Addis Ababa University

College of Health Sciences

School of Medicine

Department of Internal Medicine

The Magnitude and Factors Associated with Pressure Ulcer Among Patients Admitted to Adult Medical and Surgical ICU, Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia: 6-Month Retrospective Study

A Thesis submitted to Addis Ababa University, College of Health Sciences, School of Medicine, Department of Internal Medicine in Partial Fulfillment of the Requirements for the Specialty Certificate in Internal Medicine

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Title of the study	The Magnitude and Factors Associated with Pressure Ulcer Among Patients Admitted to Adult Medical and Surgical ICU, Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia: 6-Month Retrospective Study
Study area	Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia
Study period	from January 1,2018 to July 1,2018.

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ACRONYMS AND ABBREVATIONS

AOR: Adjusted odds ratio

CI: confidence interval

COR: crude odds ratio

FMOH: Federal Ministry of Health

ICU: Intensive Care Unit

IQR: Interquartile range

MICU: Medical ICU

MRN: Medical Registration Number

MV: Mechanical Ventilator

NPUAP: National Pressure Ulcer Advisory panel

PI: Pressure injury

PU: Pressure ulcer

Q: Quartile

RTA: Road Traffic Accident

SICU: Surgical ICU

TASH: Tikur Anbessa Specialized Hospital

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ABSTRACT

Title: The Magnitude and Factors Associated with Pressure Ulcer Among Patients Admitted to Adult Medical and Surgical ICU, Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia: 6-Month Retrospective Study, from January 1,2018 to July 1, 2018.

Background: Pressure ulcer represents a widespread, painful, and expensive health care problem directly associated with increased morbidity, mortality, and length of hospital stay. Knowledge of the magnitude and factors associated with to the development of pressure ulcer allows identification of patients at risk for ulcer development such that preventive measures may then be targeted to those specific patients. There were no previous local studies assessing the magnitude and factors associated with pressure ulcer among ICU admitted patients and this study aimed to fill this gap.

Objective: To assess the magnitude and factors associated with pressure ulcer among patients admitted to adult medical and surgical ICU unit of Tikur Anbessa specialized hospital (TASH).

Methods and materials: A 6-month facility based retrospective cross-sectional study was conducted to determine the magnitude and factors associated with pressure ulcer among patients admitted to adult medical and surgical ICU unit of Tikur Anbessa Specialized hospital (TASH). The study was done in a sample of 237 patients which were admitted to the ICU of TASH, from January 1,2018 to July 1, 2018. Data were collected using structured checklists from chart reviews. The collected data was cleaned and analyzed using SPSS version 26. Bivariate and Multivariate logistic regression models were used to identify the degree of the association. The degree of association between dependent and independent variables was interpreted by using crude odds ratio with 95% confidence intervals and P-value <0.05 was considered statistically significant.

Results: From a sample of 237, a total of 58 (24.5%) participants had pressure ulcer. The magnitude of pressure ulcer among MICU admitted study participants was 36.6% whereas among SICU admitted participants was 11.4%. The length of ICU stay was found to be strongly associated with the development of pressure ulcer. Those who stayed in the ICU for more than 14 days were 8.9 times at increased risk of developing pressure ulcer compared to those who stayed for less than 14 days (AOR=8.995, P value=<0.0001, 95% CI 3.634 to 22.264**).**

Conclusion: A quarter of adult patients admitted to the ICU had pressure ulcer and prolonged hospital stay was found to be associated with the development of the ulcer.

1.INTRODUCTION

1.1. Background

Pressure Ulcer is a lesion caused by unrelieved pressure that results in damage to the underlying tissue. It is the result of soft tissue compression between a bony prominence and an external surface for a prolonged period of time [1,2]. The consequences of pressure ulcer range from non-blanchable erythema of intact skin to deep ulcers extending to the bone. Pressure ulcer imposes a significant burden not only on the patient but also on the entire health care system and reducing their frequency is an important component of current goals for patient safety [3-5].

PU represents a widespread, painful, and expensive health care problem directly associated with increased morbidity, mortality, and length of hospital stay [23].

Pressure ulcer is among the most common conditions encountered in acutely hospitalized patients or those requiring long-term institutional care. The incidence varies widely by clinical setting. An estimated 2.5 million pressure-induced injuries are treated each year in acute care facilities in the United States alone [6,7].

Methods of studying and reporting the prevalence of pressure injuries include direct patient examination, use of databases, and surveys and, from these, the most accurate estimates are derived from studies where clinician-researchers have directly examined patients [9-11].

The prevalence of pressure injury varies widely by clinical setting and the method of the study used [6,8,10,11]. Most pressure-induced injuries develop during acute hospitalizations in spite of the adoption of national prevention objectives. Among patients in acute care hospitals, prevalence rates have ranged from 3 to 17 percent [6,8,9]. However, rates are higher in high-risk groups. In one report of patients in an intensive care unit, over 50 percent of patients developed a stage 1 or greater pressure injury when managed with a standard mattress bed [11].

Over 100 risk factors for the development of pressure-induced skin and soft tissue injuries have been identified in literatures [7]. Risk factors can be those that impact the magnitude and duration of pressure or those that affect individual susceptibility and tolerance. The most important factors include immobility, malnutrition, reduced perfusion, and sensory loss [12].

Other identified risk factors include cerebrovascular disease, cardiovascular disease, recent lower extremity fractures, incontinence, and diabetes [7,13-17].

Globally, the exact magnitude of pressure ulcer varies with the type of illness and among specific clinical populations [25,29].

The prevalence of pressure ulcer among 850 patients in a Swedish ICU, between 1998 and 1999 was found to be 28.7% and a one year,2003, study in Canadian ICU showed a prevalence of PU to be 25.7% [28,31].

There are few local data which were done in zonal and regional hospitals of Ethiopia and from these studies the prevalence of pressure injury in general ward admissions of adult patients to medical ward, surgical ward and Gynecology and Obstetrics ward ranges from 3.4 to 16.8% and the commonest identified risk factor was prolonged immobilization [18-24]. But all of these studies were done in general ward admissions and thus, it could not reflect the magnitude and associated factors of pressure ulcer in the ICU setup. There is no regional and local data assessing the magnitude of pressure injury focusing in the ICU setup.

For various reasons, patients admitted to the ICU are at a higher risk of developing pressure ulcer compared to those admitted to the general ward. So, this study tried to assess the magnitude and factors associated with pressure ulcer among adult patients admitted to medical and surgical ICU of Tikur Anbessa Specialized Hospital over six months period.

1.2.Statement of the Problem

Pressure Ulcer (PU) or pressure injury (PI) represents a widespread, painful and expensive health care problem directly associated with increased morbidity, mortality and length of hospital stay [18].

Pressure ulcer is one of the contributing factors for increased morbidity, mortality, increased ICU stay and as well increased risk of future ICU re-admissions. It is one of the preventable complications associated with ICU admissions [18-22,28,31].

The impact of PU is more pronounced in resource limited settings where we have a very limited ICU service. We know that ICU is a very expensive health service that requires a great health expenditure. So, identifying factors which contribute for increased ICU length of stay, increased morbidity and mortality rate are of very great importance [18-24].

There are few local data which were done in zonal and regional hospitals of Ethiopia and from these studies the prevalence of pressure injury in general ward admissions of adult patients to medical ward, surgical ward and Gynecology and Obstetrics ward ranges from 3.4 to 16.8% and the commonest identified risk factor was prolonged immobilization [18-24]. But all of these studies were done in general ward admissions and thus, the results could not be directly applied to adult patients admitted to the ICU. Otherwise, there is no regional and local data assessing the magnitude of pressure injury focusing in the ICU setup.

In our ICU, from day-to-day clinical observation, the magnitude of pressure ulcer is unacceptably high but its exact magnitude and contributing factors were not studied.

So, this study tried to assess the magnitude and factors associated with pressure ulcer among patients admitted to adult medical and surgical ICU of Tikur Anbessa Specialized Hospital over six months period.

1.3. Significance of the study

This study will identify the magnitude and associated factors of pressure ulcer among patients admitted to adult medical and surgical ICU unit of Tikur Anbessa Specialized Hospital. Hence, it will help to devise preventive measures and serve as a basis for large scale studies. The findings and recommendations of this study will be provided the ICU head, hospital administrators, national stakeholders and policy makers.

2.LITERATURE REVIEW

Pressure ulcers affect millions of people worldwide and nearly always occur over bony areas of the body where pressure and tissue distortion is greatest. It is largely preventable patient safety problem, recognized globally as one of the most common causes of harm to patients. Patients with medical conditions that limit their ability to change position, those who require wheel chair and those who confine to bed for a long time are at risk of pressure ulcers [18].

Pressure ulcers are serious health issue in health care settings. Common both in acute and chronic care facilities and impose a significant burden on patients, their relatives and care givers. The pain and discomfort due to pressure ulcer leads to costly and physically debilitating complications which prolongs; duration of illness, time of discharge, and even contribute to disability and death. They are also described as an indicator of quality of care provided by health care organization [18].

2.1 Magnitude and associated factors of pressure ulcer

Globally, the exact magnitude of pressure ulcer varies with the type of illness and among specific clinical populations [25,29].

In an institution based cross sectional study which was conducted among 228 hospitalized patients in Hawassa University referral hospital, Southern Ethiopia from April 1- April 30, 2016, it was found that the overall prevalence of pressure sore was found to be 8.3% and length of hospital stay, less frequent change in position, completely limited sensory perception ,presence of moisture and poor nutritional status were found to have as association with the development of pressure sore[18].

In a community based cross-sectional study conducted in Felegehiwot referral hospital, Bahir Dar, Ethiopia on patients admitted from March 25, 2013, to May 1, 2013.A total of 422 patients were included in the study. From this study, the prevalence of pressure sore was found to be 16.8%; prolonged length of stay in hospital, slight limit of sensory perception, and friction and shearing forces were significantly associated with the presence of pressure ulcer [19].

There are also other local studies which were done at Jimma University teaching Hospital, Wolayta Sodo University teaching hospital, Dessie Referral Hospital and Debremarkos Referral Hospital by using institution based cross sectional study design among general hospital admissions and the prevalence of pressure ulcer was found to be 9.6%,13.4%,14.9%, and 3.4% respectively.

But all the above local studies were done in the general hospital admissions and it will not reflect the magnitude of pressure ulcer in the ICU setup.

There are also studies assessing the prevalence and associated factors of pressure sore in different areas of the world and the magnitude of pressure ulcer is really high especially in the ICU patients [25-34]. For example, in a national survey which was done in Sweden between 1998 and 1999 among 850 patients who were admitted to ICU, the prevalence of pressure ulcer was found to be 28.7% [28]. In a Canadian study which was done between January 2003 and November 2003 among patients admitted to ICU, the prevalence of pressure ulcer was found to be 25.7% [31].

2.2 Associated factors of pressure ulcer:

Patients with medical conditions that limit their ability to change position, those who require wheel chair and those who confine to bed for a long time are at risk of pressure ulcers [18].

Pressure ulcer is an indirect indicator of quality of care provided by health care organization [18]. More than 200 risk factors have been identified in literatures as a risk factor for pressure ulcer [28,31].

In a study conducted at Hawassa, Bahirdar, Dessie, Wolayta sodo, Jimma and Debremarkos; impaired sensory perception, prolonged hospital stay and poor nursing care were consistently associated with an increased risk of pressure ulcer [18,19,21,23,24].

3.OBJECTIVES

3.1. General Objective

-to assess the magnitude and factors associated with pressure ulcer among patients admitted to adult medical and surgical ICU of Tikur Anbessa specialized hospital (TASH).

3.2. Specific Objectives

- evaluate the magnitude of PU in adult patients admitted to the ICU

-to assess the patterns of pressure ulcer among patients admitted to medical versus surgical ICU

-to identify the factors contributing for pressure ulcer development

4.METHODS AND MATERIALS

4.1. Study setting

Study area: The study was conducted at Tikur Anbessa specialized hospital which is the largest hospital in Ethiopia located in the capital city Addis Ababa. TASH is a teaching hospital for the Addis Ababa University, College of Medicine and Health sciences and is involved in undergraduate, postgraduate and fellowship trainings in different fields of clinical medicine. It has its own pulmonary and critical care unit, that is responsible for care of critically ill patients from every unit and chest patients, both as inpatients and outpatients. The care at ICU is being given by trained ICU nurses, residents (internal medicine, surgical, anesthesiology, and emergency and critical), pulmonary and critical care fellows, and pulmonary and critical care consultants. In the ICU, Pulmonary and critical care consultants make a round twice in a day, and fellows are always there during the working hours.

Study period: the study was be conducted among patients admitted to TASH, ICU unit over 06 months, from January 1,2018 to July 1, 2018.After we have assessed the number of admissions from the ICU HMIS logbook, a six month study was considered to be representative for the calculated sample size.

4.2. Study Design

A facility based retrospective cross-sectional study was conducted to assess the magnitude and associated factors of pressure ulcer among patients admitted to ICU unit of TASH over 06 months, from January 1,2018 to July 1,2018

4.3. Source population: All patients admitted to adult medical and surgical ICU unit of TASH

4.4. Study population: all patients admitted to ICU from January 1,2018 to July 1,2018 and who fulfil the inclusion criteria

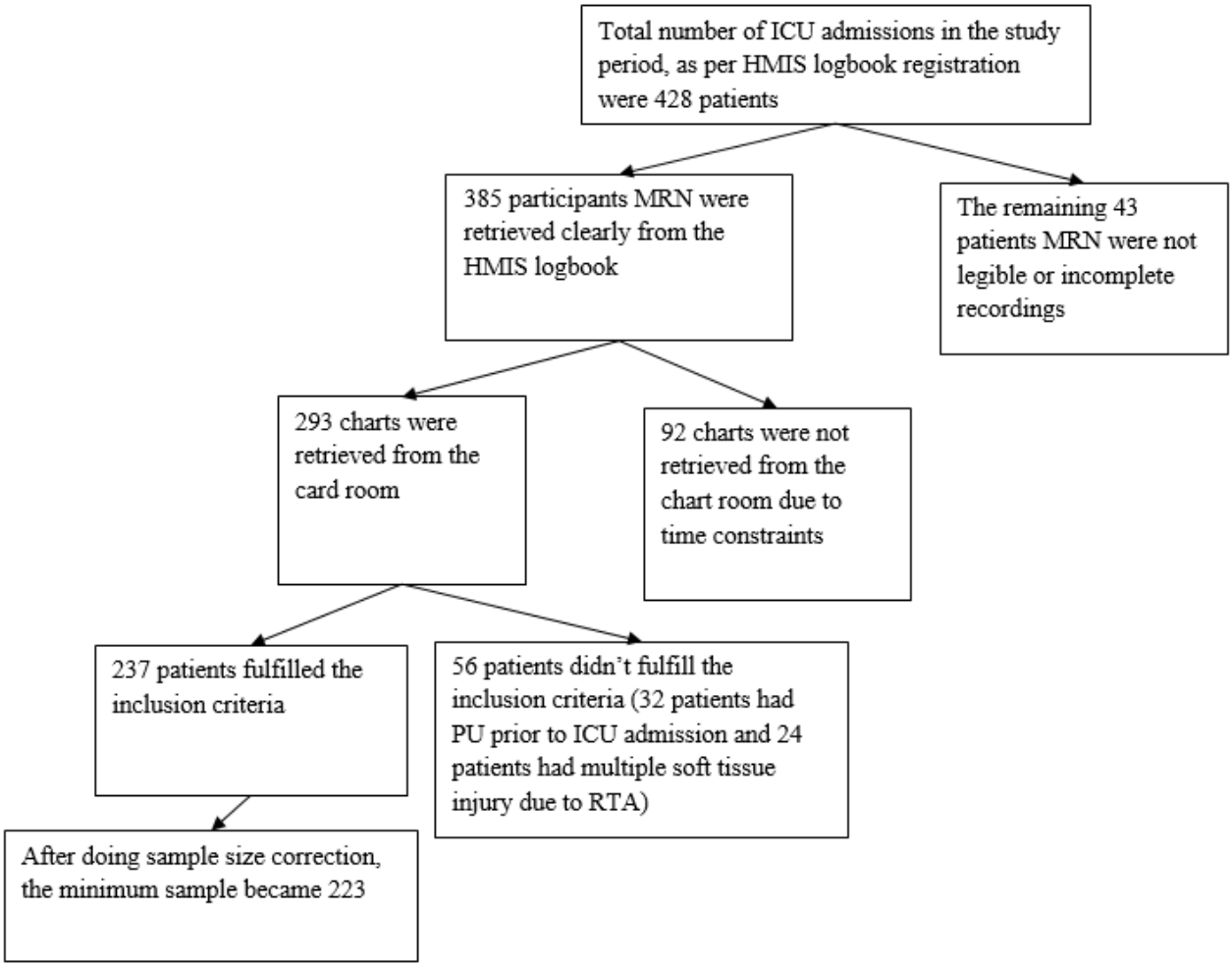
4.5. Sample size calculation

A sample size of 384 patients was calculated assuming a population proportion of 50% or 0.5(because there is no previous study, at TASH or other hospitals in Ethiopia, assessing magnitude of pressure sore in the ICU setup), confidence interval of 95%, margin of error of 0.05, and given total population less than 10,000.

By using sample size correction $\mathbf{n=no/\ (1+\ no\text{-}1/N),}$

where **no** is the estimated sample size which means 384, **N**-the average total number of ICU admissions over 06 months which was around 428. By adding 10% for possible missing or incomplete data, the corrected final sample size will be 223.This study will include all patients admitted to the ICU in the specified time period, from January 1,2018 to July 1, 2018, provided that patient's chart can be retrieved and they fulfil the inclusion criteria. But a sample of 223 will suffice, if in case there are patients among the 428 admissions, which will not be included in this study for various reasons.

4.6. Sampling procedures



4.7. Inclusion and exclusion criteria for patients

Inclusion criteria

-All patients with age >= 18 years admitted to the ICU during the specified time period, from January 1,2018 to July 1, 2018.

Exclusion criteria:

-patients with accidental injury over bony prominence areas

-patients who had already pressure ulcer at the time of admission

-patients readmitted for the 2nd or more times during the study period if they have already developed pressure ulcer in the initial admission.

4.8. Study variables

Dependent variables: magnitude of pressure ulcer

Independent variables: Age, sex, primary reason for ICU admission, admission to MICU versus SICU, mechanical ventilator requirement, duration on mechanical ventilator, malnutrition, neurologic weakness, recent upper/lower extremity fracture length of ICU stay, use of pressure ulcer supportive device, and frequency of bedside repositioning.

4.9. Data collection and procedures

Data was collected by using structured checklists from chart reviews by both the principal investigator and selected research assistants, who had training on the data extraction format/questionnaire. The research assistants were 2 BSC nurses.

4.10. Data analysis and presentation

Each collected data was cleaned, and checked for quality. The data was coded and entered to SPSS version 26. After checking data completeness, it was then analyzed and the results from the frequency tables, custom tables and graphical representation of outcomes was displayed. Bivariate and Multivariate logistic regression models were used to identify the degree of the association between the dependent and independent variables. The degree of association between dependent and independent variables was interpreted by using crude odds ratio with 95% confidence intervals and P-value of <0.05 to be considered statistically significant.

4.11. Data quality assurance

Data was collected by using systematically structured checklists from chart reviews by both the principal investigator and selected research assistants. Completeness was checked by a research assistant who was not involved in the data collection process.

4.12. Ethical consideration

Ethical approval was obtained from the research and ethics committee of the department of internal medicine. Data were deidentified.

4.13. Dissemination of the results

The results of the study will be presented to Addis Ababa University, college of health sciences, school of medicine, department of internal medicine. The results and recommendations of this study will also be distributed to ICU heads, Hospital administrators, different stakeholders and Federal Ministry of health, Ethiopia (FMOH).

The results of the study will also be sent for reputable journals for publication.

4.14. Operational Definitions

ICU=refers to adult medical and surgical ICU

Pressure Ulcer=no consensus on the terminology but for this study purpose Pressure ulcer (pressure sore) was defined as bedsore, decubitus ulcer, pressure injury, and pressure associated skin and soft tissue injury

Staging of pressure ulcer= is based on NPUAP and it is included under the annexes

5. RESULTS

5.1. Sociodemographic and clinical profile of study participants

A total of 237 ICU admitted patients participated in the study. Among the participants of the study 123 (51.9%) were admitted to MICU and 114 (48.1%) were admitted to SICU. In this study, 113 participants (47.7%) were males and 124 (52.3%) were females. The median age of the study participants was 38 years with quartile 1 and quartile 3 of 25 and 50 years respectively. The interquartile range was 25.

Table 1: The median and quartile age of the study participants

Study participants	Median age	Q1	Q3	IQR
Overall ICU admission	38	25	50	25
MICU participants	42	25	75	50
SICU participants	36	28	46	18

Table 2: Admission sites of the study participants

Admission ICU	Frequency	percent
MICU	123	51.9
SICU	114	48.1
Total	237	100

Figure 1: Sex distribution of the study participants

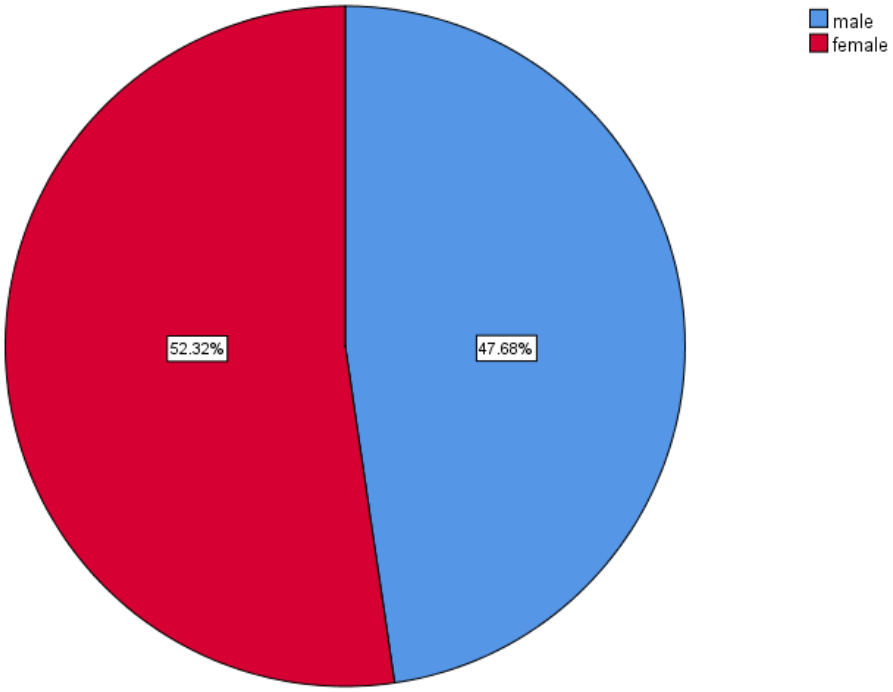
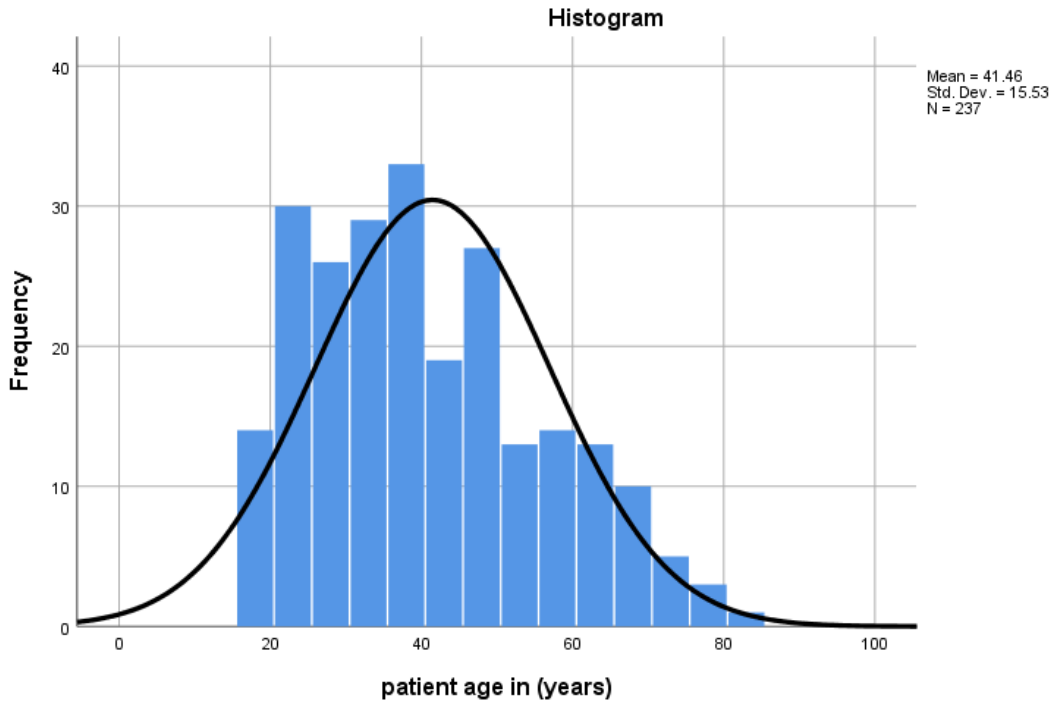


Figure 2: Age distribution of the study participants



Clinical profiles of the study participants

Primary reasons for ICU admission

The primary reasons for overall ICU admission were perioperative condition (46%), respiratory failure (25.3%), septic shock (11.4%), cardiogenic shock (5.9%), cerebrovascular accidents/any cause of neurologic weakness (7.6%), acute coronary syndrome (2.1%) and other/miscellaneous causes (1.7%).

Among MICU admitted patients, the primary reasons for admission were respiratory failure (47.2%), septic shock (19.5%), cerebrovascular accident/any cause of neurologic weakness (14.6%), cardiogenic shock (11.4%), acute coronary syndrome (4.1%) and others/miscellaneous causes (3.3%).

Among SICU admitted participants, the primary reasons for admission were perioperative condition (95.6%), septic shock (2.6%), and respiratory failure (1.8%). All of SICU admitted patients were perioperative surgical patients.

Table 3: Primary reason for ICU admission among study participants

Primary reason for ICU admission	Frequency	percent
Perioperative condition	109	46.0
Respiratory failure	60	25.3
Septic shock	27	11.4
cerebrovascular accident/coma from any cause	18	7.6
Cardiogenic shock	14	5.9
Acute coronary syndrome	5	2.1
Others: specify	4	1.7
Total	237	100.0

Mechanical ventilator requirement, duration of mechanical ventilation and length of ICU stay

Among the study participants,34.6% of them were on mechanical ventilator. Majority of patients stayed on mechanical ventilator for 8 to 14 days.

The duration of mechanical ventilation was 8 to 14 days,24 hrs. to 3 days, 4 to 7 days,15 to 21 days and less than 24 hrs. in 26.8%, 25.6%, 24.4%, 14.6% and 8.5% of the participants respectively. The length of ICU stay was less than 3 days, 3 to 7 days, 8 to 14 days and greater than 14 days in 47.3%, 27.4%, 12.7% and 12.7% of the participants respectively.

Among MICU admitted study participants, 56.1% of them were on mechanical ventilator. The duration of mechanical ventilation was 8 to 14 days, 24 hrs. to 3 days, 4 to 7 days,15 to 21 days and less than 24 hrs. in 27.5%, 23.2%, 23.2%, 17.4% and 8.7% of the participants respectively. The length of ICU stay was less than 3 days, 3 to 7 days, 8 to 14 days and greater than 14 days in 31.7%, 27.6%, 19.5% and 21.1% of the participants respectively.

Among SICU admitted study participants, only 11.4% of them were on mechanical ventilator. The duration of mechanical ventilation was 24 hrs to 3 days, 4 to 7 days, 8 to 14 days and less than 24 hrs. in 38.5, 30.8%, 23.1%, and 7.75 % of the participants respectively. There was no patient on mechanical ventilator for >= 14 days. The length of ICU stay was less than 3 days, 3 to 7 days, 8 to 14 days and greater than 14 days in 64%, 27.2%, 5.3% and 3.5 % of the participants respectively

Figure 3: Ventilator requirement of the study participants

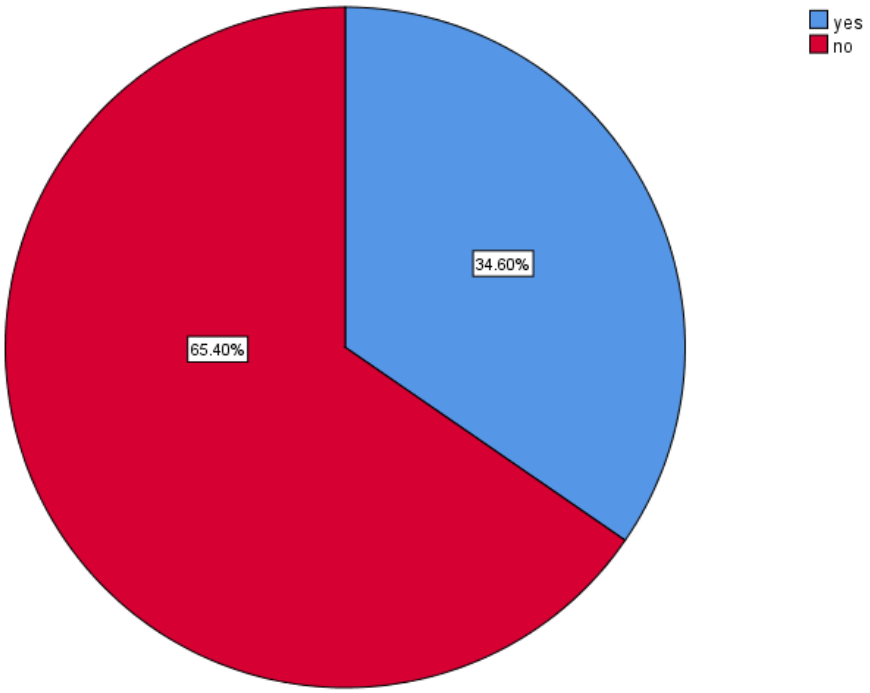


Figure 4: Duration on mechanical ventilator among MV requiring study participants

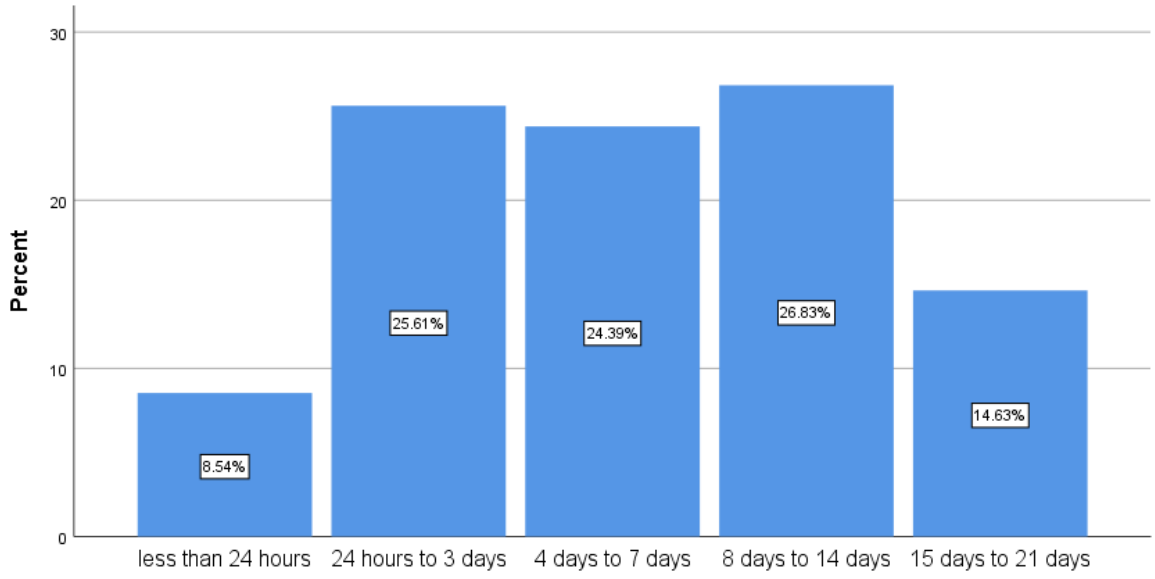


Figure 5: Length of ICU stay of the study participants

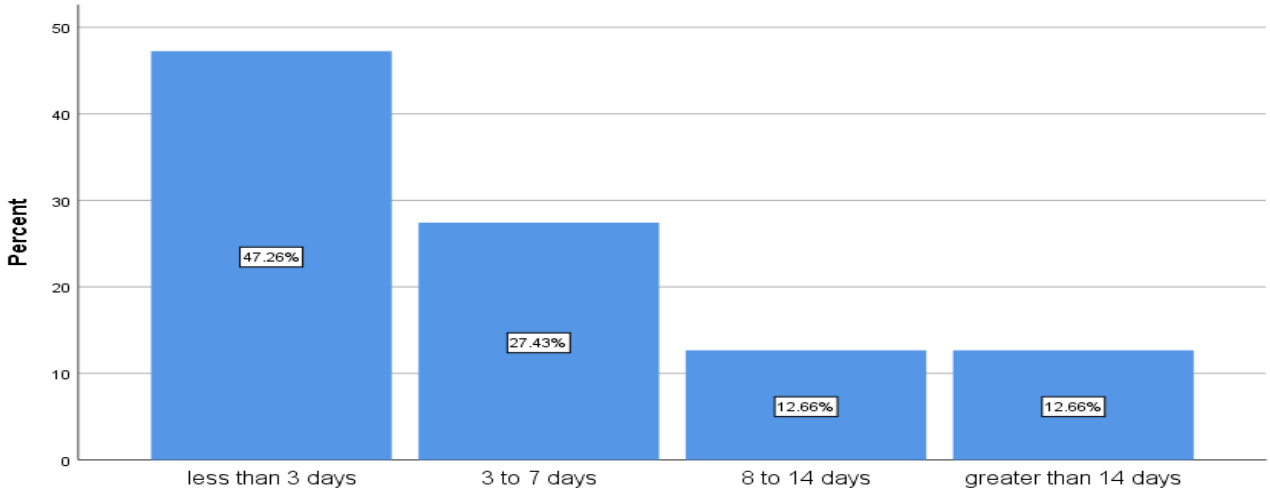


Table 4: mechanical ventilator requirement among MICU admitted participants

MV requirement	Frequency	Percent
Yes	69	56.1
No	54	43.9
total	123	100.0

Table 5: Duration of mechanical ventilation among MICU admitted MV requiring study participants

Duration on MV	Frequency	Percent
less than 24 hours	6	8.7
24 hours to 3 days	16	23.2
4 days to 7 days	16	23.2
8 days to 14 days	19	27.5
15 days to 21 days	12	17.4
Total	69	100.0

Table 6: Length of ICU stay among MICU admitted participants

Length of ICU stay	Frequency	Percent
less than 3 days	39	31.7
3 to 7 days	34	27.6
8 to 14 days	24	19.5
greater than 14 days	26	21.1
Total	123	100.0

Table 7: Mechanical ventilator requirement among SICU admitted participants

Ventilator requirement	Frequency	Percent
yes	13	11.4
no	101	88.6
total	114	100.0

Table 8: Duration of mechanical ventilation among SICU admitted MV requiring study participants

Duration on MV	Frequency	Percent
less than 24 hours	1	7.7
24 hours to 3 days	5	38.5
4 days to 7 days	4	30.8
8 days to 14 days	3	23.1
Total	13	100.0

Table 9: Length of ICU stay among SICU admitted study participants

Length of ICU stay	Frequency	Percent
less than 3 days	73	64.0
3 to 7 days	31	27.2
8 to 14 days	6	5.3
greater than 14 days	4	3.5
Total	114	100.0

Neurologic weakness, malnutrition and upper/lower extremity fracture among the study participants

Among the study participants, 32 (13.5%) of them had cerebrovascular accident/coma/any cause of neurologic weakness and 2 participants (0.8%) of them had adult-onset malnutrition. Both cases of adult-onset malnutrition were from participants admitted to MICU. Of the 32 participants, which were having cerebrovascular accident/coma/any cause of neurologic weakness,27 (84.3%) was from participants admitted to MICU.
None of the participants had upper/lower extremity fracture.

Use of pressure ulcer supportive device, frequency of repositioning and feeding among the participants during their ICU stay

There was no documentation about the use of pressure ulcer supportive device, frequency of repositioning and feeding of the study participants during their stay in the ICU.

5.2. Magnitude of pressure ulcer among the study participants

Among the study participants,58 of them (24.5%) had developed pressure ulcer. The magnitude of pressure ulcer among MICU admitted participants was higher (36.6%) than those to SICU admitted participants (11.4%).

Figure 6: Magnitude of pressure ulcer among the study participants

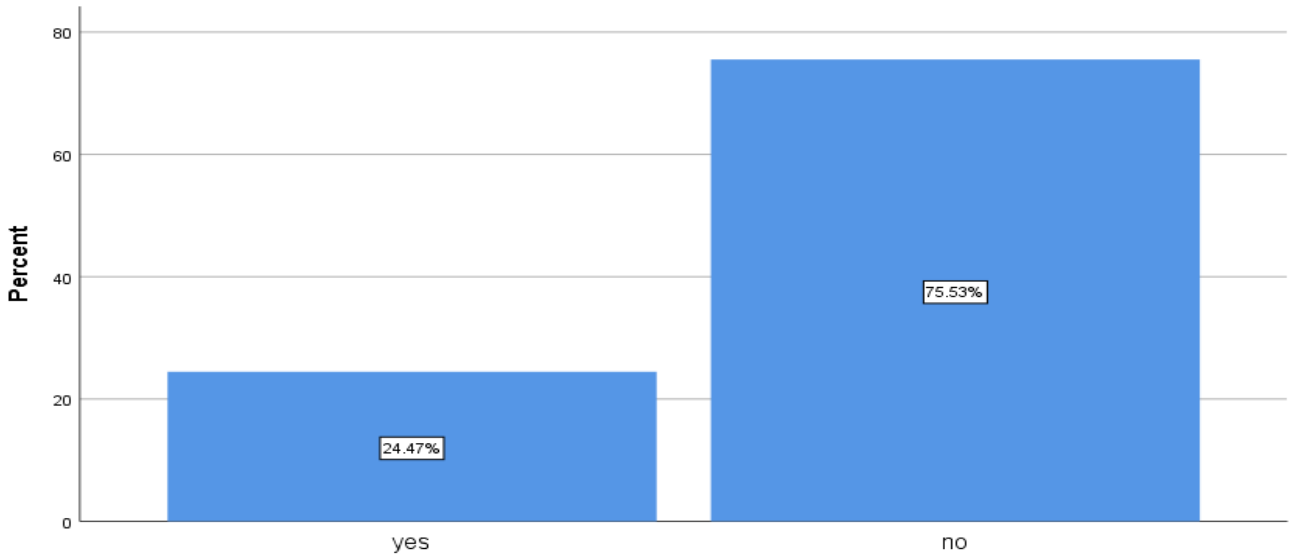


Figure 7: Magnitude of pressure ulcer among MICU admitted participants

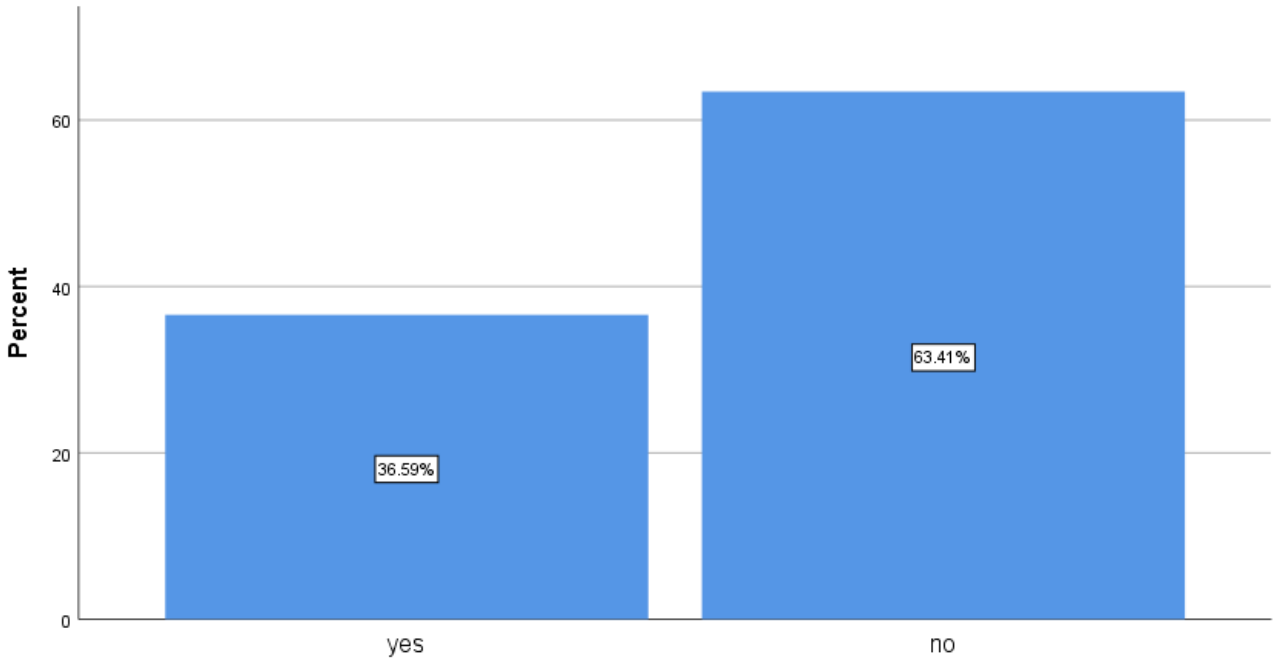
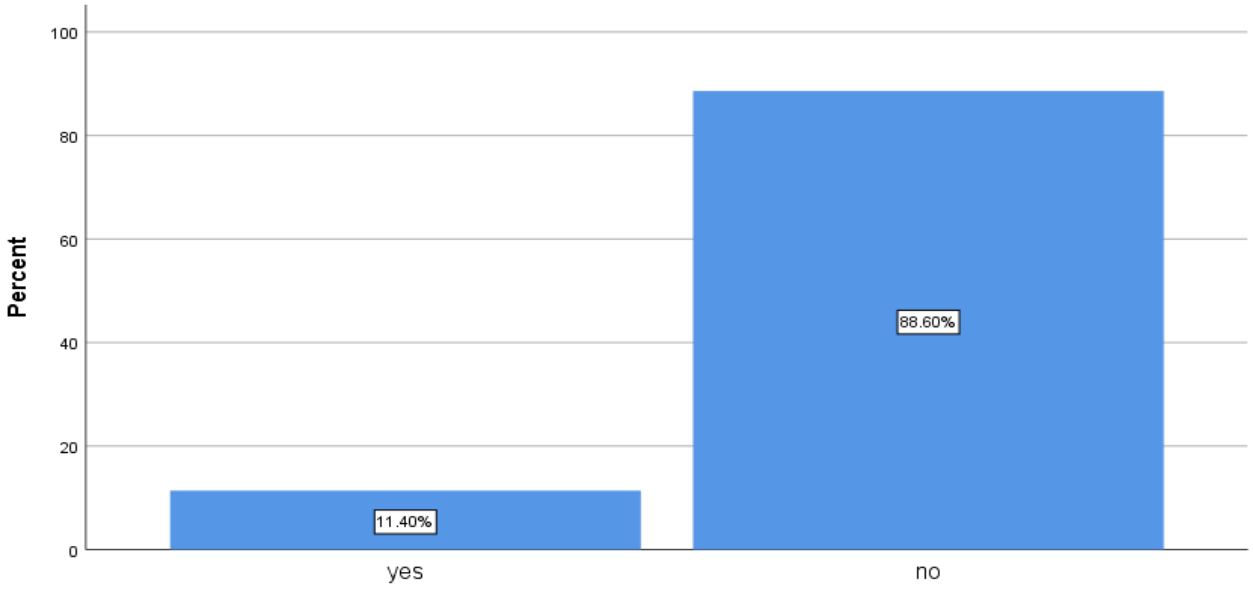


Figure 8: Magnitude of pressure ulcer among SICU admitted participants



Stage and anatomical site of pressure ulcer among study participants

Table 10: stage of pressure ulcer among the study participants

Stage of pressure ulcer	Frequency	Percent
stage II	33	56.9
stage III	17	29.3
stage IV	7	12.1
Not mentioned	1	1.7
Total	58	100.0

Table 11: Anatomical sites of pressure ulcer among the study participants

Anatomical site of PU	Frequency	Percent
sacral	19	32.8
elbow	1	1.7
mentioned as gluteal	24	41.4
multiple site	13	22.4
others: specify	1	1.7
Total	58	100.0

Table 12: Time of pressure ulcer development

Time of PU	Frequency	Percent
in less than 24 hours after ICU admission/intubation	1	1.7
24 hours to 3 days of ICU admission/intubation	17	29.3
4 days to 7 days after ICU admission/intubation	29	50.0
8 days to 14 days after ICU admission/intubation	7	12.1
greater than 14 days after ICU admission/intubation	4	6.9
Total	58	100.0

Table 13: Descriptive statistics showing the magnitude of pressure ulcer based on the type of ICU admission, sex and comorbidities of the participants

Variables		Did the patient develop pressure ulcer? yes n	yes %	no n	no %
To which ICU was the patient admitted?	MICU	45	36.6%	78	63.4%
	SICU	13	11.4%	101	88.6%
Sex of the patient	male	30	26.5%	83	73.5%
	female	28	22.6%	96	77.4%
Did the patient had comorbidities?	Cerebrovascular disease/any cause of neurologic weakness/coma	18	56.3%	14	43.8%
	Malnutrition (if documented)	2	100.0%	0	0.0%
	No neurologic weakness/malnutrition	38	18.7%	165	81.3%

Table 14: Descriptive statistics showing the magnitude of pressure ulcer based on the primary reason for ICU admission and ventilator requirement

Variables		Did the patient develop pressure ulcer? yes n	yes %	no n	no %
primary reason for ICU Admission	respiratory failure	33	55.0%	27	45.0%
	septic shock	7	25.9%	20	74.1%
	cardiogenic shock	1	7.1%	13	92.9%
	perioperative condition	11	10.1%	98	89.9%
	cerebrovascular accident/coma from any cause	6	33.3%	12	66.7%
	acute coronary syndrome	0	0.0%	5	100.0%
	others	0	0.0%	4	100.0%
was the patient on mechanical ventilator?	yes	45	54.9%	37	45.1%
	no	13	8.4%	142	91.6%

Table 15: Descriptive showing the magnitude of pressure ulcer based on the duration on mechanical ventilator

Variable		Did the patient develop pressure ulcer? yes n	yes %	no n	no %
Duration on MV	less than 24 hours	1	14.3%	6	85.7%
	24 hours to 3 days	1	4.8%	20	95.2%
	4 days to 7 days	11	55.0%	9	45.0%
	8 days to 14 days	20	90.9%	2	9.1%
	15 days to 21 days	12	100.0%	0	0.0%
	greater than 21 days	0	0.0%	0	0.0%

Table 16: Descriptive showing the magnitude of pressure ulcer based on the length of ICU stay

Variables		Did the patient develop pressure ulcer? yes n	yes %	no n	no %
Length of ICU stay	less than 3 days	0	0.0%	112	100.0%
	3 to 7 days	10	15.4%	55	84.6%
	8 to 14 days	19	63.3%	11	36.7%
	greater than 14 days	29	96.7%	1	3.3%

5.3. Factors associated with the development of pressure ulcer

In bivariate analysis of this study, there was an evidence which showed a significant association between the development of pressure ulcer; and place of ICU admission, primary reason for ICU admission, Ventilator requirement, duration of mechanical ventilation, comorbidities, and length of ICU stay. These variables were entered into multivariate logistic regression model. But, after multivariate logistic regression, only the length of ICU stay was found to be independently associated with the development of pressure ulcer. Those who stayed in the ICU for more than 14 days were 8.9 times at increased risk of developing pressure ulcer compared to those who stayed for less than 14 days (AOR=8.995, P value=<0.0001, 95% CI 3.634 to 22.264).

Table 17: Multivariate logistic regression model showing pressure ulcer development and independent variables:

Did the patient develop pressure ulcer?	Independent variables	AOR	95% CI	P value
YES	Place of ICU admission	3.4	0.78 to 15.3	0.101
	Being on MV	80.3	0.7 to 9161.5	0.07
	Primary reason for ICU admission	**0.5**	0.26 to 0.95	**0.036**
	Duration on MV	3.8	0.91 to 15.96	0.067
	Length of ICU stay	**8.9**	3.6 to 22.2	**0.0001**
	Comorbidities	0.44	0.16 to 1.24	0.12

NB.the reference category is NO.

6. Discussion

6.1. Magnitude of pressure ulcer

In this study the overall magnitude of pressure ulcer among ICU admissions in TASH was found to be 24.5%. The magnitude of pressure ulcer among MICU admitted participants was higher (36.6%) than those to SICU admitted participants (11.4%). Those admitted to MICU were 4.48 times at increased risk to develop pressure ulcer than those admitted to SICU (COR=4.482, P value=0.000004,95% CI =2.261-8.885).

This result is slightly higher when compared to the magnitude of pressure ulcer in regional hospitals of Ethiopia; Dessie, Wolayta Sodo, Bahirdar, Hawassa, Debremarkos, and Jimma in which the maximum magnitude of pressure ulcer was 16.8% among general hospital admissions [18,19,21,23,24].Higher magnitude in our study could be due to the nature of the study participants(critically sick, type of ailment, underlying reason for ICU admission).There is no previous local study done in critically sick ICU patients to compare our findings

The magnitude of pressure ulcer in this study is somehow less compared to a study done in Sweden between 1998 and 1999 among 850 ICU admitted patients and in this study the magnitude of pressure ulcer was found to be 28.7%. However, it is comparable with a finding in a Canadian study in which the magnitude of pressure ulcer was found to be 25.7% [28,31].

The above (Swedish and Canadian) studies were done in the form of a national survey and the study participants were a bit huge a number. So, it is difficult to draw this conclusion with our six-month retrospective study.

Globally, the exact magnitude of pressure ulcer varies with the type of illness and among specific clinical populations [25,29].

6.2. Associated factors of pressure ulcer

In this study, the length of ICU stay was found to be independently associated with the development of pressure ulcer. Those who stayed in the ICU for more than 14 days were 8.9 times at increased risk of developing pressure ulcer compared to those who stayed for less than 14 days (AOR=8.995, P value=<0.0001, 95% CI 3.634 to 22.264). This is consistent with a facility based cross-sectional survey conducted in Bahirdar[18].However unlike the latter, due to the retrospective nature of our study, we could not assess the quality of nursing care and the Braden pressure ulcer risk assessment.

In a facility based cross-sectional survey conducted in Felegehiwot referral hospital, Bahirdar, Ethiopia; prolonged hospital stay, limitation of sensory perception and poor nursing care were found to be strongly associated with the development of pressure ulcer [18]. But in our study, we couldn't assess the nursing care, and Braden pressure ulcer risk assessment due to the retrospective nature of the study.

Patients admitted with the diagnosis of acute coronary syndrome were having a 50% decreased risk of developing pressure ulcer than those admitted for another reason (P value=0.036, AOR=0.5, 95% CI of 0.26 to 0.95). But,this result could be due to shorter length of ICU stay in these study participants and it is difficult to draw this conclusion as patients with acute coronary syndrome were only 5 (2.1% of the study participants).

7.Strengths and limitations of the study

7.1. Strength

This study is the first which tried to assess the magnitude and factors associated with pressure ulcer among adult patients admitted to ICU, TASH, Addis Ababa, Ethiopia. So, it might help a lot for future large-scale studies in this regard.

7.2. Limitations:

The retrospective nature of the study is one of the great limitations which preclude us from assessing the nursing care, the Braden pressure ulcer assessment tool, and other important parameters. The initial plan was to undertake prospective cross-sectional study but due to the current COVID-19 pandemics, the study design was made to be a retrospective one. So, the results of this study could actually be underestimates of the actual magnitude of pressure ulcer in our setting.

All pressure ulcer documentations from our study were stage II and above. The likely explanation for this could be stage I pressure ulcers might be missed given the dark colored skin of our population.

8.Conclusion and Recommendations

8.1. Conclusion

A quarter of ICU admitted patients had developed pressure ulcer and prolonged ICU stay was identified as a main risk factor. The magnitude of pressure ulcer among MICU admitted participants was higher (36.6%) than those to SICU admitted participants (11.4%). These figures are really high even in the background of a study design which is likely to give an underestimate of the magnitude of pressure ulcer. So, future large scale, and well-designed studies should be conducted in this area.

8.2. Recommendations

To health care professionals working in ICU: we should be able to assess our patients for any pressure ulcer on daily basis, we should improve our documentation and we should do all our best to minimize the magnitude of pressure ulcer.

To ICU heads and directors: It is better to look in to the factors contributing to the high magnitude of pressure ulcer in our setting and forward those things to the responsible stakeholders. And if possible, it is better to arrange ICU trainings for nurses and residents working there.

To Hospital administrators: it would be better if the hospital tries to avail pressure ulcer supportive devices and the hospital should also give all the necessary support to ICU heads and directors in an effort to improve ICU care.

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10. ANNEXES

Annex-I: Checklists

This is a checklist for a research project of a six month retrospective study on the magnitude and associated factors of pressure ulcer among adult patients admitted to ICU unit of Tikur Anbessa Specialized Hospital (TASH). The data will be collected from chart reviews by the principal investigator and as well by a research assistant.

CHECKLISTS

Patient admitted to: Medical ICU □ Surgical ICU □

MRN/ I-care number----------

Part I: patient's sociodemographic data

Serial no.	Checklist questions	responses
1	Age	----------years
2	Sex	1.male 2. female

Part II: Pressure Ulcer Assessment Checklists

Serial no.	Questions	Responses
3	Primary reason for ICU admission	1.Respiratory failure 2. Septic shock 3. Cardiogenic shock 4. Perioperative condition 5.Cerebrovascular accident/coma from any cause 6. Acute coronary syndrome 7.others(specify)---------- 8. Can't tell
4	Was the patient on mechanical ventilator?	1.yes 2. No 3. Can't tell
5	If ''yes'' to question no 4, for how long was the patient on MV?	1.<24 hrs 2. 24hrs to 3 days 3. 4 days to 7 days 4. 8 days to 14 days 5. 15 days to 21 days 6. >21 days 7.Others(specify)-------- 8. Can't tell
6	Did the patient have one or more of the following comorbidities?	1.Cerebrovascular disease/any causes of neurologic weakness/coma 2.Malnutrition (if documented) 3. None of the above 4. Can't tell
7	Did the patient develop pressure ulcer?	1.yes 2.no
8	If ''yes'' for question no.7, where did she/he develop pressure ulcer?	1.after admission to the ICU 2.before he came to the ICU

8.1	**If the patient developed it after ICU admission, after how many hours or days of ICU admission/intubation did the patient develop pressure ulcern**	**1. <24 hrs after admission/intubation** **2. 24 hrs to 3 days after admission/intubation** **3. 4days to 7 days after admission/intubation** **4.8 days to 14 days after intubation/admission** **5. >14 days after admission/intubation** **6.Can't tell**
9	**What was the stage of pressure ulcer if the patient has developed it after being admitted to the ICU?**	**1.stage I 2. stage II** **3.stage III** **4.stage IV** **5.unstageable** **6.suspected deep tissue injury** **7.can't tell**
10	**If the patient developed pressure ulcer at ICU, what was the anatomical location of the PU?**	**1.sacral 2. greater trochanter** **3. Shoulder** **4. occipital 5. heel 6. elbow** **7.mentioned as gluteal** **8.multiple site** **9.other: specify** **10.Can't tell**
11	**Length of ICU stay**	**1. <3 days** **2. 3 to 7 days** **3. 8 to 14 days** **4. >14 days**

		5.can't tell
12	**Was the patient on any pressure ulcer supportive device?**	**1.yes 2.no 3.can't tell**
13	**If 'yes' to question no. 12, mention the device(s)**	**----------**
14	**Did the patient get position change service?**	**1.yes 2.no 3.can't tell**
15	**If 'yes' to question no. 14, how often did the patient get position change service?**	**1.every 2 hrs. 2.every 3 hrs 3. every 4 hrs 4. every 6 hrs. 5.can't tell 6.other(specify)**
16	**Was the patient getting feeding as per physicians' order?**	**1.yes 2.no 3.can't tell**
17	**If 'no' to question number 16, specify the reason.**	**1.Supply issue 2.GI intolerance 3.Patient kept NPO for various reasons 4.can't tell 5.other(specify)**
18	**Did the patient have recent upper or lower extremity fracture?**	**1.Yes □ 2. No □ 3.can't tell**
19	**Was the patient admitted for perioperative condition requiring ICU management?**	**1.Yes □ 2. No □ 3.can't tell**
20	**If ''yes'' to question number 19, what type of surgery did the patient have undergone?**	**1.GI/hepatobiliary 2.Neurosurgical 3.Urosurgical 4.Cardiothoracic 5.Vascular 6.Multidisciplinary 7.Gynecologic/cesarean 8.Orthopedic 9. Other(specify)----------**

Annex II: NPUAP staging of pressure ulcer

Stage	Description
1	Skin intact but with non-blanchable redness for >1 hour after relief of pressure.
2	Blister or other break in the dermis with partial thickness loss of dermis, with or without infection.
3	Full thickness tissue loss. Subcutaneous fat may be visible ;destruction extends into muscle with or without infection.
4	Full thickness skin loss with involvement of bone ,tendon, or joint with or without infection.
Unstageable	Full thickness tissue loss in which the base of the ulcer is covered by slough and/or eschar in the wound bed.
Suspected deep tissue injury	Purple or maroon localized area of discolored intact skin or blood-filled blister due to damage of underlying tissue from pressure and/or shear.