ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCE,

TIKUR ANBESSA SPECIALIZEDHOSPITAL

DEPARTMENTOFANESTHESIOLOGY,CRITICAL CARE AND PAIN MEDICINE

A Research thesis to be submitted to Addis Ababa University, College of health science, Department of Anesthesiology, Critical care and Pain medicine; in partial fulfillment of the requirements of a specialty certificate in Anesthesiology, Critical care and Pain medicine.

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Full title of research project	**Incidence of adverse event and associated factor during Intrahospital transport of critically ill patient in ICU at TASH, Dec 2024-Feb 2025G.C,prospective observational study.**
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Abstract

Background: Intra-hospital transport of critically ill patients is a vital component of intensive care unit (ICU) operations, necessary for various diagnostic, therapeutic, or procedural interventions. Despite its critical role, this process can introduce significant risks, including adverse events such as changes in vital signs, procedural complications, or deterioration in patient's condition.

Objectives: To determine the incidence and associated factors of adverse events during intra-hospital transport of critically ill patients in the ICU at Tikur Anbessa Specialized Hospital.

Methods: Prospective cross sectional study was conducted. All patients that were transported between Dec 2024- March 2025 G.C. 141 patients were included in the study. Data was collected through patient records and observation checklists. Analysis was done by using SPSS 27. The association between categorical variables was determined using logistic regression. Odds ratio were calculated to determine the association between the adverse event and each independent variables through binary and multiple logistic regressions. And p-value < 0.05 at 95% confidence intervals was considered as statistical significance.

Result: The finding of this study revealed that the incidence of adverse events was 36.9%. Of these adverse event 59.6% were clinical, 21.2% were non clinical and 19.2% of them experience both clinical and non-clinical adverse events. At 5% level of significant multivariable logistic regression analysis, only high NEWS and below standard monitor were significantly associated with adverse events. The odds of developing adverse events among patients who had NEWs score of >7 were 7 time more likely than those whose score is 0-4(AOR=7.7, 95%CI: 1.67, 8.3). Those who were on below standard had 3.4 time odds of developing adverse event than standard monitor (AOR=3.4, 95% CI: 2.29, 6.4). But age, requirement of presser, transporting team, time of transport, duration of transport, use of sedation were not found associated on multivariate analysis.

Conclusion and recommendations: The incidence of adverse event is significant in our study were high. We need to prioritize and optimize patients before transport and have proper monitoring according to standard.

Keywords: Intra-hospital transport, critically ill patients, adverse events, protocol, ICU, Tikur Anbessa Specialized Hospital, Ethiopia

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Abbreviations and Acronyms

AARC	American association of respiratory care
ACCPM	Anesthesiology, critical care and pain medicine
AEs	Adverse Events
APACHE-II	Acute Physiology and Chronic Health Evaluation II scores
CICU	Cardiac intensive care unit
ICU	intensive care unit
IHT	Intrahospital transfer
IV	intravenous line
LMIC	Low and middle income country
MV	Mechanical ventilator
NEWS	National early warning score
NGT	Nasogastric tube
PEEP	Positive end expiratory pressure
SICU	Surgical intensive care unit
SOFA	Sequential organ failure assessment
TASH	Tikur Anbessa specialized hospital

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1. Introduction

1.1 Background

The intra-hospital transport (IHT) of critically ill patients is a routine yet inherently risky aspect of care in modern healthcare settings(1). This process involves transferring patients within the hospital to access specialized services or diagnostic procedures, which is crucial for comprehensive patient management.With technological advancement like availability of diagnostic testing such as computed tomography (CT), magnetic resonanceimaging (MRI), angiography, cardiac catheterization, and nuclear imaging, as well asvarious interventions , critically illpatients are increasing being transported not only between the intensive careunit (ICU) and the operating room (OR), but also a long longer journeys to remote locations throughout the hospital(2–5).

Globally adverse event was mentioned in different literature and were significantly high ranging from 1.6%-79%(1,3,4). Although definition and classification of adverse events varies among literature, frequently mentioned AE are usually classified as clinical and non-clinical AEs. Clinical AEs are usually related to respiratory, cardiovascular and central nervous system (CNS) and non-clinical are related to equipment, communication gabs(7).

Several risk factors contribute to the occurrence of AEs during IHT. Among the frequently mentioned are age and the severity of the underlying condition, Physiological instability, as measured by the Acute Physiology and Chronic Health Evaluation II scores(APACHE-II), with higher scores correlating with increased incidents of cardiovascular instability(8).Transport team composition and equipment quality are also critical factors(9).

The absence of trained personnel, inadequate equipment, such as poor-quality monitoring tools, has been identified as a significant contributor to AEs, with 66.7% of patients experiencing complication(10).

Physiologic impact of transport of critically ill patients happens because of two reasons. One is because of patient movement during transport, acceleration and deceleration, changes in posture resulting in potential physiologic disturbance. The other is because of the change in environment from highly protected initial care unit; equipment changes (like ventilator), noise and the hardness of the transporting table are all sources of extra discomfort. To mitigate associated adverse events standard of care and guideline has been developed by different institution. According to American association for respiratory care(AARC), patient has to be stabilized, proper monitoring equipment (ECG,BP,pulseoxymetry,EtCO2) has to be avail0able, well trained transporting team on airway management and resuscitation should accompany the transportation and there should be proper documentation of patient condition pre and post-transport with clear communication.

To mitigate these risks, implementing standardized protocols and enhancing staff training are crucial(1,7,11–13). Evidence suggests that adherence to standardized procedures and thorough pre-transport stabilization can reduce the frequency of AEs. According to the Intensive Care Society and the Faculty of Intensive Care Medicine guidelines, checklists must be used during transfers, to ensure, and for each stage of the process, all the necessary preparations are made(4,12,13). Continuous monitoring and assessment of transport processes are also vital in identifying and addressing potential risks associated with IHT(14).Despite the inherent risks, research indicates that with appropriate protocols and staff training, the incidence of AEs during IHT can be significantly reduced(15).

1.2 Statement of the Problem

Although necessary for accessing specialized diagnostics and therapeutic interventions, these transfers expose patients to potential adverse events (AEs) that can compromise their already precarious health status(1). These AEs might reach up to 79% especially in LMIC(6).

At Tikur Anbessa Specialized Hospital (TASH), the challenges associated with IHT are compounded by a high volume of critically ill patients, limited resources, and potential gaps in standardized protocols and staff training. Despite the hospital's role as a major referral center with advanced care capabilities, there is a lack of localized research investigating the frequency and determinants of AEs during IHT within this setting. This lack of data leaves a critical gap in understanding how these adverse events manifest in the context of Ethiopian healthcare practices especially in TASH and what specific factors contribute to their occurrence.

1.3 Significance of the Study

This study holds considerable significance for multiple reasons:

Enhancing Patient Safety: By identifying the frequency and types of AEs during IHT, this study will provide crucial information on how these adverse events impact critically ill patients. Understanding these factors will help in developing targeted interventions and improving safety protocols, reducing unnecessary bad outcomes and enhancing overall patient safety during intra-hospital transfers.

Informing Policy and Practice: The findings will offer evidence-based insights that can guide the development and implementation of standardized transport protocols and training programs at TASH. This will contribute to establishing best practices for IHT, potentially influencing similar practices in other hospitals across Ethiopia and in comparable settings.

Guiding Future Research: The study will fill a significant gap in the literature by providing localized data from a low-resource setting. This contribution will pave the way for further studies in other similar contexts, enhancing the understanding of IHT risks and management in diverse healthcare environments.

2. Literature Review.

There are many researches done all over the world on adverse event and associated factor during intrahospital transport of critical ill patient ,among these majority are done from high income country with significant variability of reported adverse events ranging from 1.6%-79%(6).

A study in 34 intensive care units from November 5 to November 25, 2012 in China which was a prospective multicenter, among 441 transport, the overall incidence of AEs was 79.8 %. Among these equipment- and staff-related adverse events was 7.9 % with 79.4 % patient-related adverse events (P-AEs). APACHE II score, low arterial oxygen tension, blood lactate level, tachycardia, lack of pulse oximetry, and use of sedation during transport were independent risk factors for critical AEs during IHT(8). Other multicenter observational study in India, from a total of 893 transport 9.6% AEs occurred, where hemodynamic instability was the most common (31, 30.4%)(16). In this study two patients sustained cardiac arrest which was immediately after transport. High APACHE-II score [OR: 1.02, 95% CI – 1.00–1.05, p = 0.04], being emergency transport (OR: 5.11, 95% CI – 3.32–7.88, p = 0.00), and team composition (OR: 5.34, 95% CI – 1.63–17.5, p = 0.00) were found to be independent predictors of AEs.

A retrospective cohort study done in Brazil$_{\text{from}}$ October 2016 to October 2017 involving 1,559 intrahospital transports, clinical adverse event was 7.5%, and non-clinical adverse event occurred in 8.0%(17). Use of sedatives, being on presser and a transport time greater than 36.5 minutes was associated with adverse clinical events on multivariate analysis. Although Communication failures were prevalent (6.7%), it was not clinically significant.

From clinical complications hemodynamic instability (with SBP < 90mmHg), respiratory deterioration (acute decrease in saturation < 90% and/or increase in respiratory rate > 24bpm), convulsion or change in level consciousness were described. Communication and equipment problems (delayed examination; and equipment batteries, pump failure and oxygen failure) were among the few Non-clinical events mentioned in this study.

Another study in France which was a prospective observational study on mechanically ventilated patients from May 2009 to March 2010 which was conducted in 38-bed intensive care unit. From 262 total transports observed, 45.8% adverse events were reported. Requirement of positive end-expiratory pressure(PEEP) >6 cmH2O on MV, use of sedation, and fluid loading while transports were found an independent risk factor(18). Other study in Japan from February 1, 2020, and July 31, 2020 which was single-center, prospective, observational study, reported adverse event was 17.1% from a total of 117 transports (19).

A prospective, observational study which was conducted in a tertiary hospital in South Africa involving perioperative patients between operating room and ICU**:** a total of 94 transports were analyzed. Adverse events recorded was 23.4% (95% CI 14.7–32.1%). Among these, hypotension requiring management accounts 55% of the adverse events, while the remaining were non-clinical adverse events (like monitor failure in 32%, ventilator failure in 9% and pump failure in 4%). Patients who developed adverse events during transfer were more likely to receive inotropic support (81.8% versus 51.4%, OR 4.26; 95% CI 1.31–13.82, $p = 0.011$) and more older than those who did not experience adverse event.

In this study there was a significant association between inotropic support and adverse events, but age was no longer associated between adverse events. Mode of ventilation, transporting personnel, the use of sedation and analgesia, and transfer time were analyzed but there was no association between adverse events(20).

In conclusion the literature highlights the complexity and risks associated with intra-hospital transport of critically ill patients. Cardiovascular and respiratory complications, are common adverse events influenced by a range of patient-related, transport-related, and equipment-related factors. While existing guidelines and protocols aim to address these risks, their effectiveness in diverse settings requires further investigation. This study aims to address the knowledge gap by focusing on the incidence and associated factors of AEs during IHT at TASH, providing insights that can enhance patient safety and care practices in similar contexts.

3. Objectives

3.1 General Objective

- To assess the incidence and identify the associated factors of adverse events during intra-hospital transport of critically ill patients in the Intensive Care Unit (ICU) at TASH, Addis Ababa, Ethiopia,from December 2024-March 2025G.C.

3.2 Specific Objectives

- To determine the incidence of adverse events during intra-hospital transport of critically ill patients in the ICU at TASH, Addis Ababa, Ethiopia from December 2024-March 2025.
- To identify the factors associated with adverse events during intra-hospital transport of critically ill patientsin the ICU at TASH, Addis Ababa, Ethiopia from December 2024-March 2025.

4. Methodology

4.1 Study Design

A prospective observational study was conducted to investigate the incidence and associated factors of adverse events during intra-hospital transport of critically ill patients. The study participants were those critically ill patients who were transferred from OR to ICU or from ICU to radiology/procedure/OR/dialysis. Data was collected by accompanied physician(residents,intern) or nurses during transport and was collected both during regular day time and night duty time. The study period was from Dec 2024-March 2025.

4.2 Study Setting

The study was conducted at Tikur Anbesa Specialized Hospital (TASH) which is located in the Central part of Addis Ababa city Administration, the capital of Ethiopia. TASH is a teaching and the largest specialized hospital in Ethiopia with over 700beds, established in 1964 and serves as a training center both for undergraduate and postgraduate education(https://aau.edu.et/pages/A-A-U-%20-S-e-r-v-i-c-s/%20%20detail?title=Tikur~Anbessa~Specialized~Hospital). Service provided includes all specialty including critical care (surgical ICU, Medical ICU, PICU, NICU, CICU) lead by different sub-specialty level. Both M-ICU and S-ICU was renovated in 2024 which was initially located at 4th floor of main building of the hospital then moved to 5th floor. M-ICU has a total of 6 bed with 6 MV, which is lead by pulmonology and critical care specialist and fellows. S-ICU has 9 bed and 7MV mostly dedicated for surgical patients from different discipline and is a mixed ICU primarily lead by anesthesiologist and intensivist. On average

35-40 patients, 20-25patients, 10-15 patients are being admitted to S-ICU, MICU and CICU on monthly base respectively. Regarding manpower we have 1:1 patient: nurse ratio, 6/7 ACCPM residents on rotation and one senior consultant.

We have also a cardiac intensive care unit (CICU) which is located at 4th floor having a total of 7 beds with MV which is dedicated for cardiac patients lead by cardiologist and cardiothoracic anesthesiology fellows. Elective main OR table are located on 4th floor except Obstetric table which is found on 6th floor of same building and orthopedics table which is found in separate building approximately 100meter away from main building.. But emergency OR is found on 3rd fool and radiology and dialysis service is being delivered on 2nd floor of main building. And we only have one functional elevator for transportation which is partially functioned. The department ofanesthesiology, critical care, and pain medicine has 8 general anesthesiologists, 2 pediatric anesthesiologist ,1 cardiothoracic anesthesiologist,2 cardiothoracic fellow and 68 residents (years 1-3).

4.3 Population

4.3.1 Source Population

The source population for this study was all critically ill patients admitted to the ICU at Tikur Anbessa Specialized Hospital from Dec 2024-March 2025.

4.3.2 Study Population

All critically ill patient who was transported with in the hospital(from ICU to radiology/procedure/OR or from OR to ICU) during study period from Dec 2024 to March 2025 who fulfill the inclusion criteria.

4.4 Inclusion and Exclusion Criteria

4.4.1 Inclusion Criteria

- Adult aged > = 18 years of age who are critically ill patient admitted to intensive care unit during study period, requiring intrahospital transfer.

4.4.2 Exclusion Criteria

- Patients who was transported from general ward to ICU or from emergency department to ICU.
- Patients who were transported to general ward after diagnostic testing.

4.5 Sample Size Determination and Technique

4.5.1 Sample Size Determination

for the first objective, the required sample size was determined by single population proportion formula, during calculating the sample size the following assumptions were considered.

In the previous study done in one of the South African tertiary hospital, adverse events during the intrahospital transfer of critically ill perioperative patients was 23.4% with 95% confidence interval,5% margin of error.

Accordingly sample size is calculated as:

$$n = \frac{(Z\alpha 1/2)^2 P (1-P)}{w2}$$

$$n = \frac{(1.96)^2 0.234 (1-0.234)}{(0.05)2} = 275$$

where n= sample size

p= incidence of adverse event = 23.4%

z= confidence interval at 95%

w=margin of error(5%)

Assumptions

Proportion of adverse event=23.4%

95% of confidence interval($Z \alpha /2$= 1.96)

Margin of error = 5% is acceptable

Non response rate =10%

Since population size is <10,000 it was adjusted using the formula

$$n = \frac{n0}{1 + \frac{n0}{N}}$$

n= 275/1+275/240=128

Considering 10% non respondent rate, total sample size was 141

Where

n0- sample size calculated early

N- Total number of population in the study area (over three month period).

4.5.2 Sampling Technique

A consecutive sampling technique was employed to recruit patients who meet the inclusion criteria and are admitted to the adult ICU during the study period.

4.6 Study Variables

4.6.1 Dependent Variable

Occurrence of adverse events during transport.

4.6.2 Independent Variables

Age

Gender

Severity of illness

Ventilated vs non ventilated

Duration of transport

Reason for transport

Present and absence of presser

Time of transport (day, night, weak day or weekend)

Experience of the transport team

Communication gaps

Presence or absence of monitor/equipment

Sedation

4.7 Operational Definitions

Clinical adverse events: Any unintended and undesirable occurrence as defined in either of the following while during or immediately after transfer.

- **Hypoxia:** A decrease in SPo2 of <90% or decrease by 5% from the baseline.
- **Hypotension:** A decrease in systolic blood pressure less than 90 or decrease by more than 20% from baseline.
- **Hypertension:** blood pressure increment more than 20% from base line or systolic BP >=140.
- **Or Either of the following**
    - **Cardiac arrest /Arrhythmia /Increased presser infusion/ Seizure/accidental extubation.**

Non clinical adverse events: Any unintended and undesirable occurrence as defined in either of the following while during or immediately after transfer;

- O2 failure, MV battery failure, line dislodgement (like central line, peripheral IV line, drainage tube, NGT).

Pretransport vital sign: Those vital sign that would be taken within 5minute before transport.

Post transport vital sign: vital sign taken within 5minute after transport.

Standard monitoring: The presence of the following monitoring equipment based on NEWS assessment.

- ✓ Use of pulseoximeter for NEWS <=4
- ✓ Presence of BP cuff, pulseoximeter and ECG for those NEWS assessment>4

Below standard monitoring: Any deviation from the standard monitoring.

4.8 Data Collection Tools

Data was collected using a combination of:

Patient Records: Review of ICU charts and transport logs to gather information on patient demographics and clinical status.

Direct observation: Data collector was directly observing transport details.

Data were captured pretransport, during transport and immediately after transport.

The questionnaire was formulated in English language and collected using google form.

Data collection, data processing was conducted by transporting team trained on how to fill and complete data entry. The questionniaris were pretested on 5% of the sample size in similar population with in study area. Principal investigator and primary advisor was assessing the clarity and completeness of the questionniaris, findings, and experiences.

4.9 Data Quality Assurance

Data collectors (nurses, physicians) were trained by principal investigator on the study objectives, detailed descriptions of the tools, and data collection procedures using Google Forms before the start of data collection. And the principal investigator were supervising, checked the completeness and consistency of the collected data throughout the data collection period.

4.10 Data Analysis

All responses to the questionnaires was coded, entered, and analyzed using SPSS 27 Version. Data cleaning was done by principal investigator.

Frequency and percentage were used for descriptive analysis then presented using tables to summarize the characteristics of the study population and the incidence of adverse events. Odds ratio were calculated to determine the association between adverse event and selected variables through binary logistic regression. Those having a P value < 0.25 entered into a multivariable logistic regression. A P value < 0.05 at 95% confidence intervals was considered as statistical significance.

4.11 Ethical Considerations

Ethical approval was obtained from Addis Ababa Universitydepartment of Anesthesiology, Critical Care and Pain medicine before the initiation of the study. Informed consent was not be taken since data collection will not affect any patients condition. But patient confidentiality was maintained throughout the study and all data was stored securely.

5. Result

5.1 Patient demographics and health conditions

We were able to collect data from one hundred forty patients (100% response rate) from Dec 2024 to March 2025. Most of the patients were in the age group of 18- 45years (43.3%) and majority are males (55.3%). Thirty nine percent of patients had a NEWS Score of 5-7 and patients who had artificial airway were 42.6%. Senior residents were leading the transport in 55.3% of the cases. The most common transport was from OR to ICU (54.6%) and most of the transportations (46.8%) took 15-30minutes.

Table 1Demographic characteristics and health conditions of critically ill patients who had intrahospital transportation ICU(n=140) at TASH,Dec 2024-March 2025.

Variables	Frequency	Percentage
Age		
18-45 yr	61	43.3
45-60 yr	57	40.4
>60 yrs	23	16.3
Sex		
Female	63	44.7
Male	78	55.3
NEWS Score		
0-4	36	25.5
5-7	55	39.0
>=7	50	35.5
Airway status		
Artificial airway	60	42.6
No artificial airway	81	57.4
Patient on mechanical ventilator		
No	88	62.4
Yes	53	37.6

Inotrop or vassopressor required		
No	102	72.3
Yes	39	27.7
Transport leading Staff level of training		
Intern doctor	2	1.4
Junior resident	52	36.9
Senior anesthesiologist	9	6.4
Senior resident	78	55.3
Monitor used during transport		
Below standard	132	93.6
Standard	9	6.4
Reason for transport		
From OR to ICU	77	54.6
To dyalysis	15	10.6
To OR	16	11.3
To radiology	31	22.0
Other	2	1.4
Time of transport		
Weekend day	23	16.3
Working day	107	75.9
Night	11	7.8
Respiratory support during transport		
Ambu bag	8	5.7
Mapleson circuit	54	38.3
mechanical ventilator	1	.7
Not required	78	55.3
Duration of the transport		
,15 minutes	52	36.9
15-30minutes	66	46.8
>30 minutes	23	16.3
Sedation and analgesia given before transport?		
No	95	67.4
Yes	46	32.6

5.2 Descriptive data of patient vital signs before and after transportation

Pre transportation patients pulse rate, blood pressure, respiratory rate, saturation were in normal range in 79.4%, 78.8%, 92.9% and 100% of the case respectively. On the other hand 3.5% of patients were hypotensive and 17.75% of patients had elevated blood pressure. After the transportation 9.9% of patients had saturation level below 90, 10.6% of patients were hypotensive and 15.6% patients had elevated blood pressure.

Table 2 Patient vital sign before and after transportation of critically ill patients who had intrahospital transportation ICU(n=140) at TASH, Dec 2024-March 2025.

Variables	Pre-transportation frequency(percentage)	Post transportation frequency(percentage)
Pulse rate before the transport		
<60	2 (1.4)	2 (1.4)
60-100	112 (79.4)	94 (66.7)
>100	27 (19.1)	45 (31.9)
Respiratory rate before transportation		
<12	0 (0)	1 (0.7)
12-25	131 (92.9)	125 (88.7)
>25	10 (7.1)	15 (10.6)
SPO2 before the transport		
<90	0 (0)	14 (9.9)
90-95	49 (34.8)	45 (31.9)
>95	92 (65.2)	82 (58.2)
Blood pressure before the transport		
Hypotensive	5 (3.5)	15 (10.6)
Normal	111 (78.7)	104 (73.8)
Elevated	25 (17.7)	22 (15.6)

5.3 Descriptive analysis of adverse events

There were adverse events in 36.9% of the transportation. Among these 59.6% of the patients had clinical adverse events, 21.2% had non-clinical adverse events and the rest 19.2% of patients had both clinical and non-clinical adverse events. 10.6% of patients required vasopressor escalation during transport and vasopressor discontinuation in 10.65% of the cases. There was one episode of cardiac arrest in our study period.

Table 3Incidence of adverse events in intrahospital transportation of critical patients in ICU,2025G.C

Variables	**Frequency**	**Percentage**
Adverse event during transportation		
No	89	63.1
Yes	52	**36.9%**
Airway related event		
ETT blocked	4	2.8
None	137	97.2
Equipment related events		
Circuit disconnection, Monitor malfuntion	6	4.2
O2 failure	**10**	**7.1**
OGT accidental dislodgement	4	2.8
None	121	85.8
Cardio vascular related events		
Arrhythmia	5	3. 5
Cardiac arrest.	1	.7
Increased presser infusion	**15**	**10.6**
None	120	85.1
Line and drug related events		
IV line dislodgement, Drain dislodged	12	8.5
Presser discontinution	**15**	**10.6**

None	114	80.8
Miscellaneous adverse events		
Altered GCS	2	1.4
Communication gaps	**10**	**7.1**
Delayed transport	5	3.5
Restlessness	2	1.4
None	116	82.3
Seizure	1	.7
Types of adverse events		
Clinical adverse events	31	59.6
Non clinicaladverse events	11	21.2
Both Clinical and non clinicaladverse events	10	19.2

5.4 Regression analysis of factors associated with adverse events

Being on vassopressor, use of below standard monitor, sedation, NEWS score, time of transport and being on mechanical ventilator were nominated for multivariate analysis. Accordingly higher NEWS score and those who were on below standard monitor during transportation were found statistically significant risk factor on multivariate logistic regression.

The odds of experiencing adverse event among patients with NEWS score of 5-7 were 4.7 times more likely than those whose score were between 0-4 (**AOR**=4.725,**CI**=2.0, 6.34), and for those NEWS score of more than seven, odds of experiencing adverse event were 7.7 times higher than those whose score is <4(**AOR**=7.730, **CI**=1.67, 8.3) .

Patients who were on below standard monitored while transport were 3.4 times more likely to experience adverse events than those who were on standard (**AOR**=3.4,**CI**=2.29,6.4). but age, requirement of presser, transporting team, time of transport, duration of transport, use of sedation were not found significantly associated on multivariate analysis.

Table 4 The logistic regression association between independent variables and adverse events at ICU,TASH 2025

Variables	**categories**	**Adverse Events**		**P value**	**COR**	**P value**	**AOR (CI=95%)**
		Yes	**No**				
Age	18-45	28	33		1	.214	1
	45-60	14	43	.337	0.907	.083	7.105 (0.001, 2.591))
	>60	10	13	.768	2.363	.294	3.008 (0.2, 1.25)
Sex	Female	24	39	.788			1
	Male	28	50	.014	1.768	.815	.843 (0.21, 2.1)
NEWS score	0-4	5	31	.000	146	1.000	1
	5-7	**13**	**42**	**.000**	**1.85**	**0.004**	**4.725 (2.0-6.34)**
	>=7	**34**	**16**	**.259**	**5002**	**.000**	**7.730 (1.67, 8.3)**
Airway status	Artificial	33	27	.000			1
	Non-artificial	19	62	.000	251	.998	.000 (0.12, 0.52)
Patienton mechanical ventilator	No	12	68	.000			1
	Yes	40	21	.017	10.7	.997	.00(.022, 6.86)
Inotrop or vassopressor required	No	28	74	.000			1
	Yes	24	15	.000	4.22	.109	7.292 (20.5, 214.6)
Transport leading Staff level of training	Intern & junior resident	9	45	.027		.954	1
	Anesthesiologist & senior residents	43	44	.999	3.692	.999	.000 (1.02, 3.14)
Monitor used during transport	Standard	3	6	.820		**.**008	1
	Under Standard	**49**	**83**	**.003**	**0.001**	**.006**	**3.4(2.29,6.4)**
Reason for	OR to ICU	29	48	.174		.924	1

transport	To dyalysis	6	9	.071	.00	.997	1.02 (.106, 56)
	To OR	9	7	.999	.360	.469	3.786(0.02,214)
	To radiology & others	8	25	.142	.187	.682	.595 (40.5,,156)
Time of transport(1)	weekend day	9	14			.753	1
	working day	40	67	.280	3.311	.687	3.080 (1.63, 7.34)
	Night	3	8	.001	3.851	.722	1.444 (8.43, 6.76)
Respiratory support during transport"	Ambu bag	4	4	.005		.911	1
	Mapleson circuit & MV	30	25	.111	.300	.465	3.553 (.106, 158)
	Not required	18	60	.000	.000	.997	.000(.075, 245.552)
Sedationand analgesia	No	26	69	.001			1
	Yes	26	20	.378	3.450	.112	9.6(.002, 3.05)
Communication gap	Yes	12	2	.001			1
	No	40	87	.005	.781	.087	23.9(.003, 26.3)
duration of the transport	15 minutes	18	34			.212	1
	15-30minutes	25	41	.673	.900	.463	.510(.02, .539)
	>30 minutes	9	14	.132	2.06	.240	6.7(.012, 9.371)

6. Discussion

The incidence of adverse events during intra hospital transportation of critical patients in our hospital, involving one hundred forty-two intrahospital transfers, was 36.9%. Of these adverse event 59.6% were clinical adverse events, twenty one percent (21.2%) were non clinical adverse events and 19.2% of them experience both clinical and non-clinical adverse events. Higher NEWS score and those who were on below standard monitors were found to be associated with the adverse events. In our view we believe that with high number of critically ill patients, no monitoring equipment, and having no hospital or national guideline, adverse event might be higher than what we found.

The frequency of adverse event in our study was found relatively low as compared to a multicenter study done in China where the overall incidence of AEs was 79.8 % and study done in France (45.7%) (8,18). But it was higher compared to study done at tertiary hospital in South Africa for perioperative patients(23.4%), multicentre study in India (9.6%), single centered observational study done at Kobe City Medical Center General Hospital, Japan (17.1%), and a retrospective cohort study in Brazil (7.5%)(16,17,19,20). This heterogeneity of the study maybe due to differences in the definition of adverse events, patient characteristics, use of checklist for intrahospital transport , a training program for medical staff , or a specialized team for intrahospital transport which is the usual practice in the other setup. In our observational study the most common observed adverse events were hypotension (10.6%), vasopressor escalation in 10.65% and hypoxia in 9.9%.

In our prospective observational study, severity of the illness which was mentioned in term of NEWS score and the absence of monitors during transportation had a significant association with the occurrence of adverse events. In our study we use NEWS score as a indirect measure

of severity of illness pretransport for quick evaluation since it's easy to use, applicable and sensitive to change in vital sign. Accordingly higher score signifies higher risk of experiencing adverse event while transportation and transporting physician should be vigilant while caring these patients. In our study high NEW score has significant association with adverse events. If NEWS score is>=7 the odds of developing adverse event were 7.7 times higher than those whose score is <4(**AOR**=7.730, **CI**=1.67, 8.3).

According to our study those patients who were on below standard monitor were found statistically significant with adverse events. Patients who were on below standard monitoring while transport were 3.4 times more likely to experience adverse events than those who were on standard (**AOR**=3.4,**CI**=2.29,6.4). And only 6.4% of our patients were monitored based on standard which signifies that our monitoring practice is way below the standard.

In a prospective multicenter observational study in china, APACHE II score, low arterial oxygen tension, high blood lactate, tachycardia, lack of pulseoximetry, and use of sedation before transport were independent risk factors for critical AEs(8). But ventilation and transport characteristics were not associated with AEs. On the other hand, in retrospective cohort study done in Brazil, the use of sedatives, use of presser and time of transport > 36.5 minutes were associated with adverse events(17), but age and communication failure were not associated which is similar to our study. Comparing to studies in Africa, In a single-centre, prospective, observational study in south Africa, inotropic support requirement was significantly associated with adverse events(20). However in our study age, use sedation, communication gaps, time of transport, duration of transport, use of vasoactive agents while transport were not associated on multivariate analysis.

7. Strength and limitation of the study

To the best of our knowledge, there is not study conducted in Ethiopia. This study uses Google forms for efficient and data collection tool, data collector were trained on how to collect and how to use Google form which enhances the study's credibility and the validity of its findings. We try to incorporate different patient population(S-ICU, M-ICU, and CICU).

Our study limitation are as follow; Being a single-center study, absence of basic monitoring equipment while transportation, and period of observation was relatively short because of financial problem.

8. Conclusion

The incidence of adverse events was found to be high in our study. Higher NEWS score and absence of monitor during transport were found statistically significant with adverse event during IHT of critically ill patients. This finding underscores the importance of optimizing and prioritizing critically ill patients before deciding transport and proper monitoring while transport.

9. Recommendation

The incidence of adverse event is high. To mitigate these adverse events; managing physician should prioritize and stabilize patients before transportation, transporting equipment (like ECG, pulseoxymetry, BP cuff) be available, has to adopt or develop protocol or guideline. Proper training and regular updates has to be given for health professionals who would be involved in transport of critically ill patients.

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11. Annexes

Annexe 1: Questionnaire

Addis Ababa University college health sciences, department of anesthesiology, critical care and pain medicine.

Questionnaire prepared to Incidence of adverse event and associated factor during intrahospital transport of critically ill patient in ICU at TASH, from Dec,2024-March 2025G.C

Consent form

Hi, good morning/afternoon.

My name is ----------, I am here on behalf of Dr. Addisu Getu, a Resident in Addis Ababa University School of medicine, department of ACCPM. He is conducting a research thesis on "Incidence of adverse event and associated factor during intrahospital transport of critically ill patient in ICU at TASH, Addis Ababa EEthiopia from Dec 2024 to March 2025 G.C". He has been granted permission from Addis Ababa University School of Medicine department of ACCPM.

This tool is designed to collect data on patient socio-demographics, patient related factor, equipment and environmental related factor, transport related factor and adverse events.

The information will be kept confidential. Only the members of the study team will have the access to the data and will not be used for purposes other than the study. Your willingness and active participation is very important for the success of this study.

For further information

Contacts are below:

Would you be willing to participate? [put "x'' mark] Yes_____ No_____

Name: Dr. Addisu Getu Tel- +251-937404169 E-mail: getuayalew25@gmail.com

Part I:- Socio-demographic characteristics of the patients

1.1 Age

1.2 Sex A. Male B. Female

Part all:- Patient related factor

2.1 NEWS score
- 0-4
- 5-7
- >=7

2.2 Airway status
- No artificial airway
- Artificial airway

2.3 Patient on mechanical ventilator
- Yes
- No

2.4 Inotrop or vassopressor required
- Yes
- No

Part III: environmental and equipment related factors

3.1 Transport leading Staff level of training
- Senior anesthesiologist
- Senior resident
- Junior resident
- Anesthetist
- Nurses
- Intern doctor

3.2.- monitor used during transport
- BP cuff
- Pulseoxymetry
- ECG
- None

Part IV : Transport related factor

4.1- Reason for transport
- To radiology
- To operative room
- From OR to ICU
- To dialysis
- Other ------

4.2- Time of transport
- Work hour (day time)
- Off working hour

- ◆ Weekend day
- ◆ Weekend night

4.3- Duration of transport
- ◆ in minutes

4.4- respiratory support provided during transport
- ◆ Mechanical ventilator
- ◆ Ambu bag
- ◆ Maplson circuit
- ◆ Not required

4.5- Sedation and analgesia given before transport
- ◆ Yes
- ◆ No

4.6- Baseline vital sign before transport
- ◆ BP-----
- ◆ PR-----
- ◆ RR------
- ◆ SPO2-----

Part V: Adverse event during transport

5.1- Airway related
- ✧ ETT kinked /blocked
- ✧ Tracheostomy blocked
- ✧ Accidental extubation
- ✧ Other ---
- ✧ None

5.2- Equipment related event
- ✧ Circuit disconnection
- ✧ O2 failure
- ✧ OGT accidental dislodgement
- ✧ MV battery failure
- ✧ Other-----
- ✧ none

5.3- Vital sign after transport
- ✧ BP----
- ✧ PR----
- ✧ RR----
- ✧ Spo2---

5.4- Cardiovascular and Respiratory system related event
- ✧ Arrhythmia
- ✧ Increased presser infusion
- ✧ Cardiac arrest
- ✧ Others specify-----
- ✧ None

5.5- Line and drug related event
- ✧ IV line dislodgement

- ✧ IV line disconnection
- ✧ Presser discontinuation
- ✧ Central line dislodgement
- ✧ Drain malfunctioned/dislodged
- ✧ Other specify------
- ✧ None

5.6- Miscellaneous

- ✧ Restlessness
- ✧ Communication gaps
- ✧ Altered GCS
- ✧ Delayed transport
- ✧ Other specify-------
- ✧ None

DECLARATION OF THE PRINCIPAL INVESTIGATOR

The undersigned agrees to accept responsibility for the scientific ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the Department and College, in effect at the time of grant is forwarded as the result of this application.

Name of the resident: ___Dr Addisu Getu Ayalew_____

Date. _____ Signature _____

APPROVAL OF THE FIRST ADVISOR

Name of the first advisor: __Dr Fetiha Alferid_____

Date. _____ Signature _____

APPROVAL OF THE SECOND ADVISOR

Name of the second advisor: ____Dr Tseganesh Tulu_____

Date. _____ Signature _____