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2024

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Mawjee, Bhavic. (2024). Assessment of current practices of intrahospital transportation in critically ill patients at an academic hospital in South Africa [Master`s dissertation, University of the Witwatersrand, Johannesburg]. WIReDSpace. https://hdl.handle.net/10539/46377

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ASSESSMENT OF CURRENT PRACTICES OF INTRAHOSPITAL TRANSPORTATION IN CRITICALLY ILL PATIENTS AT AN ACADEMIC HOSPITAL IN SOUTH AFRICA

Bhavic Mawjee

A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in the partial fulfilment of the requirements for the degree of Master of Medicine in the branch of Anaesthesiology.

Johannesburg, 2023

Declaration

I, Bhavic Mawjee, declare that this Research Report is my own, unaided work. It is being submitted for the Degree of Master of Medicine at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University. The article is prepared according to the Author Guidelines for Journal of Critical Care (Section 2) and may differ from the rest of the document.



_____ (Signature of candidate)

On this day of 31 October 2023

Abstract

Purpose:

There is a paucity of guidelines for safe intrahospital transportation(IHT) in a resource-limited setting. The aim of this study was to describe the practices of IHT of critically ill patients perioperatively by anaesthetists.

Methods:

We conducted a prospective, cross-sectional study including 101 IHTs between theatre and Intensive care unit (ICU) . The most senior anaesthetist completed an adapted questionnaire. Frequency distributions were described, and Chi-square/Fisher's exact tests were performed to identify associations between IHT practices and categorical variables with anaesthetist seniority and first and subsequent IHTs.

Results:

The majority(72.97%) of the variables investigated were below the expected compliance rate(75%). Only 22.80% of anaesthetists were aware of IHT guidelines. Statistically significant differences were observed in IHT practices between senior and junior anaesthetists for: airway equipment taken(OR 0.25 95% CI 0.08-0.84), emergency drugs taken(inotropes(OR 1.49 95%CI 1.29-1.73), muscle relaxants(OR 5.81 95% CI 1.70-19.83), induction agents(OR 7.23 95% CI 1.86-28.13)) and awareness of IHT guidelines(OR 1.35 95% CI 1.20-1.53); and between first and subsequent transfers for: notification of the current condition(OR 0.23 95% CI 0.08-0.71), use of manual resuscitation bag(OR 3.64 95% CI 1.21-11.00), and awareness of IHT guidelines(OR 0.14 95% CI 0.04-0.49).

Conclusion:

The majority of IHT practices interrogated during this study were below the expected compliance level irrespective of the seniority of the anaesthetist or the number of IHTs. Resource limitations and education seem to be the major contributors.

Acknowledgements

I would like to thank the following people:

My supervisors, Sujai Mohanadasan and Zainub Jooma for their ongoing assistance, encouragement, and patience.

Mrs Zvifadzo Matsena Zingoni for her assistance and guidance during statistical analysis.

My wife and family for their constant encouragement during the study.

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Abbreviations

AA	Association of Anaesthetists
AAGBI	Association of Anaesthetists of Great Britain and Ireland
ANZCA	Australian and New Zealand College of Anaesthetists
CCSSA	Critical Care Society of South Africa
DA	Diploma in Anaesthesia
FCA	Fellowship of the College of Anaesthetists
HICs	High income countries
ICU	Intensive care unit
IHT	Intrahospital transportation
LMICs	Low-middle income countries
NICE	National Institute for Health and Care Excellence
SASA	South African Society of Anaesthesiologists

Statement

The Research Report consists of a draft article and appendices.

The article is prepared according to the Author Guidelines for Journal of Critical Care (Section 2) and may differ from the rest of the document.

The study proposal is included for background reference and is not for examination.

Section 1: Draft Article

Assessment of current practices of intrahospital transportation in critically ill patients at an academic hospital in South Africa

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Keywords: Intrahospital transportation, perioperative, current practices, critically ill, anaesthetist

Highlights:

- Poor awareness of intrahospital transportation guidelines in South African hospital.
- Low compliance level during intrahospital transportation in South African hospital.
- Experience of the anaesthetist did not change intrahospital transportation practice.
- The number of transfers done did not change intrahospital transportation practice.
- Resource limitations and education seem to be the major contributors to low compliance.

Abstract

Purpose:

There is a paucity of guidelines for safe intrahospital transportation(IHT) in a resource-limited setting. The aim of this study was to describe the practices of IHT of critically ill patients perioperatively by anaesthetists.

Methods:

We conducted a prospective, cross-sectional study including 101 IHTs between theatre and intensive care unit (ICU). The most senior anaesthetist completed an adapted questionnaire. Frequency distributions were described, and Chi-square/Fisher's exact tests were performed to identify associations between IHT practices and categorical variables with anaesthetist seniority and first and subsequent IHTs.

Results:

The majority(72.97%) of the variables investigated were below the expected compliance rate(75%). Only 22.80% of anaesthetists were aware of IHT guidelines. Statistically significant differences were observed in IHT practices between senior and junior anaesthetists for: airway equipment taken(OR 0.25 95% CI 0.08-0.84), emergency drugs taken(inotropes(OR 1.49 95%CI 1.29-1.73), muscle relaxants(OR 5.81 95% CI 1.70-19.83), induction agents(OR 7.23 95% CI 1.86-28.13)) and awareness of IHT guidelines(OR 1.35 95% CI 1.20-1.53); and between first and subsequent transfers for: notification of the current condition(OR 0.23 95% CI 0.08-0.71), use of manual resuscitation bag(OR 3.64 95% CI 1.21-11.00), and awareness of IHT guidelines(OR 0.14 95% CI 0.04-0.49).

Conclusion:

The majority of IHT practices interrogated during this study were below the expected compliance level irrespective of the seniority of the anaesthetist or the number of IHTs. Resource limitations and education seem to be the major contributors.

Introduction

Critically ill patients have life threatening injuries or illnesses that are often associated with reduced physiological reserves. These patients often require transfer from the intensive care unit (ICU) to other departments in the hospital for therapeutic or diagnostic purposes [1]. The risks associated with intrahospital transportation (IHT) need to be outweighed by the benefits from the procedure required [2,3]. Critically ill patients should be monitored and receive physiological support during patient transport identical to that which would be given while in the ICU [2]. Transportation of these patients to various departments require highly trained and skilled medical practitioners with appropriate essential equipment [2]. It has been accepted that system failures and errors can stem from a culture of non-compliance, perceptions of invulnerability, or inherently poor practices [3].

Some studies from high income countries (HICs) and some low- and middle-income countries (LMICs) have highlighted the risk of adverse events occurring during IHT [1,4,5]. These adverse events that occur during IHT may have a direct or indirect role in influencing the patient's risk of morbidity and mortality [4,6–8]. The incidence of adverse events occurring during IHT can vary from 1.7% to 67.9% [4,9] depending on the level of experience of the practitioner present. A South African study noted that in the absence of an adverse event, a medical officer transporting a patient to the ICU perioperatively, as opposed to a registrar, was associated a higher in-hospital mortality rate [5]. This might allude to different levels of experience or skill sets having an impact on the patient's condition during an IHT [4,5]. Although some adverse events are inevitable, many are preventable [4].

Several guideline documents and checklists have been produced to guide safe IHT and thereby decrease IHT related adverse events [1,4,5,10–17] . These are summarised in Table 1.

While many guidelines exist in HICs, there is a paucity of standardized protocols or guidelines for safe IHT of critically ill patients in a resource-limited setting, specifically in South Africa [4]. At the time this study was conducted, there were no guidelines published by the South African Society of Anaesthetists (SASA) or the Critical Care Society of South Africa (CCSSA) for IHT of critically ill patients. It is at the discretion of the medical practitioner transporting a critically ill patient to determine the

equipment and drugs required during the IHT. To the best of our knowledge, there are no known studies that describe IHT practices in any LMICs. The aim of this study was to describe the current practices of IHT of critically ill patients perioperatively by anaesthetists in a quaternary hospital in South Africa.

Table 1-1:Overview of content of published IHT checklists and guidelines

Author		Warren et al. [13]	Fanara et al. [11]	Jarden and Quirke [14]	Brunsveld-Reinders et al. [12]	ANZCA guideline[15]	Williams et al. [1]	Geldenhuys et al. [4]
Year		2004	2010	2010	2015	2015	2020	2020
Administrative guidelines						+		
Pre IHT	Patient assessed prior to transfer	+	+	+		+		+
	IHT to destination beneficial/ required	+					+	+
	Transport team required	+	+	+		+		
	Consent confirmed		+	+			+	
	Equipment and consumables present	+	+	+	+	+	+	+
	Sufficient oxygen level in cylinder	+	+		+	+	+	+
	Sufficient IV medication present	+	+	+	+	+	+	+
	Extra IV fluids and medication	+	+	+	+	+	+	+
	Enteral feeding and insulin stopped				+			
	Check tubes and lines		+	+	+	+	+	+
	Suctioned airway						+	
	Check and set monitor alarms	+	+	+	+	+	+	+
	Check and set transport ventilator alarms	+	+		+	+		+
	Preparation and equipment adapted to procedure. (MRI compatible)	+	+		+		+	
	Register baseline vital signs	+	+	+	+	+	+	+
	Notification of destination department	+			+	+	+	+
	Transport route clear		+			+		+

Author		Warren et al. [13]	Fanara et al. [11]	Jarden and Quirke [14]	Brunsveld-Reinders et al. [12]	ANZCA guideline [15]	Williams et al. [1]	Geldenhuys et al. [4]
Year of publication		2004	2010	2010	2015	2015	2020	2020
During IHT	Equipment checked	+		+	+	+		+
	Record IV fluids or medication given			+	+	+	+	+
	Vital signs recorded every 20min	+		+	+	+	+	+
Post IHT	Enteral feeds and insulin restarted				+			
	Humidifier switched on				+			
	HME filter changed				+			
	Suction bag changed if used			+	+			
	Transport bag restocked				+			+
	Equipment placed on charge							+
	Reported any adverse events on route			+	+	+	+	+
	Handed over to destination staff	+		+	+	+	+	+

Method

This was a prospective cross-sectional study that focused on IHTs between the ICU and operating theatre, conducted by an anaesthetist in a quaternary, academic hospital in Johannesburg, South Africa, from December 1st, 2021, to February 28th, 2022, during the second wave of the COVID-19 pandemic.

Approval was obtained from the Human Research Ethics Committee (M210708) and relevant authorities. The study included patients transported between theatre and the following ICUs: medical, surgical, trauma, neurosurgery, and cardiothoracic. Table 2 summarizes the capacity and average number of monthly admissions from the theatre for each ICU and highlights the differences in numbers during the COVID-19 pandemic.

A minimum sample size of 80 was determined using StatCalc® with the following assumptions: a population size of 100 transfers per month, an alpha error of 5%, a 95% confidence interval, and an expected minimum compliance of 75%.

The current IHT practices were not known in LMICs. Compliance to IHT guidelines is unlikely to be the same as HICs due to the limited resources, thus an expected compliance rate was adjusted to 75%.

Table 1-2: Capacity of various ICUs and number of admissions from theatre

ICU	Number of beds available	Discipline ICU serves	Average number of admissions from theatre over a month	
			Pre/post covid peak	During covid peak
Main ICU	24	Medical, Surgical and covid patients	27	11
Cardio-thoracic ICU	6	Cardiothoracic	32	16
Neurosurgery ICU	8	Neurosurgery	16	17
Trauma ICU	12	Trauma	22	24

The study population consisted of any anaesthetist at the hospital who transported a critically ill patient between the theatre and ICU during the study period. In this study, a junior anaesthetist was defined as an anaesthetist with less than or equal to three years' anaesthetic experience and a senior anaesthetist was defined as an anaesthetist with more than three years' anaesthetic experience. A critically ill patient was defined as any patient requiring cardiovascular, respiratory, renal, or neurological organ support, needing ICU admission for mechanical ventilation, inotropic infusions, intensive monitoring, or other supportive measures.

The questionnaire used for the study was adapted from Williams et al's checklist (1). Adaptations were made to account for the use in a resource-limited environment, as the checklist was originally developed and designed for use in a HIC. The adapted questionnaire contained seven sections with 58 variables in total, namely: demographics of the patient and participant, patient destination, patient preparation, airway management, emergency drugs, adverse events, and potential barriers to adherence to guidelines (Supplementary file 1). Questionnaires were made available electronically and were completed by the most senior anaesthetist accompanying the patient after IHT. Participation in the study was voluntary and completion of the questionnaire implied consent.

The inclusion criteria for the study included patients aged >12 years, critically ill, undergoing IHT between the ICU and theatre, and IHT done during the perioperative period by an anaesthetist. Exclusion criteria included IHT of critically ill patients to/from a ward/high care setting, IHT to/from endoscopy and radiology suites, and incomplete questionnaires.

The data was analysed using IBM SPSS version 21 (SPSS version 21.0; IBM Corporation, Armonk, NY, USA) statistical software. Frequency distribution was expressed in numbers and percentages for categorical variables . Chi-square and Fisher's exact tests were performed and univariant odds ratio and 95% confidence interval was calculated where appropriate comparing junior with senior anaesthetists' practices and first IHT with subsequent IHT practices with categorical variables. Statistical significance was set at a p-value of < 0.05.

Results

A total of 104 questionnaires were completed, of which 101 met the inclusion criteria (Figure 1). Tables 3 and 4 provide information about the demographics of the patients and anaesthetists, respectively.

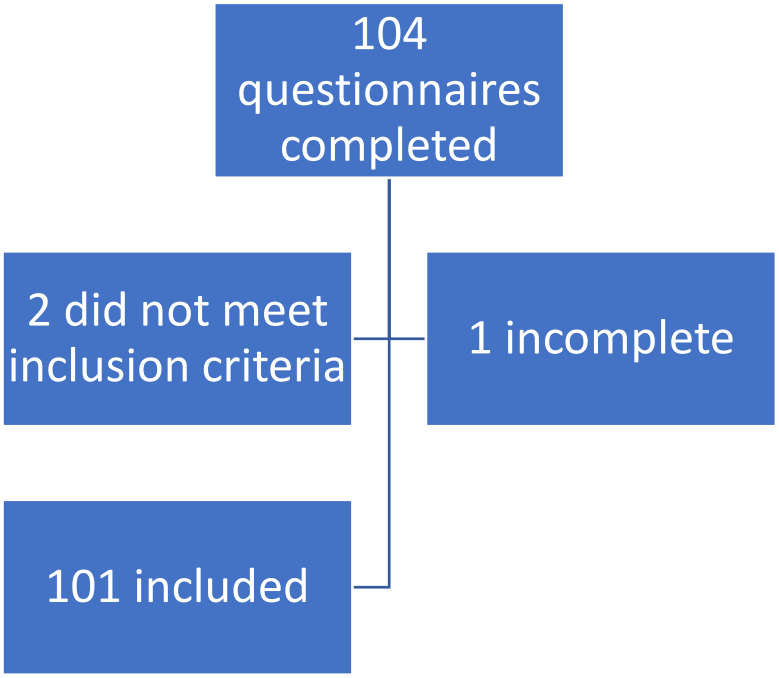


Figure 1-1: Study flow diagram

Table 1-3:Patients' demographics

Variables	n (%)
Age	
12-18	4 (3.96)
19-30	18 (17.82)
31-40	18 (17.82)
40-65	41 (40.59)
>65	20 (19.80)
ASA category	
ASA 1	1 (1.00)
ASA 2	10 (9.90)
ASA 3	61 (60.40)
ASA 4	26 (25.74)
ASA 5	3 (2.97)
ASA 6	0
Transfer from	
ICU	35 (34.65)
Theatre	66 (65.35)
IHT destination	
To ICU	78 (77.23)
To theatre	23 (22.77)
Reason for requiring ICU care	
Mechanical ventilation	60 (59.41)
Inotropic support	34 (33.66)
Intensive monitoring	90 (89.11)
Renal replacement therapy	12 (11.88)

Table 1-4: Anaesthetists' demographics

Variables	All n (%)	Seniority of anaesthetist	
		Junior n=13	Senior n= 88
Age			
25-30	19(18.81)	7(53.85)	12(13.64)
31-40	58(57.43)	5(38.46)	53(60.23)
41-60	15(14.85)	0	15(17.05)
>60	9(8.91)	1(7.69)	8(9.10)
Gender			
Female	58(57.43)	3(23.08)	55(62.50)
Male	43(42.57)	10(76.92)	33(37.50)
Level of Training			
Medical officer	5(4.95)	3(23.08)	2(2.27)
Registrar	91(90.10)	10(76.92)	81(92.05)
Consultant	5(4.95)	0	5 (5.68)
Number of times participated in study			
1	44(43.56)	8(61.54)	36 (40.90)
> 1	57(56.44)	5(38.46)	52 (59.10)

The study investigated 37 different variables related to IHT practices and found that 27 (72.97%) of these variables were below the expected compliance rate of 75%. Consent was checked by 91.10% of anaesthetists, and vitals were checked by 99% of anaesthetists prior to IHT.

Only 23 (22.80%) anaesthetists were aware of IHT guidelines, including guidelines from the Association of Anaesthetists (AA), National Institute for Health and Care Excellence (NICE), and the Association of Anaesthetists of Great Britain and Ireland (AAGBI). Among the 44 first-time participants, only 6.80% (n=3) were aware of IHT guidelines. Whereas, of those having subsequent transfers, 35.10% participants (n=20) were aware of IHT guidelines. This comparison was statistically significant (OR 0.14 95% CI 0.04-0.49, p-value = 0.001).

No anaesthetist reported a major adverse event occurring during IHT. These include accidental extubation, airway obstruction, hypotension requiring management, new onset arrythmias, initiation of cardiopulmonary resuscitation, infusion pump failure,

monitor failure and ventilator failure. Most anaesthetists (67.30%) reported no barriers to adherence to IHT guidelines, while 32.70% reported potential barriers to practicing safe IHT guidelines (Figure 2).

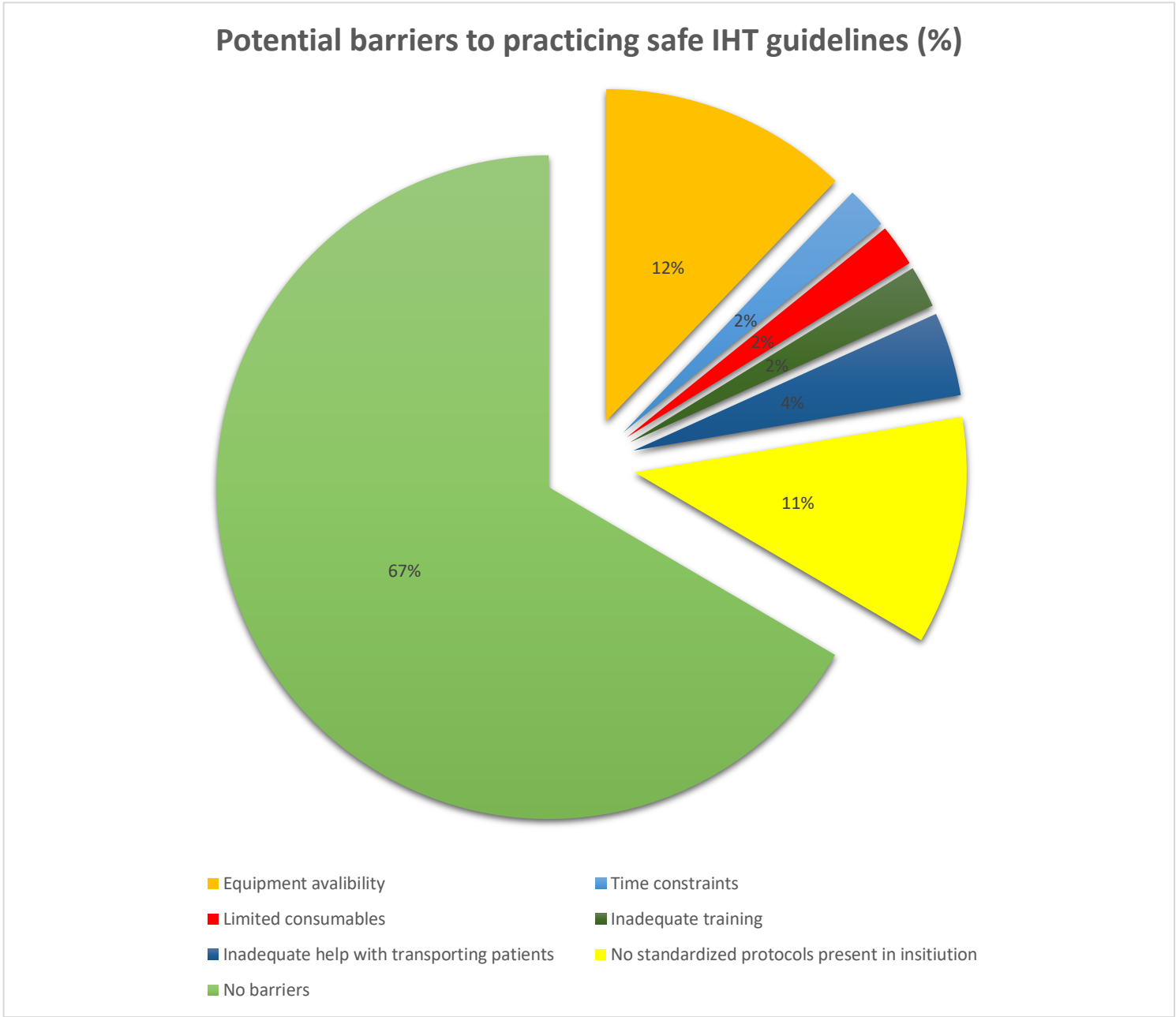


Figure 1-2: Potential barriers to practicing safe IHT guidelines

Table 5 presents the current practices of anaesthetists during IHT of critically ill patients perioperatively between theatre and ICU, and the comparisons based on seniority and number of IHTs performed.

There were no statistically significant differences in IHT practices between junior and senior anaesthetists, except in five variables, namely: airway equipment taken during IHT (supraglottic devices), emergency drugs taken during IHT (inotropes, muscle relaxants, and induction agents) and awareness of IHT guidelines. There were statistically significant differences in IHT practices between first and subsequent transfers for the following variables: notification of the current condition, use of manual resuscitation bag, and awareness of IHT guidelines.

Table 1-5: Comparison of IHT practices based on seniority of anaesthetist and number of IHTs done

	All	Senior vs Junior anaesthetists		First vs subsequent IHT	
Practices done prior to IHT	n (%)	Odds Ratio (CI 95%)	p-value	Odds Ratio (CI 95%)	p-value
Notification of destination prior to IHT	99 (98.00)[#]	1.02 (0.99-1.06)	1.00	0.96 (0.90-1.02)	0.19
Expected time of arrival	67 (66.30)	1.16 (0.33-4.09)	1.00	0.47 (0.20-1.09)	0.08
Notification of current condition	83 (82.10) [#]	0.43 (0.11-1.58)	0.24	0.23 (0.08-0.71)	0.01*
Infusions required on arrival	49 (48.50)	1.83 (0.56-6.05)	0.31	1.57 (0.67-3.39)	0.29
Requirement of ventilator support	57 (56.40)	1.27 (0.39-4.20)	0.69	1.43 (0.64-3.18)	0.38
Route cleared of potential delays prior to IHT	66 (65.35)	1.22 (0.35-4.30)	1.00	0.51 (0.22-1.18)	0.11
IV line checked and flushed	98 (97.00) [#]	0.28 (0.02-3.32)	0.34	1.56 (0.14-17.82)	1.00
Monitors checked and used					
Pulse oximeter	99 (98.00) [#]	0.14 (0.01-2.35)	0.24	1.04 (0.99-1.09)	0.50
ECG	90 (89.10) [#]	-	0.35	3.93 (0.81-19.25)	0.11
NIBP or invasive BP monitoring	92 (91.00) [#]	-	0.60	7.02 (0.84-58.42)	0.07
Practices during IHT					
Airway equipment taken with during IHT					
Oropharyngeal/ nasopharyngeal airway	23 (22.8)	1.61 (0.45-5.82)	0.49	1.00 (0.93-2.54)	0.99

Supplemental oxygen device (e.g.: Nasal prong oxygen)	55 (54.5)	0.97 (0.30-3.13)	0.96	0.86 (0.39-1.89)	0.70
Extra endotracheal tubes (appropriate sizes)	5 (5.00)	1.06 (1.01-1.12)	1.00	0.31 (0.03-2.86)	0.38
Emergency supraglottic device	74 (73.3)	0.25 (0.08-0.84)	0.02*	0.63 (0.26-1.54)	0.31
Laryngoscope with appropriate blade sizes	1 (1.00)	0.92 (0.79-1.08)	0.13	0.97 (0.93-1.02)	0.44
Airway management					
Airway was suctioned	49 (48.50)	0.67 (0.19-2.43)	0.54	0.74 (0.29-1.86)	0.52
ETT size and depth noted if patient was intubated	52 (51.50)	0.31 (0.06-1.54)	0.16	0.31 (0.07-1.93)	0.15
ETT tape/securing device checked and secured (if intubated)	59 (58.40)	0.18 (0.01-3.15)	0.30	0.74 (0.04-12.33	1.00
IHT practices related to Transport ventilator					
Transport ventilator was used during IHT	45 (44.60)	6.00(0.71-50.47)	0.08	0.77 (0.29-2.09)	0.61
Battery level of ventilator checked	42 (41.60)	0.71 (0.07-7.71)	1.00	0.56 (0.07-4.36)	0.62
Ventilator checked for leaks	37 (36.60)	0.45 (0.01-2.26)	0.38	0.32 (0.08-1.35)	0.15
Ventilator settings and alarm limits set	43 (42.60)	0.46 (0.04-5.68)	0.49	1.19 (0.10-14.14)	1.00
IHT practices related to manual resuscitation bag					
Manual resuscitation bag was **not** taken	27 (26.70)	0.54 (0.10-3.04)	0.69	0.72 (0.29-2.00)	0.57
Manual resuscitation bag was used	19 (18.80)	0.34 (0.04-2.98)	0.43	3.64 (1.21-11.00)	0.02*
Appropriately sized masks were present	31 (30.70)	1.12 (0.29-4.29)	0.87	1.02 (0.36-2.77)	0.97
PEEP valve was attached to manual resuscitation bag	27 (26.70)	1.04 (0.23-4.67)	1.00	0.92 (0.31-2.68)	1.00
IHT practices related to oxygen cylinder					
Oxygen cylinder was taken	90 (89.10) #	- ^	0.35	2.23 (0.56-8.96)	0.34
Oxygen gauge was checked for leaks	92 (91.10) #	- ^	1.00	0.39 (0.03-4.39)	0.58
Oxygen cylinder was full	84 (83.20) #	- ^	0.35	1.73 (0.49-6.20)	0.54

IHT practices related to emergency drugs					
Adequate volumes of drugs were prepared	85 (84.20) #	1.03 (0.99-1.07)	1.00	1.04 (0.99-1.10)	0.52
Battery life of infusion pump was checked when infusion pumps taken during IHT	47 (46.50)	0.35 (0.05-2.29)	0.27	0.96 (0.18-5.24)	1.00
Drugs taken with during IHT					
Inotropes	72 (71.30)	1.49 (1.29-1.73)	0.02*	0.93 (0.39-2.22)	0.87
Muscle relaxant	27 (26.70)	5.81 (1.70-19.83)	0.01*	1.94 (0.80-4.73)	0.14
Induction agent	12 (11.90)	7.23 (1.86-28.13)	0.002*	0.39 (0.10-1.54)	0.17
Sedation	52 (51.50)	1.6 (0.49-5.28)	0.44	1.46 (0.66-3.23)	0.35
Analgesia	53 (52.50)	2.25 (0.65-7.85)	0.24	0.61 (0.27-1.34)	0.21
Awareness of any IHT guidelines	23 (22.80)	1.35 (1.20-1.53)	0.04*	0.14 (0.04-0.49)	0.001*

Above expected compliance level of 75%; * Significant association (p value < 0.05) ^ Calculation not done due to small numbers in each group

Discussion

Our study's primary finding was that only 27.03% of IHT practices that were investigated were above a compliance rate of 75%. This was unexpectedly low, even after having adjusted the compliance rate. This is below multiple HIC's IHT practices which range from 80.8% to 98.5% compliance [1,18–20]. Multiple studies have highlighted the risks associated with the IHT of critically ill patients and the need to improve patient safety [1,3,12,18,21–23]. There has been a recurrent theme of limited resources and/or the disconnect of knowledge and practice during IHT in this study.

Williams et al. [1] reported that 86.7% of IHT practices were in accordance with the ANZCA/CICM/ACEM intercollegiate guidelines. In this study, the authors conducted a prospective, pre-, and post-interventional study on the IHT of 76 critically ill patients in a tertiary academic hospital in Australia to compare compliance with locally recommended guidelines before and after the introduction of a transport checklist. A statistically significant difference in compliance was noted after the introduction of the transport checklist. This was not noticeable in our study if subsequent transfers were regarded as the post-interventional phase. In our study, there were statistically significant differences in only three IHT practices between first and subsequent transfers: notification of the current condition, use of manual resuscitation bag, and awareness of IHT guidelines.

While acknowledging the importance of all practices recommended by IHT guidelines, it is essential to recognize that some practices are more critical than others. In a prospective observational study by Winter et al. [20] compliance with recommended guidelines during IHT occurred 83.3% of the time. Although this study also highlighted compliance was not fully achieved, key practices were performed 100% of the time, namely the presence of manual resuscitation bag, infusion pumps with alarms and suction availability during IHT [20] . This is significantly higher than what was reported in our study; 73.3% of IHTs had the presence of a manual resuscitation bag and infusion pumps were checked in 46.5% of IHT. The presence of suction during IHT was not assessed because portable suction is not readily available at our institution. Each theatre has its own manual resuscitation bag allocated, and thus is available for use during IHT. This precludes resource limitations as being the only factor for the variance in IHT practices. Possible explanations

include a disconnect between knowledge and practice or a false sense of security due to no adverse events being reported in this study. The variances between other studies in HICs illustrated above could be a result of compliance rates being measured using different methods and guidelines in each publication.

Many of the IHT guidelines [1,11,13,15–17,23,24], often used in HICs, specify the presence of a specialist during IHT. Adherence to this recommendation occurred rarely in this study (5%), this is often due to a limited number of specialists in the department. A specialist is frequently responsible for multiple theatres with a registrar/medical officer present for the full duration of the surgery in each theatre. Due to this limitation, the use of a specialist to idealistically lead each IHT, can be difficult. The majority of participants in this study were registrars, a further explanation for the differences in current IHT practices.

Another explanation for the differences in compliance is the disconnect of knowledge and practice. A substantial proportion of participants, 67.30%, reported no barriers to safe IHT. However, overall compliance in this study was found to be 27.03%. The care for a critically ill patient and the IHT of these patients is included in the curriculum for the Diploma in Anaesthesia (DA), usually completed within the first year of anaesthesia practice, and the Fellowship of the College of Anaesthetists (FCA) final exit exam. Despite having received theoretical knowledge regarding safe transfer of patients, adherence to recommended practices is subpar. This precludes knowledge as being the only factor for the variance in IHT practices and increases the probability of participants transporting critically ill patients with a false sense of security or invulnerability.

Previous publications have found an association between the transferring doctor's level of experience and the occurrence of adverse events, alluding to a difference in practices based on seniority [5,25]. This was not found during our analysis of practices between junior and senior anaesthetists in most categories. When compared to senior anaesthetists, junior anaesthetists were more likely to take a rescue airway device (supraglottic device) during IHT. Senior anaesthetists were more likely to be aware of IHT guidelines and ensure adequate volumes of emergency drugs were available for IHT when compared to junior anaesthetists. The absence of standardized protocols or guidelines in the institution could infer that these practices were guided by previous adverse events . Senior anaesthetists may

also have better insight of the logistics involved and anticipate potential problems that they could encounter during IHT compared to junior anaesthetists. This could be attributed to experience, management of more complex patients, time spent in intensive care units and the amount of time senior anaesthetists have spent in the institution as part of their training.

The majority of the participants (77.20%) were not aware of IHT guidelines. This implies that participants' practices are rooted in tradition, departmental teachings, or long-standing habits, rather than being informed by evidence-based practices. This is in keeping with another South African study by Jordan et al, which showed that more than half of ICU nurses in the public and private sector were not aware of evidence-based practices [26].

Multiple studies have highlighted that the use of IHT checklists improve safety [1,3,12,21–23]. Fanara et al. had subdivided IHT-related adverse events into human-, equipment-, organisational- and patient-related factors [11]. A more significant change in practices was anticipated in our study as the questionnaires were perceived to function as a reminder or checklist for IHT. Despite being exposed to a checklist, practice of anaesthetists in this study did not change significantly except for differences in human- (notification of the current condition and organisational-related factors (awareness of IHT guidelines). The questionnaires in our study were completed after IHT, while the majority of the aforementioned studies used checklists either during or before IHT and therefore found an improvement in compliance with recommended practices [1,12,16,23]. Although completion of a checklist after an IHT may not be an effective method to improve IHT practices, it is an effective method to assess differences in applied knowledge of IHT. Thus, the introduction of a standardized checklist prior to IHT might provide a more effective method to improve IHT practices in a resource-limited setting.

The recurrent theme of complacency during IHT is also highlighted by the decreased likelihood of a senior anaesthetists taking a supraglottic device with during IHT and anaesthetists during their subsequent IHT were less likely to take a manual bag resuscitator during transfer.

This alludes to anaesthetists, irrespective of their level of experience, not continuously applying what was learnt for safe IHT. This emphasizes the potential

benefit in introducing a standardized protocol or checklist for safe IHT in the LMIC setting. Thus, the introduction of a standardized protocol, checklist or guideline may improve IHT practices in a resource-limited setting. Simulation based training may aid in reducing the discrepancies in safe IHT practices between HICs and LMICs. Manggala et al.[27] have highlighted the benefits of high-fidelity simulations on transferring critically ill patients during the SARS COVID-19 pandemic. These benefits include improved global performance skills, communication, and teamwork during IHT of critically ill patients.

Although there is a lower-than-expected compliance to practices, no adverse events were reported in our study. We only enquired about major adverse events during IHT and not minor physiological changes. The possibility of self-reporting bias must be considered when conducting any questionnaire. The incidence of adverse events during IHT is reported to range from 1.70%-67.90% in other studies [4,9,21,22,28] . Veiga et al [8] found that the incidence of clinical and non-clinical events during IHT in another LMIC with a similar setting as our study was 7.50% and 8.00% respectively.

The majority of participants reported no barriers to adhering to safe IHT guidelines, while 10.9% highlighted that there were no standardized protocols present in the institution and 4% reported inadequate training for IHT. Due to the SARS COVID-19 pandemic, the institution’s simulation-based training was suspended during the study period which could have contributed to some participants feeling there was inadequate training. Although competency based training and assessments for IHT are well established in many HICs, 95% of these trainees still reported the need for formal training in IHT [25]. The large disparity in trainees reporting the need for formal training in HIC and our institution highlights the apparent lack of significance placed on transfer care.

A strength of this study is that it focused on IHT practices of anaesthetists with varying levels of experience, transferring a heterogenous population of critically ill patients from different ICUs. The study was conducted prospectively, limiting recall bias. Standardized statistical tests were used, and the study is easily replicable. This allows this data to function as a baseline for other studies in LMICs.

Our study had some limitations. It was conducted in a single institution, investigating the IHT practice of only anaesthetists alone making it difficult to generalise these

findings to practice in other practitioners involved in the care of critically ill patients. Institution specific factors that affect IHT with specific reference to adverse events, namely human- (relating to transport teams), equipment-, organisational- and patient-related factors as described by Fanara et al., could not be delineated during data analysis [11].

The data was collected from self-reported questionnaires after IHT was completed. When comparing adherence rates between self-reported and objective measures of adherence, self-reported adherence rates have been shown to exceed the objective adherence rates [29]. While self-reported questionnaires may provide useful information with minimal impact on service delivery and are somewhat easier to implement in an institution, they are subject to bias and should not be used as the only measure of guideline adherence.

The data for comparisons between first vs subsequent IHT practices are at risk of bias as well. The hawthorne effect could have been present as participants were aware their IHT practices were being observed. Cognitive bias is another consideration as participants were aware their transfer was the first IHT vs a subsequent IHT.

Another limitation of this study is that IHT of the paediatric population and IHT to remote sites were excluded; and these are known to have a higher incidence of adverse events and may require more specific equipment and expertise [30,31].

This study highlights areas which can improve IHT safety considerably in a relatively cost-effective manner. Further studies should focus on the perceived importance of IHT, what resources are available for safe IHT and the adverse events and/or physiological changes that occur during IHT in resource-limited setting. This will be required to afford the development of an IHT guideline suitable for a resource-limited setting. These studies should include other specialties and be conducted as a multicentre pre- and post-intervention observational study once an appropriate guideline has been proposed.

Bearing in mind the lack of previous studies, this study offers an important contribution to the literature and sets the path for future researchers. Research data can be used as a foundation for institutions in LMICs to develop guidelines tailored to

the resources available in their setting while ensuring adequate patient care is achieved.

Conclusion

This is one of the first studies to describe the current IHT practices in a LMIC and highlights the disparity in practice between HIC and LMIC. Although this is multifactorial, resource limitations, lack of significance placed on IHT practices and education seem to be the major contributors.

More than half of IHT practices interrogated during this study were below the expected compliance level irrespective of the seniority of the anaesthetist or the number of IHTs done during this study.

Practitioners performing IHT need appropriate training and the importance of safe IHT practice must be emphasised. There is a need for a clear and considered guideline to ensure standardized and safe IHT practice.

Ethics approval and consent to participate

Approval to conduct this study was obtained from Human Research Ethics Committee (M210708) and relevant departments.

Informed consent was implied from all participants on completion of the electronic questionnaire.

Consent for publication

Every author gave their approval on the final version of the manuscript.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors' contributions

Bhavic Mawjee: Project administration, Conceptualization, Investigation, Methodology, formal analysis, Writing – original draft, Writing – review & editing.

Sujai Mohanadasan: Project administration, Conceptualization, Writing – review & editing, supervision.

Zainub Jooma: Project administration, Conceptualization, formal analysis, Writing – review & editing, supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. This research was completed as partial fulfilment of a Masters in Anaesthesiology degree at the University of the Witwatersrand.

Data availability

The de-identified datasets used and analysed during the current study are available from the corresponding author on reasonable request.

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Supplementary file 1: Questionnaire

Demographics of Patient

1. Age of patient *

   Mark only one oval.

   - ≤ 12
   - 13-18
   - 19-30
   - 31-40
   - 40-65
   - ≥ 65

2. ASA category *

   Mark only one oval.

   - ASA 1
   - ASA 2
   - ASA 3
   - ASA 4
   - ASA 5
   - ASA 6

3. Please select reasons for the patient requiring ICU care. More than one option can be selected *

Check all that apply.

- [ ] Mechanical ventilation
- [ ] Inotropic support
- [ ] Intensive moinitoring
- [ ] Renal replacement therapy

Other: [ ] _____

Demographics of Participant

4. Age *

Mark only one oval.

- ◯ 25-30
- ◯ 31-40
- ◯ 41-60
- ◯ >60

5. Sex *

Mark only one oval.

- ◯ Female
- ◯ Male
- ◯ Prefer not to say
- ◯ Other: _____

6. Level of training (the most senior person involved in the IHT) *

Mark only one oval.

- ◯ Medical Officer
- ◯ Registrar
- ◯ Consultant

7. Years of experience in anaesthesia *

Mark only one oval.

- ◯ ≤ 3 years
- ◯ > 3 years

8. How many times have you participated in this study? *

Mark only one oval.

- ◯ One
- ◯ Two
- ◯ Three
- ◯ Other: _____

Patient Destination

9. Where was the patient being transferred FROM? *

Mark only one oval.

- ◯ Main ICU (576/567)
- ◯ Trauma ICU
- ◯ Cardio-thoracic ICU
- ◯ Neurosurgery ICU
- ◯ Theatre

10. Where was the IHT destination? *

Mark only one oval.

- ◯ Main ICU (576/567)
- ◯ Trauma ICU
- ◯ Cardio-thoracic ICU
- ◯ Neurosurgery ICU
- ◯ Theatre

Patient preparation prior to intrahospital transportation (IHT)

11. Was consent checked? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Not applicable

12. Were vitals recorded prior to IHT? *

Mark only one oval.

- ◯ Yes
- ◯ No

13. Was IHT destination notified? *

Mark only one oval.

- ◯ Yes
- ◯ No

14. If yes, which of the following actions were done? More than one option can be selected

Check all that apply.

- [ ] Expected time of arrival
- [ ] Notification of of current condition of patient
- [ ] Infusions required on arrival (eg: preparation of inotropes)
- [ ] Requirement of ventilatory support

15. Was the route cleared if expected IHT had potential delays ? (eg: Elevators) *

Mark only one oval.

- ◯ Yes
- ◯ No

16. Was IV access confirmed and flushed prior to IHT? *

Mark only one oval.

- ◯ Yes
- ◯ No

17. Which of the following monitors were checked and taken with for IHT? More than one option can be selected *

Check all that apply.

- [ ] Pulse oximetry
- [ ] ECG
- [ ] NIBP or invasive BP monitoring

Other: [ ] _____

Airway management and Ventilatory support

18. Which of the following airway equipment was taken with for IHT? More than one option can be selected *

Check all that apply.

- [ ] Oropharyngeal/ nasopharyngeal airway
- [ ] Supplemental oxygen device (eg: Nasal prong o2)
- [ ] Extra endotracheal tube (appropriate sizes)
- [ ] Emergency supraglottic device
- [ ] Laryngoscope with appropriate blade sizes

Other: [ ] _____

19. Was the airway suctioned prior to IHT? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Not applicable

20. Was the ETT size and depth noted prior to IHT? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Not applicable, patient not intubated

21. Was the ETT tape/securing device checked and secured? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Not applicable, patient not intubated

22. Answer the following questions with regards to transport ventilation practice during IHT: *

Mark only one oval per row.

	Yes	No	Not applicable
Transport ventilator was used	◯	◯	◯
Battery level of ventilator checked	◯	◯	◯
Ventilator checked for leaks	◯	◯	◯
Ventilator settings and alarm limits set	◯	◯	◯

23. Answer the following questions with regards to manual ventilation during IHT: *

Mark only one oval per row.

	Yes	No	Not Avalible	Not applicable
Manual resuscitation bag was USED	◯	◯	◯	◯
Manual resuscitation bag was NOT taken	◯	◯	◯	◯
Appropriately sized masks were present	◯	◯	◯	◯
PEEP valve was attached to manual resuscitation bag	◯	◯	◯	◯

24. Answer the following questions with regards to the oxygen cylinder used during IHT: *

Mark only one oval per row.

	Yes	No	Not applicable
Oxygen cylinder was NOT taken	◯	◯	◯
Oxygen gauge was checked for leaks	◯	◯	◯
Oxygen cylinder was full	◯	◯	◯

Emergency drugs taken with during IHT

25. Were there adequate volume of drugs prepared prior to IHT? (eg: adrenaline infusion, sedation infusion) *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Not applicable

26. Was the battery life of the infusion pump checked? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Not applicable

27. Which of the following drugs were taken with you during IHT? More than one option can be selected *

Check all that apply.

- ☐ Inotropes
- ☐ Muscle relaxant
- ☐ Induction agent
- ☐ Sedation
- ☐ Analgesia

Intrahospital transport guidelines and adverse events

28. Are you aware of any IHT guidelines? *

Mark only one oval.

- ◯ Yes
- ◯ No

29. If yes, for above question, please state which guideline you are aware of.

_____

30. Were there any major adverse events from the IHT? If yes , please select appropriate box. More than one option can be selected. *

Check all that apply.

- ☐ No adverse event occurred
- ☐ Accidental extubation
- ☐ Airway obstruction
- ☐ Hypotension requiring management
- ☐ New onset arrythmia
- ☐ Initiation of cardiopulmonary resuscitation
- ☐ Infusion pump failure
- ☐ Monitor failure
- ☐ Ventilator failure

Other: ☐ _____

31. Were there any barriers to adhering to guidelines for safe transportation of critically ill patients for current transfer, only select barriers that are applicable for current IHT. More than one option can be selected *

Check all that apply.

- [ ] No barriers
- [ ] Equipment availability
- [ ] Equipment inadequately functioning
- [ ] Time constraints (eg: time pressured from senior or surgical team)
- [ ] Limited consumables (eg: Limited number of syringes or drugs)
- [ ] Inadequate training
- [ ] Inadequate help with transporting patients
- [ ] No standardised protocols present in institution

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Section 2: Authors guideline for Journal of Critical Care

JOURNAL OF CRITICAL CARE

Improving Patient Care by Integrating Critical Care Systems Knowledge into Practice Behavior

AUTHOR INFORMATION PACK

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ISSN: 0883-9441

DESCRIPTION

The Journal of Critical Care, the official publication of the World Federation of Intensive and Critical Care (WFICC) and the Society for Complex Acute Illness (SCAI), is a leading international, peer-reviewed journal that aims to improve patient care by publishing manuscripts that contain new or updated information that can be integrated into clinical practice, with the exception of experimental research.

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[dataset] [6] Oguro M, Imahiro S, Saito S, Nakashizuka T. Mortality data for Japanese oak wilt disease and surrounding forest compositions, Mendeley Data, v1; 2015. https://doi.org/10.17632/xwj98nb39r.1.
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Section 3: Proposal

Proposal: Assessment of current practices of intrahospital transportation in critically ill patients at an academic hospital in South Africa

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1.1. Introduction

Critically ill patients have life threatening injuries or illnesses that are often associated with reduced physiological reserves. Critically ill patients can be defined as any patient presenting with dysfunction or failure of one or more vital organs [1,2]. These patients are often required to be transferred from the intensive care unit (ICU) to other departments in the hospital for therapeutic or diagnostic purposes [3]. The risks associated with intrahospital transportation (IHT) need to be outweighed by the benefits from the procedure required [4,5]. Transportation of these patients to various departments require highly trained and skilled medical practitioners with appropriate essential equipment [4].

Multiple studies from high income countries (HICs) and some low- and middle-income countries (LMICs) have highlighted the risk of adverse events occurring during IHT [3,6,7]. The adverse events during IHT can have a direct or indirect role in influencing the patient's risk of morbidity and mortality [7–10]. These adverse events may also lead to an increased incidence of long-term complications such pneumothoraxes, atelectasis, deep vein thrombosis, prolonged length of intensive care unit stay, ventilator-associated pneumonia [11], raised intracranial pressure and cardiac arrest [7,12,13].

Although some adverse events are inevitable, many are preventable [7]. Incidence of adverse events occurring during IHT can vary from 1.7% to 67.9% [7,14] depending on the level of experience of the practitioner present. Physiologic changes that occur during IHT of critically ill patients can have a significant impact on the patient's mortality and morbidity [3,6,13,15]. A South African study noted that in the absence of an adverse event, a medical officer transporting a patient to the ICU perioperatively, as opposed to a registrar, was associated a higher mortality rate [6]. This might allude to different levels of experience or skill sets having an impact on the patient's condition during an IHT [6,7]. Critically ill patients being transported should be monitored and receive physiological support identical to that which would be given while in the ICU [15].

Fanara et al. [16] have subdivided IHT related adverse events into human-, equipment-, organisational- and patient-related factors [16]. This study highlighted patient-related factors such as physiologic changes in response to transportation as

not modifiable [16]. Modifiable factors such as human-related, equipment-related, and organisational-related factors need to be minimised to mitigate adverse events during IHT [8,16]. These factors are often related to poor planning [17,18].

Slave et al. [14] studied IHT of 47 critically ill patients ventilated with a manual resuscitator bag (as opposed to a transport ventilator) from theatre to ICU in a tertiary hospital in Johannesburg, South Africa [14]. They demonstrated an adverse event occurred in 26 patients; of which 41.7% were patient-related, 8.3% were equipment-related and 50% were organisational-related [14]. This finding is in keeping with another South African study conducted at a tertiary hospital in Durban where an adverse events incidence of 23.4% was found [6]. [14]. Meneguin et al. [19] reported an adverse rate of 11.3% in 459 IHT of critically ill patients in a tertiary hospital in Sao Paulo, Brazil. During these IHT, 82.7% were due to patient-related factors, while institutional-related (9.6%) and equipment-related factors (7.7%) followed [19].

Data from the Australian Incident Monitoring study was analysed by Beckmann et al [13];191 incidents that occurred during IHT were reviewed. It was found that 39% of adverse events were equipment-related while the other 61% was patient- or staff-related. The cause of most adverse events were multifactorial however human-related factors were highlighted to be the most common [13]. The human-related factors included poor preparation prior to transportation, haste, failure to follow protocols, errors of judgement and errors of problem recognition [13,17]. Geldenhuys et al. [7] devised a bundled intervention attempting to minimize the human-, equipment- and organisational-related factors contributing to adverse events [7]. The interventional bundle included: IHT protocol, a transport bag with emergency drugs based on the protocol and IHT simulation training [7].

Several guideline documents and checklists have been produced in order to decreased IHT related adverse events [1,3,6,7,16,18,20–24] . These are summarised in Table 1 and are recommended practises for safe IHT.

Table 3-1:Overview of content of published intrahospital transportation (IHT) checklists and guidelines

Author		Warren et al. [20]	Fanara et al. [16]	Jarden and Quirke [21]	Brunsveld-Reinders et al. [18]	ANZCA guideline[22]	Williams et al. [3]	Geldenhuys et al. [7]
Year		2004	2010	2010	2015	2015	2020	2020
Administrative guidelines						+		
Pre IHT	Patient assessed prior to transfer	+	+	+		+		+
	IHT to destination beneficial/ required	+					+	+
	Transport team required	+	+	+		+		
	Consent confirmed		+	+			+	
	Equipment and consumables present	+	+	+	+	+	+	+
	Sufficient oxygen level in cylinder	+	+		+	+	+	+
	Sufficient IV medication present	+	+	+	+	+	+	+
	Extra IV fluids and medication	+	+	+	+	+	+	+
	Enteral feeding and insulin stopped				+			
	Check tubes and lines		+	+	+	+	+	+
	Suctioned airway						+	
	Check and set monitor alarms	+	+	+	+	+	+	+
	Check and set transport ventilator alarms	+	+		+	+		+
	Preparation and equipment adapted to procedure. (MRI compatible)	+	+		+		+	
	Register baseline vital signs	+	+	+	+	+	+	+
	Notification of destination department	+			+	+	+	+
	Transport route clear		+			+		+

Author		Warren et al. [20]	Fanara et al. [16]	Jarden and Quirke [21]	Brunsveld-Reinders et al. [18]	ANZCA guideline [22]	Williams et al. [3]	Geldenhuys et al. [7]
Year of publication		2004	2010	2010	2015	2015	2020	2020
During IHT	Equipment checked	+		+	+	+		+
	Record IV fluids or medication given			+	+	+	+	+
	Vital signs recorded every 20min	+		+	+	+	+	+
Post IHT	Enteral feeds and insulin restarted				+			
	Humidifier switched on				+			
	HME filter changed				+			
	Suction bag changed if used			+	+			
	Transport bag restocked				+			+
	Equipment placed on charge							+
	Reported any adverse events on route			+	+	+	+	+
	Handed over to destination staff	+		+	+	+	+	+

Many of these guidelines recommend the IHT is done by ICU trained staff and are led by an intensivist [4,7,16,23,24]. Safely transporting critically ill patients has already become a workplace training objective with formal training provided in many HICs [25]. In a resource limited environment, the use of an intensivist as a team leader during transfers may not be feasible due the scarcity of specialists in the critical care environment [7].

These guidelines and checklists have a common goal of improving the quality of transport and thus minimizing adverse events and physiological changes that occur during IHT, however, they are of limited significance unless the medical practitioner at the bedside translates them into effective action [5].

Williams et al. [3] conducted a prospective pre- and post- interventional study at a tertiary hospital in Melbourne [3]. The primary objective of their study was to assess compliance to the guidelines recommended by the Australian and New Zealand College of Anaesthetists (ANZCA). Williams et al. [3] collected all the data points prior to IHT being commenced with the exception of variables which are normally completed post-IHT such as handover and documentation of observations [3]. Compliance to guidelines was reported as 86.7% prior to the introduction of the checklist [3]. After the introduction of checklist and education given to nursing staff and junior staff, compliance was improved from 86.7% to 90% [3]. Although Williams et al. [3] found no statistically significant improvement in compliance to guidelines, the use of a pre-transport checklist has shown to improve safety and quality in transporting critically ill patients [3,7,18,24]. Ash et al. [24] and Geldenhuys et al. [7] conducted prospective interventional studies focusing on adverse events during IHT after the introduction of checklists. Both these studies highlighted a significant decrease in adverse events during IHT [7,24]. The development of these checklists, by the respective authors, were guided by current guidelines, recommendations and previous checklists published [7,24]. This may allude to the use of checklists improving compliance to IHT guidelines.

1.2. Problem statement

Adverse events often occur during IHT of critically ill patients [6,7,10,24]. While many guidelines exist in HICs, there is a paucity of standardized protocols or guidelines for safe IHT of critically ill patients in a resource limited setting [7]. At the time of this

study, there are no guidelines published by the South African Society of Anaesthesiologists (SASA) or the Critical Care Society of South Africa (CCSSA) for transporting critically ill patients. After discussions with the ICU consultants at the academic hospital where the study will be conducted, no institutional policies regarding IHT of critically ill patients are present. It is the discretion of the medical practitioner transporting a critically patient to determine the equipment and drugs required during the IHT. A review of the current literature did not identify studies conducted on current practices of IHT of critically ill patients perioperatively by anaesthesiologists in South Africa. Conducting a study, focusing on current practises and potential barriers to safe IHT, may highlight patterns unique to resource limited countries. This data has the potential to advocate for the development of standardized protocols and guidelines, adequate resource allocation, improved patient care and a standardized level of training regarding safely transporting critically ill patients perioperatively.

1.3. Aim

1. To assess current practice of IHT of critically ill patients perioperatively by anaesthesiologists
2. To identify possible barriers to practicing recommended guidelines.

1.4. Objectives

1. Describe current practice during IHT of critically ill patients perioperatively by anaesthesiologists
2. Compare practice between junior and senior anaesthesiologists
3. Describe barriers to following recommended IHT guidelines
4. Compare IHT practice of first transfer to practice of IHT of subsequent transfer

1.5. Research assumptions

The following definitions will be used in the study:

Critically ill patient: Any patient requiring cardiovascular, respiratory, renal or neurological organ support, needing ICU admission for mechanical ventilation, inotropic infusions, intensive monitoring or other supportive measures [7].

Intensive Care Unit (ICU): A specialized area in the hospital; providing intensive and specialized medical and nursing care, enhanced capacity for monitoring and multiple

modalities of physiologic organ support to sustain life during a period of life threatening organ dysfunction [2]. The ICUs in this study will include main ICU, trauma ICU, neurosurgery ICU and cardiothoracic ICU.

Anaesthesiologist: HPCSA registered medical practitioner part of the anaesthesia department at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH), which includes medical officers, registrars, and consultants.

Medical officer: Is a qualified doctor practising in the Department of Anaesthesiology under specialist supervision.

Registrar: Is a qualified doctor who is registered with the Health Professional Council of South Africa as a trainee anaesthesiologist.

Consultant: A qualified anaesthesiologist who has completed advanced training in anaesthesia in accordance with the requirements of the Fellowship of the College of Anaesthesiologists and is registered with the Health Professions Council of South Africa, as an anaesthesiologist. A career medical officer, who is a medical officer with more than 10 years of experience, will be considered a consultant in this study.

Junior anaesthesiologists: An anaesthesiologist with experience as an anaesthesiologist for less than or equal to three years.

Senior anaesthesiologists: An anaesthesiologist with experience as an anaesthesiologist for more than three years.

Perioperatively: The period surrounding a surgical procedure, including the preoperative, intraoperative, and postoperative periods.

Intrahospital transport (IHT): Transport of critically ill patients from one area of a hospital to another area within the hospital. IHT in this study will only be limited to transfers between ICU and theatre complex at any time.

Subsequent transfer: the mean of number of IHT done by participants. Used for statistical analysis to compare practices of first IHT to subsequent IHT.

1.6. Demarcation of study field

Study will be conducted CMJAH, Gauteng, South Africa. Areas of focus include main ICU, trauma ICU, neurosurgery ICU, cardiothoracic ICU, and theatre complex.

CMJAH is a quaternary hospital in Johannesburg and is part of the University of Witwatersrand circuit. There are approximately 21 theatres operational daily. The table below summarises the capacity and average number of admissions per month from theatre for each ICU mentioned above.

Table 3-2: Capacity of various ICUs and number of admissions from theatre

ICU	Number of beds available	Discipline ICU serves	Average number of admissions from theatre over a month	
			Pre/post covid peak	During covid peak
Main ICU	24	Medical, Surgical and covid patients	27	11
Cardio-thoracic ICU	6	Cardiothoracic	32	16
Neurosurgery ICU	8	Neurosurgery	16	17
Trauma ICU	12	Trauma	22	24

1.7. Ethical considerations

Approval to conduct this study will be obtained from Human Research Ethics Committee (HREC) (medical), Graduate Studies Committee of the University of the Witwatersrand, the head of department of Anaesthesiology (Appendix A) along with the various Head of Departments for the respective ICUs. Permission to conduct study in various ICUs in CMAJH has been requested (Appendix A).

The study will be conducted in accordance with the Declaration of Helsinki [12] and the South African Guidelines for Good Clinical Practice [13]. The principal investigator will complete the required ethics courses as per the HREC of the university.

The study will not impact service delivery as the online form will not take longer than 10 minutes to complete. This will be achieved by devising questions in a succinct manner and using an easy–to-read checkbox or multiple-choice format. Participants will be able to access the questionnaire via a QR code or link provided via email.

Minimising the risk of spreading the SARS-CoV2 virus will be achieved by requesting participants to complete questionnaire on their own mobile device.

Participants will be given information on study and ethics approval prior to starting the questionnaire (Appendix B). Participation in study will be completely voluntarily and consent will be implied on completion of questionnaire. Once the questionnaire is fully completed, participants will receive voucher to redeem a cup of coffee from theatre complex cafeteria, Olives & Plates. This will be done to encourage participation. Participants will not be allowed to submit the questionnaire if any questions are left blank. This will deter any participants who wish to skew the data in study to receive the voucher code.

Anonymity of the participants will be maintained as no personal data, login details, email address or IP tracking will be necessary to access the questionnaire.

Permission has been obtained for use and adaptation of checklist from Williams et al (Appendix C).

Permission to conduct the study has been provisionally obtained by the CEO of CMJAH, Ms. Bogoshi. (Appendix E). The condition for approval includes HREC approval and post-graduate studies committee approval.

Raw data of study will be stored in a Microsoft excel file for six years. This will be stored on the Google forms database and backed up on a stand-alone pc. The raw data will only be accessible to the authors of the study, and data safety will be ensured by encrypting the file and use of a unique login details to the survey database.

If the results of the survey show that there is underutilisation of equipment available for transportation or poor practice of IHT of critically ill patients, the Head of the Department of Anaesthesiology as well as the Heads of Department of the various ICUs at our institution will be informed and suggestions will be made to improve awareness and education regarding the available equipment and standards of practise.

1.8. Research Methodology

1.8.1. Research design

This study will be a prospective, descriptive study design. Questionnaires will be completed by the most senior anaesthesiologist accompanying patient after IHT.

The study will be a prospective study as data will be collected for the duration of the study by anaesthesiologists after transporting critically ill patients between ICU and theatre complex. The study will describe current practices of IHT of critically ill patients by anaesthesiologists at CMJAH.

1.8.2. Study population

The study's population will be any anaesthesiologist transferring any critically ill patient (as per the definition in this study) between any of the mentioned ICUs and theatre at CMJAH during the study period.

1.8.3. Study sample

1.8.3.1. Sample size

After consultation with a biostatistician, using an average of 100 transfers of critically ill patients between the theatre complex and respective ICUs per month (based on the average number of transfers per month in the last month), a sample size of 75 transfers was determined to be adequate. This calculation was done using StatCalc® with the following assumptions: random sampling for survey/descriptive study with confidence interval of 95% and expected frequency of 75%.

Williams et al. [3] reported 86.7% of IHT prior to intervention were in compliance with recommended guidelines. This study was conducted in a HIC where resource limitations are minimal. It would be unrealistic to assume compliance to IHT guidelines are the same as a HIC due to the limited resources available in the current setting. An expected frequency of 75% is used as the current practices are not known in resource limited countries, thus an assumption of the adherence to standard practise occurring is set as 75%.

The sample size will be determined over the duration of three months or until the sample size is achieved.

1.8.3.2. Sampling method

In this study, non-probability sampling will be used. Individuals in the study population that are readily accessible will be selected to participate, thus a convenience sampling method will be used. Questionnaires will be made available electronically to anaesthesiologists transporting critically ill patients between ICU and theatre complex.

1.8.3.3. Inclusion criteria

- Age of patient > 12
- Critically ill patient
- IHT between ICU and theatre at CMJAH
    - Main ICU (576/567)
    - Trauma ICU
    - Neurosurgical ICU
    - Cardiothoracic ICU
- IHT done during perioperative period
- IHT done by anaesthesiologist

1.8.3.4. Exclusion criteria

- IHT of critically ill patient to ward/ high care setting
    - Obstetric high care
    - Folateng wards
    - Trauma high care (377)
    - Neonatal ICU
- Patients placed on cardio-pulmonary bypass or assist devices
- IHT to/from MRI suite or other imaging intervention
- IHT to/from endoscopy suites
- Incomplete questionnaires
- Patients admitted to the ICU not meeting the definition for critically ill as defined in this study

1.8.4. Data collection

Questionnaires will be completed by the most senior anaesthesiologist accompanying patient after IHT .The questionnaire used for study was adapted from Williams et al. [3]. The goal of that study was to assess if compliance to their guidelines would change after the introduction of a checklist. The checklist was developed using the guideline entitled: Transport of critically ill patients. This is an intercollegiate guideline from the Australian and New Zealand College of Anaesthetists (ANZCA) and College of Intensive Care Medicine of Australia and New Zealand (CICM) and Australasian College for Emergency Medicine (ACEM) [22]. The checklist was designed for use in a tertiary academic hospital in a HIC. The variables

mentioned in the checklist were selected by the authors, Williams et al. [3] after discussions with the consultant Anaesthesiologist and Intensivists in a tertiary hospital in Melbourne [3]. These variables covered the major sections of the intercollegiate guidelines.

Adaptations to this checklist have been done to account for use in resource limited environment [7]. The adapted questionnaire contains seven sections namely: demographics of patient, demographics of participant, patient destination, patient preparation, airway management, emergency drugs, adverse events, and potential barriers to adherence to guidelines. The adapted questionnaire can be reviewed in Appendix D.

The general section of the original checklist has been removed; this was done to maintain anonymity of patient data. A demographics section was added to allow for different levels of experience as anaesthesiologist to be compared. Patient destination information was included to attempt to identify if any behaviours changed based on destination.

The questionnaire elaborates on equipment taken during IHT as the department currently does not have a standardized airway/transport bag. End-tidal carbon dioxide monitoring and metaraminol were excluded from the questionnaire as they are not available in our setting.

The subsection, adverse events, was included to identify if any potential major adverse events occurred during IHT. Although this is not the main theme of the study, this information will be used to correlate current practices with adverse events. The major adverse events chosen for the questionnaire was based on the study by Seilbea and de Vasconcellos [2].

The questionnaire will be hosted by Google forms. The questionnaire will not require any personal details or login details. This will be accessible via a link provided or QR code.

Participants will receive an email containing a synopsis of the study and link to the questionnaire. Flyers with the QR code for the questionnaire will be placed in common areas to remind participants of current study; these will include notice boards in ICU and in the theatre complex and the anaesthesia tearoom. The

questionnaire will be completed by the participant using their own mobile phone, minimising the risk of spreading the SARS-CoV2 virus. Participants will be encouraged to complete the questionnaire by offering them a unique voucher code after completion of study. This voucher code will allow participants to redeem a cup coffee from the theatre complex cafeteria, Olives & Plates. Should they wish to participate in the study, a QR code will be made available to the participant after IHT is completed. Each IHT of a patient, IHT to theatre or IHT to ICU, will be counted as a single event. This allows for multiple transfers of the same patient on the same day or different days to be included. The practices of a patient being transported to theatre from ICU may differ to the IHT of the same patient returning to ICU from theatre, thus each IHT is counted as a single event. These differences may be due to equipment availability, different participants, or changes in clinical condition of patient.

1.8.5. Data analysis

Data collected will be captured onto spread sheets using Microsoft Excel 365. Data collected from the questionnaire will be summarised with the help of a biostatistician by using various descriptive statistics.

Categorical data will be expressed as percentages and frequencies.

Depending on the distribution of the data, variables will be described using means and standard deviations or median and interquartile ranges.

Comparison between junior and senior anaesthesiologists' IHT practices will be done by performing a chi-square test or a fisher exact test if the chi-square test assumptions are violated. A p-value of 0.05 will determine if a statistically significant difference is present. An odds ratio with a 95% confidence interval will be done, comparing junior to senior anaesthetist IHT practices and first to subsequent IHT for each variable.

1.8.6. Significance of the study

A South African study has shown an adverse event rate of 63.3% [7] during IHT of critically ill patients. Safe transporting practices have been shown to reduce adverse events during IHT [9,17,18,26], thus improving patient safety and care.

There is currently a paucity of data of current practises of IHT of critically ill patients in South Africa. There are no known or widely accepted IHT safety guidelines for

critically ill patients available at CMJAH or the hospitals associated with the University of Witwatersrand circuit. This study's results will assist in establishing the baseline practice of anaesthesiologists at CMJAH and may highlight any patterns or potential barriers to practising according to recommended guidelines. These results may also be utilised to develop a standardized protocol and assist in adequate resource allocation. The results may assist in identifying the need for more simulations/teaching about safe practises of transporting critically ill patients perioperatively to be incorporated into registrar training.

Identifying potential barriers to safe practises is another objective of the study. This can have a potential of improving patient care and safety as well as improving the burden of care on fellow anaesthesiologists in the department.

1.9. Validity and reliability of the study

The validity and reliability of the study will be maintained by the following:

- Use of an appropriate study design
- A clearly stated definition of critically ill patients
- Use of an adapted questionnaire which was validated and used in another published study [3]
- Calculation of the sample size in consultation with a biostatistician
- Analysis of data with the assistance of a biostatistician

1.10. Potential limitations of the study

- Limited to current practises done by anaesthesiologists between theatre and ICU
    - Cannot be generalized to transfers to other parts of the hospital
    - Cannot be generalized to other specialties transporting critically ill patients
- Self-reported survey
    - Can lead to bias
        - Over reporting
        - Recall bias
- Survey can act as prompt for checks to be done prior to IHT
    - Risk of skewing data
- IHT done during perioperative period

- Excludes IHT for non-surgical interventions, thus cannot be generalised to all patients who are critically ill. Remote sites have different levels of expertise as opposed to theatre; the latter has a set-up is more appropriate for management and resuscitation of a critically ill patient

1.11. Project outline

1.11.1. Time frame

Table 3-3: Time frame

Month	Feb 21	Mar 21	April 21	May 21	June 21	July 21	Aug 21	Sept 21	Nov 21	Dec 21	Jan 22	Feb 22
Proposal	X	X										
Ethics approval			X	X								
Postgraduate approval			X	X								
Data collection					X	X	X					
Data analysis								X	X			
Submission										X	X	X

1.11.2. Financial plan

Table 3-4:Financial plan

Description	Price per item	Number of pages/items	Copies	Total
Printing proposal	R2/page	33 pages	1	R66
Printing ethics	R2/page	10 pages	2	R40
Coffee	R25	100 cups		R2 500
Final Document	R2/Page	100 pages	3	R600
Binding	R300/copy		1	R300
Total				R3 506

The above-mentioned costs of the study will be incurred by the principal investigator.

1.12. References

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1.13. Appendices

1.13.1. Appendix A: Permission from the Head of Department

Dr B Mawjee

Department of Anaesthesiology

University of the Witwatersrand

Bhavicmawjee@gmail.com

March 2021

Dear Prof (Department)

I am currently conducting research for the completion of my M Med in Anaesthesiology titled: Assessment of current practices of intrahospital transportation (IHT) in critically ill patients at an academic hospital in South Africa

I hereby request permission to conduct my research by means of a self-administered electronic questionnaire over a three-month period. This will be completed by the most senior anaesthesiologist accompanying the patient after IHT. The protocol for my proposed study is attached to this email. The aims of this study are to assess current practice of IHT of critically ill patients perioperatively by anaesthesiologists at CMJAH and to identify possible barriers to practicing recommended guidelines.

A South African study has shown an adverse event rate of 63.3% during IHT of critically ill patients. Safe transporting practices have been shown to reduce adverse events during IHT, thus improving patient safety and care.

There are no known or widely accepted IHT safety guidelines for critically ill patients available at CMJAH or the hospitals associated with the University of Witwatersrand circuit. This study's results will assist in establishing the baseline practice of anaesthesiologists at CMJAH and may highlight any patterns or potential barriers to practising according to recommended guidelines. These results may also be utilised to develop a standardized protocol and assist in adequate resource allocation.

Should you require more information, please do not hesitate to contact me on 0711917585 or Bhavicmawjee@gmail.com.

Permission to conduct the study will be obtained from the Human Research Ethics Committee (Medical) and the Graduate Studies Committee of the University of the Witwatersrand.

Thanking you in advance. Sincerely

Dr Bhavic Mawjee

Registrar: Department of Anaesthesiology

I hereby give permission for this study

Name

Signature Date

1.13.2. Appendix B: Information sheet

Dear Colleague,

My name is Bhavic Mawjee. I am a registrar in the Department of Anaesthesiology at the University of the Witwatersrand, and I am currently busy with my MMed degree. I would like to invite you to participate in my research study titled: Assessment of current practices of intrahospital transportation (IHT) in critically ill patients at an academic hospital in South Africa. Identifying the current practice of transporting critically ill patients between ICU and theatre complex within the department will assist in the continued professional development in the department, improve patient outcomes and reduce hospital costs.

Participation is completely voluntary; consent will be implied on completion of this self-administered questionnaire. The questionnaire is anonymous. Confidentiality will be maintained as only the researcher and supervisor will have access to the raw data. Should you not wish to participate you can withdraw from the study at any time prior to the submission of the questionnaire.

The questionnaire should not take longer than 10 minutes to complete and participants are encouraged not to share the information provided.

Before completion of this questionnaire, please ensure that you understand the above information. Any questions regarding this study or want access of the final report, you can contact the following:

Bhavic Mawjee – 0711917585, bhavicmawjee@gmail.com

My supervisors:

Dr Sujai Mohanadasana at iajus24@gmail.com

Dr Zainub Jooma at zainub.jooma@gmail.com

The final report can be accessed at the Wits Institutional Repository Environment on DSpace (WIReDSpace) at www.wiredspace.wits.ac.za.

Permission to conduct the study has been obtained from the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg. A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concern regarding the way the study is being conducted, please contact the Chairperson of this Committee, Professor Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretary are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Thank you for taking time to read this letter.

March 2021

1.13.3. Appendix C: Permission to use and adapt checklist

From: Peter Williams
Sent: Monday, 14 September 2020 10:42
To: Bhavic Mawjee
Subject: Re: Request access to questionnaire assessing compliance with transportation safety guidelines

Hi Bhavic,

No problem. Please find it attached. I hope it helps.

Cheers,

Pete

On Tue, 8 Sep 2020 at 15:28, Bhavic Mawjee <bhavicmawjee@gmail.com> wrote:

> Good day Dr Williams
>
> My name is Bhavic Mawjee, I'm a medical officer in anaesthesia at Charlotte Maxeke Johannesburg Academic Hospital, Johannesburg, South Africa. I'd like to request permission from you and your colleagues to gain access and adapt the questionnaire used in your study "A checklist for intrahospital transport of critically ill patients improves compliance with transportation safety guidelines".
>
> I intend to conduct a study for my Mmed, "Assessment of adherence of intrahospital transportation safety guidelines in critically ill patients perioperatively at Wits circuit".
>
> We often transport critically ill patients between the Intensive care unit and theatre, however there are varying levels of compliance to transportation safety guidelines.
>
> The aim of the study would be: to assess adherence to recommended intrahospital transfer guidelines and to identify possible barriers to practicing these recommended guidelines.
>
> This study intends to highlight the deficiencies that occur during the transportation of critically ill patients and thus motivate for more education and attention regarding transportation safety guidelines. The ultimate goal is to ensure patient safety and minimize adverse events during transporting critically ill patients perioperatively.
>
> Should you require more information, please do not hesitate to contact me
>
> Take care and hope you have a good day.

1.13.4. Appendix D: Data Collection Sheet

Transferring a critically patient between theatre and ICU? Please assist by participating in my MMed Study, Assessment of current practices of intrahospital transportation (IHT) in critically ill patients at an academic hospital in South Africa.

INCLUSION CRITERIA	EXCLUSION CRITERIA
Critically ill patient*	Patients placed on cardio-pulmonary bypass
IHT between Theatre at CMJAH and Main ICU (576/567), Trauma ICU, Neurosurgical ICU or Cardiothoracic ICU	IHT of critically ill patient to ward/ high care setting including Obstetric high care, Folateng wards, Trauma high care (377) and Neonatal ICU
IHT done during perioperative period	IHT to/from MRI suite or other imaging intervention
IHT done by Anaesthesiologist	IHT to/from endoscopy suites
Age > 12 years old	Patient not meeting the definition of critically ill patient

*Critically ill patient: any patient requiring EITHER cardiovascular or respiratory or renal or neurological organ support, needing ICU admission for mechanical ventilation, inotropic infusions, intensive monitoring, or other supportive measures.

Please complete questionnaire using this link or QR code.

Google forms Link and QR code: https://forms.gle/g61uwHc7uFzoW4Sh9

Demographics of Patient

1. Age of patient *

   Mark only one oval.

   - ≤ 12
   - 13-18
   - 19-30
   - 31-40
   - 40-65
   - ≥ 65

2. ASA category *

   Mark only one oval.

   - ASA 1
   - ASA 2
   - ASA 3
   - ASA 4
   - ASA 5
   - ASA 6

3. Please select reasons for the patient requiring ICU care. More than one option can be selected *

Check all that apply.

- [ ] Mechanical ventilation
- [ ] Inotropic support
- [ ] Intensive moinitoring
- [ ] Renal replacement therapy

Other: [ ] _____

Demographics of Participant

4. Age *

Mark only one oval.

- ◯ 25-30
- ◯ 31-40
- ◯ 41-60
- ◯ >60

5. Sex *

Mark only one oval.

- ◯ Female
- ◯ Male
- ◯ Prefer not to say
- ◯ Other: _____

6. Level of training (the most senior person involved in the IHT) *

Mark only one oval.

- ◯ Medical Officer
- ◯ Registrar
- ◯ Consultant

7. Years of experience in anaesthesia *

Mark only one oval.

- ◯ ≤ 3 years
- ◯ > 3 years

8. How many times have you participated in this study? *

Mark only one oval.

- ◯ One
- ◯ Two
- ◯ Three
- ◯ Other: _____

Patient Destination

9. Where was the patient being transferred FROM? *

Mark only one oval.

- ◯ Main ICU (576/567)
- ◯ Trauma ICU
- ◯ Cardio-thoracic ICU
- ◯ Neurosurgery ICU
- ◯ Theatre

10. Where was the IHT destination? *

Mark only one oval.

- ◯ Main ICU (576/567)
- ◯ Trauma ICU
- ◯ Cardio-thoracic ICU
- ◯ Neurosurgery ICU
- ◯ Theatre

Patient preparation prior to intrahospital transportation (IHT)

11. Was consent checked? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Not applicable

12. Were vitals recorded prior to IHT? *

Mark only one oval.

- ◯ Yes
- ◯ No

13. Was IHT destination notified? *

Mark only one oval.

- ◯ Yes
- ◯ No

14. If yes, which of the following actions were done? More than one option can be selected

Check all that apply.

- [ ] Expected time of arrival
- [ ] Notification of of current condition of patient
- [ ] Infusions required on arrival (eg: preparation of inotropes)
- [ ] Requirement of ventilatory support

15. Was the route cleared if expected IHT had potential delays ? (eg: Elevators) *

Mark only one oval.

- ◯ Yes
- ◯ No

16. Was IV access confirmed and flushed prior to IHT? *

Mark only one oval.

- ◯ Yes
- ◯ No

17. Which of the following monitors were checked and taken with for IHT? More than one option can be selected *

Check all that apply.

- [ ] Pulse oximetry
- [ ] ECG
- [ ] NIBP or invasive BP monitoring

Other: [ ] _____

Airway management and Ventilatory support

18. Which of the following airway equipment was taken with for IHT? More than one option can be selected *

Check all that apply.

- [ ] Oropharyngeal/ nasopharyngeal airway
- [ ] Supplemental oxygen device (eg: Nasal prong o2)
- [ ] Extra endotracheal tube (appropriate sizes)
- [ ] Emergency supraglottic device
- [ ] Laryngoscope with appropriate blade sizes

Other: [ ] _____

19. Was the airway suctioned prior to IHT? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Not applicable

20. Was the ETT size and depth noted prior to IHT? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Not applicable, patient not intubated

21. Was the ETT tape/securing device checked and secured? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Not applicable, patient not intubated

22. Answer the following questions with regards to transport ventilation practice during IHT: *

Mark only one oval per row.

	Yes	No	Not applicable
Transport ventilator was used	◯	◯	◯
Battery level of ventilator checked	◯	◯	◯
Ventilator checked for leaks	◯	◯	◯
Ventilator settings and alarm limits set	◯	◯	◯

23. Answer the following questions with regards to manual ventilation during IHT: *

Mark only one oval per row.

	Yes	No	Not Avalible	Not applicable
Manual resuscitation bag was USED	◯	◯	◯	◯
Manual resuscitation bag was NOT taken	◯	◯	◯	◯
Appropriately sized masks were present	◯	◯	◯	◯
PEEP valve was attached to manual resuscitation bag	◯	◯	◯	◯

24. Answer the following questions with regards to the oxygen cylinder used during IHT: *

Mark only one oval per row.

	Yes	No	Not applicable
Oxygen cylinder was NOT taken	◯	◯	◯
Oxygen gauge was checked for leaks	◯	◯	◯
Oxygen cylinder was full	◯	◯	◯

Emergency drugs taken with during IHT

25. Were there adequate volume of drugs prepared prior to IHT? (eg: adrenaline infusion, sedation infusion) *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Not applicable

26. Was the battery life of the infusion pump checked? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Not applicable

27. Which of the following drugs were taken with you during IHT? More than one option can be selected *

Check all that apply.

- ☐ Inotropes
- ☐ Muscle relaxant
- ☐ Induction agent
- ☐ Sedation
- ☐ Analgesia

Intrahospital transport guidelines and adverse events

28. Are you aware of any IHT guidelines? *

Mark only one oval.

- ◯ Yes
- ◯ No

29. If yes, for above question, please state which guideline you are aware of.

_____

30. Were there any major adverse events from the IHT? If yes , please select appropriate box. More than one option can be selected. *

Check all that apply.

- ☐ No adverse event occurred
- ☐ Accidental extubation
- ☐ Airway obstruction
- ☐ Hypotension requiring management
- ☐ New onset arrythmia
- ☐ Initiation of cardiopulmonary resuscitation
- ☐ Infusion pump failure
- ☐ Monitor failure
- ☐ Ventilator failure

Other: ☐ _____

31. Were there any barriers to adhering to guidelines for safe transportation of critically ill patients for current transfer, only select barriers that are applicable for current IHT. More than one option can be selected *

Check all that apply.

- [ ] No barriers
- [ ] Equipment availability
- [ ] Equipment inadequately functioning
- [ ] Time constraints (eg: time pressured from senior or surgical team)
- [ ] Limited consumables (eg: Limited number of syringes or drugs)
- [ ] Inadequate training
- [ ] Inadequate help with transporting patients
- [ ] No standardised protocols present in institution

This content is neither created nor endorsed by Google.

Google Forms

1.13.5. Appendix E: Permission from CEO of CMJAH



GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL (CMJAH)
OFFICE OF THE SENIOR CLINICAL MANAGER

Enquiries: *Ms. TT Mahlangu*
Email: Thandi.Mahlangu4@gauteng.gov.za
Tel: *011 488 3365*
Ref: *1/7/2*
Date: 17 August 2021

GP_202106_040

To: Dr Bhavic Mawjee

RE: PROVISIONAL APPROVAL

TITLE: ASSESSMENT OF CURRENT PRACTICES OF INTRAHOSPITAL TRANSPORTATION IN CRITICALLY ILL PATIENTS AT AN ACADEMIC HOSPITAL IN SOUTH AFRICA

Permission to conduct the above-mentioned study is provisionally granted subject to:

1. Submitting an Ethics Clearance Certificate from the University of Witwatersrand Human Research and Ethics Committee (HREC).
2. Submitting an proof of post graduation approval.

Please submit the above documents at your earliest convenience for final approval to be granted. Please note that your study cannot commence until a final approval letter is issued.

Supported / ~~Not Supported~~
Signed by:Jayshina Punwasi
Signed at:2021-08-19 16:07:24 +02:00
Reason:Witnessing Jayshina Punwasi

Dr J. Punwasi
Clinical Director

Approved / ~~Not Approved~~
Signed by:Gladys Magugudi Bogoshi
Signed at:2021-08-20 06:21:30 +02:00
Reason:Witnessing Gladys Magugudi Bo

Ms. Bogoshi

CEO: CMJAH

Section 4: Annexures

1.14. Annexure 1: Postgraduate Approval letter

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Mrs Sandra Benn
E-mail: sandra.benn@wits.ac.za

06 January 2023
Person No: 361961
PAG

Dr B Mawjee
Unit 19,06 Bompas Road
Dunkeld West
2196
South Africa

Dear Dr Bhavic Mawjee

Master of Medicine in Anaesthesia: Approval of Title

We have pleasure in advising that your proposal entitled *Assessment of current practices of intrahospital transportation in critically ill patients at an academic hospital in South Africa* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

1.15. Annexure 2: Human research ethics committee clearance certificate

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R49 Dr B Mawjee

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M210708

NAME: (Principal Investigator)	Dr B Mawjee
DEPARTMENT:	School of Clinical Medicine Department of Anaesthesiology Medical School University
PROJECT TITLE:	*Assessment of current practices of intrahospital transportation in critically ill patients at an academic hospital in South Africa*
DATE CONSIDERED:	2021/07/30
DECISION:	Approved unconditionally
CONDITIONS:	
NOTE:	If contact information regarding student study participants is required, please contact the Registrar's office - <Nicoleen.Potgieter@wits.ac.za>
SUPERVISOR:	Mr S Mohanadasan and Dr Z Jooma
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2021/10/08

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

1.16. Annexure 3: Plagiarism/Turnitin report

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