020).**

Regarding to age the findings of this study revealed that advancing age is significantly associated with an increased risk of mortality among critically ill patients transferred from the ICU. This aligns with the results of previous studies, such as those conducted by **(Fluck et al., 2021)**, which reported that older patients tend to have poorer physiological reserves and are more susceptible to complications following ICU discharge. The increased vulnerability in elderly patients may be attributed to multiple comorbidities, frailty, and a diminished capacity to recover from critical illness. These findings emphasize the need for age-specific risk assessments and more tailored transitional care plans to improve outcomes for older adults after ICU transfer.

Regarding gender distribution, the findings of the current study revealed that the majority of patients were male (59.4%), while females accounted for 40.6% of the total sample. This findings is consistent with the results reported by (**Ali et al., 2019)**, who also observed a higher prevalence of male patients among critically ill Patients. This pattern may be attributed to gender-related differences in health-seeking behaviors, prevalence of chronic illnesses, or occupational exposures that increase the likelihood of ICU admission among males. Understanding these differences is essential for tailoring preventive strategies and post-ICU care to address the specific needs of both genders.

Regarding to diagnosis of studied patients**,** the present study demonstrated that the most common condition was postoperative status. This finding is in line with the study conducted by **(Abdelghafour et al., 2025),** which also identified postoperative patients as the predominant group among ICU admissions. The high prevalence of postoperative cases in intensive care units may be attributed to the need for close monitoring, advanced pain management, and early detection of complications such as bleeding, respiratory distress, or hemodynamic instability.

Regarding to Acute Physiologic Assessment and Chronic Health Evaluation (APACHE II), the results revealed that on the third day of the ward stay, the mean APACHE II score was higher among patients have physiologic deteriorations. This finding is synchronized with the study conducted by (**Abdelghafour et al., 2025),** which also demonstrated a significant association between elevated APACHE II scores and increased complications during intra-hospital transport. This could be explained by the fact that higher APACHE II scores reflect greater physiological instability and the presence of multiple organ dysfunctions, which may not fully resolve by the time of ICU discharge. As a result, patients with higher scores are more likely to deteriorate clinically after transfer to a lower level of care. Moreover, early discharge decisions may sometimes be based on subjective assessments, rather than objective indicators like APACHE II, which can underestimate residual risk.

With regard to the Modified Early Warning Score (MEWS), is a clinically validated tool designed to detect early signs of physiological deterioration based on simple vital parameters such as heart rate, respiratory rate, blood pressure, temperature, and level of consciousness. A higher MEWS indicates greater instability and may reflect unresolved or

worsening clinical conditions following ICU discharge.

Therefore, patients with elevated Modified Early Warning Score (MEWS) during or after ICU stay are more likely to require re-admission due to insufficient recovery or emerging complications, the present study showed that MEWS was higher among readmitted patients compared to those who were not readmitted. This finding is in line with the study conducted by **(Daller 2023),** which also reported a significant association between elevated MEWS and an increased risk of ICU readmission.

Regarding to the Patient Acuity and Complexity Score (PACS), the present study demonstrated that on the third day of the hospital ward stay, less than half of the readmitted patients exhibited a moderate level of acuity and complexity, while the majority had a mild PACS score. This difference was statistically significant and is consistent with the findings of **(Sanson et al., 2020),** who reported that even patients with low to moderate PACS levels may still be at risk of clinical deterioration and unplanned ICU readmission. This observation underscores the limitations of relying solely on static acuity scores and highlights the importance of continuous, multidimensional patient assessment.

Regarding to Stability and Workload Index for Transfer Score to Predict Unplanned Readmissions after ICU Discharge The data presented in this table show that, on the first day of ICU stay, more than half of the readmitted patients were identified as having a positive risk for unplanned readmission, whereas the majority of non-readmitted patients were classified as having a negative risk. This difference was statistically significant and aligns with the findings of **(Kastrup et al., 2013),** who similarly reported that early identification of readmission risk is a reliable predictor of future ICU utilization. The presence of a positive risk status in readmitted patients may reflect unresolved clinical instability, suboptimal recovery, or unaddressed comorbid conditions at the time of initial discharge.

Conclusion:

The transition of critically ill patients from the intensive care unit (ICU) to the general ward is a highly vulnerable period associated with a substantial risk of adverse events. This study identified several key predictors that contribute to the occurrence of such hazards, including the severity of the patient's condition at discharge, inadequate communication during handover, limited staffing, and insufficient monitoring in the ward setting. Recognizing these predictors is essential for healthcare providers to implement targeted interventions that mitigate risks and improve patient safety during this transitional phase.

Recommendation:

- **Implement standardized transfer protocols:** Hospitals should adopt structured handover procedures to ensure comprehensive information exchange between ICU and ward teams.
- **Enhance post-ICU monitoring:** Early warning systems and close observation during the initial days post-transfer can help detect patient deterioration promptly.
- **Strengthen staff training:** Ward nurses and staff should receive specialized training in recognizing and managing post-ICU patient needs.
- **Optimize nurse-to-patient ratios:** Improving staffing levels in general wards can significantly reduce the likelihood of adverse events.

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